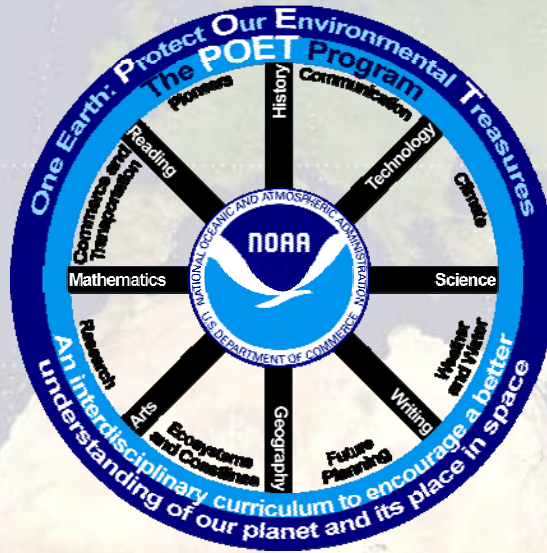


# Using Different Models of Earth

**Category**  
Geography, Science

**Real World Connection**  
Commerce, Transportation



**Materials**  
Scissors, Glue or Tape, String, Globe Map of the World

Copies of a Two Dimensional Map (Flat) - Icosahedron Pattern - to Construct a Model of Earth (Included)

Optional: String to Suspend Model of Earth

## Problem Question

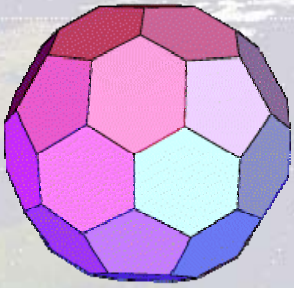
*How do the shapes, sizes, and distances of land masses appear to be different on two different models of Earth? (An icosahedron and a flat map)*

### Prior Knowledge What I Know

*Based on your prior knowledge, answer the problem question to the best of your ability.*

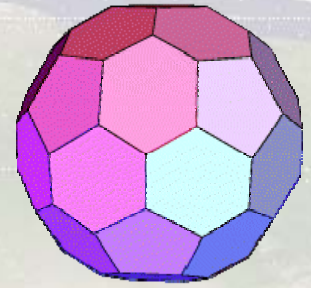
### Conclusion What I Learned

*Answer the problem question after completing the activity. Include an example in your answer.*



## FYI

An icosahedron is a three dimensional figure with the maximum number of faces that can be cut out and assembled into a spherical shape from a flat piece of paper.

