Forcing Mechanisms for the Coastal Dynamics of the upper Gulf of Thailand
Suriyan Saramul and Tal Ezer

Center for Coastal Physical Oceanography, Old Dominion University, Norfolk, Virginia 23508 (e-mail: ssara002@odu.edu; tezer@odu.edu)

I. Introduction
The upper Gulf of Thailand (UGoT), a shallow semi-enclosed basin with an averaged depth of 15 m, is strongly influenced by the monsoon system: Previous hydrodynamics models of the upper Gulf, indicate clockwise/clockwise-circulation patterns during summer SW/winter NW monsoons; models do not always agreed with observations (e.g., discrepancy found in July). Buranapratheprat et al. (2008, 2009). The interaction or the UGoT with the lower Gulf is also unclear, as is the influence of ENSO. Since the upper Gulf is very shallow and located at low latitudes (where the Coriolis effect is expected to be small), the mechanisms that control the circulation need further research, as are the role of factors that may be important for the dynamics (e.g., wind, surface heat fluxes, friction, buoyancy, Coriolis, tides, etc.).

II. Methodology
- The Princeton Ocean Model (POM Mellor, 2004), a 3-D primitive equations model is used.
- Grid: 113x98 horizontal grid cells (~1 km resolution) and 21 vertical sigma layers.
- Tidal forcing: 8 constituents on 2 tide gauges near the southern open boundary.
- Surface heat flux: includes air-sea feedback (see Ezer, 2000) and cloud/tidally clear sky effect (if) on short wave radiation (see formulation below).
- Twice daily wind stress and heat fluxes above) from the global analysis of Yu et al. (2008)

III. Results

Tides
- Fig. 2: Water levels comparison observed (blue) and model (red) at BPT station. Mean of absolute error and SD of error are 0.09 and 0.07 m respectively. The comparison between observed and model (blue) amplitude and (red) phase are also shown.

Winds & sub-tidal circulation
- Fig. 3: Ambient current velocity field and average surface elevation (color in m) for (a) NE and (b) SW monsoons. The wind is the main force that pile-up water, especially in b. The clockwise and counter-clockwise circulations during SW and NE monsoons, respectively, are in general agreement with previous results (Buranapratheprat, 2008, 2009), but other small scale patterns are also found.

IV. Conclusions
1. The model water level is in good agreement with observed water levels. The absolute error and standard deviation of absolute error are 0.09 and 0.07 m, respectively.
2. The model generates the counter-clockwise and strong clockwise circulations during NE and SW monsoons, respectively, which seem to be strongly wind driven.
3. Warmer shelf waters and associated near coast plumes are generated; despite the fact that heat flux, wind stress and SST in the model are spatially constant (river discharge is also neglected in the model for now), there are no fresh water plumes.
4. The mechanism that pushes water from the lower Gulf to the upper Gulf is unclear, so it requires further studies on the interaction between the upper Gulf and the lower Gulf.

Generation of temperature plumes
- Fig. 4: Comparison of spatial distribution of SST between satellite and model results on January 30, 2000 (left) and June 20, 2000 (middle, monthly average) (right). Here the shallow plumes near the coast despite the spatially constant heat fluxes and wind forcing, and the model and observed plumes (right) of warm water that seem to intrude into the upper Gulf along the southeast boundary of the lower Gulf.

References