Workshop Program

and

Book of Abstracts

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ARC CENTRE OF EXCELLENCE FOR CLIMATE SYSTEM SCIENCE

Welcome to 7th International Workshop on Modeling the Ocean (IWMO) 1-5 June 2015, Canberra, Australia

On behalf of the IWMO 2015 local steering committee, I welcome you to Canberra, Australia, for the 7th International Workshop on Modeling the Ocean (IWMO) 2015 1-5 June.

The IWMO originated from meetings for the Princeton Ocean Model (POM) users. It is now open to users of other ocean models. The IWMO focuses on all aspects of ocean and coupled air-wave-sea, ice and current-sediment modeling: processes, analysis and prediction. The earth system is inter-connected on a broad range of temporal and spatial scales, and the workshop also welcomes coastal, regional and basin-scale studies, as well as interdisciplinary topics. The first IWMO workshop was in 2009 in Taiwan, and has since been held annually across the globe: Norfolk USA, Qingdao China, Yokohama Japan, Bergen Norway, Halifax Canada, and this year Canberra Australia (https://kaigi.eventsair.com/QuickEventWebsitePortal/iwmo2015/information).

Canberra is the capital city of Australia. With a population close to 400,000, it is Australia's largest inland city. A recent OECD report has ranked Canberra the best place in the world to live among 34 countries on nine measures of well-being. Canberra is filled with all types of fun, interesting things including national museums, art galleries, arboretums, tourist attractions, historical sites and many natural wonders. Note that the official snow season opens on the June 6-7 in the nearby ski fields of Perisher and Thredbo, about 2 hours drive from Canberra.

The 7th IWMO received some 70 papers submitted by participants from 16 countries around the globe. These papers represent the most recent work by their authors in various fields of ocean, atmosphere and terrestrial modelling and data analyses. I am very much looking forward to hearing and studying these papers. I wish you all a productive workshop and a pleasant stay in Canberra.

Last but not least, I would like to acknowledge our workshop sponsorship: CSIRO, Canberra Convention Bureau/Think Canberra, ARC Centre for Excellence/Climate System Science, UNSW Canberra and The Sino-Australian Research Centre for Coastal Management.

Xiao Hua Wang
Chairman, IWMO 2015 Local Steering Committee

International Workshop on Modeling the Oceans

The IWMO evolved from a small group meeting of the Princeton Ocean Model (POM) http://www.ccpo.odu.edu/POMWEB/ but it is open to the ocean modeling community at large. The IWMO focuses on all aspects of ocean and coupled air-wave-sea, ice and current-sediment modeling: processes, analysis and prediction. The earth system is inter-connected on a broad range of temporal and spatial scales, and we welcome coastal, regional and basin-scale studies, as well as interdisciplinary topics. As in the past workshops, we particularly encourage participation from young scientists – graduate students and postdocs – and will again host the Outstanding Young Scientist Awards competition. Papers presented at the workshop will be eligible for submission to the IWMO-7 Special Issue to be published by *Ocean Dynamics* Journal.

International Scientific Committee

Leo Oey (Princeton University, USA)
Xiao Hua Wang (UNSW Canberra, Australia)
Jinyu Sheng (Dalhousie University, Canada)
Jarle Berntsen (University of Bergen, Norway)
Bo Qiu (University of Hawaii, USA)
Huijie Xue (University of Maine, USA)
Vasiliy Vlasenko (University of Plymouth, UK)
Yasumasa Miyazawa (JAMSTEC, Japan)
Richard J. Greatbatch (GEOMAR, Germany)
Jianping Gan (Hong Kong University of Science and Technology, China)
Tal Ezer (Old Dominion University, USA)
Yign Noh (Yonsei University, Seoul, Korea)
Jia Wang (NOAA/GLERL, USA)

Local Steering Committee

Chairman: Xiao Hua Wang (UNSW Canberra, Australia)
Andy Hogg (ANU, Australia)
Alexander Babanin (Swinburne University, Australia)
Moninya Roughan (UNSW/SIMS, Australia)
Gary Brassington (BOM, Sydney)
Andrew Kiss (UNSW Canberra, Australia)
Emlyn Jones (CSIRO, Australia)
Younjong Sun (UNSW Canberra, Australia)
Julie Kesby (UNSW Canberra, Australia)

Contents

Conference secretariat

Please do not hesitate to contact the Conference Secretariat if you require any assistance.

KAIGI conferencing and events

Phone: +61 2 6198 3218   Email: tricia@kaigi.com.au

Mobile: 0488 445 029

Program at a glance

All sessions will be held in The Hall at University House. Morning tea, afternoon tea and lunch will be in the foyer. Poster sessions will also be held in the foyer.

The Conference Banquet (and group photo) will be held at University House Hall from 7:00pm on Thursday 4 June 2015.

Monday, June 1, 2015

2:00 PM - 3:00 PM	Registration
3:00 PM - 5:00 PM	Monday Poster session and Icebreaker

Tuesday, June 2, 2015

8:00 AM - 9:00 AM	Registration
9:00 AM - 9:30 AM	**CONFERENCE OPENING**
9:30 AM - 10:00 AM	KEYNOTE PRESENTATION: Professor Matt England
10:00 AM - 10:35 AM	Morning tea
10:35 AM - 12:15 PM	Climate dynamics and modeling (Session One)
12:15 PM - 1:30 PM	Lunch
1:30 PM - 3:10 PM	Climate dynamics and modeling (Session Two)
3:10 PM - 3:40 PM	Afternoon tea
3:40 PM - 5:20 PM	Sediment transport in coastal and shelf seas (Session One)
5:30 PM - 6:30 PM	Tuesday Poster Session and Reception

Wednesday, June 3, 2015

8:10 AM - 8:40 AM	KEYNOTE PRESENTATION: Professor Changshen Chen
8:40 AM - 9:20 AM	Sediment transport in coastal and shelf seas (Session Two)
9:20 AM - 10:20 AM	Circulation and dynamics (Session One)
10:20 AM - 10:50 AM	Morning tea
10:50 AM - 12:30 PM	Circulation and dynamics (Session Two)
12:30 PM - 1:45 PM	Lunch
1:45 PM - 3:45 PM	Circulation and dynamics (Session Three)
3:45 PM - 4:15 PM	Afternoon tea
4:15 PM - 5:35 PM	Circulation and dynamics (Session Four)

Thursday, June 4, 2015

8:00 AM - 10:20 AM	Waves, currents and their interactions in coastal and shelf seas
10:20 AM - 10:50 AM	Morning tea
10:50 AM - 12:30 PM	Multi-scale ocean and atmospheric processes
12:30 PM - 2:00 PM	Lunch
2:00 PM - 2:30 PM	INVITED PRESENTATION: Professor Leo Oey
2:30 PM - 3:50 PM	Coupled bio-physical ocean models (Session One)
3:50 PM - 4:10 PM	Afternoon tea (Thursday)
4:10 PM - 5:30 PM	Coupled bio-physical ocean models (Session Two)
7:00 PM - 10:00 PM	CONFERENCE BANQUET (Includes IWMO 2015 Group Photo)

Friday, June 5, 2015

8:30 AM - 9:00 AM	KEYNOTE PRESENTATION: Professor Nadia Pinardi
9:00 AM - 10:20 AM	Operational oceanography and numerical methods (Session One)
10:20 AM - 10:50 AM	Morning tea
10:50 AM - 12:30 PM	Operational oceanography and numerical methods (Session Two)
12:30 PM - 2:00 PM	Lunch
2:00 PM - 3:20 PM	Modeling and prediction of extreme marine events
3:20 PM - 3:50 PM	Afternoon tea (Friday)
3:50 PM - 5:00 PM	Presentation of prizes and awards Discussion - IWMO 2016

IWMO 2015 Program

Monday, June 1, 2015

2:00 PM – 3:00 PM	Registration
3:00 PM – 5:00 PM	Monday Poster session and Icebreaker *Poster presenters are requested to stand by their posters. This is an opportunity to view posters and meet other delegates in a relaxed atmosphere.*

Tuesday, June 2, 2015

8:00 AM – 9:00 AM	Registration and arrival tea/coffee
9:00 AM – 9:30 AM	CONFERENCE OPENING Welcome remarks: Local Steering Committee Chair, Xiao Hua Wang Sponsor address: Andreas Schiller, CSIRO, Australia
9:30 AM – 10:00 AM	KEYNOTE PRESENTATION: Matt England Session Chair: Andy Hogg Ocean modelling for climate system science, **Matt England**, *ARC Laureate Fellow and UNSW Scientia Professor, Climate Change Research Centre (CCRC) and ARC Centre of Excellence for Climate System Science, The University of New South Wales, NSW, Australia*
10:00 AM – 10:35 AM	**Morning tea**
10:35 AM - 12:15 PM	Climate dynamics and modeling (Session One) Session Chair: Andy Hogg 10:35-10:55 - Examining Western South Atlantic wave climate for different representations of present and future conditions, **Ricardo De Camargo**, *IAG/USP, Sao Paulo, Brazil* 10:55-11:15 - Climate change, ocean dynamics and sea level rise: A comparison between the two sides of the North Atlantic Ocean, **Tal Ezer**, *Center for Coastal Physical Oceanography, Old Dominion University, Norfolk, United States* 11:15-11:35 - Statistical estimation of the impact of climate change on extreme waves over the northwest Atlantic, **Jinyu Sheng**, *Dalhousie University, Halifax, Canada* 11:35-11:55 - A model study of interannual variability of the Pacific North Equatorial Current, **Huijie Xue**, *University of Maine, Orono, USA* 11:55-12:15 - Winter climate over East China Sea, **Leo Oey**, *National Central University, Taiwan*
12:15 PM – 1:30 PM	**Lunch**
1:30 PM – 3:10 PM	Climate dynamics and modeling (Session Two) Session Chair: Leo Oey 1:30-1:50 - The role of Pacific Trade Wind trends in driving ocean heat uptake and global hiatuses, **Nicola Maher**, *Climate Change Research Centre, UNSW, Sydney, Australia*

	1:50-2:10 - The CMIP6 Ocean Model Inter-comparison Project (OMIP), **Simon Marsland**, *CSIRO Oceans and Atmosphere Flagship, Aspendale, Australia* 2:10-2:30 - Is there any relationship between sea level variability and East Australian Current in Brisbane?, **Mona (Fatemeh) Ziaeyan Bahri**, *School of Physical, Environmental and Mathematical Sciences, The University of New South Wales Canberra, Australia (OYSA)* 2:30-2:50 - The influence of ocean on typhoons in South China Sea, **Jingru Sun,** *Tsinghua University, China (OYSA)* 2:50-3:10 - Past and future submissions of ACCESS to the Climate Model intercomparison project, **Simon Marsland**, *CSIRO Oceans and Atmosphere Flagship, Aspendale, Australia*
3:10 PM – 3:40 PM	**Afternoon tea**
3:40 PM – 5:20 PM	Sediment transport in Coastal and Shelf Seas (Session One) Session Chair: Katja Fennel 3:40-4:00 - Tide adjustment along with the construction of Yangshan Harbour, Shanghai, China, **Guo Wenyun**, *East China Normal University, Shanghai, China (OYSA)* 4:00-4:20 - Flood-ebb asymmetry on suspended sediment transport in the upper reach of the Changjiang Estuary, **Zhanhai Li**, *East China Normal University, China* 4:20-4:40 - Numerical simulation on sediment transport and geomorphological change of the radial sand ridge system in the southern Yellow Sea, **Ya Ping Wang,** *School of Geographic and Oceanographic Sciences, Nanjing University, Nanjing, China* 4:40-5:00 - Numerical modeling of near-shore pollutant transport in Singapore coastal waters, **Vivien Pei Wen Chua**, *National University of Singapore, Singapore* 5:00-5:20 - Local and far-field effects of land reclamation on sea level changes in China Seas, **Xiao Hua Wang**, *The Sino-Australian Research Centre for Coastal Management, UNSW, Australia*
5:30 PM – 6:30 PM	Tuesday Poster session and Reception *Poster presenters are requested to stand by their posters.*

Wednesday, June 3, 2015

8:10 AM – 8:40 AM	KEYNOTE PRESENTATION: Changshen Chen Session Chair: Xiao Hua Wang FVCOM: Development, improvement, and applications, **Changshen Chen**, *School for Marine Science and Technology, University of Massachusetts-Dartmouth, New Bedford, MA 02742, USA; Department of Physical Oceanography, Woods Hole Oceanographic Institution, Woods Hole, MA 02543, USA; International Center for Marine Studies, Shanghai Ocean University, Shanghai 201306, P.R. China*
08:40 AM – 09:20 AM	Sediment transport in Coastal and Shelf Seas (Session Two) Session Chair: Xiao Hua Wang 8:40-9:00 - Effects of tidal flats slope on tidal dynamics and its implication on sediment transport in Xiangshan Harbour, Zhejiang, China, **Li Li**, *Zhejiang University, Hangzhou, China* 9:00-9:20 - The impacts of land reclamation on suspended-sediment transport in Jiaozhou Bay, Qingdao, China, **Guadong Gao**, *School of Physical, Environmental and Mathematical Sciences, The University of New South Wales, Canberra; Key Laboratory of Physical*

	Oceanography, Ministry of Education, Ocean University of China, Qingdao 266100, China, Qingdao, China (OYSA)
9:20 AM – 10:20 AM	Circulation and dynamics (Session One) Session Chair: Andrew Kiss 9:20-9:40 - Interannual variability of the Patagonian shelf circulation, **Vincent Combes**, *CEOAS - Oregon State University, Corvallis, USA* 9:40-10:00 - Modeling submesoscale processes in the Gulf of Finland - case scenario upwelling events in the summer 2006, **Germo Väli**, TUT Marine Systems Institute, Tallinn, Estonia 10:00-10:20 - The simulation of the meso-scale eddies in the South China Sea, **Changshui Xia**, *The First Institute of Oceanography, China*
10:20 AM – 10:50 AM	**Morning tea**
10:50 AM – 12:30 PM	Circulation and dynamics (Session Two) Session Chair: Huijie Xue 10:50-11:10 - The criteria for the application of the tidally-averaged water and salinity transports quantities in the Pearl River Estuary, **Shouxian Zhu**, *College of Harbor, Coastal and Offshore Engineering, Hohai University, China* 11:10-11:30 - The anisotropy of ocean eddies, **Kial Stewart**, *UNSW, Sydney, Australia, COECSS, Sydney, Australia* 11:30-11:50 - A behaviour of coastal upwelling driven by wind in Jervis Bay, NSW: A numerical study for 2011, **Younjong Sun**, *UNSW Canberra, Canberra, Australia* 11:50-12:10 - Identifying coastal upwelling along the southeast coast of Australia using time-series MODIS data, **Dr Chunhui Zhou**, *School of Navigation, Wuhan University of Technology, Wuhan, China* 12:10-12:30 - Seasonal SSH variability of the Northern South China Sea, **Fanghua Xu**, *Center for Earth System Science, Tsinghua University, Beijing, China*
12:30 PM – 1:45 PM	**Lunch**
1:45 PM - 3:45 PM	Circulation and dynamics (Session Three) Session Chair: Jinyu Sheng 1:45-2:05 - Upwelling induced by the frictional stress curl and vertical squeezing of the vortex tube over a submerged valley in the East China Sea, **Jianping Gan**, *Hong Kong University of Science and Technology, Hong Kong, China* 2:05-2:25 - Formation mechanism of quasi-stationary Jets in the North Pacific Subarctic Frontal Zone, **Humio Mitsudera**, *Hokkaido University, Sapporo, Japan* 2:25-2:45 - Contribution of mesoscale eddies in the carbon subduction in the southern ocean, **Clothilde Langlais**, *CSIRO Ocean and Atmosphere, Hobart, Australia* 2:45-3:05 - Centrifugal instability - A novel submesoscale mixing mechanism, **William Dewar**, *The Pierre Welander Professor of Oceanography, Florida State University, USA* 3:05-3:25 - Isoguchi Jets: Conduits from subtropical to subarctic Pacific Ocean, **Toru Miyama**, *Japan Agency for Marine-Earth Science and Technology, Yokohama, Japan* 3:25-3:45 - The impact of subtropical counter current eddies on Kuroshio Transport off East China Sea, **Mao Cheng Huang**, *National Taiwan Normal University, Taipei City, Taiwan*
3:45 PM – 4:15 PM	**Afternoon tea**

4:15 PM – 5:35 PM	## Circulation and dynamics (Session Four) Session Chair: Jianping Gan 4:15-4:35 - Jet-topography effects on horizontal eddy mixing in the Southern Ocean, **Alice Barthel**, *University of New South Wales, Climate Change Research Centre, Sydney, Australia, ARC Centre of Excellence for Climate System Science, UNSW, Sydney, Australia (OYSA)* 4:35-4:55 - A study on meso-scale eddies off the Fraser Island, North Eastern Australia and its possible mechanisms, **Zhibing Li**, *School of Physical, Environmental and Mathematical Sciences, The University of New South Wales, Canberra, Australia (OYSA)* 4:55-5:15 - Impacts of SCSTF on seasonal and interannual variability of ITF, **Mingting Li**, *Department of Atmospheric and Oceanic Sciences, Peking University, Peking, China* 5:15-5:35 - Impacts of tidal-mixing parameterization on the simulation of the South China Sea circulations, **Shiqiu Peng**, *South China Sea Institute of Oceanology, Guangzhou, China*

Thursday, June 4, 2015

08:00AM - 10:20 AM	## Waves, currents and their interactions in coastal and shelf seas Session Chair: Vasiliy Vlasenko and Jarle Bernsten 8:00-8:20 - Gravity currents down canyons: Effects of rotation, **Jarle Berntsen**, *University of Bergen, Norway, Bergen, Norway, Uni Research, Bergen, Norway* 8:20-8:40 - Investigation of wave-current interaction over the eastern Canadian shelf using a coupled circulation-wave model, **Jinyu Sheng**, *Dalhousie University, Halifax, Canada* 8:40-9:00 - Modelling of internal waves in the Celtic Sea, **Nataliya Stashchuk**, *Plymouth University, Plymouth, United Kingdom* 9:00-9:20 - Manifestation of internal tidal waves on the sea surface off the north-eastern Japan from PALSAR SAR images and ocean modelling, **Sergey Varlamov**, JAMSTEC, Yokohama, Japan 9:20-09:40 - The role of wave-current interactions in marine renewable energy near Japan, **Adrean Webb**, *The University of Tokyo, Kashiwa, Japan (OYSA)* 09:40-10:00 - Tidal-cycle variations on mixing and stratification and their relationship to residual flow in micro-tidal estuary, **Ziyu Xiao**, *UNSW Canberra, Canberra, Australia (OYSA)* 10:00-10:20 - High resolution modelling of horizontal dispersion in shear currents, **Vasiliy Vlasenko**, *Plymouth University, Plymouth, United Kingdom*
10:20 AM - 10:50 AM	**Morning tea**
10:50 AM – 12:30 PM	## Multi-scale ocean and atmospheric processes Session Chair: Tal Ezer 10:50-11:10 - Can surface buoyancy forcing drive large scale ocean gyres? **Andy Hogg**, *The Australian National University (ANU), Canberra, Australia* 11:10-11:30 - Temperature at a mooring in Northern South China Sea and its connection with surface heat flux, wind and eddies, **Yuchun Lin**, *National Central University, Taiwan (OYSA)*

	11:30-11:50 - The difference of MLD from observation and simulation, and its dependence on a diffused thermocline, atmospheric forcing, and parameterization, **Yign Noh**, *Yonsei University, Seoul, South Korea* 11:50-12:10 - Heat transport in the upper ocean during summer in the North Pacific, **Eunjeong Lee**, *Yonsei University, Seoul, South Korea (OYSA)* 12:10-12:30 - Investigating sea surface temperature diurnal variation over the tropical warm pool using satellite data from IMOS, **Haifeng Zhang**, *UNSW Canberra, Canberra, Australia (OYSA)*
12:30 PM – 2:00 PM	**Lunch**
2:00 PM – 2:30 PM	INVITED PRESENTATION: Leo Oey Session Chair: Marco Zavatarelli Right-side cooling and phytoplankton bloom in the wake of a tropical cyclone – a new view, **Leo Oey**, *National Central University, Taiwan*
2:30 PM – 3:50 PM	Coupled bio-physical ocean models (Session One) Session Chair: Marco Zavatarelli 2:30-2:50 - Investigating the northern Adriatic Sea ecosystem state with a very high resolution model, **Gelsomina Mattia**, *University of Bologna, Physics and Astronomy Department, Bologna, Italy; National Interuniversity Marine Sciences Consortium, Rome, Italy* 2:50-3:10 - The nutrient and biomass cycle in San Francisco Bay during high and low river flow years: A numerical study, **Shivanesh Rao**, *School of Marine Sciences, University of Maine, Orono, USA* 3:10-3:30 - Future changes of nutrient dynamics and biological productivity in California Current System, **Fei Chai**, *School of Marine Sciences, University of Maine, Orono, USA* 3:30-3:50 - Modeling spring-summer phytoplankton bloom in Lake Michigan with and without riverine nutrient loading, **Jia Wang**, *NOAA Great Lakes Environmental Research Laboratory, Michigan, USA*
3:50 PM – 4:10 PM	**Afternoon tea**
4:10 PM - 5:30 PM	Coupled bio-physical ocean models (Session Two) Session Chair: Fei Chai 4:10-4:30 - Ocean circulation, larval retention, and connectivity among coral populations on the Northwest Shelf of Australia, **Ming Feng**, *CSIRO, Canberra, Australia* 4:30-4:50 - Does bottom roughness determine hypoxic extent? A model intercomparison for the northern Gulf of Mexico, **Katja Fennel**, *Dalhousie University, Halifax, Canada* 4:50-5:10 - Future ecosystem changes built on CMIP5 models and RCP scenarios for North Sea and Baltic Sea, **Dhanya Pushpadas**, *University of Bergen, Bergen, Norway* 5:10-5:30 - Physical–biological coupling induced aggregation mechanism for red tides in low nutrient waters: A modeling approach, **Kedong Yin**, *School of Marine Sciences, Sun Yat-sen University, Guangzhou, China*
7:00 PM – 10:00 PM	**CONFERENCE BANQUET** (Includes IWMO 2015 Group Photo)