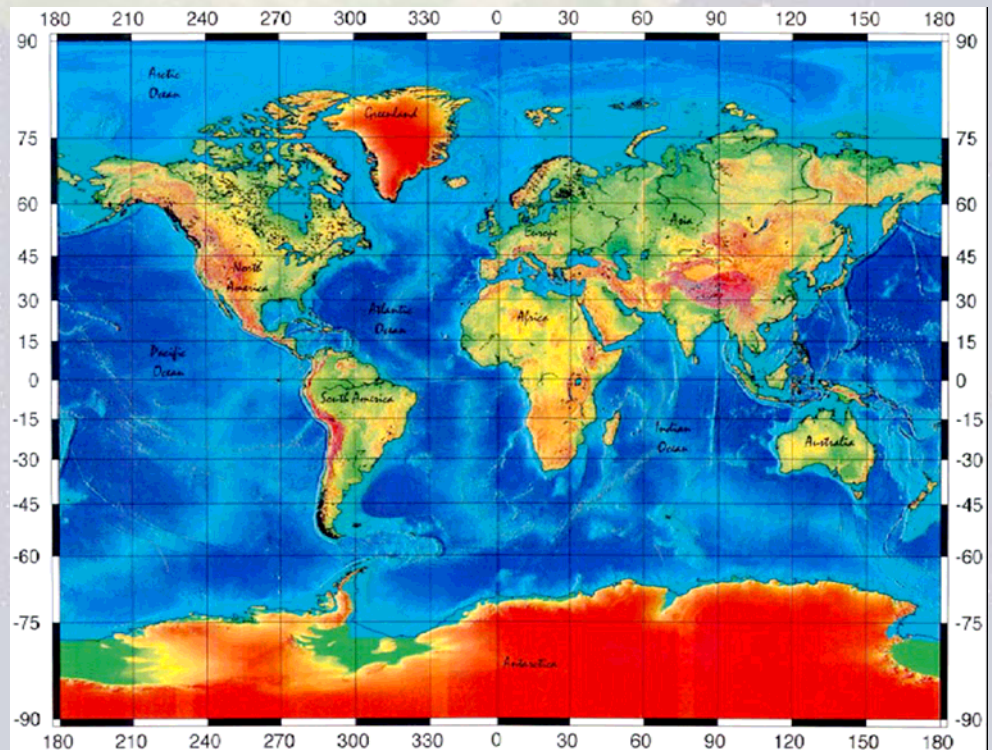


## Background

Using a globe map of the world and a piece of string, find the shortest distance between New York, New York and Paris, France. You can accomplish this by stretching the string tightly between these two cities (points) on the globe. The resulting route is called a Great Circle. It is the shortest possible route on the surface of a sphere.

## For Thought

Which route would save fuel for airlines flying between these two major cities – a circle route or a flat map route?



*Miller Projection World Map*

## Procedure - Part 1

1. If your icosahedron model of Earth (Figure 2-1) is black and white, color your model according to the teacher's master color template (Figure 2-1) that comes with this activity.
2. Assemble the icosahedron model of Earth (Figure 2-1). (Hint: Cut the tabs larger so that the sections of the icosahedron fit together more easily for gluing or tape.)
3. Answer the following questions as you construct your icosahedron model of Earth.

## Questions - Part 1

1. How are the icosahedron map and the flat map similar and different?

2. How does Antarctica appear different on the flat map compared to the icosahedron map?

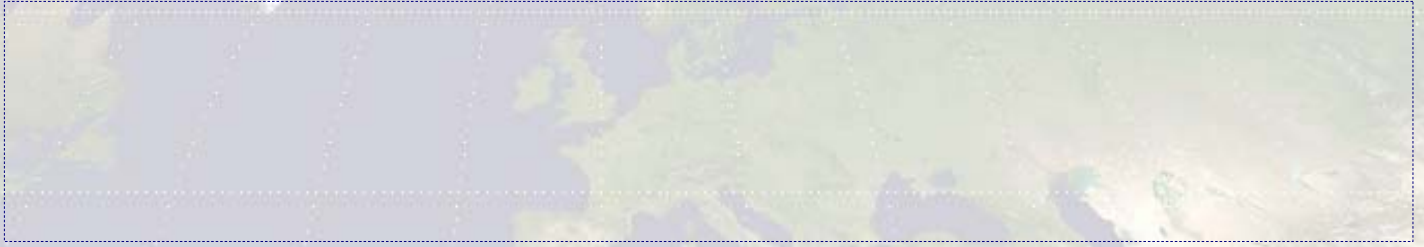
3. How does Greenland appear different on the flat map compared to the icosahedron map?

