

## Earth Observation Days

---

### **Learning Goal:**

The learning goals of Earth Observation Day are:

- 1- To work on observation and pattern recognition skills.
- 2- To learn about the Earth System through observations of specific features and processes on the Earth. Some of these will form the basis for future activities and projects.

### **Materials:**

To meet the learning goals of Earth Observation Day students will use a variety of visualizations of terrestrial features and processes including maps, satellite imagery, graphs and, technical drawing.

### **Activity:**

1- During Earth Observation Day you will view different types of visualizations and make observations. You should concentrate on recognizing patterns, breaks or changes in patterns, edges of patterns and/or gradients or slopes in graphs. See the table for details about the visualizations.

2- After completing your observations, choose three visualizations to investigate how these features are related.

### **Requirements:**

1- Each visualization should include the following items:

- a. The title of the visualization
- b. A brief introduction of the visualization. At the minimum this should include items such as: Is this a map or graph? For maps, how are the datasets represented (different colors, dots, contour lines, etc.)? For a graph, what values are portrayed on the axes?
- c. A description of the patterns

This can be hand-written but has to be very neat, legible and organized.

2- For the three visualizations that you choose, write a 2 page summary of how these features are related. This should include a description of the visualizations (taken from your observations) and the relationship between them. You should make some hypothesis/hypotheses about why these features are related. This should be typed, double spaced, 12 font Times, 1 inch margins.

## *LIST OF VISUALIZATIONS*

| <b>Feature or Process</b>                               | <b>What should you be looking for</b>   | <b>Complete</b> |
|---|---|-----------------|
| Plate tectonic map with EQ, volcanoes, velocity vectors | This is a full visualization. Concentrate on one feature at a time. For the point data concentrate on the distribution of patterns. For the velocity vectors, concentrate on changes in magnitude and directions.   |                 |
| Topographic variation of continents                     | Look for the distribution and patterns of high and low areas. Are there areas that are especially high and low? Are these areas arranged around the globe in a specific manner or are they random?  |                 |
| Topographic variation of seafloor                       | Look for the distribution and patterns of high and low areas. Are there areas that are especially high and low? Are these areas arranged around the globe in a specific manner or are they random?  |                 |
| Global ocean surface temperature: January and July 2001 | Describe the general shape/pattern of the temperature distribution. Where is it warmest? Where is it coldest? How does the temperature distribution vary between July and January?  |                 |
| Global temperature                                      | Describe the general shape/pattern of the temperature distribution. Where is it warmest? Where is it coldest? How does temperature vary between continents and oceans? How does the temperature distribution vary between July and January?   |                 |
| Global heat flow  | What are the shapes of the areas of high and low heat flow? How are these areas distributed across the globe? What is the pattern between the areas of high and low heat flow?  |                 |
| Geothermal gradient graph                               | How does temperature change with depth into the earth? Is there a consistent change or does the slope of the line vary? Are there any relationships between the different earth layers and temperature change? In your observations make sure you include some of the temperature values. |                 |
| P and S wave velocity with depth graph                  | A very interesting visualization! Which are faster, P- or S-wave velocities? How do the velocities vary with depth in the earth? Is the variation smooth or are there sudden jumps and changes? What is the relation between velocity changes and the different layers in the earth?      |                 |
| Crustal thickness map                                   | Where is the thickest and thinnest crust? What are the shapes of the areas of thick crust? Where does the crust have uniform thickness? Where do rapid changes in crustal thickness occur?  |                 |
| Gravity anomaly map and globes                          | What is the distribution of high positive and high negative anomalies? Where are the very highly anomalous areas? What shape are the anomalies? Are they linear or irregular in shape?  |                 |

| Feature or Process                    | What should you be looking for  | Complete |
|---------------------------------------|---|----------|
| Magnetic field strength map           | Describe the shape of this pattern. Where are the areas of low magnetic intensity? Where are the areas of higher magnetic intensity?  |          |
| Biome map                             | This is a very complex visualization. What does the complexity suggest about the number of factors that affect the distribution of biomes? Describe the shape and distribution of the different biomes. Do the different biomes appear to be “controlled” by or follow longitude or latitude? |          |
| Annual precipitation distribution map | Describe the pattern(s) of global precipitation.  |          |
| Human population distribution map     | Describe the pattern(s) of global population distribution.  |          |

## Assessment of Earth Observation Activity

Part of my job as an educator is to constantly evaluate the success (or failure) of my curriculum. The Earth Observation activity is part of a larger effort to use Earth processes and visualizations as a framework for understanding various aspects of physical sciences. Therefore, I am very interested in your opinions and ideas about this part of the course. Please complete the following questionnaire including specific comments or recommendations about this activity. Your response will, in no way, affect your grade in this class. Thanks for your time, ideas and honest opinions.

1- The goals of the Earth Observation Activity were:

|            |   |                |   |         |
|------------|---|----------------|---|---------|
| Very clear |   | Somewhat clear |   | Unclear |
| 1          | 2 | 3              | 4 | 5       |

2- As a result of this activity, my ability to recognize patterns on the visualizations:

|          |   |                |   |           |
|----------|---|----------------|---|-----------|
| Improved |   | Did not change |   | Got worse |
| 1        | 2 | 3              | 4 | 5         |

3- The number of visualizations included in the Earth Observation Activity was:

|         |   |            |   |          |
|---------|---|------------|---|----------|
| Too few |   | Just right |   | Too many |
| 1       | 2 | 3          | 4 | 5        |

4- Rate the degree to which you could correlate patterns between different visualizations.

|        |   |          |   |            |
|--------|---|----------|---|------------|
| Easily |   | Somewhat |   | Not at all |
| 1      | 2 | 3        | 4 | 5          |

5- Rate the overall success of this activity in terms of your learning about the Earth.

|                 |   |                     |   |              |
|-----------------|---|---------------------|---|--------------|
| Very successful |   | Somewhat successful |   | Unsuccessful |
| 1               | 2 | 3                   | 4 | 5            |

6- Rate the overall success of this activity in terms of your learning about and recognizing patterns.