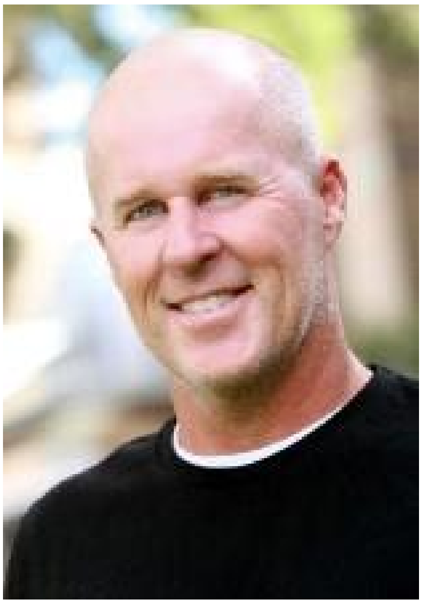
Friday, June 5, 2015

8:30 AM – 09:00 AM	KEYNOTE PRESENTATION: Nadia Pinardi Session Chair: Yasumasa Miyazawa The science of ocean predictions, operational oceanography and applications, **Nadia Pinardi**, *Laboratorio SINCEM*, *Laboratori R.Sartori*, *University of Bologna; Istituto Nazionale di Geofisica e Vulcanologia, Italy*
09:00 AM – 10:20 AM	Operational oceanography and numerical methods (Session One) Session Chair: Yasumasa Miyazawa 9:00-9:20 - Hindcast of waves during Typhoon Bolaven(1215) Using SWAN and WWIII, **Taerim Kim**, *Kunsan University, South Korea* 9:20-9:40 - An operational coastal ocean forecasting system for the Great Barrier Reef region, **Gary Brassington**, *Australian Bureau of Meteorology, Sydney, Australia* 9:40-10:00 - Real-time observation monitoring and verification of operational OceanMAPS, **Xinmei Huang**, *Australian Bureau of Meteorology, Docklands, Australia* 10:00-10:20 - Emulator assisted data assimilation into chaotic models, **Nugzar Margvelashvili**, *CSIRO Ocean and Atmosphere, Hobart, Australia*
10:20 AM – 10:50 AM	**Morning tea**
10:50 AM – 12:30 PM	Operational oceanography and numerical methods (Session Two) Session Chair: Gary Brassington 10:50-11:10 - Internal pressure gradient errors in sigma-coordinate ocean models in high resolution fjord studies, **Jarle Berntsen**, *University of Bergen, Norway, Bergen, Norway* 11:10-11:30 - The vorticity dynamics required for realistic western boundary current separation, Andrew Kiss, UNSW Canberra, Canberra, Australia 11:30-11:50 – Limits of scalability and performance of global high-resolution ocean simulations on the NCI computing platforms, **Marshall Ward**, *National Computational Infrastructure, Canberra, Australia* 11:50-12:10 - Vertical circulation derived from Omega equation in the upwelling region east of Hainan Island, **Lingling Xie**, *Guangdong Province Key Laboratory for Coastal Ocean Variation and Disaster Prediction Technologies, Guangdong Ocean University, Zhanjiang, China* 12:10-12:30 - A long-term tide-resolving OGCM simulation around the Japan coastal ocean, **Yasumasa Miyazawa**, *Japan Agency for Marine-Earth Science and Technology, Yokohama, Japan*
12:30 PM – 2:00 PM	**Lunch**

2:00 PM – 3:20 PM	Modeling and prediction of extreme marine events Session Chair: Yign Noh 2:00-2:20 - Coupling hurricane and ocean wave modelling, **Saima Aijaz**, *Swinburne University of Technology, Hawthorn, Australia* 2:20-2:40 - Investigating relationships between severe weather and East Australian Current eddies during East coast lows, **Christopher Chambers**, *School of Earth Sciences, University of Melbourne, Melbourne, Australia; Centre for Australian Weather and Climate Research, Sydney, Australia; Department of Oceanography, Dalhousie University, Halifax, Canada* 2:40-3:00 - Perspectives of storm surge occurrences for the upcoming decades at Western South Atlantic, **Ricardo De Camargo**, *IAG/USP, Sao Paulo, Brazil* 3:00-3:20 - Increasing trend of storm surge along the East Asian continent and its causes, **Leo Oey**, National Central University, Taiwan
3:20 PM – 3:50 PM	**Afternoon tea**
3:50 PM – 5:00 PM	**Presentation of Awards and Prizes** **Discussion - IWMO 2016**

KEYNOTE AND INVITED SPEAKERS

Professor Matthew England



Professor Matthew England is an Australian Research Council Laureate Fellow and Deputy Director of the UNSW Climate Change Research Centre (CCRC) as well as being a Chief Investigator in the ARC Centre of Excellence for Climate System Science. In 2014 England was elected a Fellow of the Australian Academy of Science.

Professor England obtained his PhD in physical oceanography and climate modelling from the University of Sydney in 1992 after having won the University Medal and 1st Class Honours from the same University in 1987. After completing an EU Postdoctoral Research Fellowship at the CNRS in France during 1992-1994, England worked as a Research Scientist at CSIRO within the Climate Change Research Program during 1994-1995. Since 1995 England has lectured in the physics of the ocean and climate system at the University of New South Wales, where he was awarded an ARC Federation Fellowship in 2005 and an ARC Laureate Fellowship in 2010.

Professor England is a former Fulbright Scholar and CSIRO Flagship Fellow, and winner of the Royal Society of Victoria Research Medal, 2007; two Eureka Prizes (Environmental Research, 2006; Land and Water, 2008); the 2005 AMOS Priestley Medal and the Australian Academy of Science Frederick White Prize, 2004. England coordinated and led the 2007 "Bali Climate Declaration by Scientists"; a major international statement by the scientific community that specifies the reductions in greenhouse gas emissions required to minimise the risk of dangerous human-induced climate change (www.climate.unsw.edu.au/bali). England was the convening lead author of the 2009 Copenhagen Diagnosis. He is currently co-chair of the CLIVAR Southern Ocean panel, and was a contributing author and reviewer of the Intergovernmental Panel on Climate Change (IPCC) Second and Third Assessment Reports. England's expertise covers the physics of the oceans and their role in climate variability and climate change.

Ocean modelling for climate system science

Matthew England[1]
[1]Climate Change Research Centre (CCRC) and ARC Centre of Excellence for Climate System Science, The University of New South Wales

Keynote Presentation
University House Hall, June 2, 2015, 09:30 AM – 10:00 AM

In this talk I will present a short overview of some of the many contributions of ocean modelling to climate system science. Ever since the climate modelling community upgraded their simulations to include a full dynamic ocean, climate system science has been deeply wedded with the ocean modelling community. Iconic results, like the projected interhemispheric asymmetry in warming in response to increasing greenhouse gases, would never have come about without dynamic ocean models. Yet decade by decade the demands of higher model resolution and improved ocean physics have required a huge community effort to resolve.

In this talk I will also describe ocean modelling results that (1) have revealed the threats of near Antarctic warming driven by changing mid-latitude westerly winds, (2) the means by which Pacific Ocean variability can lead to hiatuses in global warming despite increasing greenhouse gas concentrations, and (3) mechanisms for Southern Ocean forcing of North Atlantic overturning circulation.

Professor Changsheng Chen

Changsheng Chen received a PhD degree in Physical Oceanography at Massachusetts Institution of Technology and Woods Hole Oceanographic Institution Joint Program in 1992, and now is Montgomery Charter Chair Professor at the School for Marine Science and Technology (SMAST), University of Massachusetts-Dartmouth (UMASSD); Adjunct Scientist at the Department of Physical Oceanography, Woods Hole Oceanographic Institution (WHOI); and Chief Scientist at the International Center for Marine Sciences (ICMS), Shanghai Ocean University (SHOU).

Dr Chen is a coastal oceanographer who is interested in modeling and observational explorations of coastal ocean circulation, oceanic frontal processes, turbulent mixing/bottom boundary layer dynamics, biological / physical interactions, and Arctic Ocean modeling. He is the leader of the Marine Ecosystem Dynamics Modeling Laboratory/SMAST-UMASSD. The UMASSD-WHOI joint research team leading by Dr Chen and Dr Robert C. Beardsley has developed an innovative unstructured grid, Finite-Volume Community Ocean Model (FVCOM). This model is widely used by ocean communities with applications to estuarine, coastal, basin and global-scale oceans.

Dr Chen has published more than 100 peer-reviewed papers on high-impact journals, and most of these papers can be downloaded on the FVCOM website: http://www.fvcom.smast.umassd.edu.

FVCOM: Development, improvement, and applications

Changsheng Chen[1,2,3], Robert C Beardsley[2]
[1]School for Marine Science and Technology, University of Massachusetts-Dartmouth, New Bedford, MA 02742, USA,
[2]Department of Physical Oceanography, Woods Hole Oceanographic Institution, Woods Hole, MA 02543, USA,
[3]International Center for Marine Studies, Shanghai Ocean University, Shanghai 201306, P.R. China

Keynote Presentation
University House Hall, June 3, 2015, 08:10 AM – 08:40 AM

Our team of University of Massachusetts-Dartmouth and Woods Hole Oceanographic Institution researchers has been continuing to develop and improve the prognostic, free-surface, three-dimensional primitive equations-based unstructured-grid, Finite-Volume Community Ocean Model (FVCOM) since 1999. The present version 3.2 of FVCOM has become a fully ice-current-wave-sediment coupled model system with options for multi-domain nesting, two-way air-sea interactions and offline or online integration of ecosystem and water quality models. A demonstration will be given for updated existing modules and new modules that will be released in the next version 4.0 of FVCOM.

A global-regional-coastal-estuarine-wetland nested FVCOM model system has been developed to resolve and examine the multi-scale oceanic response to climate change. This system features an unstructured grid, finite-volume numerical algorithm with accurate fitting of the complex coastal geometry and resolving spatial scales up to 2 km in the global ocean to 10 m over wetlands. This nested model system has been validated by a 36-year hindcast simulation through comparisons with available observational data. A demonstration will be given for various ocean problems including the circulation and ice formation/melting in the Arctic Ocean, the tidal and wind-induced currents and mixing in the Gulf of Maine, the shelf-estuarine-wetland interaction over the Massachusetts coast, and the inundation application for Scituate, MA.

In 2007, we began to develop the Northeast Coastal Ocean Forecast System (NECOFS). The present NECOFS is an integrated atmosphere-ocean model system in which the ocean model domain covers the northeast US coastal region (the New England Shelf, Georges Bank, Gulf of Maine, and the Scotian Shelf) with a horizontal resolution of 10-15 km in the open ocean, 1-5 km on the shelf, and down to 20 m in estuaries, inner bays, inlets and harbors. The system includes: 1) the community mesoscale Weather Research and Forecasting (WRF) model modified to incorporate the COARE 4.0 air-sea flux algorithm; 2) FVCOM configured for this region (FVCOM-GOM5) with a nested higher resolution FVCOM configured for Massachusetts coastal waters (FVCOM-MASS); 3) the unstructured-grid surface wave model (FVCOM-SWAVE); and 4) storm-induced coastal inundation models. The system produces 3-day forecast fields of surface weather, surface icing, surface waves, water level, 3-D water temperature, salinity, and currents; with daily updating using hindcast data assimilated fields whenever field data are available. This forecast system has been validated for both hindcast simulation over 1978-2014 and forecast operations for storm-induced inundation. Built on successful validation studies, NECOFS is being used by the Northeast regional Weather Forecast Offices for storm-driven coastal inundation, Northeast River Forecast Office for river flooding, U.S. Coast Guard for search and rescue operational planning, NMFS Northeast Fisheries Science Center for fishery related research, state and local government agencies for coastal zone management, private companies for environmental assessment, and research and education applications.

Professor Leo Oey

Leo Oey is a Professor at the Institute of Hydrological & Oceanic Sciences and the Department of Atmospheric Science of National Central University, Taiwan. Dr Oey obtained his BSc in aeronautical engineering from the University of London in 1974, and PhD from Princeton University in 1978. Dr Oey has conducted research and is interested in a wide range of oceanographic, atmospheric and air-sea coupled problems: from coastal seas to basin & global circulation, from wind waves and internal waves to eddies and jets, from explosive tropical cyclones to climate variability, and their mutual interactions. Dr Oey was a co-founder (with Dr Chau-Ron Wu) of IWMO, and has served on its Scientific Committee and the Special Issue Editorial Board since 2009; he currently also serves as the Editor of *JGR-Oceans*

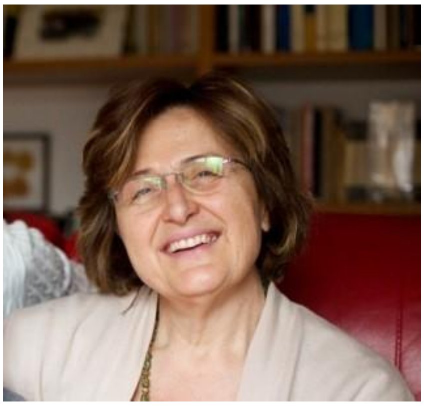
Right-side cooling and phytoplankton bloom in the wake of a tropical cyclone – a new view

Shiming Huang[1], **Leo Oey[1]**, K.K. Liu[1], YC Lin[1]
[1]*National Central University, Taiwan*

INVITED PRESENTATION: Professor Leo Oey
University House Hall, June 4, 2015, 2:00 PM - 2:30 PM

The rightward tendency (in Northern hemisphere) of enhanced phytoplankton bloom often observed in the wake of a tropical cyclone has commonly been attributed to the rightward bias of mixing due to stronger wind and wind-current resonance. We demonstrated using a high-resolution biophysical model that vertical mixing alone resulted only in weak asymmetry. The bloom asymmetry was caused instead by intense sub-mesoscale recirculation cells produced on the right side, rightward shift of cool isotherms, and spin-up of a subsurface jet. We showed using a two-time scale asymptotic expansion that these slower evolving features developed during the course of the storm, forced by resonance Reynolds stresses of the energetic and rapidly oscillating near-inertial internal waves.

Professor Nadia Pinardi



Professor Nadia Pinardi holds a PhD in Applied Physics from Harvard University, and she is tenure Professor of Oceanography at Bologna University, Italy. Her interests range from ocean numerical modelling and forecasting to data assimilation, predictability and numerical modelling of the marine physical-biological interactions. She has written more than hundred papers in peer reviewed journals on a wide range of subjects. The last topic of her research is the understanding of uncertainties in ensemble forecasting and oil spill numerical modelling coupled to operational oceanographic forecasts.

Since the middle of the nineties she has coordinated the development and implementation of operational oceanography in the Mediterranean Sea, inside the strategy of the Global Ocean Observing System (GOOS) of Unesco-IOC. She has been the Director of the National Group of Operational Oceanography of the Istituto Nazionale di Oceanografia Operativa since 2004. She has been a member of the European Environment Agency Scientific Advisory Committee and member of the European Research Council for Earth Sciences. She is now co-president of the Joint Committee for Oceanography and Marine Meteorology (JCOMM), a WMO and Unesco-IOC coordinating group for the development of operational meteo-marine and oceanographic services

In 2007 Professor Pinardi was awarded the European Geophysical Union (EGU) Fridtjof Nansen Medal for Oceanography, and in June 2008 the Roger Revelle Unesco Medal.

The science of ocean predictions, operational oceanography and applications

Nadia Pinardi[1],
[1]*Laboratorio SINCEM, Laboratori R.Sartori, University of Bologna;Istituto Nazionale di Geofisica e Vulcanologia, Italy*

Keynote Presentation
University House Hall, June 5, 2015, 08:30 AM – 09:00 AM

ORAL PRESENTATIONS

Climate dynamics and modeling (Session One)

Tuesday 2 June, 2015 10:35 AM – 12:15 PM, University House Hall

Examining Western South Atlantic wave climate for different representations of present and future conditions

Ricardo De Camargo[1], M.Sc. Fabricio Branco[2], Ilana Wainer[2], M.Sc. Bruno Biazeto[1], M.Sc. Enzo Todesco[1]
[1]IAG/USP, Sao Paulo, Brazil, [2]IO/USP, Sao Paulo, Brazil

Climate dynamics and modeling (Session One)
University House Hall, June 2, 2015, 10:35 AM - 12:15 PM

Biography:
Bachelor in Physics; M.Sc. in Physical Oceanography; PhD in Meteorology; since 1997 working as Professor at the Department of Atmospheric Sciences of IAG/USP.

This paper presents the preliminary analysis of numerical simulations to characterize the climatology of surface gravity waves and the correspondent perspectives of changing in the near future for the Western South Atlantic region, focusing on its southern portion. A complex strategy of global wave modeling to represent swell propagation associated with regional wave modeling forced by mesoscale winds is adopted; the models employed are WAVEWATCH-III and BRAMS. The period 1982-1999 is used to represent the 20th century with atmospheric fields from NCEP/Reanalysis-I, which results are used as reference. The period 2030-2049 is investigated based on two projected scenarios of the coupled climate model CCSM3. In terms of projected scenarios for Campos Basin and Santos Basin, some small differences in the average significant wave height appear basically from May to December, when the results suggest a small increase of wave height in both locations compared to the correspondent 20th century results. On the other hand, the obtained spatial distribution of trends during the period 2030-2049 shows a variable pattern, but a common feature appears in both SRESB1 and SRESA2 projected scenarios of CCSM3: decrease of the wave heights in the open ocean area and part of the shelf around 20oS, while the South Western portion of the study region presents a small increase. This is not a monotonic behaviour, because interannual and decadal variability are evident in both scenarios, with different amplitudes and phases between them.

Climate change, ocean dynamics and sea level rise: A comparison between the two sides of the North Atlantic Ocean

Tal Ezer[1]
[1]Center for Coastal Physical Oceanography, Old Dominion University, Norfolk, United States

Climate dynamics and modeling (Session One)
University House Hall, June 2, 2015, 10:35 AM - 12:15 PM

Highlighted presentation

Biography:
PhD in Physical Oceanography, Florida State University
1989-2006 Research Scholar, Princeton University
2007- Professor, Old Dominion University

Recent studies indicate that climatic changes in ocean dynamics can strongly impact coastal sea level rise (SLR). However, the sea level response is complicated and regional in nature as it combines basin-wide atmospheric and oceanic patterns such as the North Atlantic Oscillation (NAO), the Atlantic Multi-decadal Oscillation (AMO) and the Atlantic Meridional Overturning Circulation (AMOC) with local effects from winds and ocean currents. As a result, the pattern of SLR along the western side of the Atlantic Ocean i.e. on the US East Coast, is very different to the pattern along the Eastern side of the Atlantic Ocean i.e. on the UK and Western European coasts. Some of those differences will be discussed in the context of various data sets. In particular, the US East coast has a clear pattern of SLR and sea level acceleration associated with variations in the Gulf Stream, while sea level along the European coast is more complex with spatial variations associated with local topography, local dynamics and local response to NAO and AMO. For example, the flow in the English Channel, estimated from the sea level difference across the Channel, shows inter-annual to multi-decadal variations which are correlated with the NAO index and with sea level pattern in the North Sea.

Statistical estimation of the impact of climate change on extreme waves over the Northwest Atlantic

Lanli Guo[1],**Jinyu Sheng[1]**
[1]Dalhousie University, Halifax, Canada

Climate dynamics and modeling (Session One)
University House Hall, June 2, 2015, 10:35 AM - 12:15 PM

Lanli Gu is a Research Associate working with Professor Jinyu Sheng in the Department of Oceanography, Dalhousie University.
Jinyu Sheng is a Professor in Physical Oceanography at Dalhousie University. He also holds the Research Chair in modelling and prediction of extreme marine events funded by Lloyd's Register Foundation.

This study is to investigate the impact of possible climate change on extreme waves over the Northwest Atlantic Ocean. Ocean waves over this study region are first simulated by WAVEWATCHIII (WW3) in an historical climate period (1979-2005) and future climate period (2071-2100). WW3 is a 3rd generation phased-averaged wave model which numerically calculates the wave action density under wind forcing and geographical constraint. The wind forcing used to drive WW3 during the historical climate period is historical predictions of winds produced by the Canadian Centre for Climate Modelling and Analysis (CCCma) using the Canadian Regional Climate Model (CanRCM4). For the future climate period, the wind forcing is projected winds also produced by the CanRCM4 but under a climate change scenario of comparatively high greenhouse gas emission known as the Representative Concentration Pathway (RCP) 8.5 scenario. The WW3 model results in the historical climate period are compared with in-site wave observations at 12 buoy stations to quantify the model performance in simulating the bulk significant wave height Hs. The peaks-over-threshold (POT) method is then used to estimate the extreme significant wave heights with the 50-year return period from 26-year wave simulations in the historical and future climate periods. The future changes in the distribution of the 50-year extreme waves over the study region will be discussed.

A model study of interannual variability of the Pacific North Equatorial Current

Zhichun Chang[1], **Huijie Xue[2]**, Fei Chai[2], Yi Chao[3]
[1]South China Sea Institute of Oceanology, Guangzhou, China, [2]University of Maine, Orono, USA, [3]Remote Sensing Solutions, Pasadena, USA

Highlighted presentation

Climate dynamics and modeling (Session One)
University House Hall, June 2, 2015, 10:35 AM - 12:15 PM

Biography:
Physical Oceanographer with expertise in ocean modeling

A multiple decadal simulation by a 1/8˚ Pacific basin model is used to investigate interannual variability of the North Equatorial Current (NEC) in the Pacific Ocean. The results show that the amplitude and standard deviation of the NEC transport increases from East to West. Anomalies of the NEC transport in the West lag behind those in the East, but the interannual signals of NEC transport are not derived from the ocean to the East. Further analysis reveals that the interannual variability of the NEC is related to the variability of the sea surface height in the tropical and subtropical Western Pacific Ocean with the former being more important than the latter, and most of which is driven directly by the wind. Moreover, the 1.5 layer reduced gravity model can reproduce about 80-90 percent of the model predicted interannual variability of the NEC transport.

Winter climate over East China Sea

Leo Oey[1]
[1]National Central University, Taiwan

Climate dynamics and modeling (Session One)
University House Hall, June 2, 2015, 10:35 AM - 12:15 PM

Biography:
Leo Oey is interested in a wide range of oceanographic, atmospheric and air-sea coupled problems, from coastal seas to basin & global circulation, from wind waves and internal waves to eddies, from explosive tropical cyclones rapid intensification to climate variability, and their mutual interactions.

Strong sea surface temperature (SST) fronts in open seas are known to affect the atmosphere. Shelf-sea fronts in winter have comparable strengths, yet their impacts on winds have not been studied. In January of 2012, a persistent, narrow band of cloud stretching ~1000 km was observed along the front of East China Sea (ECS). Numerical and analytical models show that the cloud was formed atop a recirculating cell induced by the front and, more generally, that β-plumes of low and high pressures emanate and spread far from fronts. Consistent with the theory, observations show that in ECS at inter-annual time scales, strong fronts co-vary with on-shelf convergent wind, strong northeasterly monsoon, and alongshelf alignment of clouds with low clouds near the coast and higher clouds offshore. Our results suggest that shelf-sea fronts are potentially an important dynamic determinant of climate variability of East Asia.

The role of Pacific Trade Wind trends in driving ocean heat uptake and global hiatuses

Nicola Maher[1], Matthew England[1], Alex Sen Gupta[1], Paul Spence[1]
[1]*Climate Change Research Centre, UNSW, Sydney, Australia*

Climate dynamics and modeling (Session Two)
University House Hall, June 2, 2015, 1:30 PM – 3:10 PM

Biography:
Nicola is completing a PhD at the Climate Change Research Centre, UNSW. She is interested in decadal trends in surface air temperature and the uptake of heat from the atmosphere into the oceans. She previously completed a Bachelor of Global and Ocean Sciences (Honours) at the Australian National University.