4. What can you say (conclude) about shape and size on a icosahedron map compared to a flat map? Why?

5. Is the icosahedron map or the flat map more true to scale?

## Questions - Part 1 (Continued)


6. Why were you asked to construct a model of Earth using an icosahedron instead of constructing a sphere (globe)?



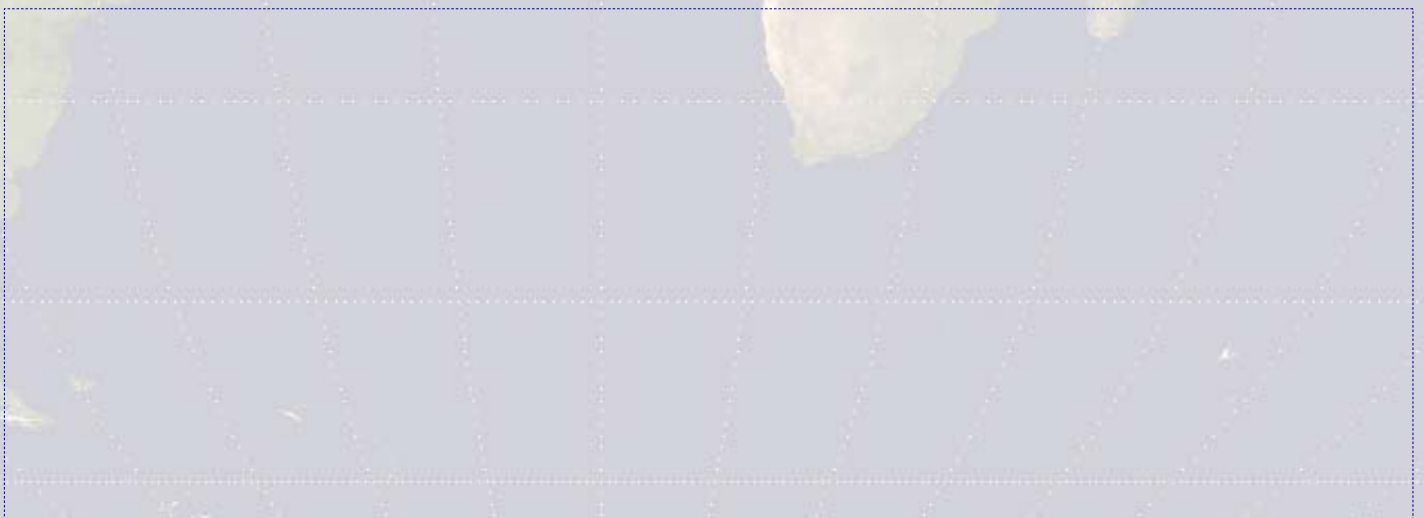
7. Describe the Great Circle route between Cape Horn, South America and Tasmania, Australia. Is the route on the icosahedron map or on the flat map more direct?



8. Find the Great Circle route between Seattle, Washington and the country of Kazakhstan on both the flat map and on the icosahedron map. Describe the most direct route.



9. What can you say (conclude) about the sizes and shapes of land masses on a globe (represented by an icosahedron map) compared to a flat map?



## Procedure – Part 2

Using your icosahedron map model (Figure 2-1), answer the following questions.

**FYI**

**To find the antipode on any model of Earth, add 180 degrees to the longitude and flip the sign of the latitude**

**Questions - Part 2**

10. Name the antipode (country or a body of water) that is opposite from the United States.

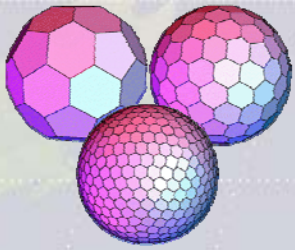
11. Name the antipode (country or a body of water) that is opposite from Antarctica.

12. Name the antipode (country or a body of water) that is opposite from Australia.

13. Does the icosahedron or the map make it easier to accurately identify the "opposite" location? Why?

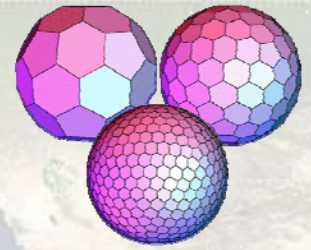
## For Teachers

The following material explains how the icosahedron is the basis for new models being developed for global weather prediction.



## Spherical Geodesic Grids: A New Approach to Modeling the Climate

*Information and Tools to get Started  
Using Spherical Geodesic Grids*



### Modeling the Atmospheric General Circulation Using a Spherical Geodesic Grid: A New Class of Dynamical Cores

Todd M. Ringler  
Rene F. Adler  
David A. Randall

Department of Atmospheric Science  
Colorado State University  
Fort Collins, Colorado

NCAR CGD Seminar Series  
May 6, 1999

NCAR CGD Seminar Series  
May 6, 1999



### An Introduction to Spherical Geodesic Grids

[http://kiwi.atmos.colostate.edu/BUGS/  
geodesic/slideshow/](http://kiwi.atmos.colostate.edu/BUGS/geodesic/slideshow/)

### Modeling the Atmospheric General Circulation using a Spherical Geodesic Grid: A Technical Report on a New Class of Dynamical Cores

version 1.0

Todd M. Ringler, Rene F. Adler, and David A. Randall

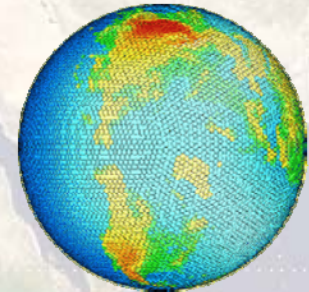
Department of Atmospheric Science  
Colorado State University  
Fort Collins, Colorado