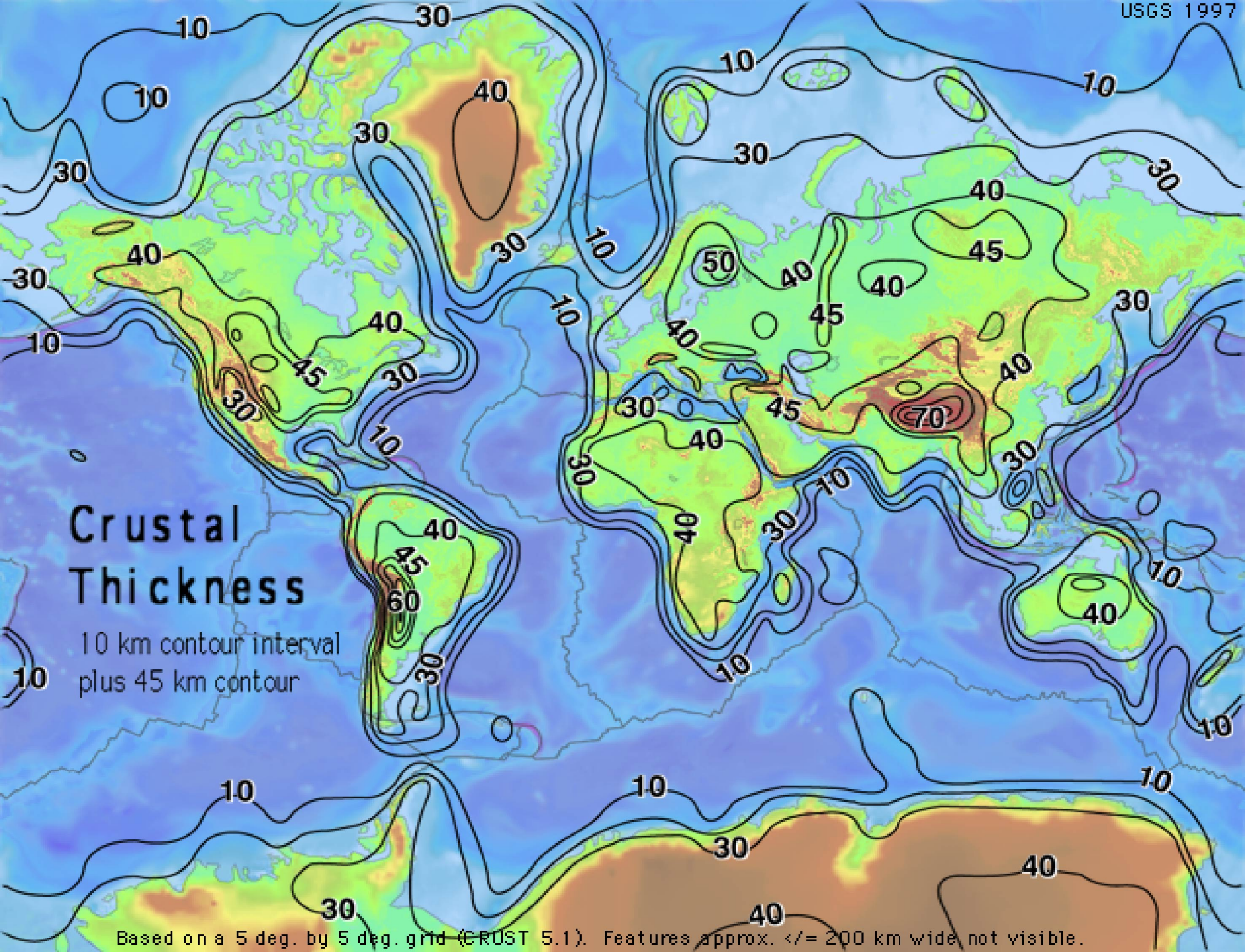
|                 |   |                     |   |              |
|-----------------|---|---------------------|---|--------------|
| Very successful |   | Somewhat successful |   | Unsuccessful |
| 1               | 2 | 3                   | 4 | 5            |



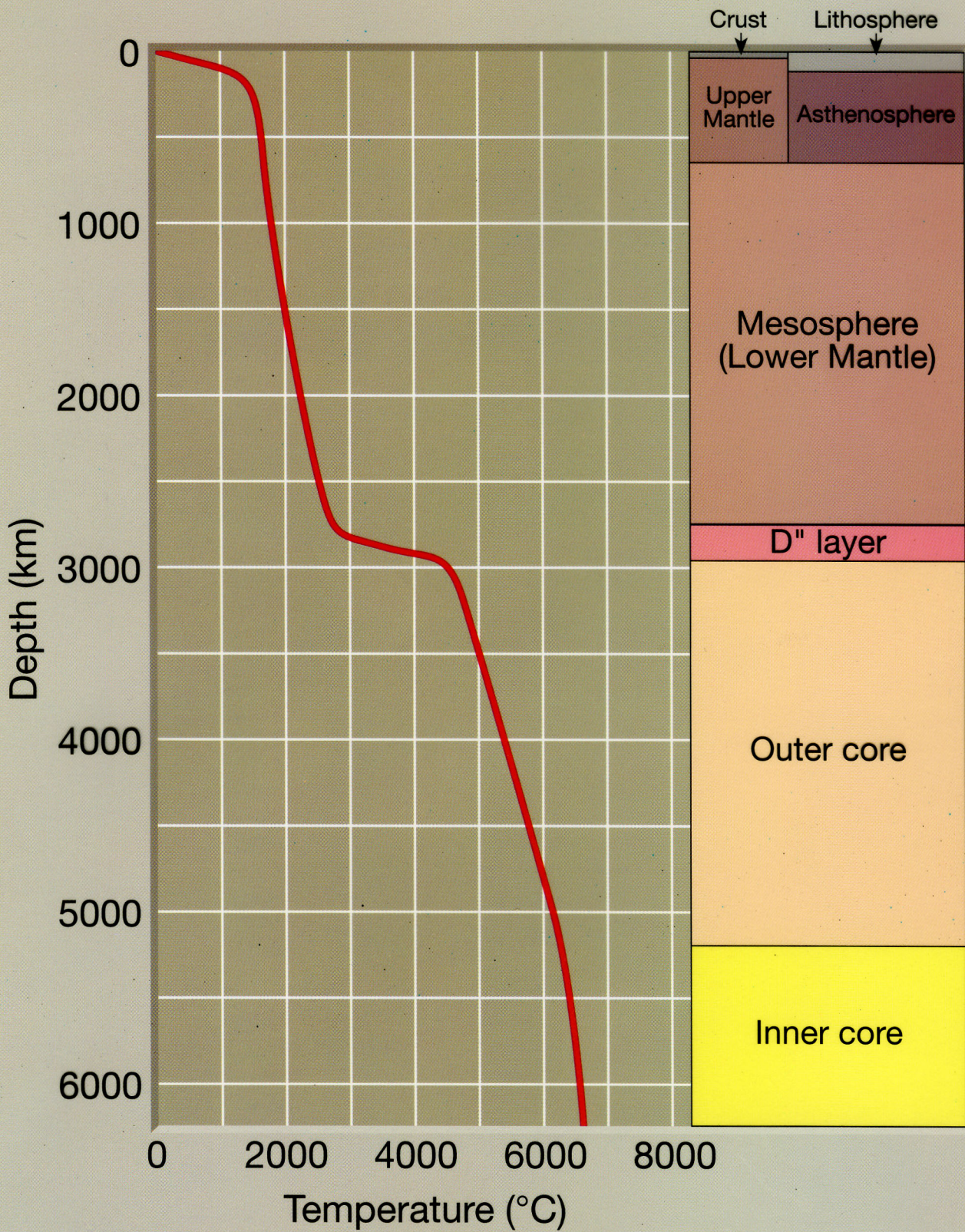
7- In your opinion, what was the most interesting or memorable visualization? Briefly explain why.

