

exercise 3

comparing polar and the tropical monthly ozone distributions through histograms

Patterns of ozone distribution differ between the polar and tropical regions. One way to analyze this difference is to compare histograms from each region. In this exercise we will define an area within the tropics and an area within the north polar region and compare histograms to look at differences and similarities in ozone distribution.

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*.

A histogram is a plot of the frequency of occurrence of a value (y axis) against the value (x axis). If we generate a histogram for a TOMS image, it provides the number of pixels in a image for values in Dobson Units (DU).

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 the June 1991 image

1 — Insert the disk *OPT_004B* from the *TOMS* set.

2 — Select 'File/IMPORT TOMS ASCII' and input "95" for the Minimum value for scaling and "601" for the Maximum value for scaling. Select 1 as the number of images to process. Click OK.

3 — Go to Desktop | HD | SEE Image | Data | Ozone | ozex3 | *GM9106.N7T*

Desktop | OPT_004B | Y91 | GM9106.N7T and click on "Open."

B

coloring the image with a color table

1 — Select 'Option/ColorTables/TOMS'

For this exercise we will define the polar region within the Arctic circle, and the tropical region as the area between the Tropic of Cancer and the Tropic of Capricorn and generate histograms for each region. Some error will be introduced because the pixels in the image we are using do not represent the same area on Earth. However, since we are looking at relative distributions of values, we will not correct for this distortion for this exercise.

Do A and B now.

We will use the CalcLatLon macro to locate the pixel boundaries for each region on the image and will use the Rectangle Selection Tool to outline the region. It is useful to know that the upper left corner of an image has a pixel value of 0,0, and the TOMS images are 288 x 180 pixel displays.

The Tropic of Cancer and Tropic of Capricorn correspond with latitudes of 23.5° N and 23.5° S respectively. The latitude for the Arctic circle is 66.7° N. Since these features span the globe we can

C

locating regions on an image using CalcLatLon

- 1 — Select 'Special/CalcLatLon'.
- 2 — Enter latitude 66.7. Click OK.
- 3 — Enter longitude -180. Click OK.
- 4 — Enter the X and Y values from the Info window below for the Arctic circle.
- 5 — Repeat 1–4 using latitude = 23.5 and longitude = -180 for the Tropic of Cancer.
- 6 — Repeat 1–4 using latitude = -23.5 and longitude = -180 for the Tropic of Capricorn.

D

defining an Arctic region of interest using the rectangle selection tool

- 1 — Select the Rectangle Selection Tool (dashed rectangle in the Tools menu).
- 2 — Move the cursor to X=0, Y=0 and click and hold the mouse button. While holding the mouse button down, move the mouse until the Width and Height value in the Info window equal 288 and 23 respectively then release the mouse button. If a "marching ants" style rectangle was not drawn, repeat the procedure.

E

generating a histogram for the Arctic region

- 1 — Select 'Analyze/Show Histogram'.

use any longitude to pinpoint them but we will use a longitude of -180° to locate where the features begin at the left side of the image.

Do C now.

Arctic circle	X= _____	Y= _____
Tropic of Cancer	X= _____	Y= _____
Tropic of Capricorn	X= _____	Y= _____

The width and height of the Arctic circle region on the image will be set at 288 wide and 23 pixels high respectively. The region between the Tropics of Cancer and Capricorn will be 288 pixels wide and 48 pixels high.

Do D now.

Now that we have defined the Arctic region we can generate a histogram for the values within that region.

Do E now.

The X axis contains the ozone values and the Y axis contains the number of pixels for a particular ozone value. To read the histogram information, select the histogram window. Move the cursor into the histogram window and move it over the black regions of the histogram while viewing the results in the Info window. "Level" shows the ozone value and "Count" lists how many pixels there are for that Level. This histogram can be printed by selecting 'File/Print Histogram'.

Important Notes: Only one histogram window is available, so if you generate a histogram for a second image or region, the first histogram will be replaced by the second. If you wish to retain the first as an image file, be sure to save it before generating another histogram. This is important if you wish to compare histograms.

You may save the histogram as an image file but you will not be able to access the Count and Level values from that image file. Be sure to record any data you need from the histogram before saving it as an image. Look in the Tutorial for directions on saving or exporting histogram information to other applications.

1. Sketch the histogram here or attach a print. On the histogram label: the minimum and maximum level values; the Level and Count for distinct peaks that characterize the shape.

F

defining a tropics region of interest using the rectangle selection tool

1 — Select the Rectangle Selection Tool (dashed rectangle in the Tools menu).

2 — Move the cursor to X=0, Y=66 and click and hold the mouse button. While holding the mouse button down, move the mouse until the Width and Height value in the Info window equal 288 and 48 respectively then release the mouse button. If a “marching ants” style rectangle was not drawn, repeat the procedure.

Do F and G now.

2. Sketch the tropics histogram here or attach a print. On the sketch label: the minimum and maximum level values; the Level and Count for the three largest peaks.

G

generating a histogram for the tropics region

1 — Select ‘Analyze/Show Histogram’.

comparing histograms of the tropics and polar regions

3. Why would the Antarctic region be a poor choice for study using this particular TOMS image (GM9106.N7T)?

Place the Arctic and Tropics histogram images side by side on the desktop. Use these and the data you recorded from them earlier to supply the information below.

4a. Ozone value that has the greatest frequency for the
Tropics_____ Arctic_____

4b. Range of ozone values for the
Tropics_____ Arctic_____

4c. What are the major differences between the two histograms?

4d. What general observations can you make about the ozone values in the tropical region compared to the north polar region for this month?

Close all images when finished. You do not need to save changes to the histograms unless directed by your instructor.