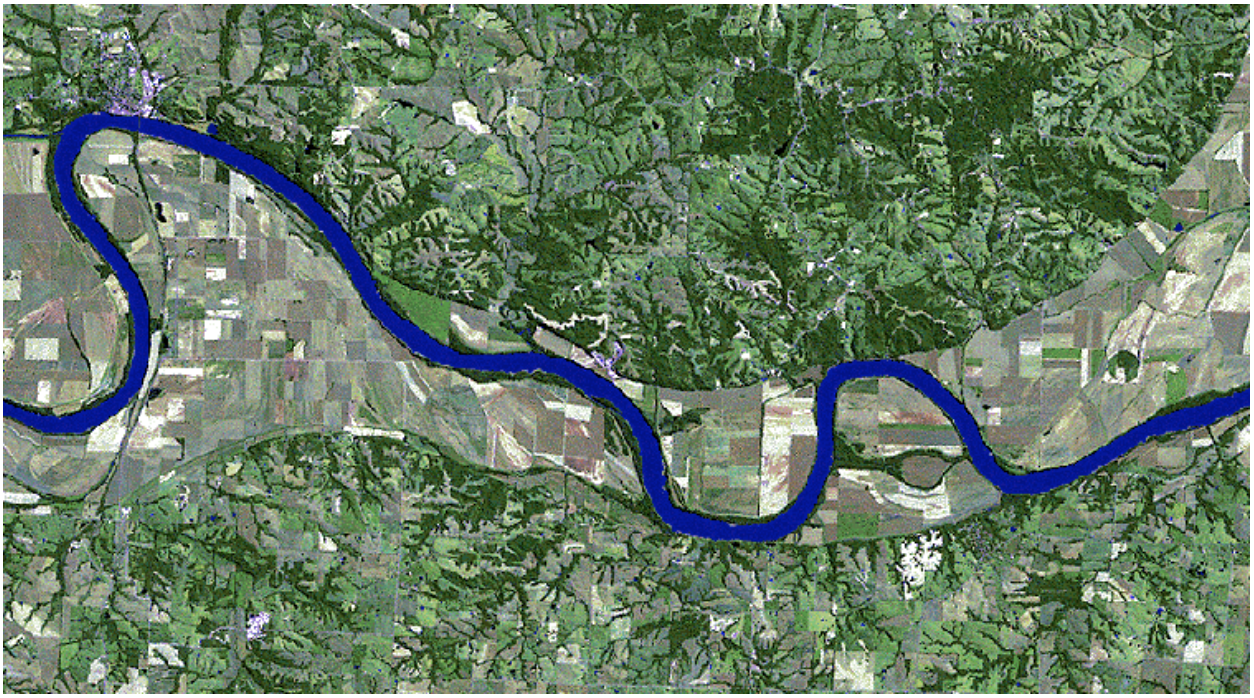
GEOL 101 - INTRODUCTION TO GEOLOGY
1993 Missouri River Flood Exercise

The flood of 1993 in the Upper Mississippi drainage basin was a “500-year flood”—the rivers reached levels expected to recur on the average about once every 500 years. The risk of such an extreme flood occurring is quite low; another way to look at this is to say that during any given year, a flood of such magnitude has a 1 in 500 chance of occurring, which is a probability of 0.2%.