8- In your opinion, what was the least interesting or confusing visualization? Briefly explain why.

Please provide any written comments, criticisms or suggestions.



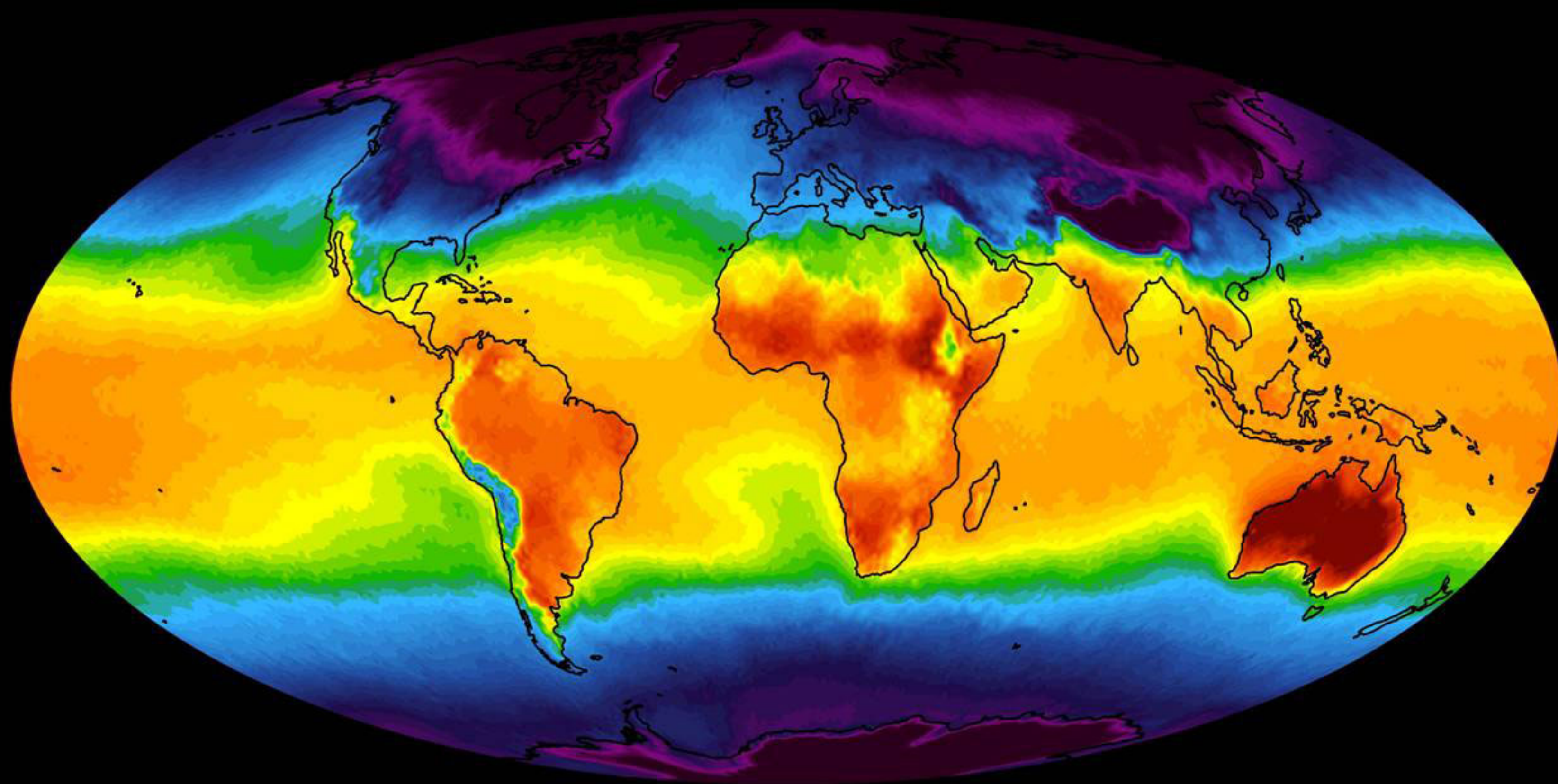