Previous work has noted the importance of the tropical Pacific in modulating global temperatures and in offsetting anthropogenic surface warming over decadal periods. This project investigates the role of the Pacific Trade Wind changes in modulating the exchange of heat into and out of the sub-surface tropical Pacific Ocean, In particular, the trade wind acceleration observed since the early 1990s is examined, with a focus on ocean heat uptake dynamics associated with phase changes of the Interdecadal Pacific Oscillation (IPO). A number of simulations are performed in an eddy-permitting global ocean model (MOM5) coupled to a sea ice model (SIS). To examine the recent period, the ocean model is forced with atmospheric CORE normal year forcing, with the observed Pacific wind trend from 1992-2013 superimposed linearly over the tropical Pacific region. The role of seasonally varying wind trends is further investigated by running a second experiment with seasonally varying wind anomalies added in the Pacific. To investigate how and when the subducted heat might re-surfaces from the ocean interior in the future, additional experiments are performed that include a ramp down the Trade winds under a variety of scenarios to mimic a future phase change in the IPO. This work has implications for decadal predictions of future global climate change.

The CMIP6 Ocean Model Inter-comparison Project (OMIP)

Simon Marsland[1], Gokhan Danabasoglu[2], Stephen Griffies[3], James Orr[4]
[1]*CSIRO Oceans and Atmosphere Flagship, Aspendale, Australia,* [2]*National Center for Atmospheric Research, Boulder, USA,* [3]*NOAA Geophysical Fluid Dynamics Laboratory, Princeton, USA,* [4]*Institut Pierre Simon Laplace, Paris, France*

Climate dynamics and modeling (Session Two)
University House Hall, June 2, 2015, 1:30 PM – 3:10 PM

Biography:
Simon Marsland is the Ocean and Coupled Modelling Team Leader at CSIRO Oceans and Atmosphere Flagship. He developed the ACCESS Ocean Model component for ACCESS submissions to CMIP5. Simon is a Co-chair of the CLIVAR Ocean Model Development Panel, and a member of the WCRP Working Group on Coupled Models.

OMIP provides a framework for evaluating, understanding, and improving ocean, sea-ice, tracer, and biogeochemical components of climate and earth system models contributing to CMIP6. It represents a merger of the previously separate Ocean Carbon Model Inter-comparison Project (OCMIP) with physical oceanography. OMIP primarily targets the CMIP6 science questions addressing the origins and consequences of systematic model biases. Additional to model evaluation, OMIP presents a framework to: i) investigate physical, chemical, and biogeochemical mechanisms that drive seasonal, inter-annual, and decadal variability; ii) attribute ocean-climate variations to boundary forced versus natural; iii) evaluate robustness of mechanisms across models and forcing data sets; iv) bridge observations and modelling by complementing ocean reanalysis from data assimilation; and v) provide consistent ocean and sea-ice states useful for initializing climate (e.g., decadal) predictions. The OMIP framework consists of i) a protocol for performing global ocean – sea-ice coupled simulations and ii) a diagnostics document containing recommendations and scientific justifications for sampling physical, chemical, and biogeochemical ocean fields for all CMIP6 simulations having an ocean component. The physical portion of OMIP follows the Coordinated Ocean-ice Reference Experiments phase II (CORE-II) protocol, involving use of inter-annually varying atmospheric data-sets. The chemical and biogeochemical portions are based on the OCMIP2/OCMIP3 protocols, respectively. OMIP contains one Tier 1 310-year global ocean – sea-ice coupled simulation, corresponding to five repeat cycles of 1948-2009 forcing, and a Tier 2 millennial-scale spin-up simulation to address long time scales associated with biogeochemical variables. OMIP is coordinated by the CLIVAR Ocean Model Development Panel (OMDP).

Is there any relationship between sea level variability and East Australian Current in Brisbane?

Mona (Fatemeh) Ziaeyan Bahri[1], Xiao Hua Wang[1]
[1]*School of Physical, Environmental and Mathematical Sciences, The University of New South Wales Canberra, Canberra, Australia*

Climate dynamics and modeling (Session Two)
University House Hall, June 2, 2015, 1:30 PM – 3:10 PM

Understanding of the relationships between changes in regional ocean dynamics and sea level variability is one of the keys to understanding the causes of coastal Sea Level Rise (SLR). However, there is much about the influence of regional oceanographic drivers, and their interactions, on relative sea level variability that we still do not understand. The impact of the East Australian Current (EAC) on sea level changes along the East coast of Australia serves as a particular example.

Recent studies indicate that a long term trend in sea level rise at Fort Denison is possibly due to long term variability in the EAC (Holbrook et al., 2011). In this paper we use an Empirical Mode Decomposition (EMD)/ Hilbert-Huang Transform (HHT) method, which was designed to study nonstationary and non-linear datasets without making any assumptions about linearity in the data (Huang et al., 2008), to analyse the EAC volume transport from OFES (OGCM for the Earth Simulator) from 1950-2012, and the sea level records from Brisbane from 1980-2012. Comparison between the results can provide better understanding of the relationship between the sea level variability and EAC changes in Brisbane.

This study focuses on long timescales. It indicates that the sea level has risen about 3.17 mm per year in last 30 years in Brisbane and that a correlation exists between the long-term trend in the EAC and sea level in this area. Discussion is offered to explain the causes of this relationship that are linked to regional climate change.

References

Holbrook, N.J., Goodwin, I.D, McGregor, S., Molina, E., Power, S.B., ENSO to multi-decadal time scale changes in East Australian Current transports and Fort Denison sea level: Oceanic Rossby waves as the connecting mechanism, Deep Sea Research II 58 (2011) 547–558; 2011.
Huang, N. E., and Z. Wu, A review on Hilbert-Huang transform: Method and its applications to geophysical studies, Rev. Geophys., 46, RG2006, doi: 10.1029/2007RG000228; 2008.

The influence of ocean on typhoons in South China Sea

Jingru Sun[1], Leo Oey[1, 2]
[1]National Central University, Taiwan, [2]Tsinghua University, Beijing, China

**OYSA presentation*

Climate dynamics and modeling (Session Two)
University House Hall, June 2, 2015, 1:30 PM – 3:10 PM

Biography:
Miss Sun is a 2nd year student from Tsinghua University, studying atmospheric and ocean dynamics.

Approximately 120 typhoons in the past 60 years passed through a narrow gap, the Luzon Strait, connecting Western North Pacific and South China Sea (SCS). About 70% of these storms reached their maximum intensities over the warm waters East of Luzon and in the Kuroshio, then rapidly weakened in SCS, suggesting some common underlying physical causes. To test and explore the hypothesis that ocean plays a dominant role, we conducted a detailed numerical model study of one such storm: Typhoon Nuri (2008) to examine the observed intensity change. We found an ocean-wind resonance response that preferentially cooled sea-surface temperature and weakened typhoon intensity in SCS. We then proposed a positive-feedback mechanism for typhoon intensification using potential vorticity.

Past and future submissions of ACCESS to the Climate Model Intercomparison Project

Simon Marsland[1], Tony Hirst[1], Daohua Bi[1]
[1]CSIRO Oceans and Atmosphere Flagship, Aspendale, Australia

Climate dynamics and modeling (Session Two)
University House Hall, June 2, 2015, 1:30 PM – 3:10 PM

Biography:
Simon Marsland is the Ocean and Coupled Modelling Team Leader at CSIRO Oceans and Atmosphere Flagship. He developed the ACCESS Ocean Model component for ACCESS submissions to CMIP5. Simon is a Co-chair of the CLIVAR Ocean Model Development Panel, and a member of the WCRP Working Group on Coupled Models.

The Australian Community Climate and Earth System Simulator (ACCESS) has been jointly developed by CSIRO and the Bureau of Meteorology, in partnership with the Australian University community through the Australian Research Council Centre of Excellence for Climate System Science (ARCCSS). Two versions of the ACCESS Coupled Model (ACCESS-CM) were submitted to the World Climate Research Programme (WCRP) Working Group on Coupled Models (WGCM) Climate Model Intercomparison Project phase 5 (CMIP5). In the first part of this presentation we give a brief overview of ACCESS performance in CMIP5 multi-model analyses, as presented in the Intergovernmental Panel on Climate Change 5th Assessment Report (IPCC-AR5) and the published literature. In the second part we outline development plans and progress for the next generation ACCESS-CM2 intended for submission to CMIP6. In addition to a core set of simulations known as the 'Diagnostic, Evaluation and Characterization of Klima' (DECK) and an historical simulation, CMIP6 will include a host of Model Intercomparison Projects (MIPs). One prominent MIP is the ScenarioMIP, which comprises the scenario simulations. These simulations will essentially be comparable to the Representative Concentration Pathway (RCP) simulations of CMIP5, and will underpin the projections of future climate in IPCC-AR6. We also present an overview of plans for ACCESS involvement in the many other CMIP6 MIPs.

Sediment transport in Coastal and Shelf Seas (Session One)

Tuesday 2 June, 2015 3:40 PM – 5:20 PM, University House Hall

Tide adjustment along with the construction of Yangshan Harbour, Shanghai, China

Guo Wenyun[1,2],Xiao Hua Wang[2,3,4],Pingxing Ding[1], Jianzhong Ge[1], Dehai Song[3]
[1]East China Normal University, Shanghai, China, [2]The University of New South Wales, Canberra, Australia, [3]Ocean University of China, Qingdao, China , [4]2nd Institute of Oceanography, State Oceanic Administration, Hangzhou, China

Sediment transport in Coastal and Shelf Seas (Session One)
University House Hall, June 2, 2015, 3:40 PM – 5:20 PM

Biography:
Guo Wenyun is a doctoral student studying at State Key Laboratory of Estuarine and Coastal Research, East China Normal University. He majors in physical oceanography and cohesive sediment transport.

Yangshan Harbour, Shanghai, China, is an important offshore engineering project in the East China Sea. Construction of this harbour has brought significant changes in local geometries. Observations show that this project has strong impact on the tidal amplitudes and phases. The objective of this study is to investigate the impact of the project on the tidal duration asymmetry, and explore the mechanisms that change tidal duration asymmetry by the project. Observed sea-level data at Xiaoyangshan (XYS) station shows that the forth-diurnal tides have been strengthened significantly during the construction of this harbour, and thus the stronger flood-dominant, which is controlled by the nonlinear interaction of M2/M4 and M2/S2/MS4.

Numerical experiments based on the Finite-Volume Community Ocean Model (FVCOM) show that the asymmetry in the Inner Harbour Area (IHA) is in a decreasing tendency, which is opposite to that of the XYS station. In addition to the reduction of tidal energy by dams, the stronger tidal choking at the East Entrance, due to the constructions, plays a major role in this asymmetry decrease. Constructions of third dam and third wharf are of particular importance for the stronger tidal choking, and the reclamation at south-islands-chain also contributes to the stronger tidal choking. Additionally, changes in bathymetries induced by the project can further impact the tidal asymmetry.

Flood-ebb asymmetry on suspended sediment transport in the upper reach of the Changjiang Estuary

Zhanhai Li[1,2]
[1]East China Normal University, [2]Nanjing University, Shanghai, China

Sediment transport in Coastal and Shelf Seas (Session One)
University House Hall, June 2, 2015, 3:40 PM – 5:20 PM

Biography:
Associate Professor, State Key Laboratory of Estuarine and Coastal Research, East China Normal University, Shanghai, China

Time-sequence measurements were conducted on suspended sediment and current velocity from neap tide to spring tide in the upper Changjiang Estuary in 2011. Strong flood-ebb asymmetry in the current velocity was observed as a result of high river runoff and tide deformation, in which the magnitude and duration of ebb currents were significantly greater than those of flood currents. The suspended sediment concentration (SSC) and suspended median grain size also exhibited remarkable flood-ebb variation; these variables were considerably larger during the ebb than during the flood and increased from neap to spring tide. Affected by the strong asymmetry in the current velocity and SSC between the flood and ebb, suspended sediment flux during the ebb was notably larger than during the flood. The balance of sediment flux illustrates that the seaward sediment transport is dominated by river flow and tidal trapping and the landward sediment transport is dominated by the Stokes drift and the shear effect. Notable resuspension occurred during the spring and moderate tides and exerted a strong effect on the sediment transport processes and induced the higher SSC and coarser sediment in the water column. The critical velocity for the resuspension of bed sediments was estimated based on the correlation between current velocity and SSC. The results show that the critical velocity was approximately 40 cm/s during the flood and approximately 80 cm/s during the ebb because the surficial flood bed sediments are much finer than the surficial ebb bed sediments.

Numerical simulation on sediment transport and geomorphological change of the radial sand ridge system in the Southern Yellow Sea

Ya Ping Wang[1], Wenfei Ni[1]
[1]School of Geographic and Oceanographic Sciences, Nanjing University, Nanjing, China

Sediment transport in Coastal and Shelf Seas (Session One)
University House Hall, June 2, 2015, 3:40 PM – 5:20 PM

The radial sand ridges system located on the seafloor of the Southern Yellow Sea, which is a unique large geomorphological system on the continental shelf. The radial patterns of the tidal current field and sand ridge-tidal channel shape have been discovered in the early 1980s. The change of geomorphology, the hydrodynamic and sediment dynamic features in this sand ridges system have received great attention and been under widely research since then. Moreover, the tidal channel, sand ridge and coastal intertidal flat form a complex tidal flat in terms of elevation along the onshore-offshore cross-sections, which is different with the previous study on the coastal intertidal flat with the monotone elevation variation. In this study, the 2DH Delft3D hydrodynamic and sediment dynamic models were applied to simulate the tidal current and suspended sediment concentration fields, for the further calculation of residual current and net sediment transport in this region over the time scale of months. The geomorphological change of the whole radial sand ridges system from 1979 to 2011 was also simulated. The sediment dynamic mechanism for the topographic evolution was further analysed.

The results showed that:

(1) The tidal current was quite strong in the study area. The current speeds ranged from 0.5 to 2.0 m/s during the spring tide, which increased landward and had the spatial pattern with stronger velocity in the trough than the shallow shoal. The bottom sediments were mainly comprised of fine sand and silt, and the sediment grain size was coarser on the ridge than in the trough. These features of sediment composition and hydrodynamics were conductive for the rapid geomorphological evolution in this region. The tidal variation of suspended sediment concentration (SSC) was related with the current velocity, which resulted from the dominating effect of re-suspension in this region. The calculated SSC field had higher value on the seaside sand ridges than the adjacent troughs, while the SSC maintained high value over 0.4 kg/m3 in the inner tidal channel over the tidal cycle, even in the low slack tide with smallest current speed. In addition to radial sand ridges area, the abandoned Yellow River Mouth and the East to Lengjiasha Sand Ridge also exhibited large SSC value.

(2) Over the time scale of neap-spring tides, the Euler residual current dominated in the Lagrange residual current in the study area. The direction of Euler residual current was mainly controlled by topography and had a tendency to follow the isobaths outside the sand ridges. The North of Abandoned Yellow River Mouth, the part between Northern radial sand ridges systems and Abandoned Yellow River Mouth developed an anticlockwise and a clockwise residual circulation respectively. A stream of residual currents valued pointed to the southeast along 50 m isobaths outside the sand ridges. A clockwise residual circulation generally developed around the outer sand ridges. The water was net transported landward in nearshore tidal channels of Southern radial sand ridge system, while it was net transported seaward in the Northern channels. There was a steam of strong Southeast Stokes residual current flowing from Abandoned Yellow River Mouth into the Xiyang Tidal Channel, with the current speed up to 0.05~0.1m/s, which might be major component of Subei coastal currents.

(3) The transport patterns of bedload and suspended load sediment were quite similar with the pattern of residual current, and the latter was 2~3 orders of magnitude larger than the former. The suspended sediment was net transport around the outer sand ridges as the residual current. The transport rate ranging from 0.2~0.4 kg/s/m decreased from slope to the trough. Also, sediments were net transported in the Southeast direction from Abandoned Yellow River Mouth into the Southern radial sand ridge system, in the rate between 0.2 and 0.5kg/s/m. Over the time scale of decades, the bedload and suspended sediments were net transported from South to North in the centre radial sand ridges by advection and diffusion. The possible net transport direction in the outer radial sand ridges might be to the South.

(4) From 1979 to 2011, the main tidal channel experienced drastic scouring and became straighter. The small underwater sand ridges merged, connected and elongated to the linear shape in the plane. The accumulated region mainly appeared in the inner sand ridges and the Southern slope of outer sand ridges. The above landward combination and migration of sand ridges can be regarded as the geomorphological manifestation of the spatial gradient of net sediment transport. There were also differences between the evolution processes of two complex tidal channel- sand ridge-coastal intertidal flat systems, namely the merging mainland type and offshore accumulation sand ridges.

Numerical modeling of near-shore pollutant transport in Singapore coastal waters

<u>Vivien Pei Wen Chua[1]</u>, Ming Xu[1]
[1]National University of Singapore, Singapore, Singapore

Sediment transport in Coastal and Shelf Seas (Session One)
University House Hall, June 2, 2015, 3:40 PM – 5:20 PM

Biography:
Vivien Chua is an Assistant Professor at the Department of Civil & Environmental Engineering, National University of Singapore. She received her PhD degree from Stanford University. She was a recipient of the MIT Technology Review Innovators Under 35 (TR35) Asia Pacific Regional List.

A nested three-dimensional unstructured-grid SUNTANS model is applied to Singapore coastal waters to simulate near-shore pollutant transport. The small domain (~50 m resolution) Singapore coastal model is nested within a large domain (~200 m resolution) regional model. Sea surface elevations and velocities are output from the large domain regional model and used to force the inner nested model. The pollutants are modelled as passive tracers, and released at six locations in Singapore coastal waters. The tracer simulations are performed from 1 to 7 December 2013 during the Northeast monsoon season, and 1 to 7 June 2013 during the Southwest monsoon season. Our results show that the rate of dispersion is twice as large for the Northeast monsoon compared to the Southwest monsoon season. A new domain-averaged diffusion coefficient k_net is introduced to assess the amount of physical diffusion in Singapore coastal waters. The minimum mean k_net of 0.23 m^2/s is found for passive tracers released near Tuas (on the western tip of Singapore), while the maximum mean k_net of 1.22 m^2/s is found for passive tracers released near St. John Island (to the South of Singapore). Our study uses a thorough and systematic numerical modelling approach to investigate near-shore pollution, and may be used to mitigate public concern about potential risks of near-shore pollution due to frequent economic and industrial activities.

Local and far-field effects of land reclamation on sea level changes in China Seas

Xiao Hua Wang[1]
[1]The Sino-Australian Research Centre for Coastal Management, UNSW, Australia

Sediment transport in Coastal and Shelf Seas (Session One)
University House Hall, June 2, 2015, 3:40 PM – 5:20 PM

Biography:
Xiao Hua Wang is the Founding Director of the Sino-Australian Research Centre for Coastal Management, University of New South Wales, Australia, and an Associate Editor for Estuarine, Coastal and Shelf Science.

In recent decades, land reclamation around the world's ocean has reached new heights as a consequence of significant economic expansion in the coastal zones, especially in the Asia-Pacific region. For example, between 1949 and 2012 reclamation has already turned approximately 13,022 km^2 of coastal wetland and tidal flats into industrial and farming lands, more than 55% of the total coastal wetland in the Bohai Sea, Yellow Sea and East China Sea (BYECS). On a regional scale, Jiaozhou Bay, Qingdao, China, is typical of a coastal area suffering from severe land reclamation. The alteration in the coastline caused by land reclamation from 1935 to 2008 has led to a decrease in the area of tidal flats by over 30%. Many studies have been conducted to examine the impact of the land reclamation on its local ecosystems and fisheries. However, little is understood as to how the land reclamation may locally affect the shallow water tides thus sediment transport patterns, and remotely induce far-field effects on the sea level changes via tidal energy re-distribution on a shelf scale. In this talk, I will use two case studies to demonstrate both local and far-field effects on tides in BYECS region caused by its severe tidal flat reclamation activities.

Sediment transport in Coastal and Shelf Seas (Session Two)

Wednesday 3 June, 2015 8:40 AM – 9:20 AM, University House Hall

Effects of tidal flats slope on tidal dynamics and its implication on sediment transport in Xiangshan Harbour, Zhejiang, China

Li Li[1], Dr Weibing Guan[2], Jianyu Hu[3], Xiao Hua Wang[4]
[1]Zhejiang University, Hangzhou, China, [2]The Second Institute of Oceanography, State Ocean Administration, Hangzhou, China, [3]Xiamen University, Xiamen, China, [4]The University of New South Wales at Canberra, Canberra, Australia

Sediment transport in Coastal and Shelf Seas (Session Two)
University House Hall, June 3, 2015, 8:40 AM – 9:20 AM

Biography:
Li Li graduated from the University of New South Wales at Canberra in 2013. She now works on coastal hydrodynamics and sediment transport in Zhejiang University, China.

The tidal dynamics of Xiangshan Harbour is studied both observationally through field data, and numerically through the FVCOM. The numerical model bathymetry includes the high resolution Xiangshan Harbour coastal lines, sea surface area and coastline variation in different years. The model is forced by tides at the ocean open boundary with constant salinity and temperature. 20 sigma layers with 3/4 logarithmic layers near the surface/bottom and 13 evenly distributed layers in the middle are used in the model. The observed tidal elevation and currents data were used to calibrate the model.

Tidal currents at the harbour mouth peak at about 2.0/0.5 ms^{-1} during spring/neap tides, respectively. Current magnitudes during peak flood of spring tides decrease gradually from the harbour mouth (2.0 ms^{-1}) to the entrance of Xihu harbour (1.0 ms^{-1}) due to the consequence of water diversion efforts of the harbour, then slightly increase when the tides passed the entrance of Xihu harbour (1.2 ms^{-1}) because of the narrowing of the channel due to the appearing island. The current speeds finally decrease when the tides propagating to the inner harbour and reduce to zero towards the upper head of the harbour. Sensitivity tests with different tidal flats slops indicate that the slopes of the tidal flats impact the tidal currents, residual currents and tidal dissipation in the vicinity. This consequently would change the sediment transport mechanism in the harbour.

The impacts of land reclamation on suspended-sediment transport in Jiaozhou Bay, Qingdao, China

Guadong Gao[1,2], Xiao Hua Wang[1,2,3]
[1]School of Physical, Environmental and Mathematical Sciences, UNSW Canberra, Canberra, Australia, [2]Key Laboratory of Physical Oceanography, Ministry of Education, Ocean University of China, Qingdao 266100, China, Qingdao, China, [3]State Key Laboratory of Satellite Ocean Environment Dynamics, 2nd Institute of Oceanography, State Oceanic Administration, Hangzhou 310012, China, Hangzhou, China

**OYSA presentation*

Sediment transport in Coastal and Shelf Seas (Session Two)
University House Hall, June 3, 2015, 8:40 AM – 9:20 AM

Biography:
PhD student at the School of Physical, Environmental and Mathematical Sciences, UNSW Canberra, Canberra, Australia

A three-dimensional tidal model coupled with the UNSW sediment model based on Finite Volume Coastal Ocean Model (FVCOM) is set up to study the suspended-sediment dynamics and its change due to the land reclamation in Jiaozhou Bay (JZB). This model can predict reliable suspended-sediment concentrations compared with observation data.

