

**Using Scientific Data for Multi-disciplinary Science Instruction**  
**2012 SEIS/EPSCoR Professional Development Course**  
**Ellwein and Nyman**

**Activity: Exploring Earth Systems Science: The GLOBE Interactive Earth System Science Poster**  
([http://classic.globe.gov/fsl/html/templ.cgi?earth\\_system](http://classic.globe.gov/fsl/html/templ.cgi?earth_system))

**Step 1: Exploring Single Images.** *Divide into 6 groups, each group receives one image depicting one variable.*

Study and interpret your image. Look for available information (data displayed, unit of measure, range of values, etc.) then look for any patterns within the image. Identify (a) spokesperson(s) to report out the answers to the following questions:

- What variable did you examine and what is the range of values shown on the scale bars?
- Where in the world do you find the highest and lowest values (the extremes) of the data in your images? Why do these locations experience the extremes and not other locations?
- Are any patterns in the data noticeable? Are patterns different on different continents? Different over water than over land? Explain these patterns.

**Step 2: Exploring Annual Changes.** *Stay with your group, each group receives all images for one variable.*

Arrange your images in chronological order, starting with January. Identify annual cycles for your variable. Identify a different spokesperson to report out the answers to the following questions:

- What changes do you see through the year? What explanations can you suggest for these patterns?
- Choose a location or region. During which months do the extreme highs and lows occur? What explanations can you suggest for the timing of those extremes?
- Which regions experience both the extreme highs and lows? Which regions don't experience the extremes? Why do you think this happens?
- What differences, if any, do you find between the year's variations over the oceans versus the year's variations over the continents?
- Are there regions that remain relatively unchanged over the year? Why do you think this happens?
- Share discoveries of patterns and interpretation of patterns.

**Step 3: Exploring Relationships Between Two Variables.** *Combine groups (insolation + surface temperature, cloud fraction + precipitation, aerosols + biosphere).*

Arrange your images in chronological order, starting with January – line up images next to each other (January next to January, etc.). Identify the relationships between the variables. Identify a different spokesperson to report out the answers to the following questions:

- What relationships or patterns do you see between the data sets?
- Do the relationships appear to be directly or inversely proportional?
- What methods did you use to identify relationships?

**Step 4: Exploring Relationships Among Variables for a Particular Month.** *Reform original groups, each group receives images of six variables for one month.*

Identify the relationships between the variables. Identify a different spokesperson to report out the answers to the following questions:

- Which regions experience the extreme highs and lows for each variable?
- Which regions don't experience extremes? Why do you think this occurs?
- What differences, if any, do you find between variations of variables over the oceans versus variations of variables over the continents?
- What amounts of insolation, surface temperature, cloud fraction, precipitation, and aerosols characterize the world's most vegetated regions for your month? Where is the greatest concentration of aerosols originating from and how would you characterize that particular environment based on the six images?

**Step 5: Exploring Relationships Among Variables Six Months Apart.** *Combine groups (January + July, March + September, May + November).*

Arrange your images by variable (Insolation January next to insolation July, surface temperature January next to surface temperature July, etc.). Identify the changes that occur in the six variable between the six-month period. Identify a different spokesperson to report out the answers to the following questions:

- Which variables change the most over the six-month period? Which variables change the least? Why do you think this happens?
- Do you see any relationships among the variables that you didn't see previously?
- What methods did you use to identify relationships?

**Step 6: Applying the Data.** *Reform original groups. Using images that are 6 months apart, answer the following questions. (In answering these questions, you are constructing questions or hypotheses based on data.)*

Notice that cloud fraction values over the equatorial region in Africa are quite high throughout the year (>50%). Also notice that precipitation is high as are vegetation (NDVI) values.

- What type of environment might this be?
- If cloud fraction values were decreased to less than 25%, what environmental changes would you expect for this region?
- Would you expect high precipitation values (e.g. >200 mm) to exist under low cloud fraction?
- What additional information might be useful in making these statements?
- What about a similar reduction in the Amazon region of South America?
- What effects would these changes have on the vegetation (NDVI)?
- Why would you expect these changes?