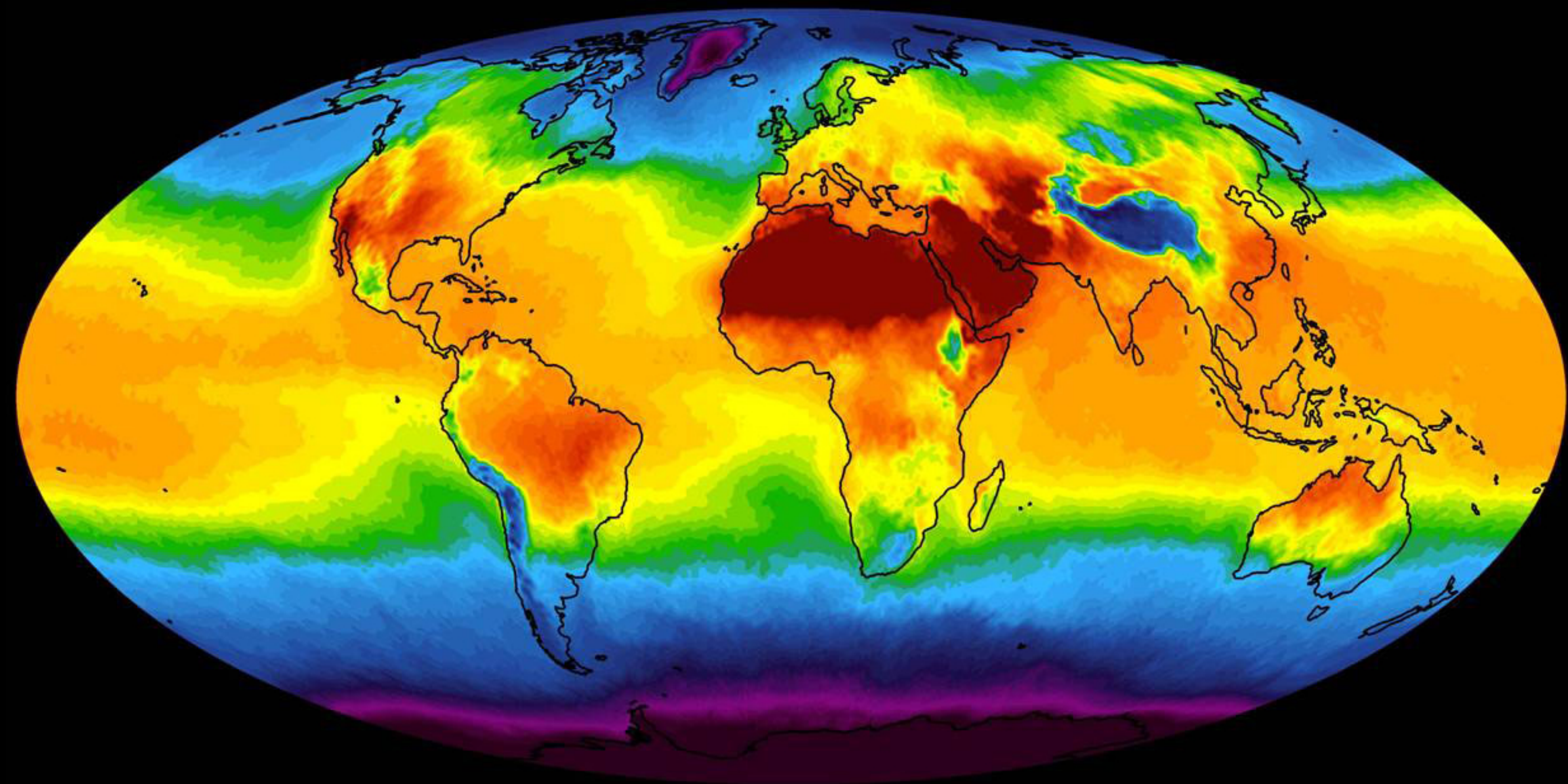
Mean Surface Air Temperature

AIRS data, January 2003

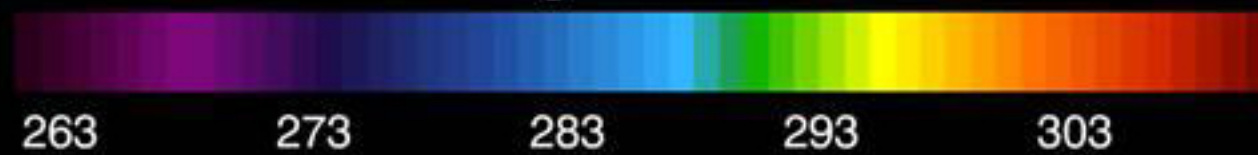


Mean Surface Air Temperature

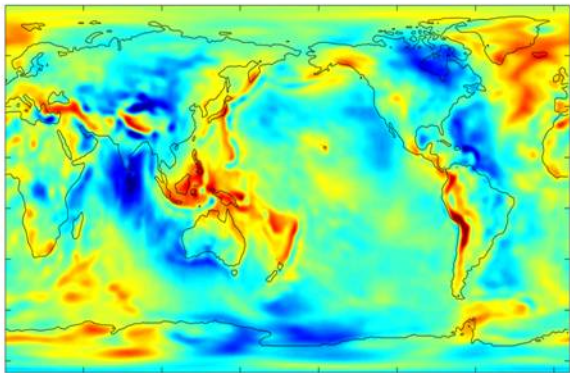