July 1999

Environmental Sciences Division, NCAR, Boulder, CO

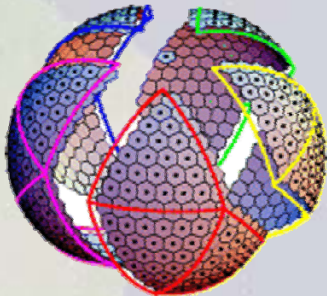
### Papers and Technical Reports

[http://kiwi.atmos.colostate.edu/BUGS/  
geodesic/pdfFiles.html](http://kiwi.atmos.colostate.edu/BUGS/geodesic/pdfFiles.html)



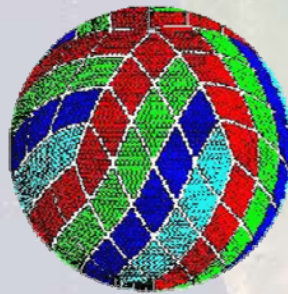
### Interpolating To and from Geodesic Grids

[http://kiwi.atmos.colostate.edu/BUGS/  
geodesic/interpolate.html](http://kiwi.atmos.colostate.edu/BUGS/geodesic/interpolate.html)



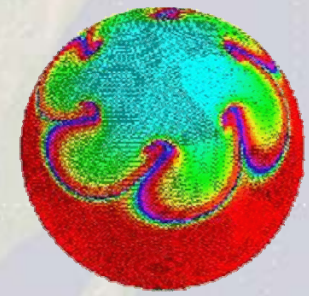
### Data Structure

[http://kiwi.atmos.colostate.edu/BUGS/  
geodesic/text.html](http://kiwi.atmos.colostate.edu/BUGS/geodesic/text.html)



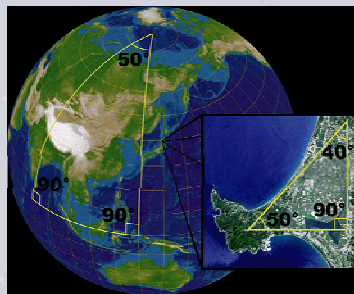
### Domain Decomposition Using Massive Parallel Architectures

[http://kiwi.atmos.colostate.edu/BUGS/  
geodesic/domain.html](http://kiwi.atmos.colostate.edu/BUGS/geodesic/domain.html)



### Geodesic Shallow Water Model

[http://kiwi.atmos.colostate.edu/BUGS/  
geodesic/swim.html](http://kiwi.atmos.colostate.edu/BUGS/geodesic/swim.html)



### Parallel Architectures

[http://kiwi.atmos.colostate.edu/BUGS/  
geodesic/domain.html](http://kiwi.atmos.colostate.edu/BUGS/geodesic/domain.html)