The tides that have experienced great changes with the loss of tidal flats from 1935 to 2008 are dominant in controlling the suspended-sediment dynamics in JZB. Other than modulating the tides, the tidal flat is a primary source for sediment resuspensions, thus leading to turbidity maxima nearshore. We analysed the model results to quantitatively investigate the change of sediment transport including horizontal sediment fluxes and the sediment erosion and deposition due to land reclamation. We also explored the relevant physical mechanisms such as tidal-residual currents and tidal-duration asymmetry contributing to the suspended-sediment transport in JZB.

Circulation and dynamics (Session One)

Wednesday 3 June, 2015 9:20 AM – 10:20 AM, University House Hall

Interannual variability of the Patagonian Shelf Circulation

Vincent Combes[1], Ricardo Matano[1]
[1]CEOAS - Oregon State University, Corvallis, United States

Circulation and dynamics (Session One)
University House Hall, June 3, 2015, 9:20 AM - 10:20 AM

Biography:
Vincent Combes graduated from the Georgia Institute of Technology (USA, PhD) in 2010. For the last 5 years he has been working at Oregon State University focusing on the Southwest Atlantic circulation.

The interannual variability of the Patagonian shelf circulation is examined using the results of a high-resolution (1/12°), two-way nested simulation. The focus is made on the shelf from 41°S to 29°S where the Rio de La Plata plume is also used to characterise the surface circulation and the entrainment of shelf water to the deep ocean. We identify two dominant modes of the shelf circulation variability. The first, which represents the alongshore variability of the circulation, is correlated with the first mode of the wind stress variability. The second mode of variability represents the exchanges between the shelf and the deep ocean. We find that the second mode is explained both by the wind and by the variability of the latitudinal position of the Brazil/Malvinas Confluence. Most specifically, the model indicates that whereas the location of the off-shelf transport is controlled by the BMC, its variability is modulated by the shelf transport from the south.

Modeling submesoscale processes in the Gulf of Finland - case scenario upwelling events in the summer 2006

Germo Väli[1], Victor Zhurbas[1,2], Urmas Lips[1], Jaan Laanemets[1], Jüri Elken[1]
[1]TUT Marine Systems Institute, Tallinn, Estonia, [2]Shirshov institute of Oceanology, Moscow, Russia

Circulation and dynamics (Session One)
University House Hall, June 3, 2015, 9:20 AM - 10:20 AM

Biography:
Germo Väli is a researcher from Tallinn University of Technology, with a main interest in studying the Gulf of Finland, Baltic Sea. During the past years he has focused on numerical modelling with revised versions of the Princeton Ocean Model from Taiwan University.

The present study is aimed to estimate the role of submesoscale processes in the Gulf of Finland using the model simulations and real case scenario for the summer 2006 when a series of upwelling events occurred along the Southern coast of the gulf. These upwelling events were widely documented by in situ observations and satellite sea surface temperature (SST) maps making it possible to validate different simulated parameters. The model applied is the Princeton Ocean Model with a domain comprising the Baltic Sea with orthogonal grid. Simulations with different horizontal resolution in the Gulf of Finland, from the lowest resolution of 0.5 nautical miles to the highest resolution of 0.125 nautical miles, have been carried out to detect and emphasize the role of submesoscale processes. The initial conditions of the thermohaline fields is taken from the High Resolution Operational Model of the Baltic Sea (HIROMB) and atmospheric forcing from the High Resolution Limited Area Model (HIRLAM). The ability of the model to reproduce upwelling and its relaxation process was verified from comparison with the simulated SST images. In addition, the validation of the model against in situ measurements from the transect Tallinn-Helsinki has been carried out.

The simulation of the meso-scale eddies in the South China Sea

Changshui Xia[1], Xunqiang Yin[1], Xianyao Chen[2]
[1]The First Institute of Oceanography, China, [2]The Ocean University of China

Circulation and dynamics (Session One)
University House Hall, June 3, 2015, 9:20 AM - 10:20 AM

Biography:
Changshui XIA is an Associate Professor in The First Institute of Oceanography, State Oceanic Administration, China. His main research area is the wave-tide-circulation coupling numerical model and the real-time marine environment forecast system for the China Marginal Seas.

Meso-scale eddies are an important phenomena in the South China Sea. Mesoscale eddies characterized by a diameter of 50-200 km can greatly impact the lateral transport of heat, momentum, and tracers. The meso-scale eddies in the South China Sea were simulated using Princeton Ocean Model (POM). The parallelised version of the POM is used in this study. The model domain covers the area (0°S-30°N, 90°E-135°E) which includes the whole South China Sea. The horizontal resolution of the model is 1/30°, about 3-4 km. The vertical is divided into 51 sigma layers. The General Bathymetric Chart of the Oceans (GEBCO_08) is used in the model. In the coastal and the area near the Dongsha Island the topography are refined using the Sea charts data.
The circulation model is driven by monthly climatological (COADS) wind stresses and heat fluxes. The initial temperature and salinity field are set to the Levitus annually averaged temperature and salinity. The three dimensional structure of the meso-scale eddies in the South China Sea are analysed using the model result.

Circulation and dynamics (Session Two)

Wednesday 3 June, 2015 10:50 AM – 12:30 PM, University House Hall

The criteria for the application of the tidally-averaged water and salinity transports quantities in the Pearl River Estuary

Shouxian Zhu[1], Xiaomei Ji[1], Jinyu Sheng[2], Wenjing Zhang[3]
[1]College of Harbor, Coastal and Offshore Engineering, Hohai University, China, [2]Department of Oceanography, Dalhousie University, Canada, [3]Meteorology and Ocean Institute of the PLA Science and Engineering University, China

Circulation and dynamics (Session Two)
University House Hall, June 3, 2015, 10:50 AM – 12:30 PM

Biography:
Not available at time of printing

This study revisits the concept of tidally-averaged transport velocities for water (TA-WTV) and substance (TA-STV) over estuarine, coastal and shelf waters. A theoretical consideration is given to demonstrate that TA-STV differs from TA-WTV due to tidal pumping and vertical variations in currents and substance concentrations. Numerical results of sea surface elevations, currents and salinity produced by a triply-nested coastal ocean modelling system for the Pearl River Estuary (PRE) are used to calculate the tidally-averaged transport velocities for water (TA-WTV) and salinity (TA-STVsa). The general circulation features of the TA-WTV and TA-STVsa are similar over the inner PRE close to the major river inlets in the summer wet season, but differ significantly in speed and direction over the salinity frontal zone. The tidally-averaged water and salinity transport velocities calculated from model results are also different from Eulerian residual current (ERC) and Lagrangian residual current (LRC). The criteria for the application of the tidally-averaged water and salinity transports quantities such as TA-WTV, TA-STV, ERC and LRC are proposed, and their characters are analysed in the Pearl River estuary.

Acknowledgments
This study is supported by the National Natural Science Foundation of China (No. 40906044, NO.41076048 and No. 41206163), the Fundamental Research Funds for the Central Universities (2011B05714), China.

The anisotropy of ocean eddies

Kial Stewart[1,2],Stephanie Waterman[2,3], Paul Spence[1,2], Julien Le Sommer[4], Jean-Marc Molines[4], Prof Matt England[1,2]
[1]UNSW, Sydney, Australia, [2]COECSS, Sydney, Australia, [3]UBC, Vancouver, Canada, [4]LEGI, Grenoble, France

Circulation and dynamics (Session Two)
University House Hall, June 3, 2015, 10:50 AM – 12:30 PM

Biography:
PhD in Physical Oceanography from ANU, Canberra Australia in 2012
Postdoc at Johns Hopkins University, Baltimore USA 2012-2014
Postdoc at UNSW, Sydney Australia 2014-

This presentation examines the anisotropy of ocean variability in an eddy-resolving (1/12-degree) global ocean model. The variability of the horizontal velocity fields are analysed using the variance ellipse framework, which characterises the geometry of the variability in terms of the eddy kinetic energy, anisotropy and orientation. It is found that the eddy anisotropy has significant vertical structure and is strongest close to the ocean bottom, where the anisotropy tends to align with the underlying isobath. The strong anisotropic bottom signal is almost entirely contained in the barotropic variability. Upper-ocean variability is predominantly baroclinic and less sensitive to the underlying bathymetry. This finding offers guidance for introducing a parameterization based on the underlying bathymetry to operate on the barotropic flow, to better account for barotropic variability unresolved in coarse-resolution ocean models.

A behaviour of coastal upwelling driven by wind in Jervis Bay, NSW: A numerical study for 2011

Younjong Sun[1]
[1]UNSW Canberra, Canberra, Australia

Circulation and dynamics (Session Two)
University House Hall, June 3, 2015, 10:50 AM – 12:30 PM

Biography:
Younjong Sun's research interests concern physical oceanography, ocean modelling, and tidal fronts.

The Princeton Ocean Model (POM) adopted with a downscaling approach for the regional ocean model and nested into the global ocean model, was used to investigate an upwelling event in Jervis Bay, New South Wales, with varying wind direction and strengths. The upwelling event for 2011 was detected from the observed wind data and the satellite SST image. The behaviour of the bottom water that intruded into the bay varied with different wind directions and strengths. The Northerly wind (N) created the strongest upwelling intrusion. The upwelling-favourable wind directions for flushing efficiency within the bay were ranked in the following order: N (0°; northerly) > NW (315°; Northwesterly) > NNE (30°; Northeasterly) > NE (45°; Northeasterly) > ENE (60°; Northeasterly). It was determined that a wind-driven downwelling within the bay plays a key role in blocking the intrusion of the cold water upwelled through the bay entrance. The study also indicated that a Northerly wind with a magnitude larger than 0.3 N/m² was required for the cold water to reach the Northern innermost bay.

Identifying coastal upwelling along the Southeast coast of Australia using time-series MODIS data

Chunhui Zhou[1,2], Xiao Hua Wang[2], Zhi Huang[3], Linlin Ge[4]
[1]School of Navigation, Wuhan University of Technology, Wuhan, China, [2]PEMS/SARCCM, UNSW Canberra, Canberra, Australia, [3]Geoscience Australia, Canberra, Australia, [4]School of Civil and Environmental Engineering, UNSW, Sydney, Australia

Circulation and dynamics (Session Two)
University House Hall, June 3, 2015, 10:50 AM – 12:30 PM

Biography:
Chunhui Zhou is a Visiting Fellow at PEMS， UNSW Canberra. He works in the SARCCM team which is led by Associate Professor Xiao Hua Wang. His objective is to study the coastal upwelling along the Southeast coast of Australia using remote sensing data.

Upwelling is an oceanographic phenomenon that involves wind-driven motion of dense, cooler, and usually nutrient-rich water towards the ocean surface, replacing the warmer, usually nutrient-depleted surface water. The nutrient-rich upwelled water stimulates the growth and reproduction of primary producers such as phytoplankton. It is of great importance to identify these coastal upwelling zones including their positions, extents, strength and variability.

Due to the biomass of phytoplankton and presence of cool water in these regions, upwelling zones can be identified by cool sea surface temperatures (SST) and high concentrations of chlorophyll-a. With the techniques of topographic position index(TPI), the spatial variability of the SST and Chl-a is calculated to find the boundaries of cold waters. Then, a compounded remote sensing image analysis method is used to extract the upwelling zones and their important attributes.

Time series Modis data are used to get the spatial and seasonal variability of the coastal cold water masses. The wind data and current model data are compared with the image analysis results to get a conclusion that which is the dominant factor of the Australian south-east coastal upwelling. Result shows that the method is quite effective in identifying the upwelling zones.

Seasonal SSH variability of the Northern South China Sea

Fanghua Xu[1], Leo Oey[2,3]
[1]Center for Earth System Science, Tsinghua University, Beijing, China, [2]Program in Atmospheric and Oceanic Sciences, Princeton University, Princeton, USA, [3]National Central University, Zhongli, Taiwan

Circulation and dynamics (Session Two)
University House Hall, June 3, 2015, 10:50 AM – 12:30 PM

Biography:
Fanghua Xu graduated from Stony Brook University in 2009. From 2009 to 2012, she worked with Leo Oey as a Postdoc in Princeton University. Now she is at a Faculty in Tsinghua University.

The seasonal response of sea surface height anomaly (SSHA) to wind stress curl (WSC) in Northern South China Sea (NSCS) and Kuroshio intrusion through the Luzon Strait is analysed using observations and models. The dominant response to WSC is through simple Ekman pumping while effects of β appear as the weaker second Empirical Orthogonal Function mode. The Luzon Strait intrusion is shown to be largely deterministic using a model forced by realistic wind in the North Pacific Ocean, and it contributes significantly to the SSH variability in the NSCS. The WSC accounts for 62% while intrusion 38% of the total forcing but the latter alters the forced Rossby wave response. Without the intrusion, westward propagation is too fast, resulting in incorrect balance and erroneous annual SSH variability in NSCS.

Circulation and dynamics (Session Three)

Wednesday 3 June, 2015, 1:45 PM – 3:45 PM, University House Hall

Upwelling induced by the frictional stress curl and vertical squeezing of the vortex tube over a submerged valley in the East China Sea

Zhiqiang Liu[1], **Jianping Gan[1]**
[1]Hong Kong University of Science and Technology, Hong Kong, China

Highlighted presentation

Circulation and dynamics (Session Three)
University House Hall, June 3, 2015, 1:45 PM – 3:45 PM

Biography:
Obtained PhD degree in physical oceanography from McGill University in 1995, and has worked in HKUST since 2003.

We conducted a process-oriented modelling study to investigate the characteristics and dynamics of the prominent upwelling over a vast submerged valley in the East China Sea (ECS). The valley is inversely funnel-shaped with the West bank and the east bank oriented in the North-South direction. A cross-bank upward transport occurred along the West bank. It intensified northward and peaked around the head of the valley. An along-bank southward pressure gradient force (PGF) formed the cross-bank geostrophic transport for the upwelling over the valley. The PGF reached its maxima at the head of the valley. Our momentum and vorticity dynamic analyses revealed that a bottom stress curl mainly contributed the PGF along the west bank. At the same time, both the bottom stress curl and the nonlinear vorticity advection contributed to the PGF around the head. The bottom stress curl was due to the bottom shear vorticity of the coastal current and the curvature vorticity around the head. The nonlinear vorticity advection formed because of the vertical squeezing of vortex tube as the current flowed over the valley. The nonlinearity mainly affected the PGF around the head, whereas the bottom stress curl contributed to the PGF over the entire valley. The ratio of the nonlinear to frictional contributions to the PGF increased as the coastal current intensified. Our study demonstrates that the PGF that drives the upwelling over the valley is the combined result of the nonlinearity due to vertical squeezing of vortex tube and bottom frictional effects.

Formation mechanism of quasi-stationary Jets in the North Pacific Subarctic Frontal Zone

Humio Mitsudera[1], Toru Miyama[2], Hajime Nishigaki[3], Taku Wagawa[4], Shinichi Itoh[5]
[1]Hokkaido University, Sapporo, Japan, [2]JAMSTEC, Yokohama, Japan, [3]Oita University, Oita, Japan, [4]Tohoku Fisheries Research Institute, Shiogama, Japan, [5]University of Tokyo, Kashiwa, Japan

Circulation and dynamics (Session Three)
University House Hall, June 3, 2015, 1:45 PM – 3:45 PM

Biography:
1987-1990: worked at UNSW in Australia
1990-1993: worked at CSIRO, Atmospheric Research in Australia
1993-1997: worked at JAMSTEC in Japan
1997-2003: worked at IPRC, U. Hawaii in USA
2003-present: Professor at Hokkaido U. in Japan

The subarctic frontal zone (SAFZ) in the North Pacific is the boundary between the wind-driven subtropical gyre and the subarctic gyre. Recently, it was found that quasi-stationary jets (QSJs) originating in the Kuroshio Extension transport warm and salty water to the subarctic gyre through the SAFZ. The jet is located over the Eastern flank of a topographic mound in the subarctic gyre although it is as high as 500 m in the deep Pacific Ocean of a total depth of 5500 m. In this

study we present a formation mechanism of the QSJs from a point of view of baroclinic Rossby wave characteristics derived from the ocean reanalysis data provided by the Japan Coastal Ocean Prediction Experiment.

Characteristics of baroclinic Rossby waves are affected significantly by the barotropic flow in high latitudes where the planetary beta is small and stratification is weak. Here we show that a characteristic curve originating in the subtropical gyre and that originating in the subpolar gyre meet and form a hyperbolic point where the QSJ is present. A surface baroclinic jet is formed along the characteristics that diverge from the hyperbolic point, because the pycnocline depth varies discontinuously across these diverging characteristics. The clockwise barotropic flow over the low-altitude mound in the subarctic gyre is important because the baroclinic Rossby waves propagate southward to the hyperbolic point along the characteristics that are deformed by the barotropic flow. The formation mechanism will be discussed further by numerical experiments using a simple two-layer model.

Contribution of mesoscale eddies in the carbon subduction in the Southern Ocean

Clothilde Langlais[1], Steve Rintoul[1]
[1]*CSIRO Ocean and Atmosphere, Hobart, Australia*

Circulation and dynamics (Session Three)
University House Hall, June 3, 2015, 1:45 PM – 3:45 PM

Biography:
Clothilde Langlais began her Physical Oceanographic career as a PhD at the University of Toulon, France. Dr Langlais is now an OCE postdoctoral research fellow at CSIRO Hobart. Her experience lies in numerical modelling approaches to Oceanography and research activities deal with ocean circulation and dynamics.

The capacity of the ocean to store and sequester Anthropogenic Carbon (Cant) is set by the ocean overturning circulation which transfers Cant from the surface into the deep ocean. However, both the pathways and rate by which Cant is sequestered in the ocean interior remain uncertain, partly due to a lack of understanding of the role of mesoscale eddies. Here we show the influence of mesoscale eddies on the rate of subduction and Cant sequestration using an eddy resolving global ocean model. We compare the vertical eddy transfers through the winter mixed layer with the divergence of eddy fluxes parameterized using the slope of isopycnals (Gent and Mc Williams parameterization). The parameterized eddy fluxes, used in low resolution ocean models and in observational estimate of subduction rate, tend to compensate the Ekman pumping with a homogeneous spatial pattern. In contrast, in the eddy resolving model, the time mean effect of the eddies reveals stationary topography-induced Rossby-wave patterns of the vertical transfers of Cant, with enhanced reventilation downstream of topographic obstacle and some regional enhancement of Cant subduction along the ACC path. Moreover, the transient effect of mesoscale eddies on mass fluxes leads to an enhancement of the subduction rate in the density classes associated with SAMW and AAIW. Finally, we try to reconcile these results with the theoretical representation of the Southern Ocean where transient eddy-fluxes act to counteract the wind-forced circulation.

Centrifugal instability - A novel submesoscale mixing mechanism

William Dewar[1],
[1]*The Pierre Welander Professor of Oceanography, Florida State University, USA*

Circulation and dynamics (Session Three)
University House Hall, June 3, 2015, 1:45 PM – 3:45 PM

Coastal currents running in the direction of topographic waves are considered, an example is the California Undercurrent. Bottom boundary layer interactions of the current generate relative vorticities of O(-10f) and so meet the necessary conditions for centrifugal and symmetric instability. We argue at points of current separation from the coast, the former is preferred and generates energetic mixing events. Process studies of centrifugal instability argue it is relatively efficient at mixing and possibly approaches the theoretical maximum efficiency. It is suggested that this is a generic coastal process.

Isoguchi Jets: Conduits from subtropical to subarctic Pacific Ocean

Toru Miyama[1], Humio Mitsudera[2], Yasumasa Miyazawa[1]
[1]*Japan Agency for Marine-Earth Science and Technology, Yokohawa, Japan,* [2]*Hokkaido University, Sapporo, Japan*

Circulation and dynamics (Session Three)
University House Hall, June 3, 2015, 1:45 PM – 3:45 PM

Biography:
Current position: Senior Scientist
2003- present: Japan Agency for Marine-Earth Science and Technology
1997 – 2002: Visiting Researcher to the International Pacific, Research Center
1997: PhD (Science), Kyoto University, Division of Earth and Planetary Sciences

It is known that a quasi-stationary jet [referred to as J1 in Isoguchi et al. (2006), and hereafter the first Isoguchi Jet] flows along the Northern part of the Kuroshio/Oyashio mixed water region in the Western Pacific Ocean. Observations (Isoguchi et al. 2006, Wagawa et al. 2014) have shown that the jet transports saline water in the subtropical Pacific Ocean to the subpolar region. To investigate how the subtropical water is transported through the first Isoguchi Jet, numerical particles were tracked using an ocean reanalysis dataset from the Japan Coastal Ocean Predictability Experiment (JCOPE2). Particles released from the region near the first Isoguchi Jet (152-158°E, 42-45°N) are tracked for one-year periods from the 15th of each month during the years 1994–2013 with daily velocity of the JCOPE2

reanalysis at 30 m depth. Backward particle tracking shows that the particles originating from the Kuroshio spreads north of the Kuroshio Extension, suggesting that eddies are important in the transport process. The number of particles that returned to the region South of 36°N within one year varies greatly with time, from 8.6% to 60.2% of the total particles. The numbers show a correlation to the monthly latitude of the Kuroshio Extension after applying13-month running mean (0.52 when the latitude leads by 8 months). Forward particle tracking shows that a part of particles flows northeastward, which indicating a route along Western subpolar gyre, while another part of the particles are trapped in another jet [referred to as J2 in Isoguchi et al. (2006)].

The impact of subtropical counter current eddies on Kuroshio transport off East China Sea

Mao Cheng Huang[1], Yu Lin Chang[1], Yasumasa Miyazawa[2]
[1]National Taiwan Normal University, Taipei City, Taiwan, [2]Japan Agency for Marine-Earth Science and Technology, Yokohama City, Japan

Circulation and dynamics (Session Three)
University House Hall, June 3, 2015, 1:45 PM – 3:45 PM

Biography:
Mr Huang is a master student. Yu Lin *Chang is an Assistant Professor.* Yasumasa *Miyazawa is a full Professor.*

In this study, 20 years JCOPE2 reanalysis data is used to study the effect of mesoscale eddies on Kuroshio east of East China Sea. These eddies come from Subtropical Counter Current (STCC) region, where is recognized as baroclinically unstable area. In eddy-rich years, upstream Kuroshio is stronger and deeper. The Kuroshio path also shifts eastward. Generally, the warm eddies increase Kuroshio transport and the cold eddies weaken the Kurshio. However, the exceptions are also observed due to the related location where eddies passed by. According to geostrophic relation, transport is calculated taking the sea surface height difference (ΔSSHA) from two sides of current. Gawarkiewicz et al. (2011) proposed the sea surface height anomaly (SSHA) at (123.2° E,23.9° N) can be the proxy of Kuroshio transport based on the good correlation between the SSHA and 20 months observed Kuroshio transport. We explain their idea and extend the time period using satellite altimeter data. The result shows that the SSHA variability at open ocean side has much greater magnitude than the near-shore side due to the effect of STCC eddies. The Kuroshio transport variation (ΔSSHA of two sides) is mainly influenced by the SSHA on oceanic side, so that the single station can serve as the proxy of Kuroshio transport. We apply this idea along the Kuroshio path. The result shows that single points SSHA variability on the open ocean side can account for the Kuroshio variability in STCC eddy effective area. This results address the importance of eddies on Kuroshio transport.

