

exercise 1

investigating characteristics and the display of TOMS ozone data

Before working with any set of data it is important to understand the characteristics of the data set. A knowledge of the data format, missing data, and data processing is critical to ensure correct scientific interpretation.

In this activity you will investigate the way the TOMS Ozone data were formatted, problems that may arise when using the data set, and ways in which the data can be displayed using *SEE Image*.

BEFORE YOU BEGIN THIS EXERCISE

make sure you have read through the Introduction to Module 1: Stratospheric Ozone Computer Lab Exercises document and have completed Sections 1–4 of the tutorial, *Using SEE Image With TOMS Ozone Data*.

NOTE

Throughout these exercises, the navigational paths shown in italics are for use only by those who are using the TOMS Ozone CD set as their data source.

A

opening a TOMS ozone data file

- 1—Insert the disk *OPT_004A* from the TOMS set.
- 2—Select 'File/Open'.
- 3—Go to Desktop | HD | *SEE Image* | Data | Ozone | ozex1 | *GA801001.N7T*
Desktop | *OPT_004A* | *Y80* | *M8010* | *GA801001.N7T*.
- 4—Click on Open. You should see a window with a header and list of numbers.

investigating the TOMS ozone data set format

We will start by having you open the data files to see how the files are named, organized, and formatted.

The header file contains information about each data set and is located in the first three lines of the data file. You can refer to the section on Nimbus–7 TOMS O₃ Gridded Data to obtain general information about the format of the data.

Do A now.

Supply the following information for the GA801001.N7T data set from the header.

1a. Day (out of 365) _____ Date _____

1b. Time of day the satellite passed over the equator at local equator crossing time (LECT) ascending _____

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1c. Longitude:

starting to ending range _____

center value _____

degrees between values _____

1d. Latitude:

starting to ending range _____

center value _____

degrees between values _____

2. Which of these values (a–c) above will change with each data set?

Scroll down the file to look at the data values. Periodically you will see a “lat= ” with a value. This marks the end of a row of data for a particular latitude.

3a. Based on the longitude range and degrees between values, how many pixels (data values) are in a row?

3b. How many rows will there be?

Refer to Nimbus-7 TOMS O₃ Gridded Data: 1978–1992 to answer the following.

4a. What are the units of the measurements? _____

4b. Define this unit for STP (Standard Temperature and Pressure) conditions? _____

4c. What is the range of values? _____

When you look at the gridded data you will notice zero values.

5a. What do the zero values represent?

5b. Give two possible reasons for zero value data.

B*importing TOMS ozone data*

1—Select 'File/IMPORT TOMS ASCII'.

2—Enter "95" for the Minimum value for scaling and "601" for the Maximum value for scaling, and enter "1" for the number of images to process. Click OK.

3—Go to Desktop | HD | SEE Image | Data | Ozone | ozex1 | GA801001.N7T

Desktop | OPT_004A | Y80 | M8010 | GA801001.N7T and click on "Open."

C*coloring an image*

1—Select 'Options/Color Tables/TOMS'.

displaying TOMS data using SEE Image

Now let's display a gridded daily (GA) TOMS data set as a gray-scale image.

Do B now.

You should now see a window with an image in shades of gray. To better distinguish value differences we can apply color to the image using a color table (or look-up table, LUT) that assigns a value or range of values to each color.

Do C now.

The image is now displayed in color.

Move the cursor over the LUT window. It turns into an eyedropper. Look at the number associated with Value in the Info window. These are the ozone values associated with each color.

6. Move the cursor to the bottom of the LUT window. What value is associated with black?_____ white?_____

Actually, all values less than 95 will be displayed in black. Any value above 601 will be displayed as white.

Move the cursor over the image and monitor the Value in the Info window. The value at each pixel corresponds to a data value in the data file you viewed earlier.

7. What approximate range of values (excluding zero) is displayed on this image?

investigating potential problems with TOMS ozone data sets

Repeat steps B and C to import and color the June 12, 1979 (GA790612), and the June 19, 1979 (GA790619), images found in the following directories.