AIRS data, July 2003



Degrees Kelvin







-60

-40

-20

0

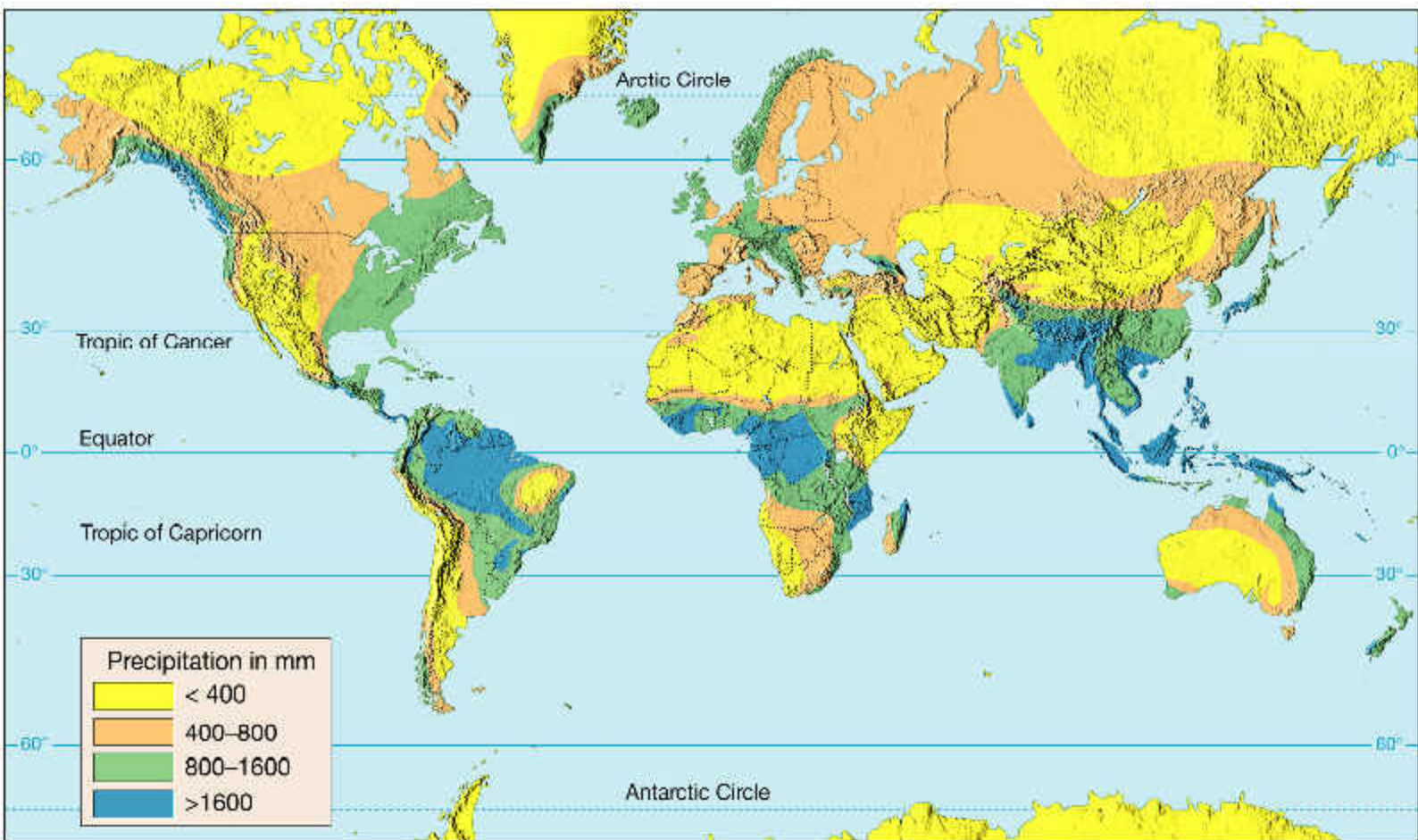
20

40

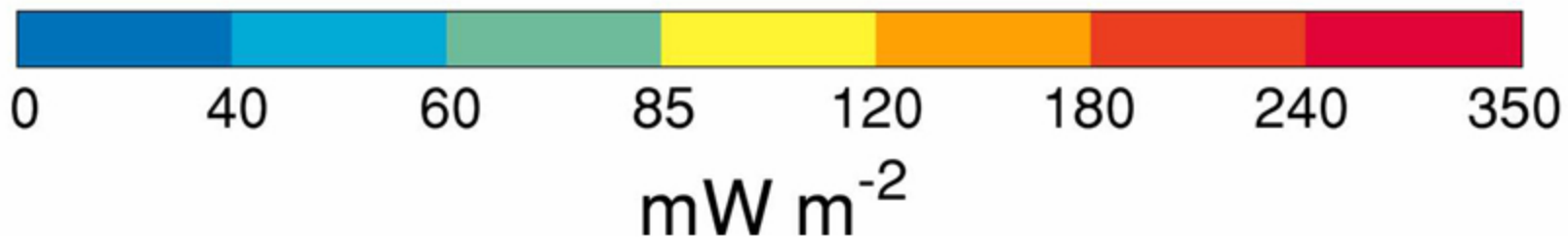
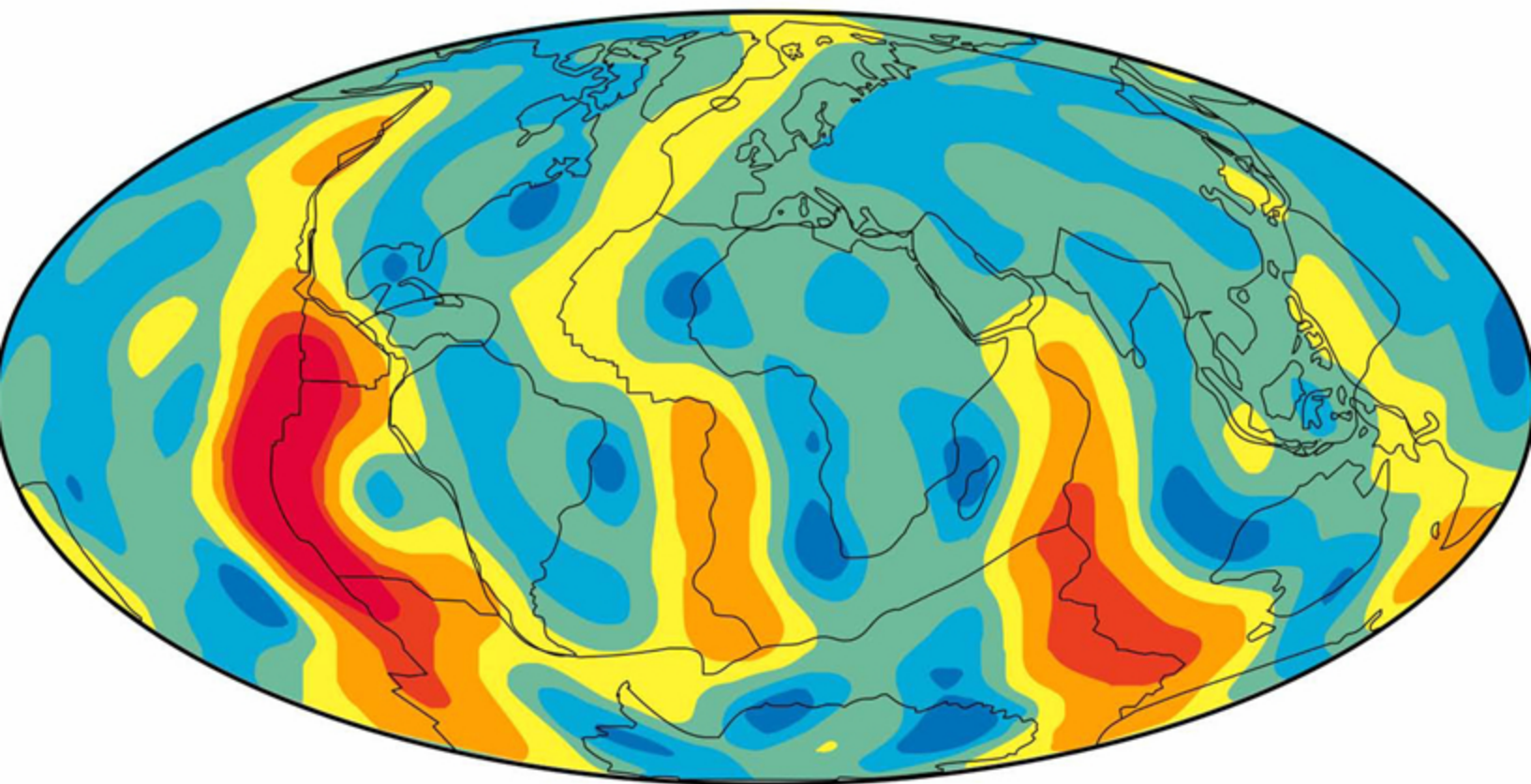
60

Gravity Anomaly (mGal)

