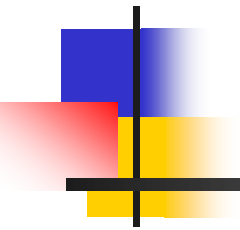
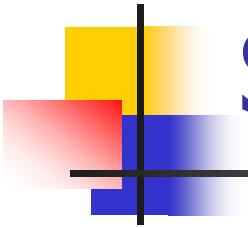


Interactive Digital Chart of the World

Silicon Valley Forth Interest Group

September 24, 2011

Chen-Hanson Ting



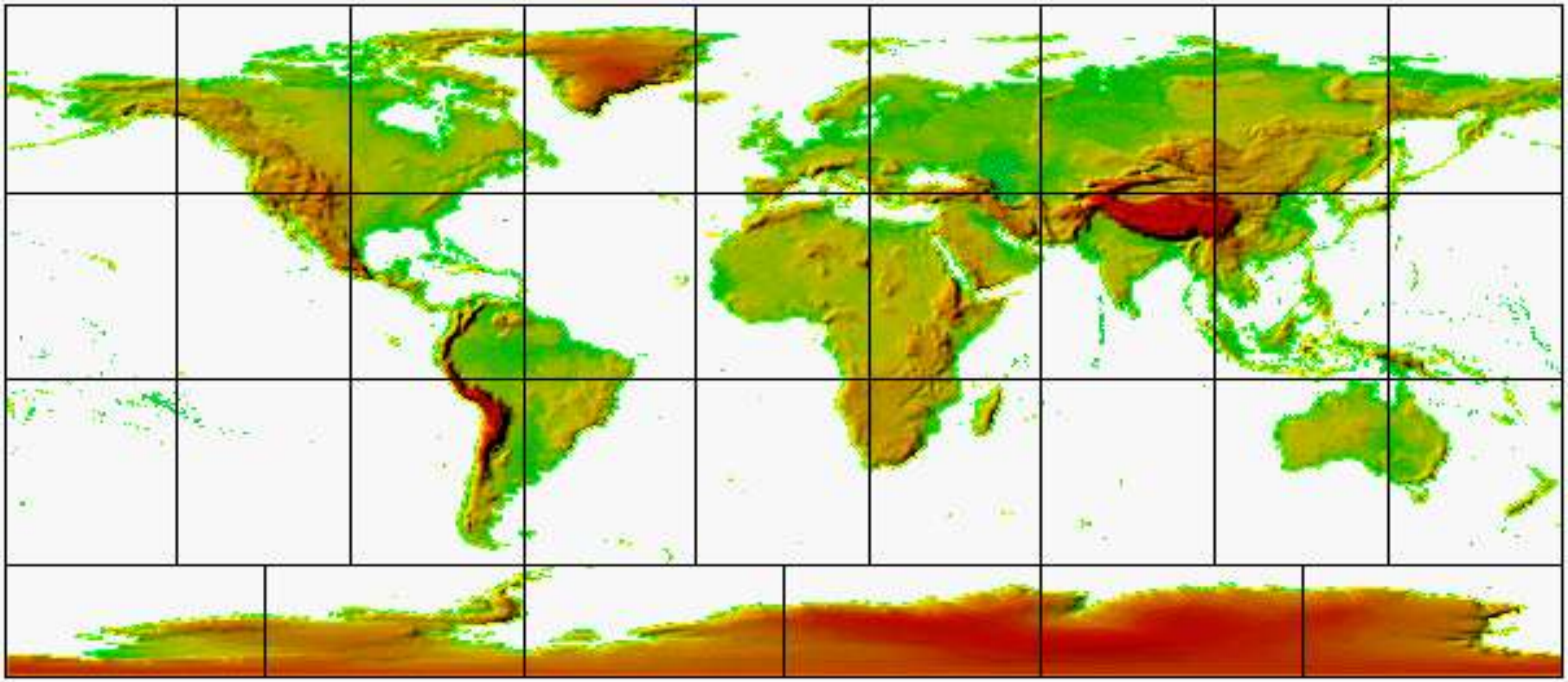
Summary

- Digital Chart of the World
- Displaying Maps
- Polar Coordinate Transform
- Coloring
- Interactive Navigation
- Demonstrations

Digital Chart of the World

- DCW, MIL-D-89009, 4/13/1992
  - 1:1,000,000 Scale
  - 4 CD's for North America; Europe and Northern Asia; South America, Africa, and Antarctica; and Australia and Southern Asia.
- GTOPO30, from the Earth Resource Observation and Service Center (EROS) in US Geological Survey, 1996
  - Digital Elevation Model (DEM)
  - 30 arc-second resolution
  - 33 DEM files, 1.8 GBytes