Circulation and dynamics (Session Four)

Wednesday 3 June, 2015, 4:15 PM – 5:35 PM, University House Hall

Jet-topography effects on horizontal eddy mixing in the Southern Ocean

Alice Barthel[1,2], Stephanie Waterman[2,3], Andy Hogg[2,4]
[1]University of New South Wales, Climate Change Research Centre, Sydney, Australia, [2]ARC Centre of Excellence for Climate System Science, UNSW Sydney, Sydney, Australia, [3]University of British Columbia, Earth- Ocean and Atmospheric Sciences, Vancouver, Canada, [4]Australian National University, Research School of Earth Sciences, Canberra, Australia

**OYSA presentation*

Circulation and dynamics (Session Four)
University House Hall, June 3, 2015, 4:15 PM – 5:35 PM

Biography:
Alice's PhD research at UNSW focuses on eddy mixing processes in the Southern Ocean, in particular on jet-eddy-topography interactions using an idealised model. Alice completed a MSc Oceanography in Southampton (UK) researching Agulhas Undercurrent variability, and also worked in Grenoble (France) on intrinsic variability of the ocean at interannual timescales.

The Southern Ocean is a region of strong eastward jet flows and intense eddy activity. Studies suggest that topography plays an important role in steering these jets and setting the location of enhanced eddy activity, which has significant implications for the meridional transport of tracers such as heat and nutrients across the jets. The dominant processes that set the intensity and distribution of eddy activity and the horizontal eddy mixing in the vicinity of topography are yet to be identified. Understanding the physical processes governing these eddy effects will reveal the dependence of eddy mixing on key parameters, allowing prediction of future changes and development of physically-based eddy parameterizations. We report on a theoretical study that investigates the effects of jet-topography interactions on eddy dynamics and the mixing of tracers. We use a quasigeostrophic model of a zonally-evolving unstable jet impinging on topography in a configuration relevant to an Antarctic Circumpolar Current frontal jet. We examine the spatial patterns of surface eddy kinetic energy and irreversible mixing of tracers, and explore their dependence on system parameters such as topography height, stratification and inflowing jet stability. Mixing is generally strongest in the lee of topography, however the relationship between the strength of the eddy field (estimated from eddy kinetic energy) and mixing is not straightforward. In addition, we find parameter regimes in which mixing occurs in front of the topography. These results suggest there is much more to learn about the mechanisms underlying jet-eddy-topography interactions and their representation in ocean models.

A study on meso-scale eddies off the Fraser Island, North-eastern Australia and its possible mechanisms

Zhibing Li[1], Xiao Hua Wang[1,2,3], Jianyu Hu[4]
[1] School of Physical, Environmental and Mathematical Sciences, UNSW Canberra, Canberra, Australia, [2]Key Laboratory of Physical Oceanography, Ministry of Education, Ocean University of China,, Qingdao, China, [3]State Key Laboratory of Satellite Ocean Environment Dynamics, 2nd Institute of Oceanography, State Oceanic Administration, Hangzhou, China, [4]State Key Laboratory of Marine Environmental Science, College of Oceanography and Environmental Science, ,Xiamen University, Xiamen, China

Circulation and dynamics (Session Four)
University House Hall, June 3, 2015, 4:15 PM – 5:35 PM

Biography:
Zhibing Li has a mathematics bachelor background and worked on marine geography during her masters study. Currently, her major is in physical oceanography and focuses on sediment transport modelling for the Great Barrier Reef area.

The East Australian Current (EAC) induced eddies offshore New South Wales coast are well studied in the last few decades. However, the existence and structures of the meso-scale eddies off the Fraser Island have been rarely discussed. In this paper, meso-scale eddies off the Fraser Island in the north eastern Australia formed in July 2009 and dissipated in October 2009 were observed by satellite and studied based on Bluelink, altimeter and Argo data. The results detailed the horizontal vertical structure of the dipole in terms of its temperature and velocity variability. A warm eddy (WE) formed besides the EAC and had relative uniform diameter of 160 km from the top to the bottom with trapped water mass of 3.8 x 10^{13} m^3. A cold eddy (CE) which generated ten days later had diameter of 166 km and a mixed layer depth extending to over 800 m in the core. The total water mass trapped by the CE are roughly 6.33 x 10^{13} m^3. Horizontal heat and salt transports by the WE and CE are calculated to be 6.36 W, 1.25 W and 6.84 kg s^{-1}, 7.03 kg s^{-1}, respectively,

Impacts of SCSTF on seasonal and interannual variability of ITF

Mingting Li[1], **Jun Wei[1]**
[1]Department of Atmospheric and Oceanic Sciences, Peking University, Peking, China

Circulation and dynamics (Session Four)
University House Hall, June 3, 2015, 4:15 PM – 5:35 PM

Biography:
Not available at the time of printing

Based on a high-resolution ocean model in the northern Pacific, this study examined impacts of the South China Sea Through Flow (SCSTF) on seasonal and interannual variability of the Indonesian Through Flow (ITF). By compared to in-situ INSTANT measurements, the model was able to reproduce reasonably well the seasonal and interannual variability of the ITF during 2004 to 2011. The ITF is a part of the southward branch of the North Equatorial Current (NEC) through Mindanao strait, but can be modulated by NEC's northward branch through the SCSTF. The model results showed that the seasonal variability of ITF is controlled by seasonal variations of the NEC transport and NEC bifurcation, and secondarily by the SCSTF through the Mindoro-Sibutu strait and through the Karimata strait. For the interannual variability, both of the NEC transport and NEC bifurcation are the factors to control ITF variability, and both of them are strongly affected by ENSO signals through oceanic passages. The NEC transport is negatively correlated to Nino index transferred to the ITF through the Mindanao strait. However, The NEC bifurcation is positively correlated to Nino index. And the branch of the SCSTF through the Luzon-Mindoro-Sibutu straits is positively correlated to Nino index and therefore modulates the ITF in a reversed manner. On the other hand, the branch of the Karimata Strait seems uncorrelated to the ENSO signals and plays a less important role on ITF's interannual variability.

Impacts of tidal-mixing parameterization on the simulation of the South China Sea circulations

Peng Shiqiu[1], Wang Xiaowei
[1]South China Sea Institute of Oceanology, Guangzhou, China

Circulation and dynamics (Session Four)
University House Hall, June 3, 2015, 4:15 PM – 5:35 PM

Biography:
Peng Shiqiu has worked in South China Sea Institute of Oceanology from 2009. Ms Wang is a doctoral student.

A parameterization of three-dimensional climatologically vertical diffusivity driven by internal tides is implemented in a regional ocean model to simulate the circulations of the SCS. This new tidal-mixing parameterization scheme takes into account the local and non-local energy dissipation of internal tides in the South China Sea (SCS) and Luzon Strait (LS) and thus enhances vertical mixing in the SCS basin significantly compared to the scheme of St. Laurent et al. (LSJ02) that only takes into account the local energy dissipation of internal tides. Results from experiments with different vertical diffusivity parameterization schemes show that the simulated stratification of the deep SCS and water transport of the LS by the new tidal mixing scheme are more stable and much closer to the previous observation reports, which suggests that the non-local dissipation of internal tides is a non-negligible energy source for the vertical mixing in the SCS and thus is important for the maintenance of the deep water transport in the LS and the circulations in the SCS. Moreover, obvious differences between the new scheme and the LSJ02 scheme are seen in the deep currents and meridional overturning circulation in the SCS, which needs further verification against observations in the future.

Gravity currents down canyons: Effects of rotation

Jarle Berntsen[1], Elin Darelius[1], Helge Avlesen[2]
[1]University of Bergen, Norway, Bergen, Norway, [2]Uni Research, Bergen, Norway

Highlighted presentation

Waves, currents and their interactions in coastal and shelf seas
University House Hall, June 4, 2015, 08:00 AM – 10:20 AM

Biography:
Jarle Berntsen has worked on ocean modeling since 1990 and is the main author of the BOM (the Bergen Ocean Model)

The flow of dense water in a V-shaped laboratory scale canyon is investigated by using a non-hydrostatic numerical ocean model. Due to the earth's rotation, there is a secondary cross-canyon circulation superimposed on the down-canyon flow. The cross-canyon circulation affects the mixing and may accordingly affect the meridional overturning circulation. With rotation, the flow speeds down the canyon are reduced and the flow become more laminar. Even so, the mixing increases substantially due to the secondary circulation when rotation is included.

Investigation of wave-current interaction over the Eastern Canadian Shelf using a coupled circulation-wave model

Jinyu Sheng[1], Pengcheng Wang[1]
[1]Dalhousie University, Halifax, Canada

Waves, currents and their interactions in coastal and shelf seas
University House Hall, June 4, 2015, 08:00 AM – 10:20 AM

Biography:
Jinyu Sheng is a Professor in physical oceanography at Dalhousie University. He also holds the Research Chair in modelling and prediction of extreme marine events funded by Lloyd's Register Foundation.
Pengcheng Wang is a PhD Student in Physical Oceanography supervised by Jinyu Sheng in the Department of Oceanography, Dalhousie University.

This study examines wave-current interactions over the eastern Canadian shelf during Hurricane Juan in 2003 using a coupled circulation-wave modelling system. The coupled system is based a 3D ocean circulation model (DalCoast) coupled to WAVEWATCH III to enable integrating oceanic and wave processes. The 3D radiation stress and wave-enhanced vertical mixing are implemented in DalCoast to account for effects of waves on the 3D ocean currents. The 3D ocean currents modify wave fields by entering the wave action equation and changing the wind input to the wave model. The coupled system is driven by the Climate Forecast System Reanalysis winds. An asymmetric Holland-type vortex is inserted to better resolve hurricane winds. DalCoast is forced by tides, the net heat and freshwater fluxes and freshwater runoff. The results produced by the coupled system demonstrate wave-current interaction plays a significant role in coastal and shelf dynamics during Juan. In comparison with observations, simulated wave fields are significantly improved during and after the highest winds occurrences by accounting for current effects. On the right hand side of the hurricane track, where currents are strong and almost propagated in the same direction as waves, the maximum significant wave height (SWH) could be reduced by up to18%. On the left hand side, the magnitudes of currents are relatively weak, and the maximum SWH does not change very much. For the effects of waves on currents, relatively strong wave-induced surface currents (~30 cm/s) are generated near the coast, along the shelf break and the hurricane track.

Modelling of internal waves in the Celtic Sea

Nataliya Stashchuk[1], Vasyl Vlasenko[1]
[1]Plymouth University, Plymouth, United Kingdom

Waves, currents and their interactions in coastal and shelf seas
University House Hall, June 4, 2015, 08:00 AM – 10:20 AM

Biography:
Nataliya Stashchuk started her job at the Marine Hydrophysical Institute (Sevastopol, Ukraine). In 1999 she moved to Germany to Darmstadt University of Technology. Since 2005 she has been with Plymouth University (UK) as a Senior Research Fellow.

The three-dimensional dynamics of baroclinic tides in the shelf-slope area of the Celtic Sea was investigated numerically and using observational data collected on the 376th cruise of the RV ''RRS Discovery'' in June 2012. The time series recorded at a shelf break mooring showed that semidiurnal internal waves were accompanied by packets of internal solitary waves with maximum amplitudes up to 105 m, the largest internal waves ever recorded in the Celtic Sea. The observed in situ intensification of tidal bottom currents at the shelf break mooring is explained in terms of a tidal beam that was formed over supercritical bottom topography at the mooring location. It was found that internal solitary waves generated over the shelf break and propagated seaward did not survive in the course of their evolution. They disintegrated to higher baroclinic modes locally over the continental slope. However, in the open part of the sea internal solitary waves were found to be generated by a baroclinic tidal beam which was radiated from the shelf break downward to the abyss and returned back to the surface where it hit the seasonal pycnocline. Due to the sharp changes of vertical fluid stratification in the main pycnocline a large proportion of the tidal beam energy that propagated

downward did not reach the bottom but reflected upward from the layered pycnocline and returned back to the seasonal pycnocline where it generated some extra higher mode internal wave systems, including internal wave breathers.

Manifestation of internal tidal waves on the sea surface off the North-Eastern Japan from PALSAR SAR images and ocean modeling

Sergey Varlamov[1], Hitoshi Tamura[1], Yasumasa Miyazawa[1]
[1]JAMSTEC, Yokohama, Japan

Waves, currents and their interactions in coastal and shelf seas
University House Hall, June 4, 2015, 08:00 AM – 10:20 AM

Biography:
Graduated Leningrad Hydrometeorological Institute (Russia), got doctoral degree in Moscow Hyrdometeorological Center of Soviet Union. Worked in Russian, Japanese and French research organizations. Now in JAMSTEC, Japan.

Synthetic aperture radar (SAR) images often demonstrate linear wave-like streaks on the sea surface over the shelf zones off the Eastern coast of Japan. Usually these features are treated as manifestation of tidal internal gravity waves on the sea surface. This is confirmed by high resolution regional tide-enabled ocean simulation for this area. On the sea surface internal tidal waves are accompanied by zones of surface sea current convergence and divergence. Position of simulated convergence zones is consistent with position of the sea surface streaks detected in the SAR images. But this resolution does not allow resolving the narrow shape of observed signal. Increasing model horizontal resolution to 0.5 km significantly modifies characteristics of simulated internal gravity waves propagating over the shelf: convergence zones on the sea surface become much more intensive and narrow compared to wider and weaker zones found in the coarser grid model. Surface convergence zones correspond well to the position of observed surface structures on the SAR images. The internal tidal gravity waves over the shelf zone could show very variable propagating patterns as result of distributed (non-localized) generation with following interference of these waves, impact of ocean currents etc. In such circumstances good consistency between available observations of surface wave-like structures on the SAR images and modeled position of surface convergence zones confirms that observed structures are generated by impact of internal tidal waves on the sea surface conditions that change its SAR reflectivity, and potentially could allow to improve analysis of SAR images.

The role of wave-current interactions in marine renewable energy near Japan

Adrean Webb[1], Takuji Waseda[1], Keiji Kiyomatsu[1]
[1]The University of Tokyo, Kashiwa, Japan

Waves, currents and their interactions in coastal and shelf seas
University House Hall, June 4, 2015, 08:00 AM – 10:20 AM

Biography:
Adrean Webb is interested in modeling geophysical flow for a wide range of scales using the latest advances in mathematical and numerical analysis. www.adreanwebb.com

Energy harvested from surface ocean waves and currents has the potential to be a significant source of green energy, particularly for countries with extensive coastlines such as Japan. As part of a larger marine renewable energy project*, The University of Tokyo (in cooperation with JAMSTEC) is conducting a state-of-the-art wave resource assessment (with uncertainty estimates) to assist with generator site identification and construction in Japan.

Previous wave assessments in Japan have been based on a simplified wave power density approximation and have neglected depth and current effects. A portion of this new publicly-available assessment will be based on a 20-year high-resolution NOAA WAVEWATCH III (version 4.18) simulation with NCEP CFSR wind and JCOPE-T current and tidal forcings. So far, considerable differences have been found when the aforementioned effects are included, particularly for regions near the Kuroshio. Here, we will briefly analyze the wave power density equation, discuss the model setup, and present wave-current interaction results from the ongoing assessment.

*New Energy and Industrial Technology Development Organization (NEDO): "Research on the Framework and Infrastructure of Marine Renewable Energy; an Energy Potential Assessment".

Tidal-cycle variations on mixing and stratification and their relationship to residual flow in micro-tidal estuary

Ziyu Xiao[1], Xiao Hua Wang[1]
[1]UNSW Canberra, Canberra, Australia

**OYSA presentation*

Waves, currents and their interactions in coastal and shelf seas
University House Hall, June 4, 2015, 08:00 AM – 10:20 AM

Biography:
Amanda conducted her MPhil studies from the Ocean Technology Group, University of Sydney on ocean nourishment and upwelling process studies in the Sulu Sea. After that Amanda joined an industry consultancy as a coastal/water resources engineer for 3.5 years specializing in advanced numerical modelling on surface waves, waterway flows etc.

In this study we have focused on isolating and determining the magnitude of the different forcing mechanisms (such as tides, winds, river discharges and horizontal salinity gradients) responsible for temporal and spatial variations on mixing and stratification conditions in the Sydney Harbour Estuary. Three-dimension coastal ocean model was used as a tool to reproduce the current and salt structure in water column within the estuary and was calibrated with field measurement data. River discharge and horizontal salinity gradients were found to induce more permanent

stratification during neap tides and tidal straining occurred with stronger stratification during ebb tides. Asymmetries in turbulent mixing and stratification during tidal cycles induced by two mechanisms: tidal oscillations over variable bathymetry and buoyancy inflow with a longitudinal salinity gradient, allowed for the development of residual flow.

High resolution modelling of horizontal dispersion in shear currents

Vasiliy Vlasenko[1], Nataliya Stashchuk[1], Mark Inall[2], Dimitry Oleinik[2]
[1]Plymouth University, Plymouth, United Kingdom, [2]Scottish Association for Marine Science, Oban, United Kingdom

Highlighted presentation

Waves, currents and their interactions in coastal and shelf seas
University House Hall, June 4, 2015, 08:00 AM – 10:20 AM

Biography:
1980-1999, - Marine Hydrophysical Institute, Sevastopol
1999-2003, - Darmstadt University, Germany
2003-now, Plymouth University, UK

The ability of a hydrodynamic model to reproduce the results of a dye release experiment conducted in a wide shelf sea environment was investigated with the help of the Massachusetts Institute of Technology general circulation model (MITgcm). In the field experiment a fluorescent tracer, Rhodamine WT, was injected into the seasonal pycnocline, and its evolution was tracked for two days using a towed undulating vehicle equipped with a fluorometer and a CTD. With a 50 m horizontal resolution grid, and with three different forcings initialized in the model (viz: tides, stationary current, and wind stress on the free surface), it was possible to replicate the dye patch evolution quite accurately. The mechanisms responsible for the enhancement of horizontal dispersion were investigated on the basis of the model results. It was found that enhancement of the dye dispersion was controlled by vertically sheared currents that, in combination with vertical diapycnal mixing, led to a substantial increase in the ‘‘effective’’ horizontal mixing. The values of ‘‘effective’’ horizontal mixing found from the model runs were in good agreement with those obtained from in-situ data, and the probable degree to which the observational techniques undersampled the dye patch was revealed.

Multi-scale ocean and atmospheric processes

Thursday 4 June, 2015, 10:50 AM – 12:30 PM, University House Hall

Can surface buoyancy forcing drive large scale ocean gyres?

Andy Hogg[1], Bishakh Gayen[1]
[1]The Australian National University (ANU), Canberra, Australia

Highlighted presentation

Multi-scale ocean and atmospheric processes
University House Hall, June 4, 2015, 10:50 AM – 12:30 PM

Biography:
Andy Hogg is a physical oceanographer who has contributed to an understanding of the dynamics of global-scale ocean circulation, with an emphasis on the Southern Ocean and high resolution ocean models.

Ocean circulation is driven by a combination of surface wind stress and surface buoyancy forcing. Recent research has shown that the Antarctic Circumpolar Current (traditionally described as a wind-driven current) may be controlled primarily by buoyancy input. In this presentation we will investigate the extent to which the midlatitude subtropical and subpolar gyres may also be driven by surface buoyancy fluxes.

A series of idealised numerical model simulations, in which wind stress and buoyancy flux are varied independently and together, are used to understand the relative importance of these two types of forcing. Surprisingly, we observe that large-scale gyres at the basin scale, and western boundary currents with realistic magnitudes, remain even in the absence of mechanical forcing by surface wind stress.

These numerical results support the notion that surface buoyancy forcing can reorganise the potential vorticity in the ocean in such a way as to drive basin-scale gyres.

Temperature at a mooring in Northern South China Sea and its connection with surface heat flux, wind and eddies

Yuchun Lin[1], Leo Oey[1,2], Shih-Ming Huang[1], Yih Yang[3], Kon Kee Liu[1]
[1]National Central University, Taoyuan, Taiwan, [2]Princeton University, USA, [3]Taiwan Ocean Research Institute, Taiwan

**OYSA presentation*

Multi-scale ocean and atmospheric processes
University House Hall, June 4, 2015, 10:50 AM – 12:30 PM

Biography:
Yuchun Lin is a third year PhD student of Leo Oey in National Central University of Taiwan. Leo Oey is Professor in National Central University, who came from Princeton University and built an advanced Taiwan Ocean prediction model (ATOP) in Taiwan.

Twenty-two month temperature profile (from surface to z=-500 m) at a mooring located west-southwest about 450 km from the Luzon Strait in northern South China Sea (NSCS) is analyzed in conjunction with altimetry, CCMP wind, and mixed-layer model forced by the NCEP surface heat flux. EOF [Kutzbach 1967, *J. App. Met*], SVD [Bretherton et al. 1992, *J. Clim*] and EMD [Huang et al.,1999, *Proc. Roy Soc*] methods are used to separate and identify different physical processes and mechanisms. The dominant fluctuations at the mooring are caused (1) by seasonal surface fluxes and local Ekman pumping on the f-plane by the wind stress curl, (2) by eddies west of the Luzon Strait spun up by wind stress curl, and (3) by Rossby waves due to Kuroshio path fluctuations in the Strait. Meso-scale eddies are embedded in the seasonal variation and they are shown to be locally generated by baroclinic instability and penetrate through the entire depth of the mooring.

The difference of MLD from observation and simulation, and its dependence on a diffused thermocline, atmospheric forcing, and parameterization

Yign Noh[1], Hyejin Ok[1], Takahiro Toyoda[2]
[1]Yonsei University, Seoul, South Korea, [2]Meteorological Research Institute, Tsukuba, Japan

Multi-scale ocean and atmospheric processes
University House Hall, June 4, 2015, 10:50 AM – 12:30 PM

Biography:
Prof., Yonsei University (1993 -)
Postdoc, Arizona St. Univ. (1987-1992)
PhD., Johns Hopkins Univ. (1987)
M.S., B.S., Seoul National Univ. (1982, 1980)

With an aim to clarify the factors to cause the difference in the mixed layer depth (MLD) other than the predictability of the OGCM, the simulated MLD from MRI OGCM is compared with the observed MLD from WOA and Argo data. It is investigated how MLD is affected by the method of calculating MLD; for example, from individual, monthly mean, and climatological density profiles, and from different density difference criteria. It is found that the MLD from averaged profiles with the diffused thermocline shows the tendency for underestimation, if stratification is strong and the small density difference criterion is used, and the tendency for overestimation, if stratification is very weak under convection during winter and the large density difference criterion is used. Comparison is also made for the thickness of the thermocline, the month of the maximum MLD, and the interannual variation of MLD such as amplitude and correlation. Furthermore, it is investigated how MLD is affected by the temporal resolution of atmospheric forcing, and how the mixing layer depth based on the vertical diffusion is different from MLD based on the density difference criterion. Based on this result it is estimated how much MLD difference between observation and simulation is due to the different characteristics of the vertical profiles, rather than to the predictability of the OGCM. Discussion is made on whether the MLD difference is due to the different characteristics of the vertical profiles or to the predictability of the OGCM in various cases.

