

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***importing, stacking, and coloring all images for January 1979***

1—Insert the disk *OPT_004A* from the TOMS set.

2—Select 'File/IMPORT TOMS ASCII'.

3—Input "95" for the Minimal Value for scaling and "601" for the Maximum value for scaling, and check the "Import all images in the folder" box. Click OK.

4—Go to Desktop | HD | SEE Image | Data | Ozone | ozex4 | M7901 | GA790101.N7T

Desktop | OPT_004A | Y79 | M7901 | GA790101.N7T and click on open. All 31 images will be imported.

5—Select 'Stacks/Windows to Stack'.

6—Select 'Options/Color Tables/TOMS' to color the stack.

B***calculating the monthly average of the January images***

1—Select 'Special/CalcAveStack'. Name the image "Ave7901" and click OK.

C***importing a TOMS monthly averaged image***

1—Select 'File/IMPORT TOMS ASCII'.

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

3—Go to Desktop | HD | SEE Image | Data | Ozone | ozex4 | GM7901.N7T

Desktop | OPT_004A | Y79 | GM7901.N7T and click Open.

exercise 4**observing global seasonal variations in total column ozone values using monthly average images**

Do ozone values vary as the seasons change? To answer this question, we will compare total column ozone values at different times of the year. We will examine monthly average images for 1979 to observe global seasonal variations. We will finish the exercise by animating the images to visually observe the distribution of ozone values across the globe throughout the year.

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*.

To look at seasonal changes in ozone values it is useful to use monthly average images of TOMS data. The monthly average image is generated by averaging the value of each pixel for all days in a month. You can obtain this average image from a gridded monthly TOMS data set (a pixel must have a value recorded for at least 20 days within that month to be included) or use a SEE Image macro that can perform this operation. We will generate a monthly average first and compare it to the TOMS monthly average (GM) image.

Do A, B, and C now.

exploring stratospheric ozone using TOMS ozone data—computer lab exercises

D**importing, stacking, and coloring monthly average images for 1979**

1—Select 'File/IMPORT TOMS ASCII'.

2—Enter "95" for the Minimal Value for scaling and "601" for the Maximum value for scaling, and "12" for number of images to process. Click OK.

3—Go to Desktop | HD | SEE Image | Data | Ozone | ozex4 | GM7901.N7T

Desktop | OPT_004A | Y79 | GM7901.N7T and click Open. All 12 images will open overlaying each other automatically.

4—Select 'Stacks/Windows to Stack'.

5—Select 'Options/Color Tables/TOMS' to color the stack.

E**coloring the images with the same LUT (color table)**

1—Click on the stack of images to activate.

2—Select 'Options/Color Tables/TOMS' and the top image (titled GM7901.N7T GM7901.N7T) will be displayed in color. The color table has been applied to all images in the stack.

F**applying an overlay of the continents**

1—Select 'File/Open' and navigate to Desktop/HD/SEE Image/Overlay/LATLONG.TIF. Click Open.

2—Select 'Edit/Select All' then 'Edit/Copy Selection'.

3—Click on the stack of images (GM7901.N7T–GM7901.N7T).

4—Select 'Special/MultiPasteReplace'. The overlay will now be pasted onto each of the images in the stack.

5—Close the LATLONG.TIF window.

G**making and saving a montage of the 12 images**

1—Select 'Stacks/Make Montage'

2—Enter 3 for columns, 4 for rows, 1 for increment and leave the rest at the default settings. Click OK.

3—Select 'File/Save As...'. Go to Desktop | HD | SEE Image | Images | Ozone. Name the file "Montage79" and select TIFF as the format. Click on Save. This will save the montage for use here and in Exercise 7.

comparing two monthly average ozone images and daily images

1. Place the two monthly average images (Ave7901 and GM7901.N7T) next to each other. How well do the two images compare? What variations can you note?

Select the stack of images (GA790101.N7T–GA790131.N7T). You can view the images in the stack sequentially by using the period (.) key to go forward and comma (,) key to go backwards. Move forward and backward through the stack observing the images. Compare the global monthly average images with the daily images. Ignore the no-data sections on the daily images.

2a. What is the major difference evident in the monthly averages when compared to the daily images?

2b. Based on your comparison, what do you think are the advantages and disadvantages of using monthly averaged data? (Consider global regions and smaller localized areas.)

Close all images and stacks of images before continuing.

Now that you have had experience calculating monthly average ozone images we will save time and use the TOMS monthly average images for the rest of this exercise.

Do D, E, F, and G now.

investigating ozone values from a montage

Visually examine the montage images. You will notice that in all of the images there are no-data areas that are black. Ignore these for the following questions.

3a. What general statement can you make about the global distribution of ozone for any one of the images?

3b. Is a distribution pattern more prominent vertically (longitudinally) or horizontally (latitudinally)? Why do you think this is so?

As you move the cursor over areas in any of the images you will see an ozone Value (in Dobson Units) displayed in the Info window. You can determine the range of values associated with any color by moving the cursor over the desired color in the LUT window and reading the Value in the Info window.

4a. Determine the approximate maximum and minimum ozone values that occur for the year and note the associated image color.

maximum _____ minimum _____
color _____ color _____

4b. For purposes of this exercise we will define the region from 60–90° latitude as polar, 30–60° as midlatitude, and 0–30° as tropical. Which geographic regions show maximum change over the year? Why do you think this is so?

4c. Make a general statement about seasonal changes in ozone value for this year based on your observations of the montage.

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H

animating a stack of images

It is often easier to see sequential changes in a series of images by “flipping” through them quickly as you would in a flip book or a film loop.

1—Click on the stack of images (GM7901.N7T–GM7901.N7T) to select it.

2—Select ‘Stacks/Animate’ to begin the animation.

When an animation is running, use the number keys 1–9 to change the speed of the animation. Lower numbers animate the images at slower speeds. You can stop the animation by clicking anywhere on the desktop. The stack and image titles will not change during the animation.

Images can be viewed one at a time or stepped through manually using the period (.) key to move forward and the comma (,) key to move backwards. When you reach the last image in the stack you must go backward through the stack to return to the first image. The stack and image titles will change during this process.

Close the montage image window when finished.

Do H now.

investigating seasonal ozone changes through an animation

5. After you have had a chance to look at the animation and move through the stack one by one, make a statement about whether your answers to seasonal changes are verified or if you wish to make changes after viewing the stack.

Close all stacks and images when finished.