# Global Annual Precipitation

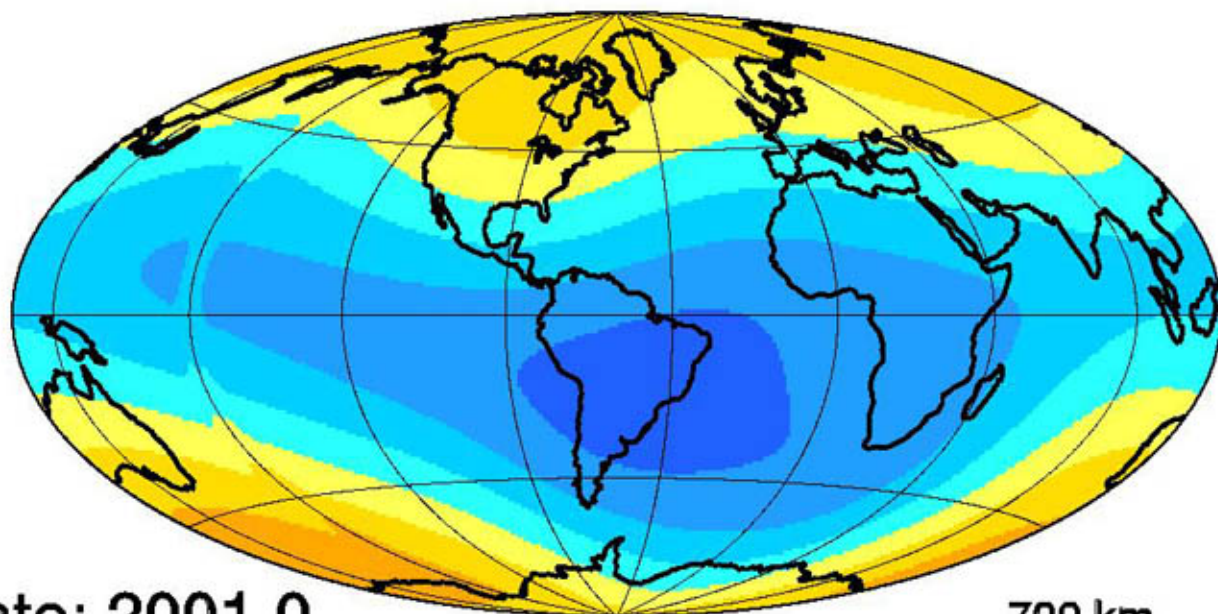


# Heat Flow



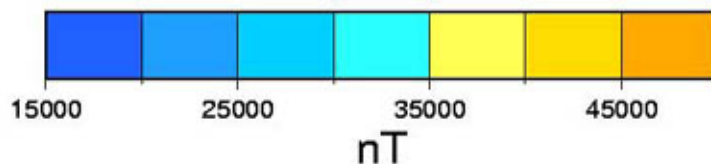
F

Magnetic field intensity



Date: 2001.0

700 km

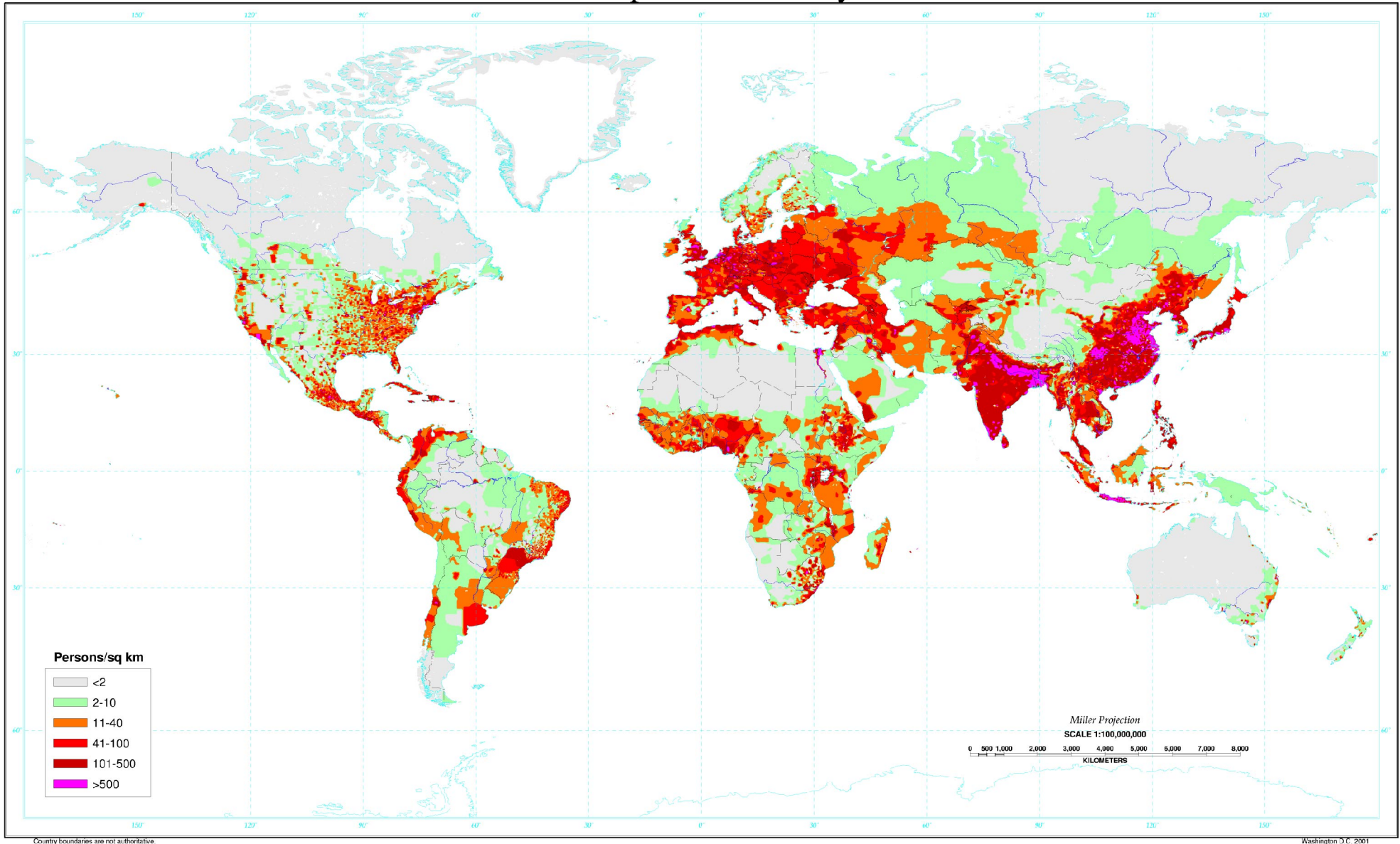


altitude

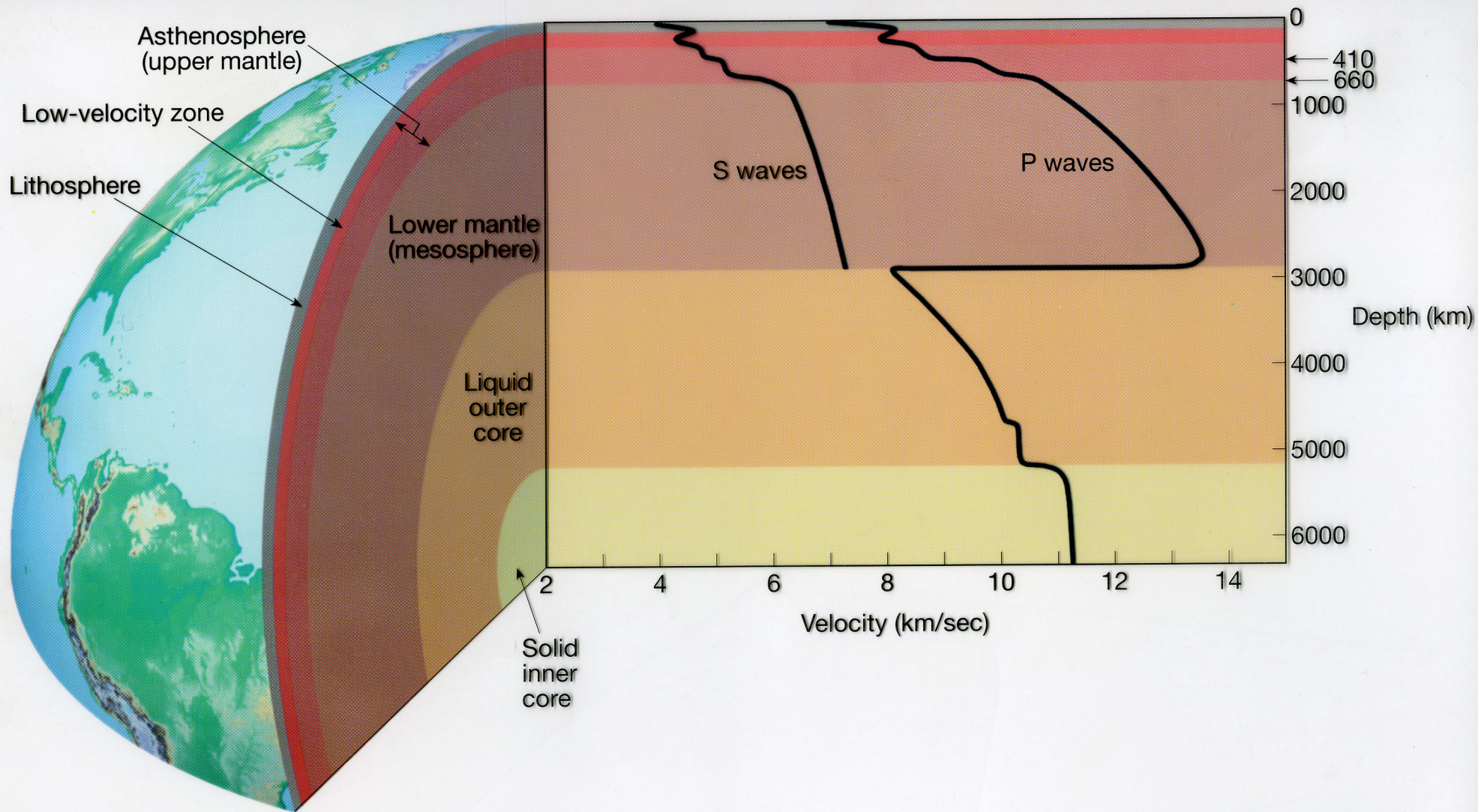
**Figure 2: Magnetic field at beginning of SAC-C mission**



