Module 2, Investigation 4: Log 1

Our coasts

The coast is where the ocean meets land. Coastlines are always changing their shape. They are being worn away in some places and built up in others. Coasts can wear away due to the force of waves and currents. Coasts can build up when sediment (sand, gravel, etc.) is carried from one spot to another. They can also be built up when lava enters the sea from land.

Coastlines also change as the sea level rises and falls. Average sea level has risen about 30 centimeters in the last 100 years. Earth's atmosphere has warmed up slightly, causing some of the ice in the polar regions to melt. Meltwater has returned to the oceans, and sea level has risen. Another reason for the rising sea level is that the oceans are also warmer, and as the water becomes warmer it expands.

More than half of the people in the world live within 80 kilometers of a coast. Many large cities are near the coast. London, New York, and New Orleans are examples. What will happen to these coastal cities if sea levels continue to rise?

1. Look in your atlas and find two large U.S. cities that are on flat coastlines and two that are on mountainous coastlines.

2. Name the cities and the oceans that they border.

   Flat Coastlines:
   City 1: _____ Ocean_____

   City 2: _____ Ocean _____

   Mountainous Coastlines:
   City 3: _____ Ocean_____

   City 4: _____ Ocean _____

3. Think about how the *region* around each city would be affected by a rise in sea level of several feet. Which two *regions* would have the most widespread flooding?

   The regions around _____ and _____.
   Write a sentence to explain your answer.

   _____

Module 2, Investigation 4: Log 2

Greenland

In much of the world, sea level is slowly rising. One important reason for this seems to be that some of the world's ice is melting and adding water to the oceans.

Most of our planet's ice is found in thick sheets that cover the land in places where the climate is cold. The largest ice sheets are in Antarctica and Greenland. If these ice sheets melt, they will add so much water to the oceans that most of the world's coastlines will be flooded.

About 4/5 of Greenland is covered by ice that is up to 3,000 meters thick. Some of the ice always melts in the summer. But summers are short there, and winters are long. During the winter, the falling snow packs down to form new ice. If the amount of ice that melts in the summer is the same as the amount of ice that forms in the winter, the ice sheet stays about the same size. If the amount of ice that melts is greater than the amount that forms each year, the ice sheet shrinks.

NASA scientists discovered that some of the ice along Greenland's coastline disappeared during the last few years. How did they find this out? They compared satellite images from 1993 with images from 1999. By measuring the changes in the ice sheet, they could tell how much of the ice had melted.

Does this mean that the ice will continue to melt? We cannot be sure yet. But the scientists will continue to compare new satellite images with older ones. Over time, they will see if the ice sheet keeps melting. If it does, the images will help them figure out how fast it has been melting. Then they can use that information to predict how fast the ice will melt in the future.

Use the information about Greenland's ice sheet to answer these questions.

1. If 4/5 of Greenland is covered by ice, how much is not covered by ice?

   _____

2. How can scientists tell if the ice sheet is melting?

   _____

3. Why is it important to know if Greenland's ice sheet is melting?

   _____

   _____

Module 2, Investigation 4: Log 3

Flooding in the Midwest—Background

Directions: Read this information to learn more about river flooding. Answer the questions on Log 4. You will share this information with the class.

Satellite images were used to help people during serious flooding in 1993. In the Midwest, heavy rains caused the waters of the Mississippi, Missouri, Illinois, and several smaller rivers to overflow their banks. Communities and farms along the rivers were in danger of being flooded.

Officials in the city of St. Louis, Missouri, needed a plan to evacuate people and property as the waters of the Mississippi River rose toward the top of the river bank. Mr. Lee Blackmore, who worked for the city, used satellite images and maps to help plan the evacuation.

"The water is rising fast," said the frantic voice on the telephone. "Can you help with the evacuation? We're losing our race against the river." Mr. Blackmore went to work. He knew the city was running out of time and that homes and businesses along the river would soon be flooded.

The St. Louis police department had been ordered to start evacuating neighborhoods that might be in danger. But these areas had seldom flooded, so many residents remained in their homes, believing they were safe.

Mr. Blackmore helped make a map from satellite images of the flooding. It clearly showed the police where the flood waters were rising fast. The successful evacuation began within four hours after Mr. Blackmore received the call for help.

Many people were affected by the flood waters, but no lives were lost.