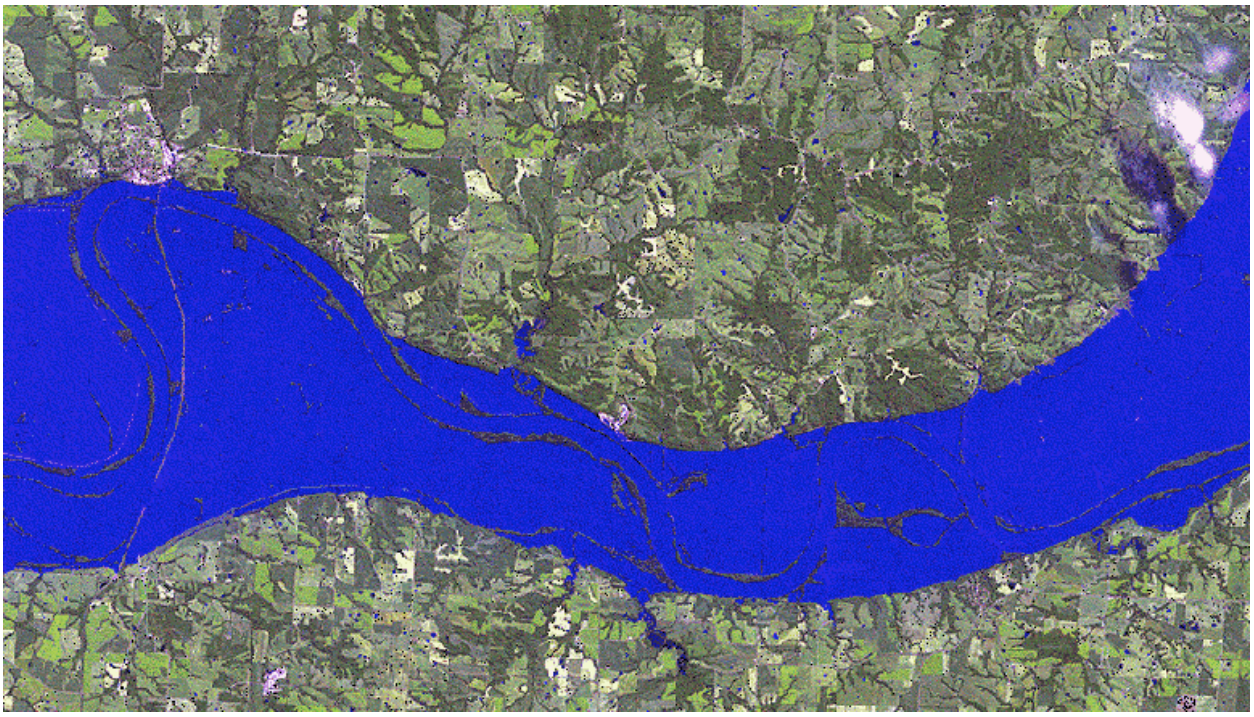
This exercise uses six sequential images depicting the changes that occurred within a portion of the Missouri River valley near Glasgow, Missouri. The Missouri River is a major tributary to the Mississippi River, and experienced the same level of flooding. The images are false-color images taken by the Landsat Thematic Mapper satellite and were obtained from the US Geological Survey.

(Slide 1) Pre-flood image (September 24, 1992):



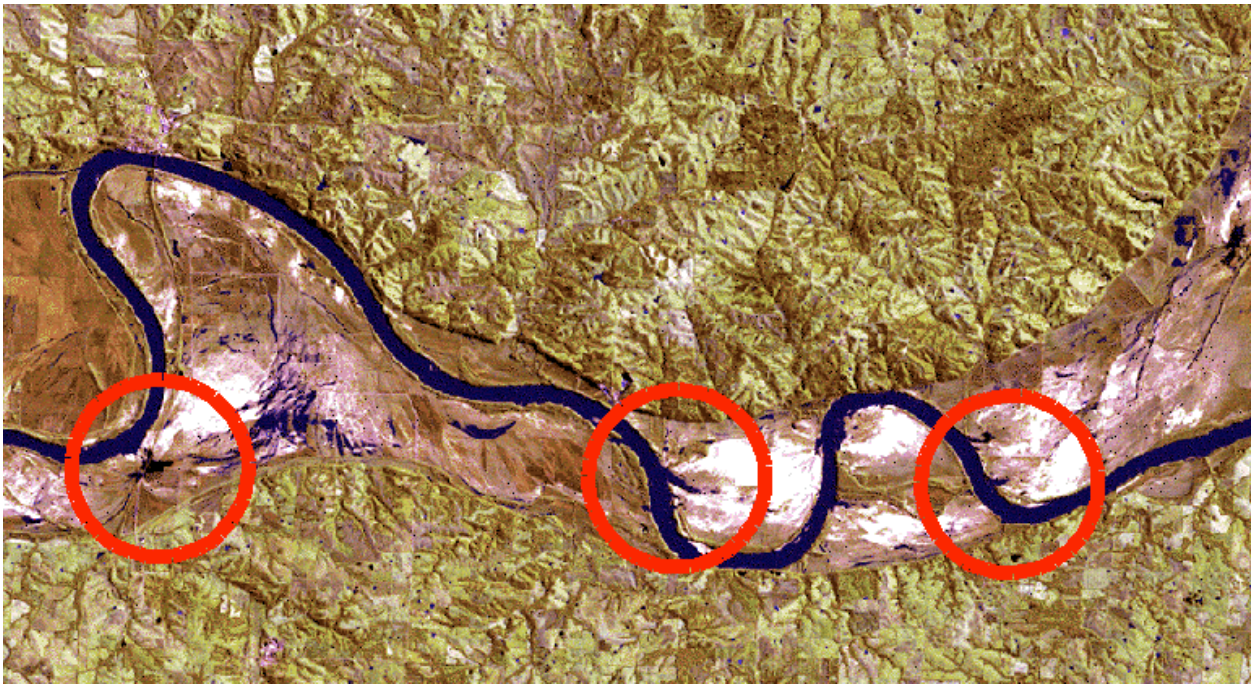
1. Most of the floodplain was being used for agriculture (note the regular pattern of rectangular fields). What features of river floodplains make them particularly attractive for agricultural use?
2. Examine the floodplain closely (note the distinct tree-covered bluffs that mark the boundaries of the floodplain). Do you see any patterns or features that represent older abandoned river channel segments? These might appear as curving tree lines or curved scar-like patterns in the vegetation. Describe what you see.