Heat transport in the upper ocean during summer in the North Pacific

Eunjeong Lee[1], Yign Noh[1]
[1]Yonsei University, Seoul, South Korea

**OYSA presentation*

Multi-scale ocean and atmospheric processes
University House Hall, June 4, 2015, 10:50 AM – 12:30 PM

Biography:
BS, Yonsei Univ., Korea (2007)
MS, Yonsei Univ., Korea (2009)
PhD graduate student (2010 -)

The vertical and horizontal heat transports of the upper ocean during summer in the North Pacific are investigated by analyzing observation data (Argo) and OGCM results (MRI OGCM). The downward transport of the surface heat flux (SHF) is found to be largely limited to the upper 100 m depth over the whole ocean. The heat budget of the upper ocean ($z < 100$ m) reveals that the contribution from OHT is much smaller than SHF except along the Kuroshio region in the high-latitude ocean but they are comparable in the low-latitude ocean. The penetration depth of downward heat transport hp, defined by the integrated SHF divided by the net increase of SST over the time period, is calculated, using the net increase of SST obtained by the real SST increase minus the contribution from OHT. It is found that both hp and the mixed layer depth hd, based on the density difference from the surface, are affected by the Coriolis force as well as by the wind stress and SHF, but hp is much deeper than hd at smaller hd, implying a large amount of heat flux penetrating below the MLD. The vertical and horizontal heat transports from the OGCM and Argo data are compared, and information is obtained from the OGCM, including the vertical profiles of heat flux, the contribution of advection and diffusion to the heat transport, the contribution of radiation penetration and vertical diffusion to the heat transport across the MLD, etc.

Investigating sea surface temperature diurnal variation over the tropical warm pool using satellite data from IMOS

Haifeng Zhang[1], Helen Beggs[2], Leon Majewski[2], Christopher Griffin[2], Janice Sisson[2], Andrew Kiss[1], Xiao Hua Wang[1]
[1]UNSW Canberra, Canberra, Australia, [2]Bureau of Meteorology, Melbourne, Australia

**OYSA presentation*

Multi-scale ocean and atmospheric processes
University House Hall, June 4, 2015, 10:50 AM – 12:30 PM

Biography:
Haifeng is investigating sea surface temperature diurnal variation over the Tropical Warm Pool (TWP) using Japanese Multi-functional Transport SATellite (MTSAT-1R) data, AVHRR data, and possibly MTSAT-2 and Himawari 8 data in the future, within the Group for High Resolution SST (GHRSST) for the TWP Diurnal Variability (TWP+) Project.

Diurnal variation (DV) of sea surface temperature (SST) plays an important role in air-sea interaction. The parameterization of DV events is potentially useful in air-sea coupled models for weather, seasonal and climate scales. The Tropical Warm Pool (TWP) in the Eastern Indian and Western Pacific Oceans experiences particularly high diurnal warming of the sea surface temperature, exceeding 5°C under low wind speed and high solar insolation conditions. It is therefore considered to be an ideal region for a coordinated study of DV using observations and models. There are a number of satellite SST data sets especially processed for DV studies currently available through the Integrated Marine Observing System (IMOS). These include the hourly, 4 km resolution, SST observations from the geostationary Multi-functional Transport Satellite (MTSAT-1R) and the newly reprocessed (1992 – 2015), 2 km resolution, High Resolution Picture Transmission (HRPT) Advanced Very High Resolution Radiometer (AVHRR) SSTs from NOAA polar-orbiting satellites (http://imos.org.au/sstproducts.html). Both IMOS data sets contribute to the “TWP+ data set”, a comprehensive dataset (1 January to 30 April 2010) used to quantify DV events and test DV models as part of the Group for High Resolution SST (GHRSST) Tropical Warm Pool Diurnal Variability (TWP+) Project. Further information can be found at https://www.ghrsst.org/ghrsst/tags-and-wgs/dv-wg/twp/.

The work will include the validation of the new HPRT AVHRR and MTSAT-1R SST data, and the quantification of the amplitude, frequency and spatial coverage of DV events over the TWP domain using these data sets – an important contribution to the TWP+ Project.

Coupled bio-physical ocean models (Session One)

Thursday 4 June, 2015, 2:30 PM – 3:50 PM, University House Hall

Investigating the northern Adriatic Sea ecosystem state with a very high resolution model

Gelsomina Mattia[1,2], Marco Zavatarelli[1,2], Tomas Lovato[3], Simone Colella[4]
[1]University of Bologna, Physics and Astronomy Department, Bologna, Italy, [2]National Interuniversity Marine Sciences Consortium, Rome, Italy, [3]Euro Mediterranean Climate Change Center, Bologna, Italy, [4]National Research Council, Institute for Climate and Atmospheric Research, Rome, Italy

Coupled bio-physical ocean models (Session One)
University House Hall, June 4, 2015, 2:30 PM - 3:50 PM

Biography:
Research staff member at the Physics and Astronomy Department and at the Interdepartment Center for Environmental Sciences of the Bologna University. Dr Mattia holds a doctorate in Marine Sciences and Engineering. Dr Mattia's main scientific activity is in the field of numerical modelling of the ocean general circulation and ecosystem dynamics.

High resolution simulations of the northern Adriatic sea ecosystem dynamics are presented and discussed. The modelling system is constituted of the on-line coupling between the BFM (Biogeochemical flux model) and NEMO (Nucleus for European Modelling of the Ocean). The BFM is a generalized model of marine biogeochemistry that employs a biomass-based, multiple-nutrient description of lower trophic levels in the marine ecosystem. The ocean model is a primitive equation model based on a grid of 800 m horizontal resolution and 48 vertical levels.

The presentation focuses on the evaluation of the ecosystem attributes (vigor, organization, resilience), in order to understand the ecosystem state of the basin with respect to the so-called “Good Ecosystem State” (GES) as defined by the EU-MSF9 Directive. Simulation in hindcast and projection mode were performed with emphasis on the primary producers and trophic exchange networks representing northern Adriatic ecosystem. In particular, we compared numerical results of time series of primary production and phytoplankton type classes and satellite data for the period 1998-2010. This is a contribution of the EU funded project "PERSEUS" (Policy oriented Environmental Research in the Southern European Seas).

The nutrient and biomass cycle in San Francisco Bay during high and low river flow years: A numerical study.

Shivanesh Rao[1], Fei Chai[1], Huijie Xue[1], Yi Chao[2], Richard Dugdale[3]
[1]School of Marine Sciences, University of Maine, Orono, USA, [2]Remote Sensing Solutions Inc., Pasadena, USA, [3]Romberg Tiburon Center, San Francisco State University, Tiburon, USA

Coupled bio-physical ocean models (Session One)
University House Hall, June 4, 2015, 2:30 PM - 3:50 PM

Biography:
The authors are experts in nutrient cycles in deep ocean, coastal oceans and estuaries. The presenter is working under their guidance to present a nutrient modeling product for San Francisco Bay.

The CoSiNE ecosystem and SCHISM hydrodynamic model are coupled to study the nutrient and biomass cycles in the San Francisco Bay. The CoSiNE ecosystem model computes nitrates, silicates, ammonium, small phytoplankton, diatoms, micro- & meso- zooplanktons, detritus nitrogen, detritus silicate, phosphate, dissolved oxygen, total CO_2 and total alkalinity. This coupled model forms part of the framework for ecosystem-based management and ecological risk assessment for the California fisheries and water management. The ecosystem model is constrained using nutrient fluxes along its ocean boundary from the Pacific-ROMS-CoSiNE model, and at its river boundaries is a constrained using USGS water quality observation for the Sacramento, San Joaquin, Napa rivers and the Coyote Creek sewage plant discharge. The ecosystem model output is tested successfully against the June-July 2009 USGS water quality observations. A 10-year simulation (2004-2014) is conducted to study the long-term cycle of the bay nutrients. Our study examines the nutrient cycle of the bay for two contrasting years: 2011 (a high river flow year) and 2012 (a low river flow year). Initial results show that the coupled model output matches well with the USGS observations for the nutrient distribution along the bay. The model outputs are used to understand how the nutrient fluxes changes in the bay in response to the river forcing.

Future changes of nutrient dynamics and biological productivity in California current system

Fei Chai[1], Peng Xiu[2], Enrique N. Curchitser[3]
[1]School of Marine Sciences, University of Maine, Orono, USA, [2]State Key Laboratory of Tropical Oceanography, South China Sea Institute of Oceanology, Chinese Academy of Sciences, China, [3]Department of Environmental Sciences, Rutgers University, U.S.A.

Coupled bio-physical ocean models (Session One)
University House Hall, June 4, 2015, 2:30 PM - 3:50 PM

A leading hypothesis relating ocean productivity and global warming is that warming increases upper ocean stratification and decreases vertical mixing, thus hampers vertical exchange of nutrient across the pycnocline and declines productivity in the upper ocean. Eastern boundary upwelling ecosystems such as the California Current System (CCS) are productive regions sustained by the supply of cool and nutrient-rich waters to the sunlit surface layer controlled mostly by alongshore winds. High sea surface temperature in this region has been observed to correlate with low biological production. Alternatively, global warming under the influence of increased greenhouse gases was hypothesized to not be uniform: land will heat up faster than the ocean. This would create an ocean-land contrast in atmospheric pressure and lead to stronger upwelling-favorable winds. A more recent study has further verified this hypothesis and predicted the intensification of coastal upwelling in the eastern boundary ecosystems under climate change. Nevertheless, a critical question emerges: how do the warming-induced stratification and intensification of upwelling-favorable winds come to play in terms of changes in ocean productivity in the coastal upwelling region?

To answer this question, we used a coupled and nested physical-biogeochemical model to examine and predict changes in the physical and biogeochemical fields by the end of 2050. The large global model is an earth system model with dynamic atmosphere-ocean general circulation and marine biogeochemistry dynamics developed at NOAA's Geophysical Fluid Dynamics Laboratory (GFDL). The nested regional model was based the Regional Ocean Modeling Systems (ROMS) coupled to a biogeochemical model CoSiNE-31. Both the ROMS and CoSiNE models have been extensively tested and evaluated with satellite and in-situ measurements in this region. We set the regional model with a mesoscale spatial resolution in order to examine eddy and front activities under climate change, which has been generally ignored by previous future projection work based on global models. The global model was forced by the emission scenario RCP8.5 with rising radiative forcing reaching 8.5 W/m^2 in 2100. The full model was run from 1970 to 2050 and model outputs from two periods were analyzed (present: 1990-2009 and future: 2030-2049). Consistent with previous studies, the model has predicted increased upwelling intensity associated with stronger alongshore winds in the coastal region, and enhanced upper stratification in the open ocean. We found these two changes both contribute to the increased vertical nutrient flux and biological productivity in the coastal region. Warming in the open ocean pushes isothermals down to make contact with water masses with higher nutrient concentrations. While in the coastal region, isothermal deepening is seriously weakened by the enhanced upwelling. The difference of isothermal deepening between the open ocean and the coast reflecting the basin-scale adjustment creates elevated onshore nutrient transport that will increase nutrient concentrations of the upwelling source water and be eventually upwelled to the sunlit layer supporting higher productivity in the coastal region. We found this basin-scale adjustment of nutrient plays a larger contribution than the enhanced wind-generated upwelling in terms of vertical nutrient flux (product of velocity and nutrient concentration) increase in the coastal region. Our model also predicted increasing eddy activities in the CCS that will increase vertical nutrient transport mostly in the coastal region. This study takes advantage of high-resolution models and highlights mechanisms of future productivity enhancements in the coastal upwelling ecosystems.

Modeling spring-summer phytoplankton bloom in Lake Michigan with and without riverine nutrient loading

Jia Wang[1], Lin Luo[2]
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Coupled bio-physical ocean models (Session One)
University House Hall, June 4, 2015, 2:30 PM - 3:50 PM

A coupled physical-biological model is used to simulate the ecosystem characteristics in Lake Michigan. The physical model is the unstructured grid, Finite-Volume Coastal Ocean Model (FVCOM). The biological model is a NPZD model, including phosphorus as the nutrient, which is the limiting element in Lake Michigan, phytoplankton, zooplankton and detritus. The models are driven by observed hourly meteorological forcing in 1998 and the model results are calibrated by satellite and in situ data. There were two phytoplankton blooms captured by remote sensing in Lake Michigan in 1998, one from March to May, and one during June. In this paper, those phytoplankton blooms have been simulated by a coupled physical-biological model, driven by observed meteorological forcing in 1998. The model reasonably reproduced the lake currents. The biological model results, with and without riverine nutrient loading, were compared with the remote sensing data. A 3-month-long donut-like phytoplankton bloom that appeared in southern Lake Michigan was well simulated only when riverine input was included, indicating the importance of riverine nutrient input for supporting the growth of phytoplankton in Lake Michigan. The model with riverine input also simulated well the results for a second event-driven phytoplankton bloom during June that occurred in mid-south Lake Michigan, which lasted for about 20 days. High chlorophyll concentration that persisted in Green Bay for almost a year was well simulated.

Coupled bio-physical ocean models (Session Two)

Thursday 4 June, 2015, 4:10 PM – 5:30 PM, University House Hall

Ocean circulation, larval retention, and connectivity among coral populations on the Northwest Shelf of Australia

Ming Feng[1]
[1]*CSIRO, Canberra, Australia*

Coupled bio-physical ocean models (Session Two)
University House Hall, June 4, 2015, 4:10 PM - 5:30 PM

The Northwest Shelf of Australia is one of the source regions of the Leeuwin Current, a poleward flowing eastern boundary current in the south-east Indian Ocean. The region also features a number of significant marine reserves and fisheries resources closely juxtaposed with an increasing number of oil and gas facilities as well as growing shipping traffic servicing onshore mining facilities. The shelf circulation on the Northwest Shelf is dominated by the southward flowing Holloway Current that feeds into the Leeuwin Current during the austral autumn and winter; and by the Australian monsoonal wind-driven currents during the austral summer. Tidal currents, tropical cyclones, and Madden-Julian Oscillation are also important factors in driving horizontal and vertical mixing processes on the shelf and in the nearshore environment.

In this study, we use the Rutgers version of the Regional Ocean Modelling System, a 3-dimensional, hydrostatic, primitive equations model, to simulate the shelf circulation of the north-west shelf at 1 km resolution. The model is initialized with temperature and salinity values from the Ocean Forecasting Australia Model and forced by OFAM 3-hourly meteorological forcing and open boundary condition and delivers hourly model outputs during 2003-2010. The tidal currents generated in the model has been assessed by comparison with current measurements from the Integrated Marine Observing System (IMOS) shelf moorings in the region. The model outputs are used to assess the seasonal variations of shelf currents, their interactions with coastal and island features, and the regional connectivity among coral reefs along the coast.

Does bottom roughness determine hypoxic extent? A model intercomparison for the northern Gulf of Mexico

Katja Fennel[1], Robert Hetland[2], Dubravko Justic[3], Dong S. Ko[4], Arnaud Laurent[1], John Lehrter[5], Michael Murrell[5], Lixia Wang[3], Liuqian Yu[1], Wenxia Zhang[2]
[1]*Dalhousie University, Halifax, Canada,* [2]*Texas A&M University, College Station, US,* [3]*Louisiana State University, Baton Rouge, US,* [4]*Naval Research Lab, Stennis Space Center, US,* [5]*Environmental Protection Agency, Gulf Breeze, US*

Highlighted presentation

Coupled bio-physical ocean models (Session Two)
University House Hall, June 4, 2015, 4:10 PM - 5:30 PM

Biography:
Katja Fennel, Professor in the Department of Oceanography at Dalhousie University and Head of the Marine Environmental Modeling Group (http://memg.ocean.dal.ca), has for the past two decades developed numerical models of marine ecosystems and biogeochemistry with particular focus on continental shelf systems and the assimilation of observations into these models.

A large hypoxic zone forms every summer over the continental shelf of the northern Gulf of Mexico because of nutrient and freshwater inputs from the Mississippi/Atchafalaya River System. Several coupled circulation-hypoxia models are

under development for this region in order to improve mechanistic understanding of hypoxia. Here we report initial results of an intercomparison of these hypoxia models, which is being undertaken within the NOAA-funded Coastal & Ocean Modeling Testbed (COMT). Four circulation models are included: two implementations of the Regional Ocean Modeling System (ROMS), one implementation of the Finite Volume Coastal Ocean model (FVCOM), and one implementation of the U.S. Navy's coastal ocean model (NCOM). In order to elucidate the effects of model physics on hypoxia, all circulation models were initially run with the same, highly simplified hypoxia model, which parameterizes oxygen sinks in water column and sediment, and includes air-sea gas exchange. The simplified hypoxia models were found to have surprisingly high predictive skill when compared with their corresponding full biogeochemical models. Oxygen consumption by the sediment was found to be the most important oxygen sink driving hypoxia generation in this region. The thickness of the bottom boundary layer effectively defines the timescale of hypoxia generation, making bottom roughness an unexpected but important factor in determining whether a model is likely to generate hypoxic conditions or not. The second step of the intercomparison will include a detailed analysis of the full ecosystem-hypoxia models. Our ultimate goal is to improve model formulations, hindcasts, forecasts and mechanistic understanding.

Future ecosystem changes built on CMIP5 models and RCP scenarios for North Sea and Baltic Sea

Dhanya Pushpadas[1], Corinna Schrum[1]
[1]University of Bergen, Bergen, Norway

Coupled bio-physical ocean models (Session Two)
University House Hall, June 4, 2015, 4:10 PM - 5:30 PM

Biography:
Dhanya Pushpadas is a PhD student at University of Bergen. Her primary research focuses on the understanding and modeling climate change impacts on the functioning of regional marine systems and regional downscaling techniques.

With the addition of CMIP5 models and scenarios, the demand to explore the uncertainty in regional climate change projections increased. Here, we investigated the potential future climate change impacts to the North Sea and the Baltic Sea ecosystem using a coherent regional downscaling strategy based on the regional coupled bio-physical model ECOSMO. ECOSMO was forced by output from different CMIP5 models and different RCP scenarios. Comparing projected changes with the present day reference condition, all these simulations predicted an increase in Sea Surface Temperature (SST) in both North Sea and Baltic Sea, reduction in sea ice in the Baltic, decrease in primary production in the North Sea and an increase in primary production in the Baltic Sea. Despite these largely consistent results on the direction of the projected changes, our results revealed a broad range in the amplitude of projected climate change impacts. Our study strengthens the claim that the choice of the ESM is a major factor for regional climate projections. The change in oceanic nutrient input appeared to be the major driver for the projected changes in North Sea primary production. We infer that the uncertainty due to CMIP5 inter-model variability is larger than the RCP inter-scenario variability. Pre-industrial simulation shows that internal model variability also accounts to uncertainties in future climate change impact studies in these regions.

Physical–biological coupling induced aggregation mechanism for red tides in low nutrient waters: A modeling approach

Kedong Yin[1], Lai Zhigang[1]
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Coupled bio-physical ocean models (Session Two)
University House Hall, June 4, 2015, 4:10 PM - 5:30 PM

Port Shelter is a semi-enclosed bay in northeast Hong Kong where high biomass red tides are observed to occur frequently in narrow bands along the local bathymetric isobars. Previous study showed that nutrients in the Bay are not high enough to support high biomass red tides. The hypothesis is that physical aggregation and vertical migration of dinoflagellates appear to be the driving mechanism to promote the formation of red tides in this area. To test this hypothesis, we used a high-resolution estuarine circulation model to simulate the near-shore water dynamics based on in situ measured temperature/salinity profiles, winds and tidal constitutes taken from a well-validated regional tidal model. The model results demonstrated that water convergence occurs in a narrow band along the west shore of Port Shelter under a combined effect of stratified tidal current and easterly or northeasterly wind. Using particles as dinoflagellate cells and giving diel vertical migration, the model results showed that the particles aggregate along the convergent zone. By tracking particles in the model predicted current field, we estimated that the physical–biological coupled processes induced aggregation of the particles could cause 20–45 times enhanced cell density in the convergent zone. This indicated that a high cell density red tide under these processes could be initialized without very high nutrients concentrations. This may explain why Port Shelter, a nutrient-poor Bay, is the hot spot for high biomass red tides in Hong Kong in the past 25 years. Our study explains why red tide occurrences are episodic events and shows the importance of taking the physical–biological aggregation mechanism into consideration in the projection of red tides for coastal management.

Hindcast of waves during Typhoon Bolaven(1215) Using SWAN and WWIII

Taerim Kim[1], Jaehyuk Lee[1], Dongsoo Kim[1]
[1]Kunsan University, South Korea

Operational oceanography and numerical methods (Session One)
University House Hall, June 5, 2015, 9:00 AM - 10:20 AM

Biography:
Not available at the time of printing

Typhoon waves are hindcasted using different wave numerical models and different wind data. Typhoon Bolaven (1215) passed through the East China Sea and the Yellow Sea in August 2012 and generated extraordinarily high waves. During the typhoon, the maximum wind velocity and the central pressure reached 53 m/sec and 920 hPa, respectively. It also generated extreme waves with maximum wave height of over 10 m lasting over 10 hours in the west coast of Korea.

Two wave prediction models, SWAN and WWIII, are executed using same wind data and same unstructured grids. The two calculated results are compared with in-situ measurement data in order to check their capacity simulating extremely high waves generated during a typhoon. Two wind data, one calculated from simple typhoon wind model (Holland, 1980) and the other one from regional data assimilation and prediction system, RDAPS (UM12km, L70) which is a currently operating wind model in Korea, are used to check their efficiency in typhoon wave prediction. The observation sites include Ieodo Ocean Research Station and two buoys of Korea Ocean Gate Arrays which were both near the typhoon track, and also several coastal wave station data.

An operational coastal ocean forecasting system for the Great Barrier Reef region

Gary Brassington[1], Frank Coberg[1], Paul Sandery[1], Pavel Sakov[1], Greg Stuart[1], Jamie Treleaven[1]
[1]Australian Bureau of Meteorology, Sydney, Australia

Operational oceanography and numerical methods (Session One)
University House Hall, June 5, 2015, 9:00 AM - 10:20 AM

Biography:
Dr Brassington is a Principal Research Scientist with the Australian Bureau of Meteorology heading the research and development team for ocean forecasting. Dr Brassington holds a PhD in Applied Mathematics from the University of New South Wales and has published in excess of 50 peer reviewed books and journal articles.

The Great Barrier Reef is a marine environment under stress from a wide range of physical and biological influences. The Australian Government is investing in several programs to improve the monitoring, modelling and management of this reef complex. One of these initiatives under the eReefs program is to develop Australia's first operational coastal ocean forecasting system to be implemented by the Bureau of Meteorology in 2018.