Figure 5 shows the St. Louis area during the dry summer of 1988. The river, in black, is narrow and runs in its normal channel. Vegetation is in green; dry soil and urban areas are shown as red and brown. Figure 6 shows the river system in full flood in July 1993.

Can you see just where the river went over the banks?

http://observe.ivv.nasa.gov/nasa/exhibits/flood/flood_2.html

Module 2, Investigation 4: Log 4

Flooding in the Midwest

Directions: Look at your two images very carefully. How are they different? Read the information about the images and answer the following questions.

1. Titles of the images

   Figure 5 _____

   Figure 6 _____

2. In which year was each image made? Figure 5 _____ Figure 6 _____

3. What changes can you see in Figure 6? _____

   _____

   _____

4. How could you measure these changes? _____

   _____

5. What could happen to people, animals, and the rest of the environment because of these changes? _____

   _____

   _____

6. Why do you think the changes occurred? _____

   _____

   _____

7. Look at a map to find the location of your images. Which states are shown in the images?

   _____

   _____

8. Which two rivers join in the Mississippi River just north of St. Louis?

   _____ _____

Module 2, Investigation 4: Log 5

Lake Chad is shrinking

Directions: Your group will use satellite images of Lake Chad to figure out how the lake changed in size between 1973 and 1997.

Place the grid (Figure 8) over the 1973 satellite image of Lake Chad (Figure 7). Take turns counting the number of squares that are on water in each numbered row. If the square falls partly on water and partly on wetland or dry land, use the following rule: If more than half of the square is on water, count it as water. If less than half the square is on water, do not count it as water. Remember that wetland is not water!

Take turns placing this information on the tally sheet below. Then do the same for the 1997 image.

Tally Sheet (Row)	**1973 Image**	**1997 Image**
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		

1. How many water squares did you count in 1973? _____ In 1997? _____

2. Each square represents 400 square kilometers. How many square kilometers

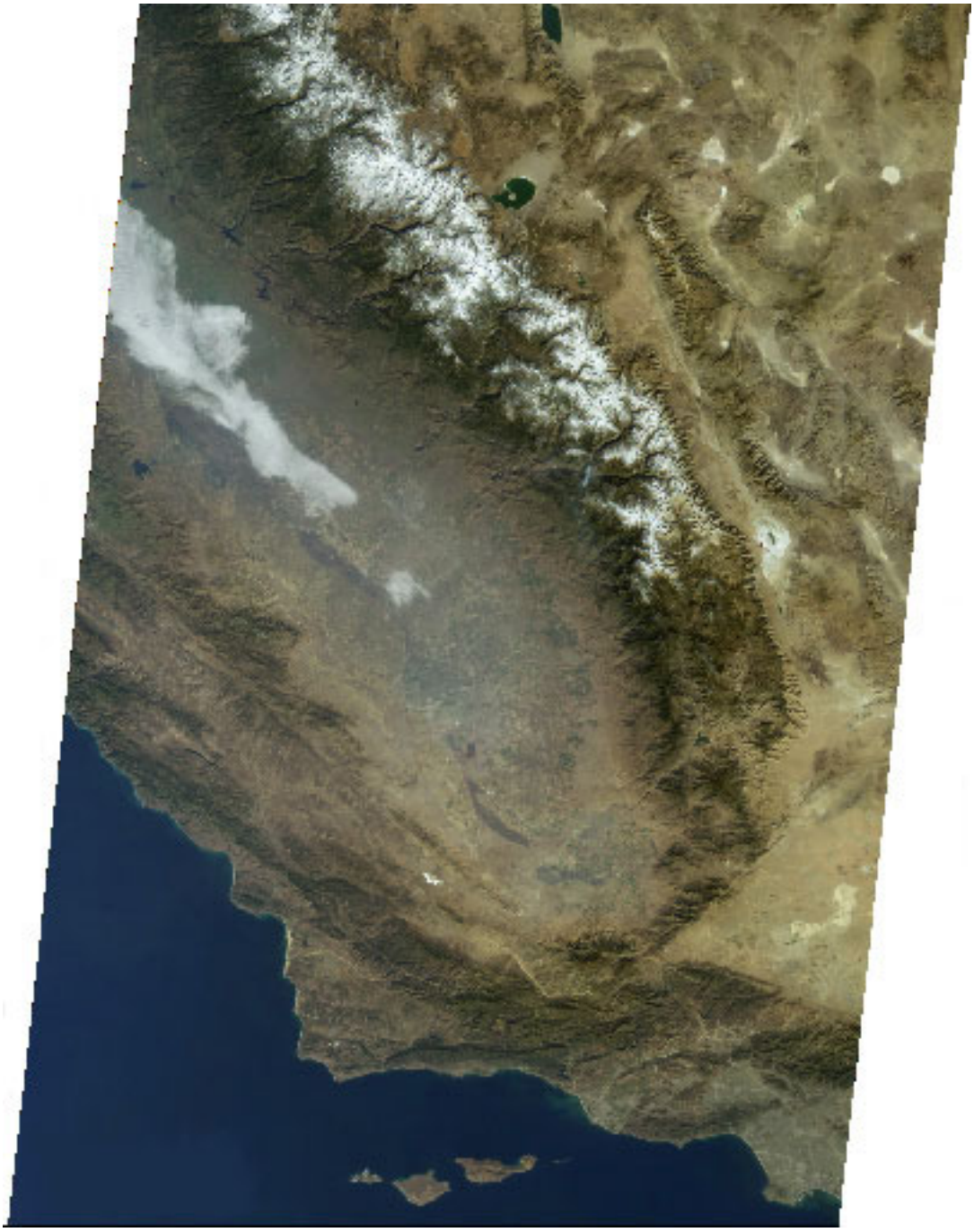
   was Lake Chad in 1973?_____ In 1997? _____