(Slide 2) Peak flood image (August 1, 1993):



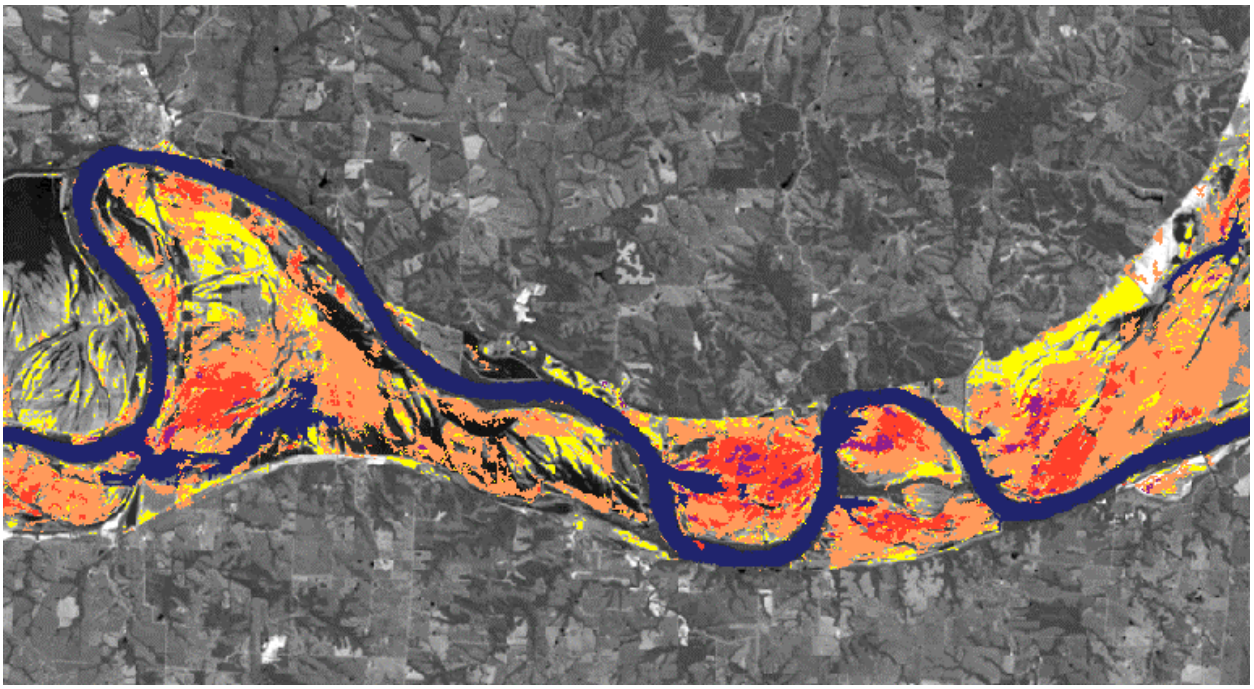
3. Note that the “normal” flow channel is still visible in most of the photo, from the vegetation growing on the levees. You should be able to find several places where the levees have been breached. How many levee breaks can you find? (You can verify your hypothesis by looking at the next photo in the sequence.)
4. Notice that the breaks in the levees seem to be associated with the bends in the river channel. What happens to the water flow as the current moves through a bend which might make levees on the bends more susceptible to failure than the levees on the straight channel segments?