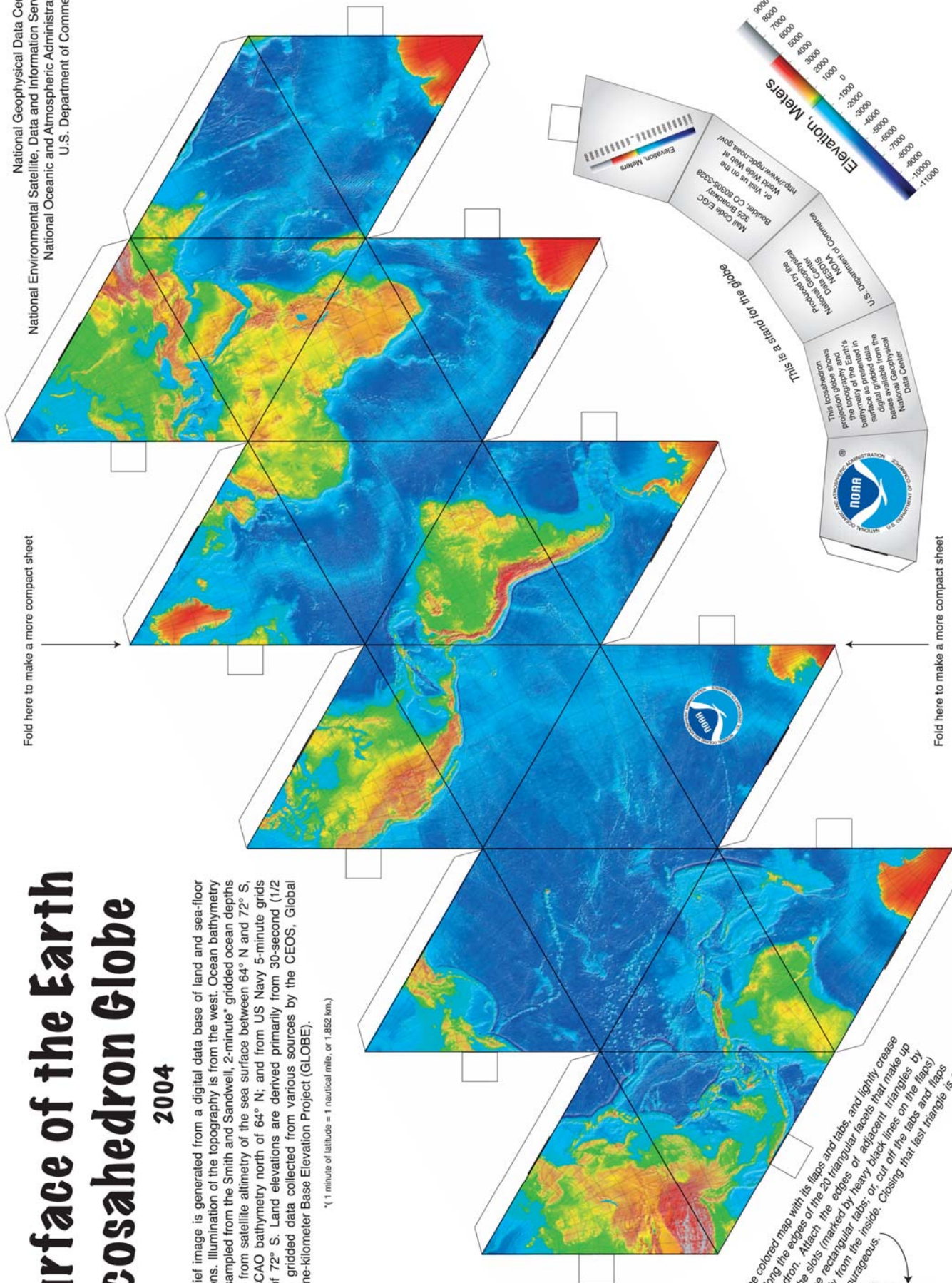
Background globe  
image courtesy NASA

National Geophysical Data Center  
National Environmental Satellite, Data and Information Service  
National Oceanic and Atmospheric Administration  
U.S. Department of Commerce

# Surface of the Earth Icosahedron Globe 2004

This relief image is generated from a digital data base of land and sea-floor elevations. Illumination of the topography is from the west. Ocean bathymetry was resampled from the Smith and Sandwell, 2-minute\* gridded ocean depths derived from satellite altimetry of the sea surface between 64° N and 72° S, from IBCAO bathymetry north of 64° N; and from US Navy 5-minute grids south of 72° S. Land elevations are derived primarily from 30-second (1/2 minute) gridded data collected from various sources by the CEOS, Global Land One-kilometer Base Elevation Project (GLOBE).

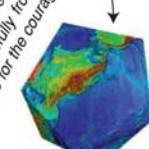
\*1 minute of latitude = 1 nautical mile, or 1.852 km.



Fold here to make a more compact sheet

Fold here to make a more compact sheet

Cut out the colored map with its flaps and tabs, and lightly crease the folds along the edges of the 20 triangular facets that make up the icosahedron. Attach the edges of adjacent triangles by cutting open the slots (marked by heavy black lines on the flaps) and inserting the rectangular tabs; or, cut off the tabs and flaps and tape carefully from the inside. Closing that last triangle is a challenge for the courageous.



**Elevation, Meters**

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**Elevation, Meters**

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NOAA  
U.S. Department of Commerce

This location shows  
projection, globe, and  
topography and  
bathymetry of the Earth in  
surface projection. In  
digital gridded data the  
National Geophysical  
Data Center

Figure 2-1. Icosahedron Model of the Earth - 1.