3. How much smaller was Lake Chad in 1997 than in 1973?

   _____square kilometers

Module 2, Investigation 4: Figure 1

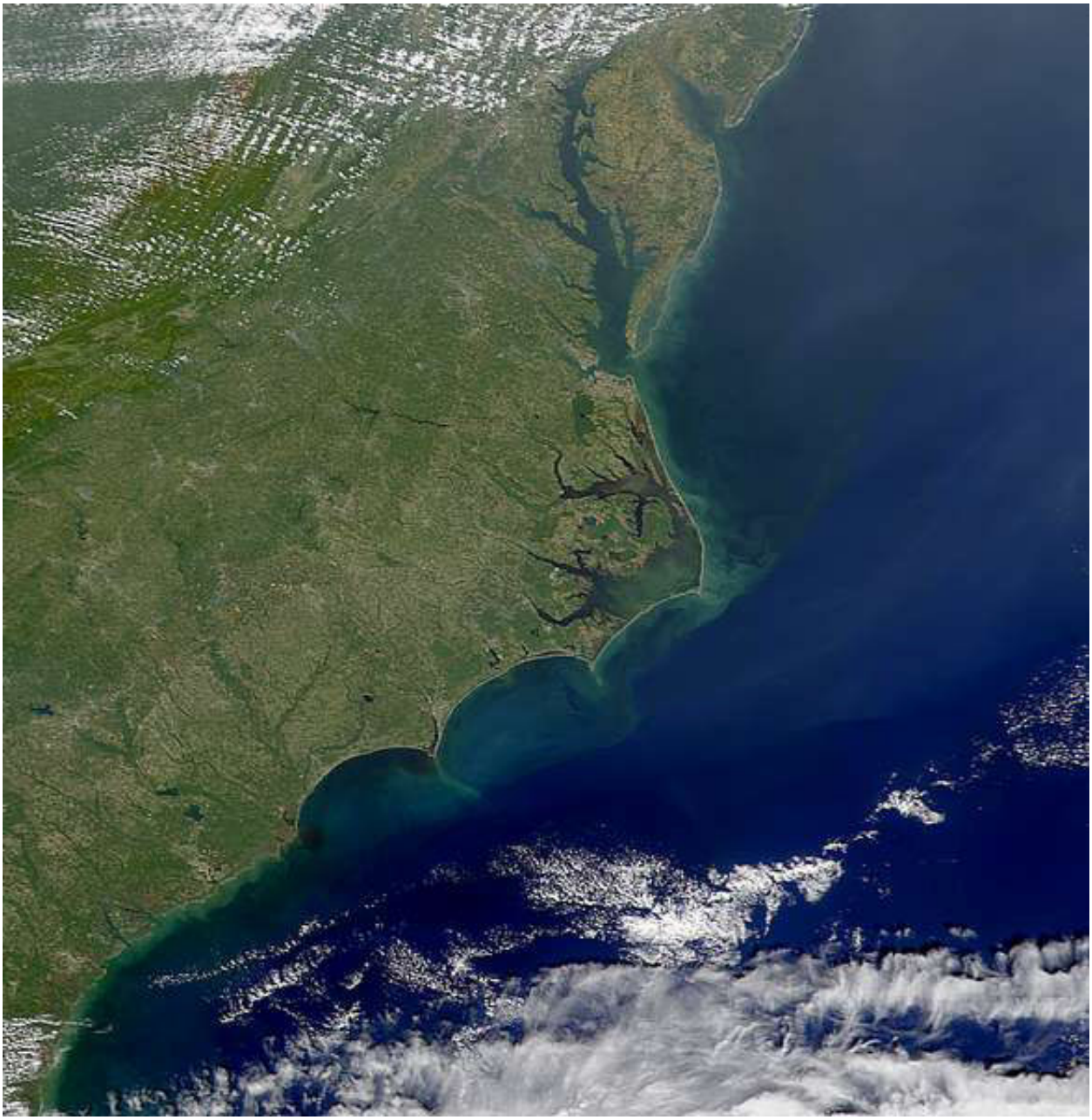
Mountainous coastline in California