(Slide 3) Post-flood image (December 7, 1993):



5. Note the scouring and huge sand deposits (bright white areas), associated with the levee breaks. What has happened to the previously well-defined pattern of cultivated fields that was visible in the pre-flood image?
6. The scouring of holes (denoted by the red circles on the image),on the downstream side of a levee break is the natural way that a mature stream changes its course across its floodplain. Based on the location of these holes, predict where the Missouri River would cut new channels during subsequent floods if the levees are not rebuilt.

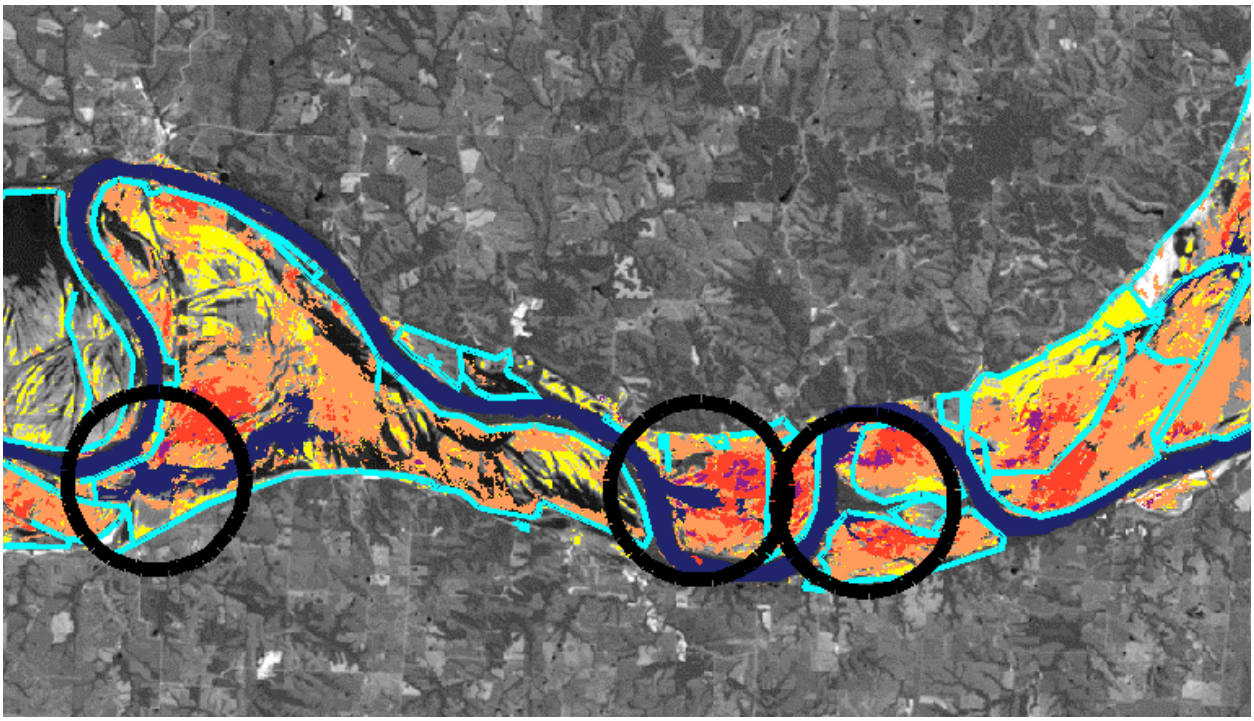
(Slide 4) Sand deposit image:



(Color key: purple = very thick, red = thick, orange = thin, yellow = trace)

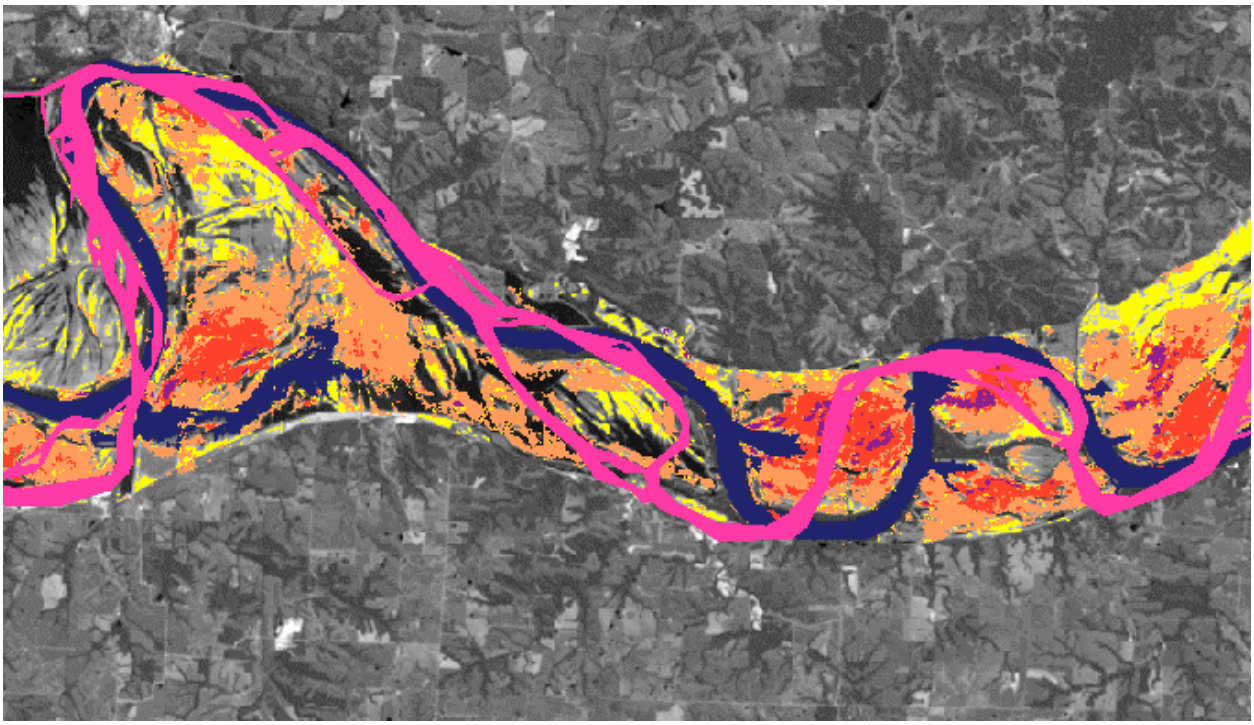
7. Notice how the thickness of the sand deposits varies with distance from the levee breaks. Why are the thickest deposits of sand closest to the levee breaks? What do you think would be the relationship between grain size and thickness of the sand deposits?

(Slide 5) Map of levees:



8. Compare the location of pre-flood levees (indicated by the light blue lines), from this image with the post-flood damage. Rebuilding the levees will be very costly; should they be rebuilt? Support your argument (for or against rebuilding) with evidence from the images and from the previously viewed video.

(Slide 6) 1879 channel image:



9. This image has the 1879 location of the Missouri River channel (shown in pink), superimposed on the post-flood image. The 1879 channel is an example of what the river looked like before the use of artificial flood control measures (artificial levees, wing dams, and revetments). Besides the fact that the present channel has migrated somewhat in the downstream direction, what other differences do you observe between the 1879 channel and the 1993 channel?
10. What effect might the channel deposits (mostly medium-coarse sand) from the 1879 channel play a role in the location of new levees in this floodplain? Support your answer using evidence from these images, and what you've learned from watching the video on the flood.