The forecasting system will be developed to describe the ocean state and circulation in the GBR region. The system will provide routine information on the heat content and accumulated heat stress as well as a description of the circulation to track materials harmful to the reef health. Some of these may be introduced into the water through maritime activities like dredging or shipping. However, the main focus of eReefs is runoff from land-based activities. Material may be carried down the rivers in rainstorms, and introduced into the coastal ocean through estuaries. The forecasting system will track the likelihood that this material reaches parts of the reef. The major rivers will be represented by catchment models and with other minor rivers represented by a more conventional statistical approach.

The core system is based on an Ensemble Kalman Filter data assimilation system and the regional ocean modeling system. This system will quantify analysis and forecast uncertainty and provide the framework for synthesising the model and observations to make the optimal use of available resources to produce high quality estimates of physical and dynamical ocean conditions.

Real-time observation monitoring and verification of operational OceanMAPS

Xinmei Huang[1]
[1]Australian Bureau of Meteorology, Docklands, Australia

Operational oceanography and numerical methods (Session One)
University House Hall, June 5, 2015, 9:00 AM - 10:20 AM

Biography:
1994: PhD, Environmental Science, Murdoch University, Australia.
2009- Senior Professional Officer, Australian Bureau of Meteorology

The ocean forecasting system called OceanMAPS (Ocean Model Analysis and Prediction System), has been running in Australian Bureau of Meteorology since August 2007.This system was upgraded to version 2.0 in November 2011 (Brassington, et al 2012). The OceanMAPS was delivered from the development of the BLUElink project, which was collaboration between the Australian Bureau of Meteorology, the Commonwealth Scientific and Industrial Research Organisation (CSIRO), and Royal Australian Navy.

The observational data used in the OceanMAPS system come from remotely sensed altimetry and Sea Surface Temperature (SST), as well as in-situ profiles. Currently the altimetry data retrieves from Radar Altimeter Database System (RADS), which was developed by the Delft Institute for Earth-Oriented Space Research and the NOAA Laboratory for Satellite Altimetry. U.S. Naval Oceanographic Office's (NAVOCEANO) real-time global area coverage SST, WindSat and AMSR2 SST are used in the ocean data assimilation. The in-situ profile data is collected under the ship-of-opportunity program (SOOP), the Argo project and moored buoys.

The oceanMAPS runs daily and provides ocean analyses and 7-days forecasts. The real-time observation monitoring and the performance of OceanMAPS are presented and discussed.

References:
Brassington, G.B., J. Freeman, X. Huang, T. Pugh, P.R. Oke, P.A. Sandery, A.Taylor, I. Andreu-Burillo, A. Schiller, D.A. Griffin, R. Fiedler, J. Mansbridge, H. Beggs, and C.M. Spillman, 2012: Ocean Model, Analysis and Prediction System: version 2. CAWCR Technical Report No. 052, (http://cawcr.gov.au/publications/technicalreports/CTR_052.pdf)

Emulator assisted data assimilation into chaotic models

Nugzar Margvelashvili[1], E. Jones[1], M. Mongin[1], R. Farhan[1], M. Herzfeld[1], M. Baird[1]
[1]CSIRO Ocean and Atmosphere, Hobart, Australia

Operational oceanography and numerical methods (Session One)
University House Hall, June 5, 2015, 9:00 AM - 10:20 AM

Biography:
Not available at the time of printing

State of the art fine-resolution ocean models can take days, weeks and longer to simulate scenarios relevant to science and management practices. Such complex, computationally expensive models are difficult to calibrate and implement. Emulators are fast and cheap surrogates of complex models that run orders of magnitude faster than the original model. Typical areas of application of emulators comprise visualisation, optimisation, data-assimilation, scenario evaluation, sensitivity study etc. In this talk we will focus on the utility of emulators when dealing with the data assimilation in chaotic models. High sensitivity of such models to initial conditions implies rapid divergence of the emulated trajectories from the simulated "truth" thus undermining the quality of the emulator. Numerical experiments with a chaotic Lorenz-95 model are conducted to illustrate this point and suggest a remedy to this problem based on localization of the data-assimilation scheme. Insights gained through our experiments are being instrumental for data-assimilation into fine-resolution 3D sediment transport model of the Great Barrier Reef region.

Operational oceanography and numerical methods (Session Two)

Friday 5 June, 2015, 10:50 AM – 12:30 PM, University House Hall

Internal pressure gradient errors in sigma-coordinate ocean models in high resolution fjord studies

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[1]University of Bergen, Norway, Bergen, Norway, [2]Uni Research, Bergen, Norway

Operational oceanography and numerical methods (Session Two)
University House Hall, June 5, 2015, 10:50 AM - 12:30 PM

Biography:
Jarle Berntsen has worked in ocean modeling since 1990 and is the main author of the BOM = the Bergen Ocean Model.

Terrain following ocean models are today applied in coastal areas and in fjords and the topography may be very steep. Recent advances in high performance computing facilitates model studies with very high spatial resolution.

In general, numerical discretization errors tend to zero with the grid size. The slopes in fjords and near the coast may however be very steep, and the internal pressure gradient errors associated with sigma-models may be significant even in high resolution studies. The internal pressure gradient errors are due to errors when estimating the density gradients in sigma-models. These errors are investigated for two idealized test cases and for the Hardanger fjord in Norway.

The methods considered are the standard second order method and a recently proposed method that is balanced such that the density gradients are zero for the case RHO = RHO(z) where RHO is the density and z is the vertical coordinate.

The results show that by using the balanced method, the errors may be reduced considerably also for slope parameters larger than the maximum suggested value of 0.2. For the Hardanger fjord case initialized with RHO = RHO(z), the errors in the results produced with the balanced method may be orders of magnitude smaller than the corresponding errors in the results produced with the second order method.

The vorticity dynamics required for realistic western boundary current separation

Andrew Kiss[1]
[1]UNSW Canberra, Australia

Operational oceanography and numerical methods (Session Two)
University House Hall, June 5, 2015, 10:50 AM - 12:30 PM

Biography:
BSc (Hons Physics), ANU, 1994
PhD (Geophysical fluid dynamics), RSES ANU, 2001
ARC Postdoctoral Fellow, RSES, ANU 2001-4
Lecturer, UNSW Canberra, 2004-present

The location at which western boundary currents (WBCs) separate from the coast is crucial for regional-scale circulation and atmospheric fluxes. However, this separation location is often difficult to simulate correctly in ocean models, and it is not always clear how to correct this problem because our understanding of the underlying separation processes is limited.

I will present results from process modelling studies using barotropic and two-layer baroclinic quasigeostrophic models which show that the presence of a strongly cyclonic region on the coastal side of subtropical WBCs is crucial to their separation behaviour. If this is absent (e.g. under free-slip boundary conditions), a nonlinear WBC will separate much too far downstream unless forced offshore by a counter-flowing subpolar WBC. When the cyclonic layer is present (e.g. with limited- or no-slip conditions) it can produce a large potential vorticity excess, and separation from the coastline is actually required in order for resolved or parameterised eddy fluxes to remove this PV excess. This suggests that modelled WBCs need to be realistically narrow in order to have sufficient relative vorticity so that they will separate in the observed way. This could explain why relatively high resolution (10km or finer) is usually required.

Limits of scalability and performance of global high-resolution ocean simulations on the NCI computing platforms

Marshall Ward[1]
[1]National Computational Infrastructure, Canberra, Australia

Operational oceanography and numerical methods (Session Two)
University House Hall, June 5, 2015, 10:50 AM - 12:30 PM

Biography:
Marshall Ward is a Senior HPC Specialist at the National Computational Infrastructure where he works on climate model optimization.

In recent years, the National Facility of the National Computational Infrastructure (NCI) has been actively supporting the Australian research community in high resolution global ocean modelling efforts, with a particular focus on improving their scalability and performance on the Raijin supercomputing platform.

Research efforts been primarily based on the MOM ocean model, coupled to the SIS sea ice model, and our optimization efforts have focussed on two experiments. Each is based on the Geophysical Fluid Dynamics Laboratory (GFDL) CM2.5 model and CM2.6 models, with respective grid resolutions of approximately 0.25° and 0.1°. These experiments represents a major transition towards an accurate representation of turbulent eddy dynamics, and provide new opportunities to evaluate their role in the global ocean.

Using timing results and scaling efficiencies for these models over various configurations, we discuss the resource requirements for these jobs, highlight the current and future computational bottlenecks, and assess the ability to run future models on newer machines using increasingly finer grids.

Vertical circulation derived from Omega equation in the upwelling region east of Hainan Island

Lingling Xie[1], Xiaolong Zong[1], Shuwen Zhang[1], Eric Pallas-Sanz[2], Quanan Zheng[3]
[1]Guangdong Province Key Laboratory for Coastal Ocean Variation and Disaster Prediction Technologies, Guangdong Ocean University, Zhanjiang, China, [2] Departamento de Oceanografía Física, Centro de Investigación Científicay de Educación Superior de Ensenada, , Mexico, [3]Department of Atmospheric and Oceanic Science, University of Maryland, USA

Operational oceanography and numerical methods (Session Two)
University House Hall, June 5, 2015, 10:50 AM - 12:30 PM

Biography:
Lingling Xie got her PhD degree of Physical Oceanography from Ocean University of China in 2009. Now she is an Associate Professor in the Department of Marine Science, Guangdong Ocean University. Her research interests include ocean circulation, mesoscale processes, and ocean mixing.

Based on hydrographic and microstructure observations in summer 2012, the vertical circulations in the upwelling region east of Hainan Island are derived from Omega equation. Alternative upwelling and down-welling velocities appear around the density front, and banded structure is found in the distribution of turbulent kinetic dissipation and mixing rate. The effects of turbulent mixing on the vertical velocities are discussed.

A long-term tide-resolving OGCM simulation around the Japan coastal ocean

Yasumasa Miyazawa[1], Sergey Varlamov[1], Takuji Waseda[1], Guo Xinyu[1], Toru Miyama[1]
[1]Japan Agency for Marine-Earth Science and Technology, Yokohama, Japan

Operational oceanography and numerical methods (Session One)
University House Hall, June 5, 2015, 10:50 AM - 12:30 PM

Biography:
Group Leader

In order to evaluate ocean renewal energy potential around Japan, we are conducting an oceanic simulation using a state-of-art ocean general circulation model with horizontal 3 km grid and 46 vertical layers (JCOPE-T; Varlamov et al. 2015) for the period from 2002 to present. Targeted ocean renewal energy includes electric power generation using geostrophic and tidal currents, and temperature difference between surface and deep levels. Our simulation product of the oceanic condition will be utilized mainly for rough design of possible power plants rather than detailed design of the actual plants. To allow evaluation of uncertainty involved with the estimation of the energy potential, the simulation product should represent the realistic temporal variability over a wide-range of time scales (hourly to interannual) as well as the climatological mean of the oceanic state. We validate the simulated mean and variance of the oceanic state using various kinds of observation data and other model products. Preliminary comparison of the simulation product in the first 9 months period (January to September 2002) with the reference data suggests that at least over 10 years simulation is required for the accurate representation of the variance.

Modeling and prediction of extreme events

Friday 5 June 2015, 2:00 PM – 3:20 PM, University House Hall

Coupling hurricane and ocean wave modelling

Saima Aijaz[1], Alexander Babanin[1], Biju Thomas[2], Malek Ghantous[1], Ginis Isaac[2]
[1]Swinburne University of Technology, Hawthorn, Australia, [2]University of Rhode Island, Kingston, USA

Modeling and prediction of extreme marine events
University House Hall, June 5, 2015, 2:00 PM – 3:20 PM

Biography:
Saima Aijaz is a Research Fellow at the Centre of Ocean Engineering, Science & Technology at Swinburne University. Her research consists implementing coupled wave, ocean circulation, and climate models. Prior to joining Swinburne University, Saima has worked with global engineering firms in Australia, USA, and UAE.

This paper presents the implementation of the concept of wave-induced turbulence due to non-breaking waves through explicit coupling of large-scale atmospheric and oceanic phenomena with the physics of surface waves.

Until recently, large-scale circulation models did not explicitly take account of ocean surface waves, a phenomenon of a much smaller scale both in space and time. However, it is now being recognized that coupling large-scale air-sea interactions with wave dynamics is necessary to improve simulations both of ocean cooling by tropical cyclones and of tropical cyclone intensities.

The study consists of dynamically coupling two well-known models: 1) Princeton Ocean Model (POM) and, 2) Wave-Watch III spectral wave model. The new wave-induced turbulence scheme is included as an additional turbulence production term in the circulation model, POM, and combined with the existing turbulence closure scheme of Mellor and Yamada (1982) in POM. The advantage of this turbulence mechanism is the fact that such turbulence is distributed vertically at a scale that is comparable with the mixed layer depth. Therefore, additional assumptions of diffusion or advection for mixing are not required.

Simulations of idealized and real hurricanes show a rapid reduction in sea temperature and deepening of the mixed layer due to additional wave mixing scheme. The non-uniform variation of wave heights and periods over the hurricane area causes the mixing and sea surface temperature (SST) alterations to vary across the area. Further, the real-case hurricane modelling demonstrated significant improvement in the correlation between modelled and observed SST.

Investigating relationships between severe weather and East Australian Current eddies during east coast lows

Christopher Chambers[1,2,3], Gary Brassington[2], Jinyu Sheng[3], Ian Simmonds[1], Kevin Walsh[1]
[1]School of Earth Sciences, University of Melbourne, Melbourne, Australia, [2]Centre for Australian Weather and Climate Research, Sydney, Australia, [3]Department of Oceanography, Dalhousie University, Halifax, Canada

Modeling and prediction of extreme marine events
University House Hall, June 5, 2015, 2:00 PM – 3:20 PM

Biography:
Chris moved to Melbourne, Australia in 2011 to work as a severe ocean weather research fellow on an investigation into the effect of East Australian Current Eddies on east coast lows. His hobbies include storm chasing, surfing, sea kayaking, cycle touring, hiking, cactus collecting and time-lapse photography.

The relationships between sea surface temperature (SST) distribution and thunderstorms, heavy rainfall, and sea level pressure, during four east coast lows are examined using both lightning observations and numerical simulation results. Atmospheric changes caused by the introduction of complex eddy and frontal structures present in Bluelink ocean datasets are investigated using the Weather Research and Forecast model. Maximum convective available potential energy (MCAPE) differences between Bluelink SST simulations and coarse SST simulations indicate that areas of greater MCAPE in the Bluelink simulations are related to regions of warmer waters with horizontal advection often displacing increased MCAPE downwind. At short timescales of 3 to 6 hours, the differences in MCAPE become larger and more localized and show a compelling correlation with observed lightning. For the damaging Pasha Bulker case, a plume of thunderstorms associated with the coastal damage occurs downwind of a region of enhanced MCAPE, increased rainfall, and lower sea level pressure, along the southern flank of a warm eddy. Based on these results it is concluded that the particular features of the warm eddy enhanced the thunderstorm potential over the coastal region and helped in localising the area of greatest impact.

Perspectives of storm surge occurrences for the upcoming decades at Western South Atlantic

Ricardo De Camargo[1], Joseph Harari[2], Enzo Todesco[1], Bruno Biazeto[1], Fabricio Branco[2]
[1]IAG/USP, Sao Paulo, Brazil, [2]IO/USP, Sao Paulo, Brazil

Modeling and prediction of extreme marine events
University House Hall, June 5, 2015, 2:00 PM – 3:20 PM

Biography:
Bachelor in Physics; M.Sc. in Physical Oceanography; PhD in Meteorology; since 1997 working as Professor at the Department of Atmospheric Sciences of IAG/USP

The Western South Atlantic storm surges are investigated through a numerical approach based on Princeton Ocean Model (POM). Long hindcast integrations using SODA2.2.4 monthly averages as initial condition (as well as a climatological background for Newtonian relaxation) were performed for the period 1979-2010 considering atmospheric forcing given by CFSR fields. For the large scale features, the performance of the system was evaluated through TOPEX/JASON altimetry and CFSR oceanic fields and the occurrence of storm surges was quantified for different stations at the coast and compared to observations when available. Other experiments for the same period were forced by the historical runs of the HadGEM2-ES, in order to compare the sensitivity of the ocean model to generate extreme events with this atmospheric forcing. Then, RCP4.5 and RCP8.5 projected scenarios of HadGEM2-ES between 2010 and 2035 were used to force the ocean model. Some interesting results were found, mainly in terms of seasonal and interannual variability of the extreme events.

Increasing trend of storm surge along the East Asian continent and its causes

Leo Oey[1]
[1]National Central University, Taiwan

Modeling and prediction of extreme marine events
University House Hall, June 5, 2015, 2:00 PM – 3:20 PM

Biography:
Leo Oey is interested in a wide range of oceanographic, atmospheric and air-sea coupled problems, from coastal seas to basin & global circulation, from wind waves and internal waves to eddies, from explosive tropical cyclone's rapid intensification to climate variability, and their mutual interactions.

Approximately one-third of all tropical cyclones (TC) originate over the warm pool of the western North Pacific Ocean, where they are referred to as typhoons. As the storms traverse westward, approximately 40% of them curve northward into central Japan or the open Pacific. The remaining 60% continue west, and nearly all of them make landfalls along the East Asian coasts, causing considerable economic losses and human sufferings. Associated with climate change, some studies have predicted an increase in the global mean of the intensity of tropical cyclones in a warmer climate, while the frequency decreases. On the other hand, another study predicted increases both in the intensity and frequency of tropical cyclones as the climate warms, and the increases are projected to be particularly significant in the western North Pacific. To understand and cope with the potential effects to storm surge of these projected changes in the characteristics of tropical cyclones, this study used typhoon data from 1951-2013 to simulate storm surges due to typhoons along the East Asian coastlines. We found a significant rise in storm surge and explained its causes.

POSTER PRESENTATIONS

Extending the scope of AR model in non-stationary and nonlinear significant wave height forecasting using EMD technique

Leemin Huang[1], Wenyang Duan[1], Yang Han[1], Detai Huang[1]
[1]Harbin Engineering University, Harbin, China

Biography:
Leemin Huang was born in Canton, China, on Feb. 18, 1988. He finished his B.Sc. degree in Ship Building and ocean engineering at the Harbin Engineering University. He is now a PhD candidate of Harbin Engineering University and undertaking research on the short-term prediction of ship motions and ocean waves.

Accurate short-term prediction of ocean wave with warming time of couple hours allows improvements in safety for various operation-related activities in the ocean. Autoregressive (AR) model has been extensively explored for ocean wave forecast as the complex phenomena is substantially simplified and the results are largely improved compared to conventional numerical wave models. However, AR model is linear and stationary approach and hence shows limitations in forecasting non-linear and non-stationary ocean waves. Inspired by the effectiveness of empirical model decomposition (EMD) technique in handling nonlinear and non-stationary signals, this paper presents a hybrid EMD-AR model for short-term prediction of non-stationary and nonlinear ocean wave. EMD decomposes wave time series into several simple components. Subsequently, AR model is applied to forecast each component individually. Finally, predictions for each component are aggregated to obtain the expected wave predictions. Investigation of EMD-AR model was implemented by using measured significant wave heights data from National Data Buoy Center (NDBC). In addition to EMD-AR model, AR and SVR models were also studied using the same data sets for comparison purpose. Prediction results indicate that EMD-AR model is superior to AR, SVR in short-term prediction of non-stationary and nonlinear ocean wave.

The retrieval of seasonal distributions of suspended sediment concentration in North Yellow Sea based on GOCI data

Zhixin Cheng[1]
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Biography:
Zhixin Cheng is a postgraduate student currently doing her MPhil project in ocean remote sensing and physical oceanography at UNSW Canberra.

Surface suspended sediment concentration (SSC) in the Yalu River estuary and northern Yellow sea was retrieved from the Geostationary Ocean Color Imager (GOCI) data in this paper. The seasonal and diurnal variation of SSC in the Yalu River estuary and its mechanism was also analyzed based on GOCI and other observations. The retrieval results from the year 2011 to 2014 reveals that SSC in this area has an obvious seasonal variation especially in estuarine region , with a higher value in winter and a low level in summer. In winter, suspended sediment was driven from the bottom to the surface by strong winds and waves then induces a higher surface SSC level in the year. Weak vertical mixing and strong coastal currents in summer contribute to the lower SSC level in study area. Seasonal variability of river discharge has a limited influence on SSC in estuarine area. Even though river runoff reaches the maximum value in summer, SSC is in the lowest level as a result of fluvial sediment is not the dominating source for sediments in this area. SSC also varied in a tidal cycle with a higher level during spring-tide and a lower value in neap-tide. The mechanism of this variability needs further hydrodynamic condition results from numerical simulation to be analyzed.

Statistical analysis and modeling of near-inertial oscillations in Xisha area using mooring observations

Xiaofei Yi[1], **Shuwen Zhang[1]**, **Lingling Xie[1]**
[1]Guangdong Ocean University, Zhanjiang, China

Biography:
Xiaofei Yi, a Phstudent, major in ocean-air interaction
Shuwen Zhang, PhD, Professor, major in regional oceanography
Lingling Xie, PhD, Associate Professor, major in ocean wave and turbulence

Based on one year of mooring Acoustic Doppler Current Profilers (ADCP) data from August 23, 2011 to August 21, 2012, this study analyzes statistical features of 1112 near-inertial oscillation (NIO) events in the Xisha area of the South China Sea. The results indicate that the NIO events characterized by near-inertial kinetic energy (NIKE) are generated by Typhoons or winter storms. The NIKE in the subsurface layer of 50-450 m exhibits the remarkable seasonal variability with peak values in local autumn. The NIO events have an e-folding timescale from 2 to 12 d. The phase velocity, vertical wavelength, and frequency shift of these events are examined. The frequencies of NIOs are mainly shifted to above the local inertial frequency, i.e., a blue shift, which is related to the background vorticity. The maximum NIKE of data induced by typhoon Nalgae was observed in October, 2011. The NIKE propagated downward from 50 to 300 m during the event. Another strong NIO event observed in February, 2012 had the e-folding timescale of 6 days, which was induced by winter storm (the local air temperature dropped for more than 10°C). Although the NIKE originates from atmospheric forcing, the stratification affected by ocean eddies is also contributed to its propagation and distribution.

Detection of winter macroalgal blooms (2014-2015) in the East China Sea using HJ-1 and Landsat data

Qianguo Xing[1,2], . Xiao Hua Wang[2], Lin Li[1,3]
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Biography:
Qianguo Xing received a Master's degree in environmental engineering from South China University of Technology. He received his PhD degree in 2007 from South China Sea Institute of Oceanology, Chinese Academy of Science. His main research interests are coastal environment remote sensing and assessment.