Source: http://visibleearth.nasa.gov/cgi-bin/viewrecord?7546

Module 2, Investigation 4: Figure 2

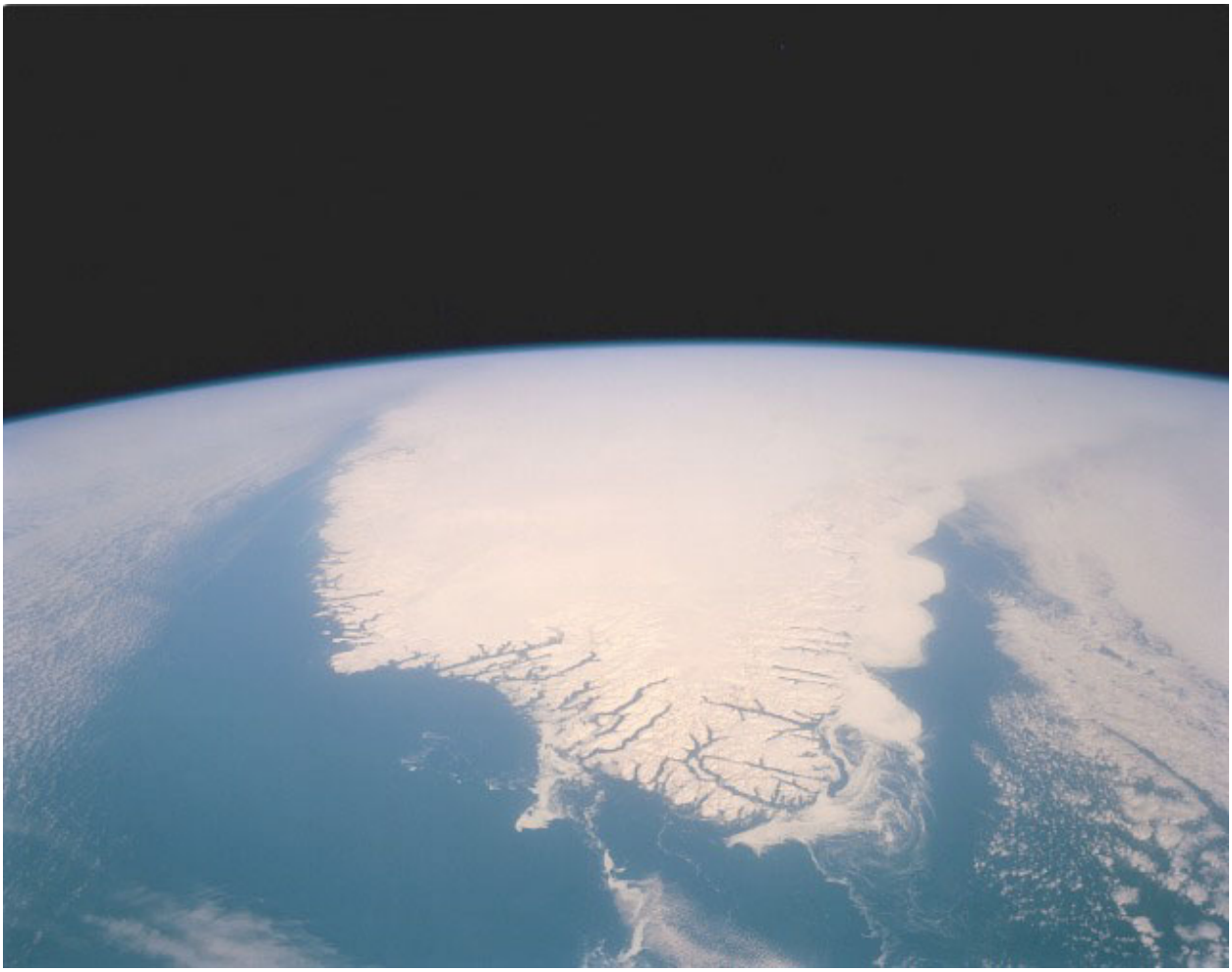
Flat coastline in the Eastern United States