Desktop | HD | SEE Image | Data | Ozone | ozex1 | GA790612.N7T

Desktop | OPT_004A | Y79 | M7906 | GA790612.N7T

Desktop | HD | SEE Image | Data | Ozone | ozex1 | GA790619.N7T

Desktop | OPT_004A | Y79 | M7906 | GA790619.N7T

Refer to Nimbus-7 TOMS O₃ Gridded Data: 1978–1992 for information to help answer the following questions.

8a. What do the black areas in all three images represent?

8b. Explain the possible cause(s) for the large black region on the GA790619.N7T image.

8c. What is the reason for the band of black at the top and bottom of GA801001.N7T and the bottom of GA790612.N7T and GA790619.N7T?

8d. What caused the cigar shape black areas for GA790612.N7T?

adding overlays and viewing different map projections

In interpreting images it helps to have overlays that will aid you in locating yourself geographically on the image. For example, we can apply an overlay with the continental boundaries and longitude and latitude lines onto a TOMS image.

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D*overlaying the continents on a TOMS image*

1—Select 'File/Open'.

2—Go to HD | SEE Image | Overlays | LATLONG.TIF

3—Click on "Open" to open the image. An image with the outline of the continents and latitude and longitude lines will be displayed.

4—Activate the LATLONG.TIF image and then select 'Edit/Select All' followed by 'Edit/Copy Selection'.

5—Next, select the GA801001.N7T image and then select 'Edit/Paste'. The overlay image will completely cover the base image at this point. To finish the overlay, select 'Windows/Show Paste Control'.

WARNING: It is important not to click on anything before selecting 'Paste Control'. Doing so can move the paste image (the overlay) or will terminate the Paste session. You will know if the Paste session terminated because when you try to do the next step you will get the error "Paste Control is only available during paste operations." If this happens, select 'Edit/Undo Paste' and then repaste the overlay image.

6—In the 'Paste Control' window, click and hold the Transfer Mode pop-up menu ('Copy' is the default setting) and select 'Replace'.

7—Select 'Windows/Hide Paste Control' to close the Paste Control window.

Graphic overlay in SEE Image is done in a "destructive" manner. In other words, when a graphic (i.e., lines, text, continental boundaries) is overlaid on an image the value of the pixels under the graphic are replaced with the graphic value itself. Once you draw or add text on an image, the data values under the graphic or text will be lost. For this reason, it is important to use graphics with care and do not use images with graphics for analysis.

Keep the GA801001.N7T image before proceeding and close the other two.

Do D now.

Map Projections are used to represent a spherical object like the Earth on a flat surface such as paper or a computer screen. The overlay image of the continents is very distorted which is obvious when you look at the outline of certain countries on the image. The surface area of a pixel on the equator (~15400 km²) is much greater than the surface area of a pixel near the poles (~100km²). Using different map projections, we can greatly reduce these distortions.

Do E now.

E*generating map projections of TOMS images*

1—Click inside the window with the October 1, 1980, image with the continental overlay (GM801001.N7T) to make it active.

2—Select 'Special/ProjectPole'.

3—Enter "2" to select a southern polar projection and click OK.

4—Enter "South Polar" for the name of the projected image. A new, square, window will be created with the south polar projection of the continents image. Notice how only the southern hemisphere is shown.

5—Select the GA801001.N7T image.

6—Select 'Special/ProjectHammer'.

7—Enter "Hammer, 100 degrees West" for the name of the projected image.

8—Enter -100 for a reference longitude. This

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E, continued

longitude corresponds to the center of the United States so the resulting image will be centered on the U.S. You will see that the Hammer projection transforms the globe into a football shape.

9—Select the GA801001.N7T image.

10—Select 'Special/ProjectGoode'.

11—Enter "Goode" for the name of the projected image.

9. Using the images and the section on "Working with map projections" in the SEE Image Tutorial, explain the advantages and disadvantages of each projection.

MAP PROJECTIONS	ADVANTAGES	DISADVANTAGES
Original Image		
South Polar		
Hammer		
Goode		