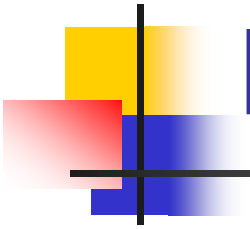
GTOPO30 DEM files



Interactive DCW

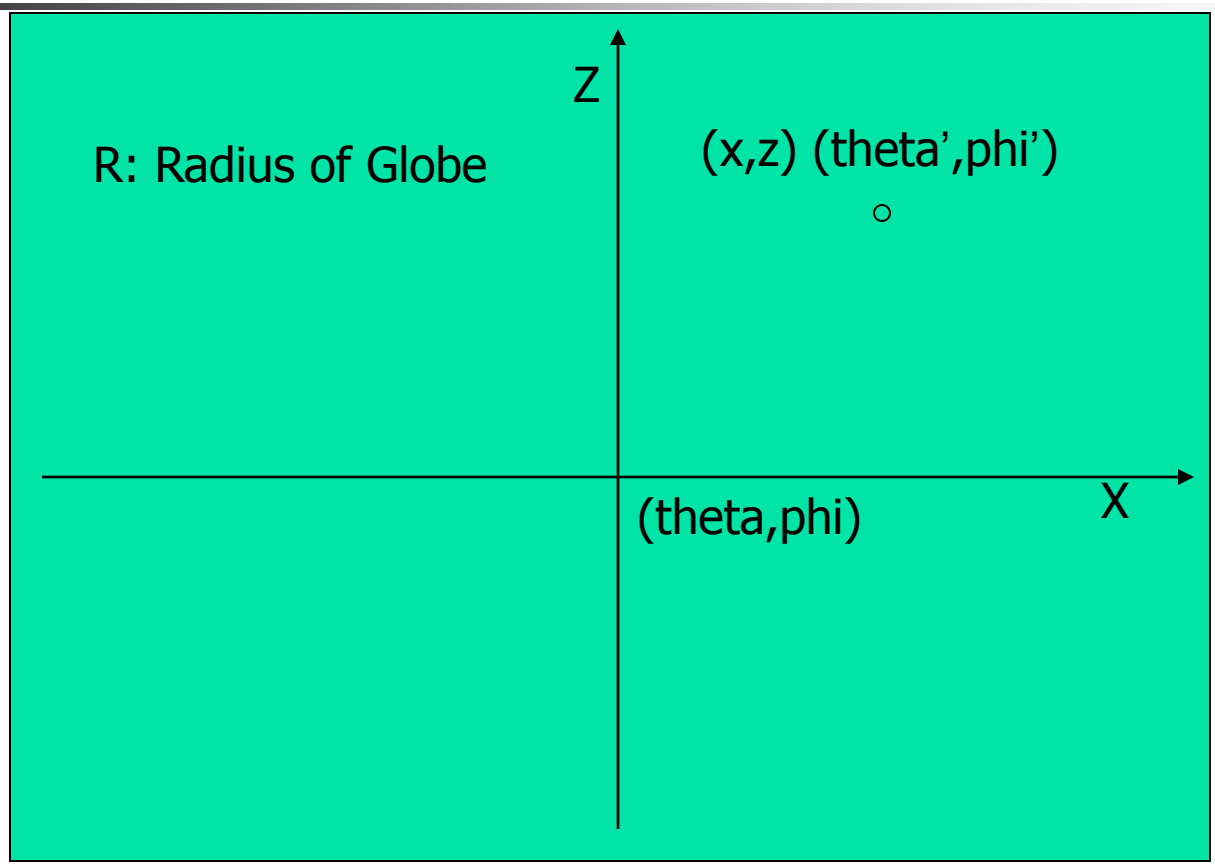
- 33 DEM data files are combined into a single 1.8 GByte file.
- Data are organized in 21600 rows (180 degrees latitude) and 43200 columns (360 degrees longitude).
- Elevations are 16-bit integers from -407 to 8732 Meters.

Displaying the Map

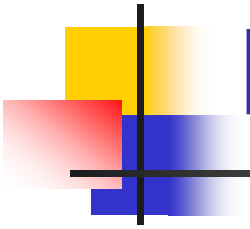


- Pick any point on the globe at (theta,phi) and place it at the center of screen, with 768x512 pixels.
- From a pixel (x,z) on the screen, compute its polar coordinates (theta’,phi’).
- From (theta’.phi’) look up elevation in DEM file, place a color pixel on screen.