Source: http://visibleearth.nasa.gov/data/ev51/ev5144_S2000277172549_md.jpg

Module 2, Investigation 4: Figure 3

Greenland



Source: earth.jsc.nasa.gov/photoinfo.cgi?PHOTO+STS045-152-105

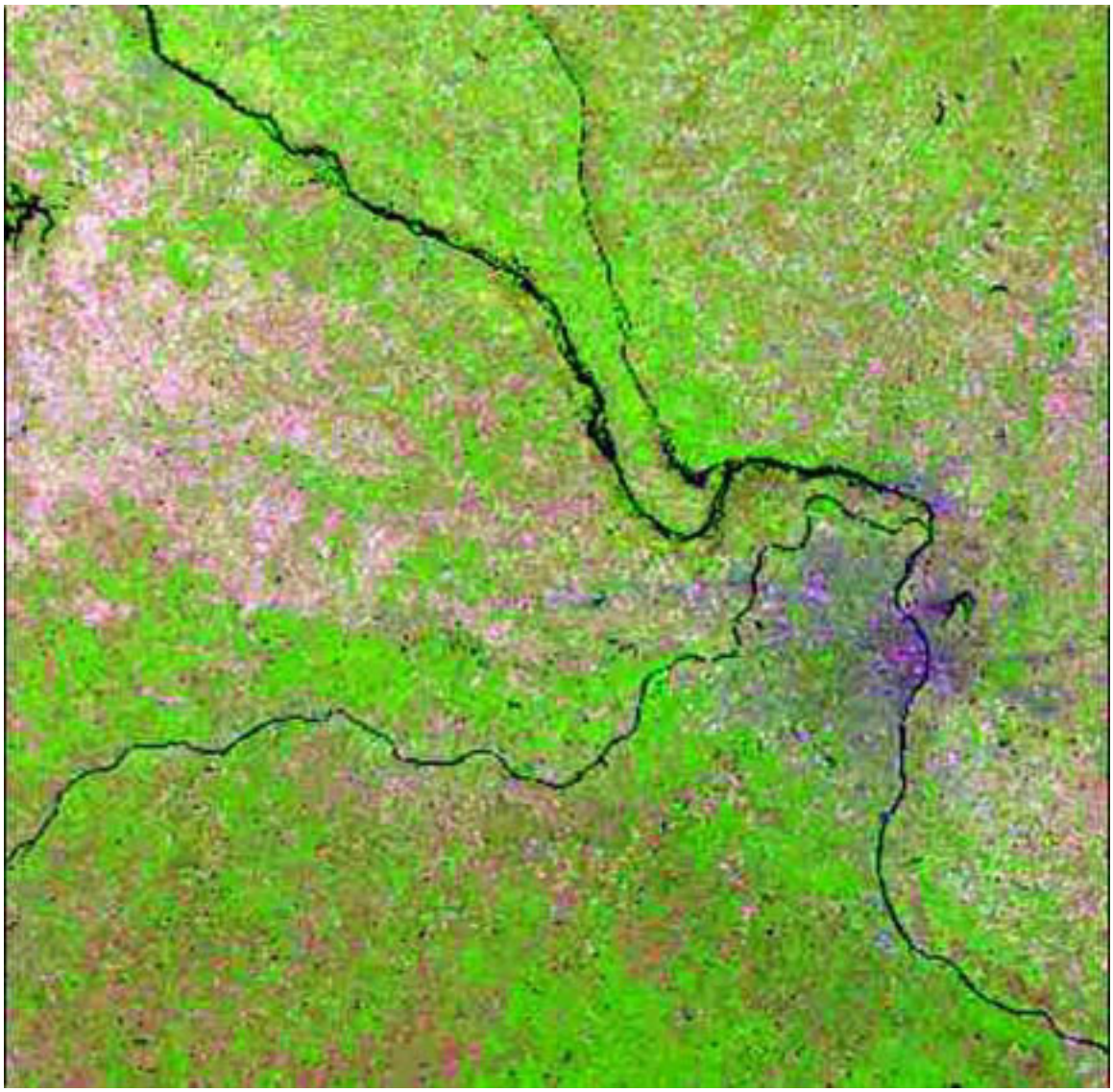
Module 2, Investigation 4: Figure 4

Map of Midwestern flooding

Source: http://observe.ivv.nasa.gov/nasa/exhibits/flood/flood_2.html

Module 2, Investigation 4: Figure 5

The Mississippi River System in 1988