# Historical Population Density - 1994

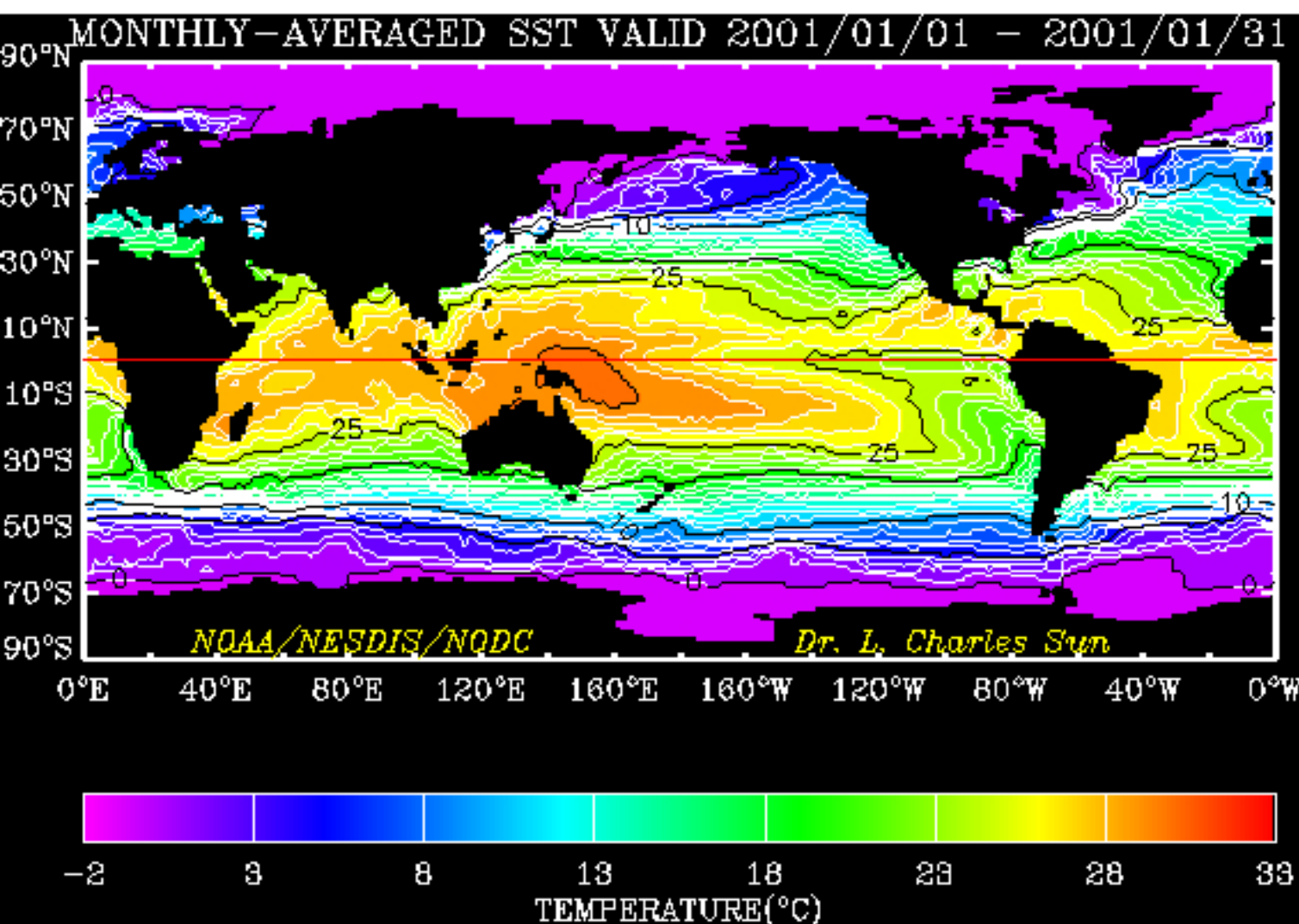




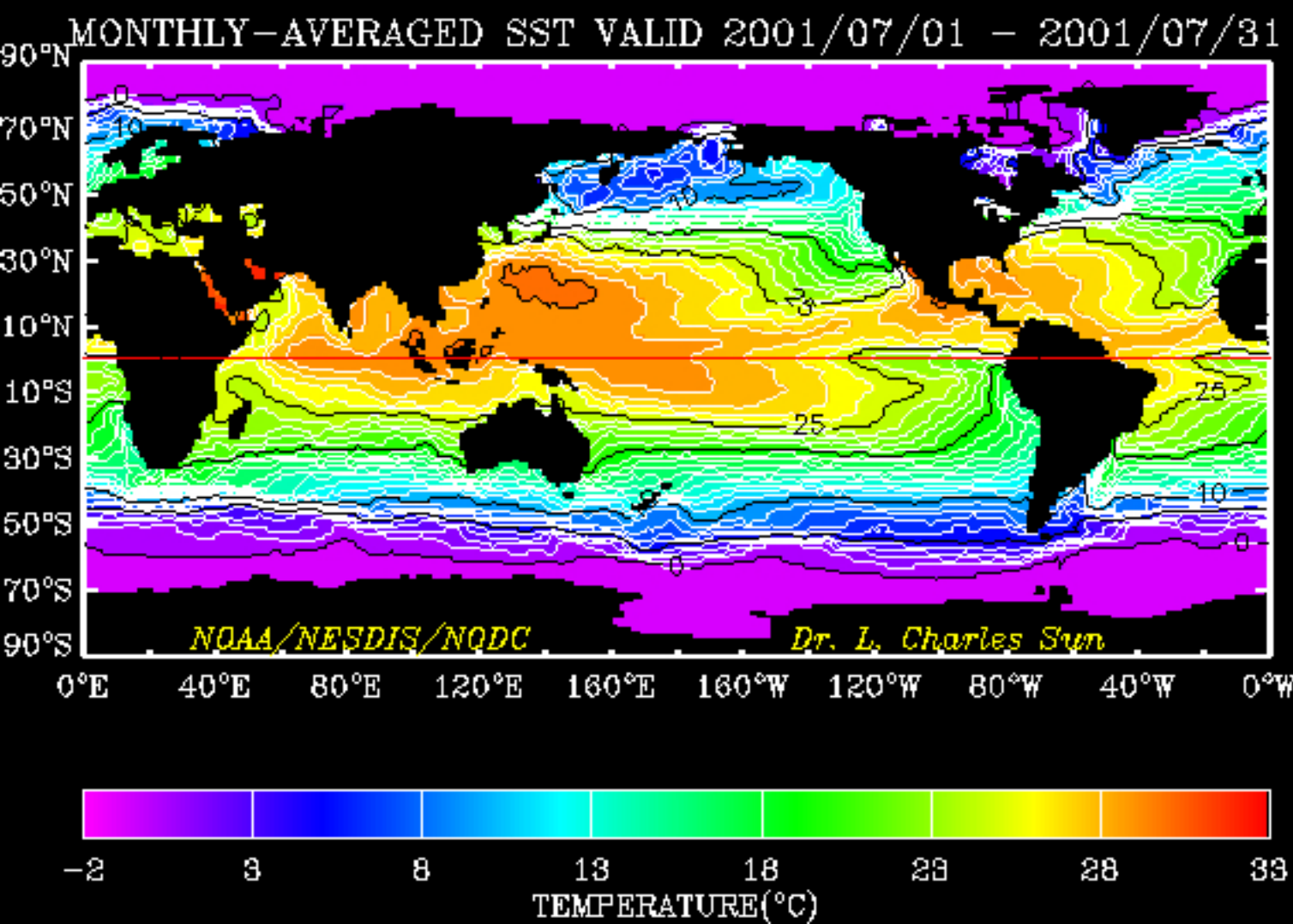




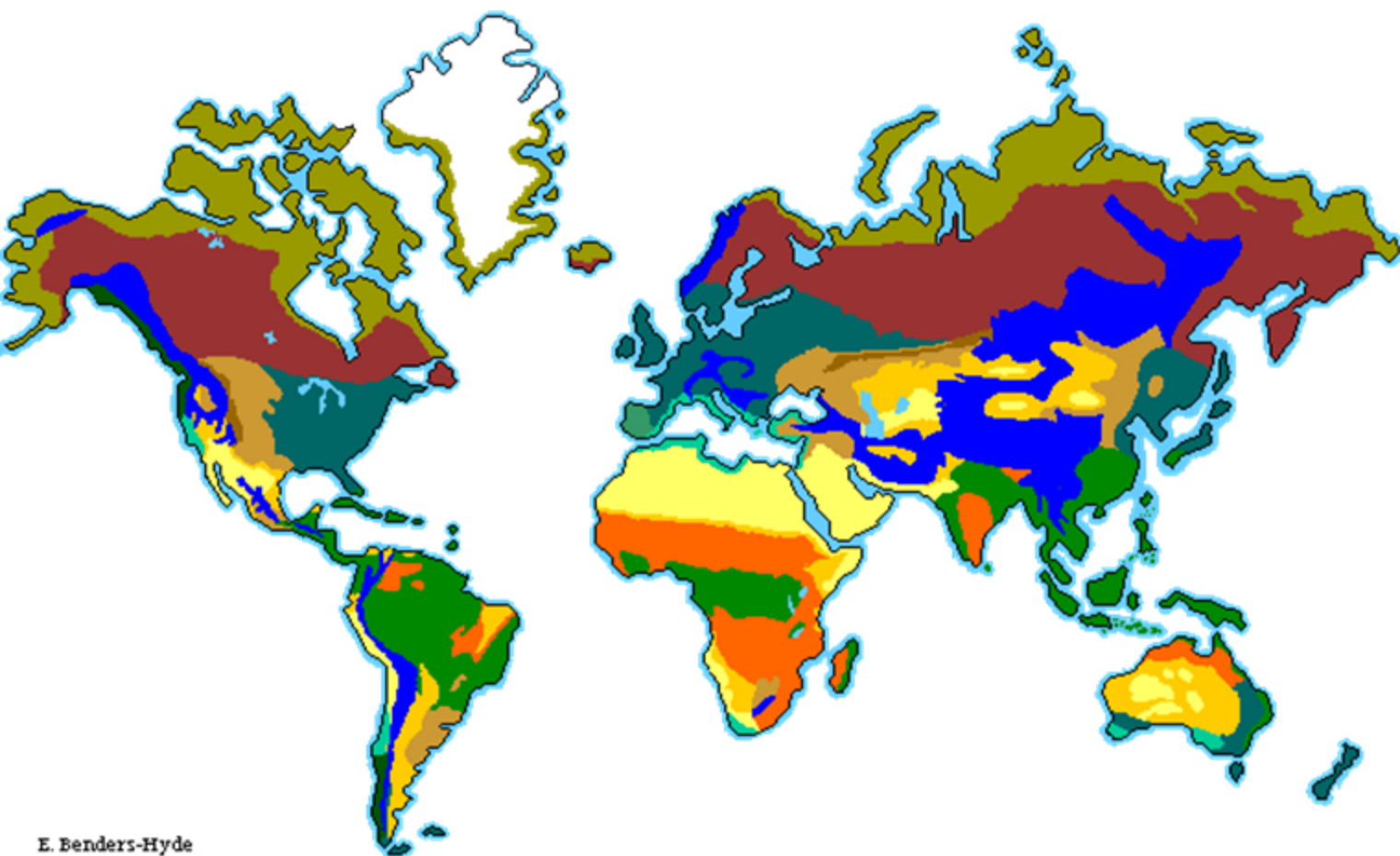
# Average Sea Surface Temperature (January 2001)



# Average Sea Surface Temperature (July 2001)



# World Biomes



Tundra

Taiga

Grasslands

Deciduous Forest

Rainforest

Chaparral

Desert

Desert-scrub

Savanna

Alpine

E. Benders-Hyde