World's largest floating macroalgal blooms (MABs, also called green tide) occur every summer in the Yellow Sea (YS) and East China Sea (ECS) since 2007, and might bring significant impacts on regional marine ecosystem and local economics. Early detection of MABs is essential for early warning and taking countermeasures to mitigate impacts of this hazard. High spatial resolution satellite images (30 m) of Landsat and HJ-1, are able to record smaller slicks or patches of floating macroalgae, which cannot be seen from the coarse resolution images (e.g., Moderate Resolution Imaging Spectroradiometer, MODIS, 250 m). In this study, we used a new index in mapping MAB in the ECS in winter season (December, 2014 - February, 2015) with the combination of HJ-1, Landsat 7 and Landsat-8 images. The results showed that MABs might be as early as January 10 in the ECS, the earliest MAB observation so far. The new results might be combined with the regular seasonal changes in North-East Asian Monsoon for early warning of MABs 5 months before the bloom peak in June and July the YS; and, a new light is shed on the causes of the world's largest MABs.

Modelling tidal asymmetry in the Xiamen Bay

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Biography:
Professor Yuwu Jiang's research interests are numerical modeling. He is dedicated to the research of coastal dynamic processes.

A high-resolution 3D model based on ROMS with wetting and drying processes is used to study the tidal distortion in the Xiamen Bay, China. Xiamen Bay is a typical tide-controlled shallow estuary consisting of extensive tidal flats on western. Overtides are generated through nonlinear physical processes by the special features in the Xiamen bay. Superposition of astronomical tidal constituents and overtides distort tidal elevation and current, enhancing the asymmetry of rise- and fall-duration of water elevation. Model is used to examine estuarine characteristics induced tidal asymmetry. Various sensitivity experiments are run to access their effects on rise- and fall-duration of elevation in the Xiamen Bay, e.g. combination of tidal constituents, bottom friction option and coefficients, intertidal storage volume and river runoff. Skewness is used to quantify tidal asymmetry and show the degree of distortion. Results show ebb-dominance in western side of Xiamen bay are due to extensive wetland, and flood-dominance in other place of Xiamen Bay are caused by combination of principal tide and overtides.

Validation of SST and significant wave height products from HY satellites

Mingsen Lin[1,2], **Jing Ding**[1,2], **Qimao Wang**[1,2], **Xiaomin Ye**[1,2], **Ying Xu**[1,2], **Yongjun Jia**[1,2]
[1]National Satellite Ocean Application Service, State Oceanic Administration, Beijing 100081, China, Beijing, China, [2]Key Laboratory of Space Ocean Remote Sensing and Application, State Oceanic Administration, Beijing 100081, China, Beijing, China

Biography:
DING Jing, PhD in Physical Oceanography. She is a Research Fellow in National Satellite Ocean Application Service, Beijing, China. Her primary research interests are ocean color remote sensing and satellite data processing. WANG Qimao, Xu Ying and JIA Yongjun are all researchers in SST applications and altimeter data processing.

The accuracy of ocean remote sensing products must be carefully tested before being accepted by users. Validation is defined as getting the accuracy of the remote sensing products by using in-situ measurements or higher quality remote sensing data. We developed a validation model for remote sensing products from China Haiyang (HY) series satellites. The validation processing involves in validated data, control parameters, matching method, spatio-temporal collocation window and statistical models. All these processing steps should be well selected with strict standards.

We did cross validation for sea surface temperature (SST) extracted from Chinese Ocean Color and Temperature Scanner (COCTS) onboard HY-1B satellite against that extracted from Moderate-resolution Imaging Spectroradiometer (MODIS) onboard American earth observation system (EOS) satellites (Terra and Aqua) over a time period from October 3, 2008 to March 23, 2011. The root mean square error (RMSE) of corrected HY-1B SST is 1.55°C in China coastal areas. We validated the along-track Ku-band significant wave height (SWH) extracted from radar altimeter onboard Chinese HY-2 satellite, the first Chinese marine dynamic environment satellite, against National Data Buoy Center (NDBC) in-situ measurements over a time period of three years from October 1, 2011 to September 30, 2014, the RMSE and mean bias of HY-2 SWH is 0.38 m and -0.13±0.35 m, respectively. Additionally, the bias for every month dropped to zero after April, 2013. The validation results indicate that remote sensing products from China HY series satellites can be used with an accepted accuracy to certain degree.

SAR observation on sea surface wind structure caused by rain cell

Mingsen Lin[1,2], **Xiaomin Ye**[1,2], **Jing Ding**[1,2], **Xinzhe Yuan**[1,2], **Liming Cui**[1,2], **Yi Zhang**[1,2]
[1]National Satellite Ocean Application Service, State Oceanic Administration, Beijing 100081, China, Beijing, China, [2]Key Laboratory of Space Ocean Remote Sensing and Application, State Oceanic Administration, Beijing 100081, China, Beijing, China

Biography:
LIN Mingsen, PhD in Microwave Remote Sensing. He is the Deputy Director of National Satellite Ocean Application Service, China. Ye Xiaomin is a PhD candidate in Physical Oceanography. His research interest is SAR applications and remote sensing products validation. Yuan Xinzhe and Cui Liming are researchers in SAR data processing.

Rain cells or convective rain, the dominant form of rain in the tropics and subtropics, can be easy detected by Synthetic Aperture Radar (SAR) images with high horizontal resolution. The footprints of rain cells on SAR images are caused by the scattering and attenuation of the rain drops, as well as the downward airflow. In this study, we extracted sea surface wind structure caused by rain cells by using a RADARSAT-2 SAR image with a spatial resolution of 100 m for case study.

We extracted the sea surface wind speed from SAR image by using CMOD4 wind retrieval method. The root-mean-square errors (RMSE) of these SAR wind speeds, validated against NCEP final operational global analysis data, advance scattermeter (ASCAT) onboard European MetOp-A satellite and microwave scattermeter onboard Chinese HY-2 satellite, are 1.48 m/s, 1.64 m/s and 2.14 m/s, respectively.

A special wind signature on SAR image is caused by the downward airflow produced by rain cell. The curve of wind speed along the diameter of the circular footprint of rain cell, the direction of which is parallel to the directions of the background sea surface wind, can be fitted as a cosine or sine curve. The linear correlation coefficient of the cosinoidal function fitting is 0.86. The background wind speed with 3.5 m/s and the diameter of footprint of the rain cell with 18.7 km can also be acquired by this fitting curve. Another three cases interpreted and analysed in this study also show the same conclusion.

Suspended sediment transport and deposition due to strong regional shear current front: An example from the shelf waters off eastern Shandong Peninsula

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[1]The First Institute of Oceanography, SOA, Qingdao, China, [2]The Ocean University of Cina, Qingdao, China

Biography:
Work: 2010.7-, Senior Engineer, Research Center for Coastal Zone and Islands in The First Institute of Oceanography, SOA. Research fields: Marine engineering environment and offshore sediment transport.

Based on temperature, turbidity and concentration of suspended matter observation in summer and winter derived from the project named National Coastal Sea Comprehensive Investigation and Evaluation (908-ST02), the suspended sediment transport and deposition due to strong regional shear current front off eastern Shandong Peninsula, combined with observation from B1 and B2 sections, circulation simulation in winter by POM model and shallow seismic profile. The results show that the transportation mechanism of suspended matter off eastern Shandong Peninsula is similar to the existing rule in East China Sea: deposition in summer and transport in winter. In summer, not only suspended matter was restricted near bottom by thermocline, but also restricted by the front formed by coastal currents off eastern Shandong Peninsula and northern Yellow Sea cold water mass. Therefore suspended matter mainly deposited in summer. In winter, with the help of strong northeast wind and the thermocline extinction, the turbidity was high vertical mixing was better off eastern Shandong Peninsula. However, two strong shear current front could be found on both sides of the topset of mud wedge, which was respectively generated by northward upwind compensation current along eastern Shandong Peninsula in the middle and lower water, northward Yellow Sea warm currents and southward coastal wind currents above topset of mud wedge. The two strong shear current fronts prevented suspended sediments from bottomset of the mud wedge getting cross eastern Shandong Peninsula continental shelf peripheral, which was helpful to omega-shaped (‘ ’) mud wedge formation off eastern Shandong Peninsula.

Assimilation of surface subtidal flow using HF radar data in a tidally dominated strait

Jihun Jung[1], Yang-Ki Cho[1], Gwang-Ho Seo[1], Myeong-Taek Kwak[1], Byoung-Ju Choi[2]
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Biography:
Jihun Jung received the B.S. degree in the School of Earth and Environmental Sciences from Seoul National University, Republic of Korea, in 2014. He is currently a second year graduate student in the School of Earth and Environmental Sciences, Seoul National University majoring in physical oceanography.

High-frequency (HF) radar is powerful tool to continuously measure the direction and speed of ocean surface current which can be used for data assimilation in coastal area. Data assimilation has been used to improve model accuracy and predictability. However, the assimilation of ocean surface current in a tidally dominated strait is difficult to improve the model performance, because assimilating tidal current and subtidal flow simultaneously is not easy. We focused on assimilation of surface subtidal flow in a tidally dominated strait, because subtidal flow is important in terms of net transport of suspended solids including marine pollutants. In this study, we developed an algorithm which can be used for assimilation of the surface subtidal flow. The currents in the Jeju Strait which has strong tidal current were simulated by the Regional Ocean Modelling System (ROMS). The Ensemble Kalman Filter (EnKF) was adapted for assimilating surface subtidal flow using HF radar data. Subtidal flow was calculated from observed and simulated currents. Eight major tidal constituents were removed using harmonic analysis. Updated subtidal flow was added to the tidal currents for real flow in the simulation. The subtidal flow showed remarkable improvement after assimilation of observed HF radar currents.

Temporal and spatial variations of mesoscale eddies in the South China Sea derived from altimeter data

Yongjun Jia[1], Mingsen Lin, Limin Cui, Jing Ding, Xinzhe Yuan
[1]*National Satellite Ocean Application Service, Beijing, China*

Biography:
Jia is working on the HY-2A altimeter data processing.
Lin, Cui, Yuan and Ding are working on the HY-2A altimeter data application.

The upper layer circulation of the South China Sea (SCS) is driven mainly by monsoon. So there are numerous mesoscale eddies each year in the South China Sea. We use the geostrophic current data from several satellites identify eddies in the SCS. The temporal and spatial variations of these mesoscale eddies are put forward in this work. The eddy occurring in the different area has different destiny. In the southwest of the SCS, the eddy is restricted seriously. It not only cannot move eastward but also northward and cross the dividing line. In the north part and southeast part, the eddy can easily move to the southwest part of the SCS. At the same time, the occurrence of the mesoscale eddy has some relationship with the El Nino event similarly. In the El Nino year, the life cycle is longer and the number of the mesoscale eddy is more than normal year.

Adaptive observation in the South China Sea using CNOP approach based on a 3-D ocean circulation model and its adjoint model

Li Yineng[1], **Peng Shiqiu**[1], Liu Duanling[1]
[1]*South China Sea Institute of Oceanology, Guangzhou,, China*

Biography:
Li Yineng has worked at the South China Sea Institute of Oceanology since 2009.

This study investigates the effect of adaptive (or targeted) observation on improving the mid-range (30 days) forecast skill of ocean state of the South China Sea (SCS). A region associated with the South China Sea Western Boundary Current (SCSWBC) is chosen as the ‘‘target’’ of the adaptive observation. The Conditional Nonlinear Optimal Perturbation (CNOP) approach is applied to a three-dimensional ocean model and its adjoint model for determining the sensitive region. Results show that the initial errors in the sensitive region determined by the CNOP approach have significant impacts on the forecast of ocean state in the target region; thus, reducing these initial errors through adaptive observation can lead to a better 30 day prediction of ocean state in the target region. Our results suggest that implementing adaptive observation is an effective and cost-saving way to improve an ocean model’s forecast skill over the SCS.

Distribution and cross-front transport of suspended particulate matter over the inner shelf of the East China Sea

Lulu Qiao[1], Shidong Liu[1], Guangxue Li[1], Jianchao Li[1], Nan Wang[1], Jichao Yang[1]
[1]*Ocean University of China, Qingdao, China*

Biography:
2008.7-2011.12, Lecturer, College of Marine-Geo Science, Ocean University of China
2012.1-present, Associate Professor, College of Marine-Geo Science, Ocean University of China

An obvious shear front between the Taiwan Warm Current and the Zhe-Min (Zhejiang-Fujian) Coastal Current exists over the inner shelf of the East China Sea (ECS). Although the cross-front spread of surface water in the ECS has been reported based on satellite images, the cross-front transport of suspended particulate matter (SPM) has not been well studied. In this study, field observations of temperature, salinity, volume concentration (VC), mass concentration (MC), and in-situ particle size of SPM at 34 stations with high vertical resolution collected in February 2007 were used to describe the cross-front transport of the SPM in the ECS. An idealized numerical model with a rectangular basin was also used to investigate the mechanism of cross-front transport. The inshore MC of the SPM was larger than the offshore MC, and the MC near the seabed was larger than that in the upper water column. Field data indicated that the SPM could be transported across a front to the open sea in the underlying bottom layer, and the composition of the SPM transported was mainly silt fraction with some clay fraction. Numerical experiment results showed that Ekman transport produced by the northerly wind in winter was the key factor to control this cross-front transport, and that strong northerly wind would strengthen this cross-front transport.

A study on the impact of different surface drag parameterizations in a coupled model

Rajesh Kumar[1], David Holland[1,2]
[1]Center for Global Sea Level Change, New York University, Abu Dhabi, Abu Dhabi, United Arab Emirates, [2]Courant Institute of Mathematical Sciences, New York University, New York, New York City, USA

Biography:
Rajesh Kumar is a Post-doctoral Associate at New York University Abu Dhabi. He is currently working on the development of a fully coupled atmosphere-ocean-wave-ice modeling system. He did his PhD in Ocean Wave modeling from IIT Kharagpur and a two year Postdoc in coupled modeling from Uppsala University Sweden.

This study investigates the momentum exchange between the atmosphere and ocean using a coupled atmosphere-ocean-wave modeling system. The coupled model consist of WRF (atmosphere), ROMS (Ocean) and SWAN (Waves) models. The main objective is to study the performance of different parameterizations of surface drag coefficient used in the models. There exist many widely used schemes to estimate the surface stress from bulk formulas. The coupled modeling system uses the COARE 3.0 bulk flux algorithm by default. We have introduced the new COARE 3.5, a refined version of the old one, into the coupled modeling framework to investigate its impact on both oceanic and atmospheric parameters. We have also investigated the impact of these parameterization schemes over a wide range of wind speeds ranging from normal to hurricane condition.

The effect of asymmetric lateral depth on the residual circulation in tidally dominated bay

Bong Gwan Kim[1], Yang-Ki Cho[1]
[1]Seoul National University, Gwanak-Gu, South Korea

Biography:
Bong Gwan Kim graduated from POSTECH, Korea, to major in mechanical engineering.
Recently, Kim has been studying oceanography for one year at SNU.

The residual circulation in tidally dominated bay with symmetric lateral depth variation has been studied extensively. However, the residual circulation in a bay with asymmetric depth variation is not known well. The Gomso Bay, Korea, has asymmetric lateral depth variation and large tidal range. The width and the length are about 4 km and 20 km, respectively. The deep channel with depth of about 12m is located in northern side. This study describes the residual circulation in the Gomso Bay with analytical and numerical models. The analytical model assumes no density gradient and Coriolis effect. The FVCOM is used for numerical experiment. For both models, a semidiurnal (S2) tide is imposed at the open end, and both the amplitude and phase of the sea level variation are assumed to be uniform. Results of both models show consistence in residual circulation with inward transport in deep area and outward transport in shallow area. Three causes of the residual velocity are analyzed. The flow from bottom friction and asymmetric tidal height, is inward in deep area and outward in shallow area. The advection induces inward flow in whole area. The mean pressure gradient force generates outward flow compensating a subtidal surface slope. Since the advective transport is balanced by the mean pressure gradient force, the net residual circulation is mainly determined by bottom friction and asymmetric tidal height. The residual transport in wide shallow area is larger than that in the narrow shallow area, due to this difference.

Investigating the variability of the northern Adriatic Sea circulation with a very high resolution model

Marco Zavatarelli[1,2], Gelsomina Mattia[1,2], Tomas Lovato[3]
[1]Bologna University, Physics & Astronomy Dept., Bologna, Italy, [2]National Interuniversity Marine Sciences Consortium, Rome, Italy, [3]EureoMediterranean Climate Change Center, Bologna, Italy

Biography:
Marco Zavatarelli (Bologna Univ.). Associate Professor at the Physics and Astronomy Department, .PhD Marine Environmental Sciences. Former research positions: Princeton University (USA), Danish Hydraulic Institute (DK), International Institute for Applied Systems Analysis (A), National Research Council (I). Main scientific activity: modelling of the ocean general circulation and ecosystem dynamics.

The NEMO model was implemented on the northern Adriatic Sea with a high resolution (horizontal resolution of 800 m and vertical resolution of 2 m). The model is off-line nested with a general circulation model of Mediterranean sea providing open boundary data.

Hindcast simulations with high frequency atmospheric forcing and daily river runoff, were performed and analyzed in order to study the interannual variability of the northern Adriatic Sea circulation, mostly in relation to the freshwater input and wind forcing. This is a contribution of the EU funded project "PERSEUS" (Policy oriented Environmental Research in the Southern European Seas)

The interannual variations of ENSO cycle and Western Pacific Warm Pool in recent 30a

Feng Xu[1]
[1]*Guangdong Ocean University, Zhanjiang City, China*

Biography:
Feng XU (1962-), Dr ,Professor. Associate Dean of Ocean and Atmosphere College, GDOU. Deputy Director of Guangdong Province Key Lab. for Coastal Ocean Variation and Disaster Prediction Technologies. Research fields: Air-sea interaction，Atmospheric physics and atmospheric environment，marine meteorology. In charge of several projects including the National Natural Science Foundations project (41475120).

Based on sea surface temperature (SST), sea level pressure (SLP), Southern oscillation index （SOI） and the average ocean Nino index （ONI） data in recent 30a (1980 ~ 2010), the trend and interannual variations of ENSO cycle and Western Pacific warm pool are analyzed in this paper. The positive anomaly of SST in Niño 3.4 region is more significant than other regions as El Niño occurs in recent 30a, indicating that the SSTA in Niño 3.4 region would be a better index of El Niño event. Comparing with the average state, the SLP in the Western Pacific Warm Pool(WPWP) shows a large low-pressure center during El Niño events, which tends to move eastward with larger coverage but smaller amplitude. The eastern boundary of WPWP interannually changes with an increasing cycle, and its average cycle is 3~4a in the studied 30 years .The air-sea mixed layer (300 m) temperature anomaly of the WPWP also changes periodically, and the El Niño occurs as this anomaly shifting from positive to negative.

Sea surface cooling in the Northern South China Sea observed using Chinese Underwater Glider measurements

Chunhua Qiu[1], Huabin Mao[2], Jiancheng Yu[3], Jiaxue Wu[1], Shumin Lian[2]
[1]*Sun Yat-Sen University, Guangzhou, China,* [2]*South China Sea institute of Oceanology ,Chinese Academy of Sciences, Guangzhou, China,* [3]*Shenyang Institute of Automation; Chinese Academy of Sciences, Shenyang, China*

Biography:
Chunhua Qiu, interested in satellite oceanography and air-sea interaction;
Huabin Mao, interested in oceanic turbulence;
Jiancheng Yu, interested in glider desination and experiment;
Jiaxue Wu, interested in current-sediment interaction;
Shumin Lian, interested in large-scale current

Based on 26 days of Chinese Sea-wing underwater Glider measurements and microwave data, we documented cooling of the upper mixed layer of the ocean in response to changes in the wind in the Northern South China Sea from September 19, 2014, to October 15, 2014. The Sea-wing underwater glider measured 177 profiles of temperature, salinity, and pressure within a 55 km × 55 km area, and reached a depth of 1000 m at a temporal resolution of ~4 h. The study area experienced two cooling events, Cooling I and Cooling II, according to their timing. During Cooling I, sea surface temperature (SST) decreased by ~1.0°C, and the corresponding satellite-derived surface winds increased locally by 4.2 m/s. During Cooling II, SST decreased sharply by 1.7°C within a period of 4 days; sea surface winds increased by 7 m/s and covered the entire NSCS. The corresponding mixed layer depth (MLD) deepened sharply from 30 m to 60 m during Cooling II, and remained steady during Cooling I. We estimated temperature tendencies using a ML model. High resolution Sea-wing underwater glider measurements provided an estimation of MLD migration, allowing us to obtain the temporal entrainment rate. Quantitative analysis confirmed that the entrainment rate and latent heat flux were the two major components that regulated cooling of the ML, and that the Ekman advection and sensible heat flux were small. Sea-wing underwater glider offer the potential to investigate diurnal variation in the sea surface, which should be pursued in future research studies.

Numerical simulation of saltwater intrusion in macro-tidal estuary

Zhilin Sun[1], Guanghui LI[1], Senjun Huang[1], Li Li[1]
[1]*Institute of Port, Coastal and Offshore Engineering, Zhejiang University, Hangzhou, China*

Saltwater intrusion is one of the major problems in macro-tidal estuaries, especially at the downstream reach of drinking water sources. Qiantang Estuary with macro-tide provides 85% fresh water supply to Hangzhou city. However, effect of saltwater intrusion on water sources has been serious during spring tides of dry seasons. Prediction of salinity is necessary to the control of saltwater intrusion by adjusting runoff discharge from reservoirs and to avoid salty water in order to supply high-quality drinking water. Three-dimensional unstructured-grid finite-volume coastal model (FVCOM) has been used to simulate flow filed and saltwater intrusion in the Qiantang estuary. The tidal levels, velocities and salinity simulated are in good agreement with measured data. It is acceptable to apply the modeling system to predict the temporal and spatial variations of salinity in drinking water sources under various combination of runoff discharge and tidal range. The peak salinity happens generally at 3~5 days after the spring tide. The salinity stratification is more obvious in the period of ebb tide than during the flood tide. Results reveal that both runoff and tidal current have great influence on saltwater intrusion in the estuarine section. Countermeasures such as increasing discharge from the reservoir can effectively restrain the saltwater intrusion and thus to reducing the chloride concentration.

Impact of Typhoons on phytoplankton bloom off northeastern Taiwan

Yuan Yao[1] Fanghua Xu*[1]
1: Center for Earth System Science, Tsinghua University

Multiple phytoplankton blooms off northeastern Taiwan in response to typhoons are investigated using multiplatform satellite data. 27 typhoons were found to pass over or further offshore of the area from 2003 to 2013. On average, the Chl-a concentration is increased to about 0.77 mg/m^3 after typhoon, while the value is only about 0.35 mg/m^3 before typhoon. Intense vertical mixing, upwelling and subsurface intrusion of Kuroshio waters induced by typhoons contribute to the blooms. The study found four typhoons simultaneous with the occurrence of cyclonic eddies in the study area stimulated stronger phytoplankton bloom. Despite the long distance from the study area or weak in strength of the four typhoons, the presence of cyclonic eddies reinforces the upwelling of subsurface nutrient-rich water, resulting in higher chlorophyll concentration. In addition, typhoons going through the south of the study area always induce stronger bloom than those through the north, attributed to stronger inertial oscillation on the right hand side of typhoon track than the left.

PRESENTERS

A

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