Source: http://observe.ivv.nasa.gov/nasa/gallery/world/graphics/flood1.jpg

Module 2, Investigation 4: Figure 6

The Mississippi River System during the 1993 floods

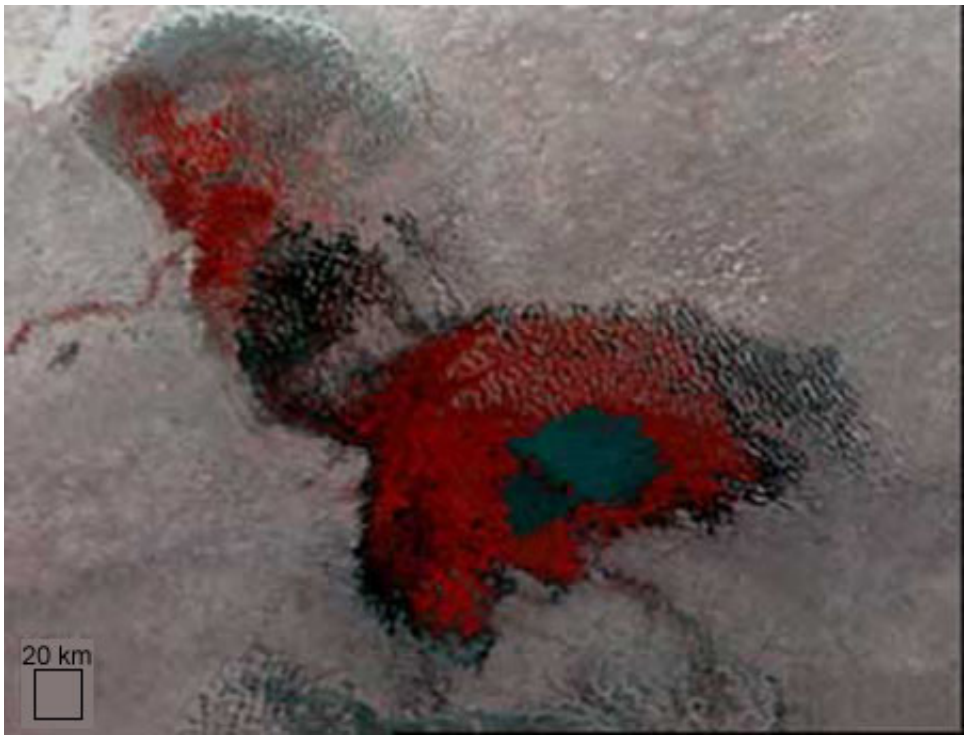
Source: http://observe.ivv.nasa.gov/nasa/gallery/world/graphics/flood2.jpg

Module 2, Investigation 4: Figure 7

Lake Chad, 1973 and 1997

Image 1: January 1973

Image 2: January 1997



Source: http://www.gsfc.nasa.gov/gsfc/earth/environ/lakechad/chad.htm

Module 2, Investigation 4: Figure 8

Grid