Polar Coordinate Transform



Polar Coordinate Transform



- Scanning point (x,y,z)

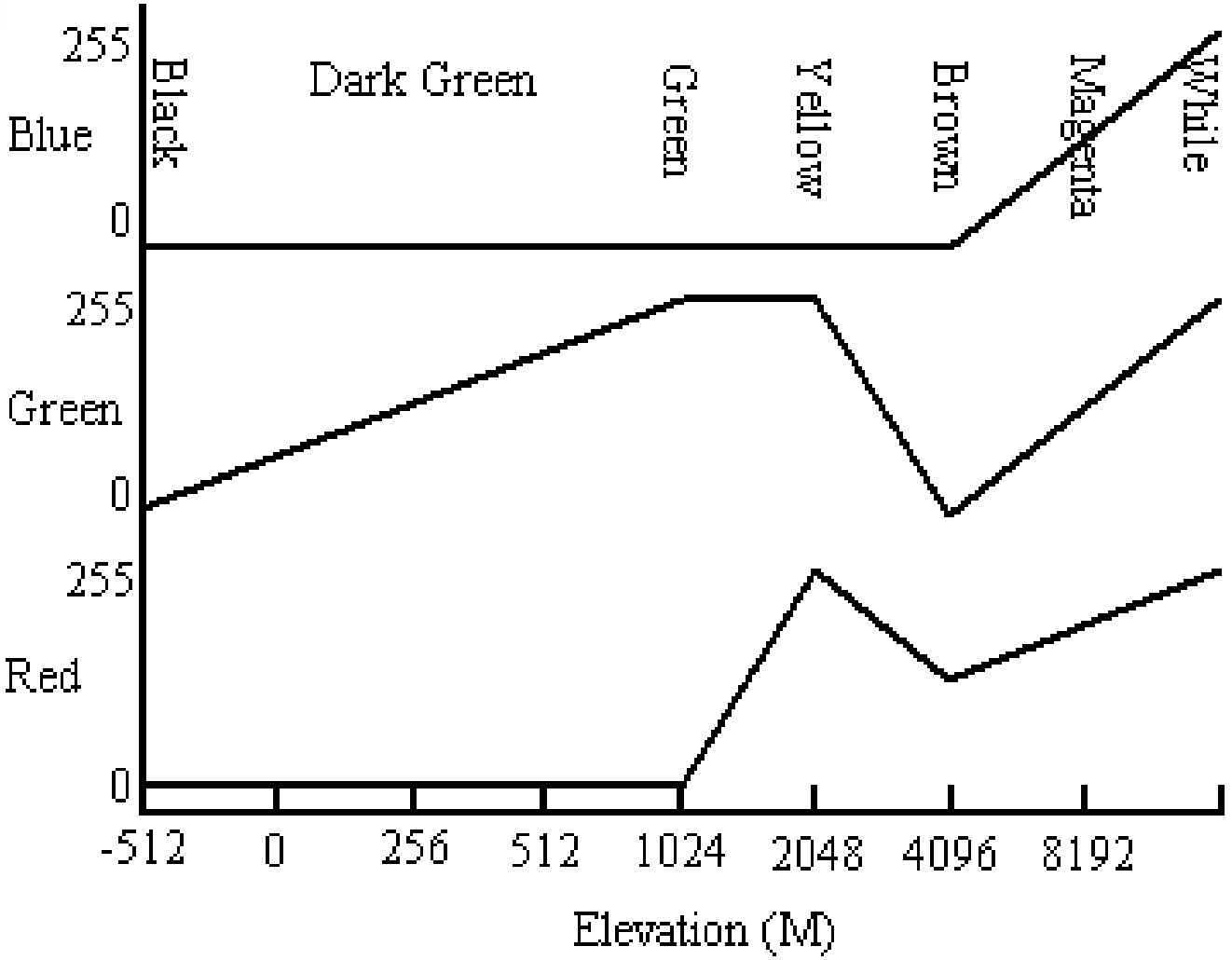
  y = sqrt(R*R-x*x-z*z)
- Rotate (y,z) an angle alpha=(90-phi), along x-axis:

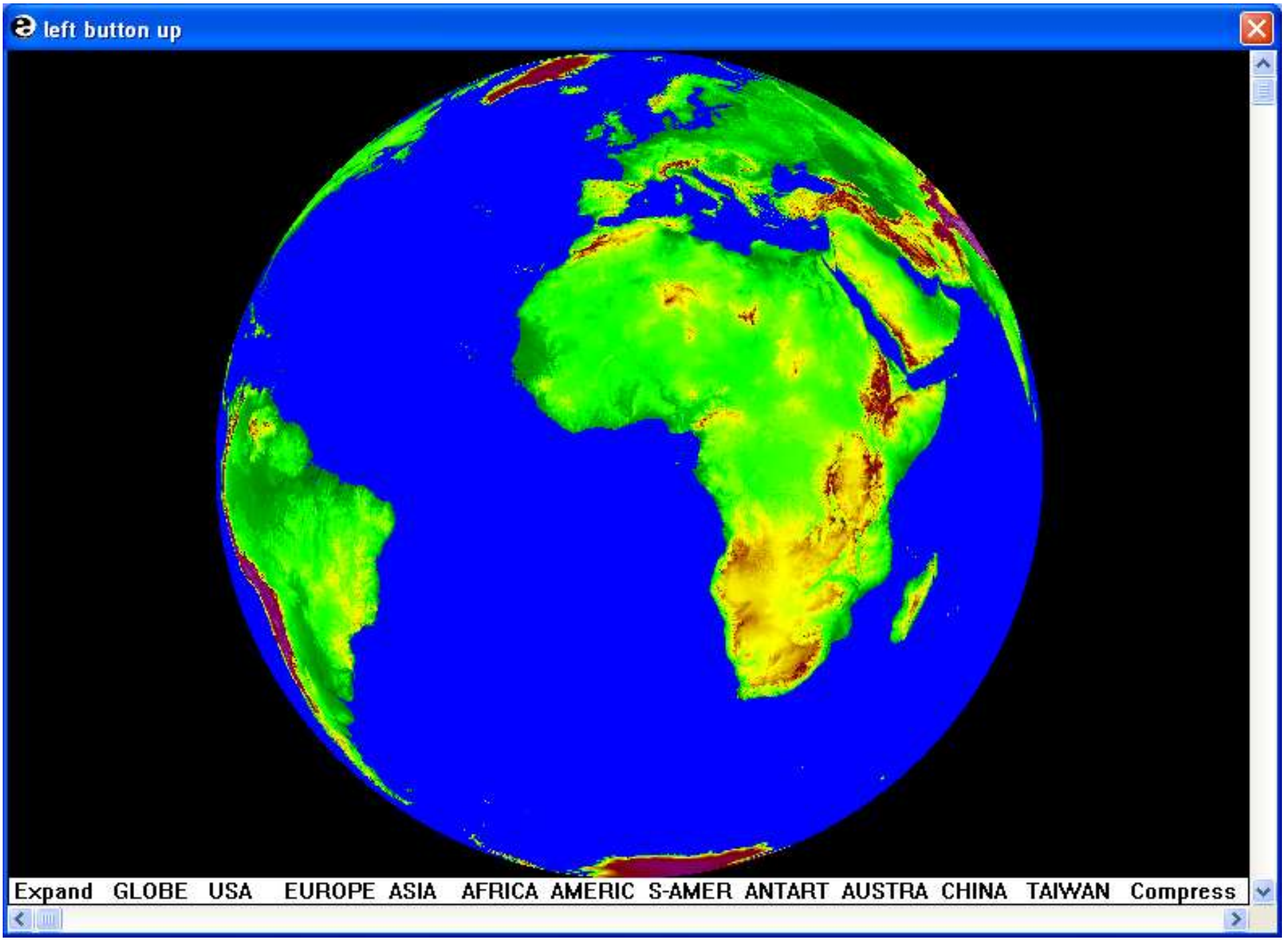
  y’ = y*cos(alpha)-z*sin(alpha)

  z’ = y*sin(alpha)+z*cos(alpha)
- phi’ = arctan(sqrt(x*x+y’*y’)/z’)

  theta’ = theta + arctan(x/y’)

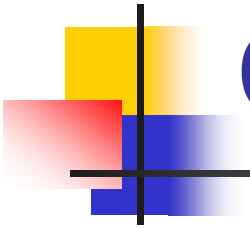
Coloring


255
Blue
0
Black
Dark Green
Green
Yellow
Brown
Magenta
White
255
Green
0
255
Red
0
-512
0
256
512
1024
2048
4096
8192
Elevation (M)


left button up
Expand GLOBE USA EUROPE ASIA AFRICA AMERIC S-AMER ANTART AUSTRA CHINA TAIWAN Compress

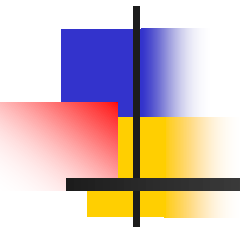
Interactive Navigation

Expand	2x
GLOBE	Globe
USA	United States
EUROPE	Europe
ASIA	Asia
AFRICA	Africa
AMERIC	Americas
S-AMER	South America
AUSTRA	Australia
ANTART	Antarctica
CHINA	China
TAIWAN	Taiwan
Compress	2/



Conclusion

- PC is not yet fast enough to display map quickly.
- DEM file is too big to read. However, once data is cached, display runs faster.
- It will be released as a game with complete source code and F# operating system, for people to explore Forth.



Thank You