Toward A Rational Global Image Data Base System

S. N. Goward, J. Townshend, R. Dubayah, S. Liang

Geography/UMIACS

L. Davis, H. Samet, C. T. Shock, M. Franklin, J. Saltz, A. Sussman

Computer Science/UMIACS

UNIVERSITY OF MARYLAND AT COLLEGE PARK

Remote Sensing Goals

Remotely sensed data should:

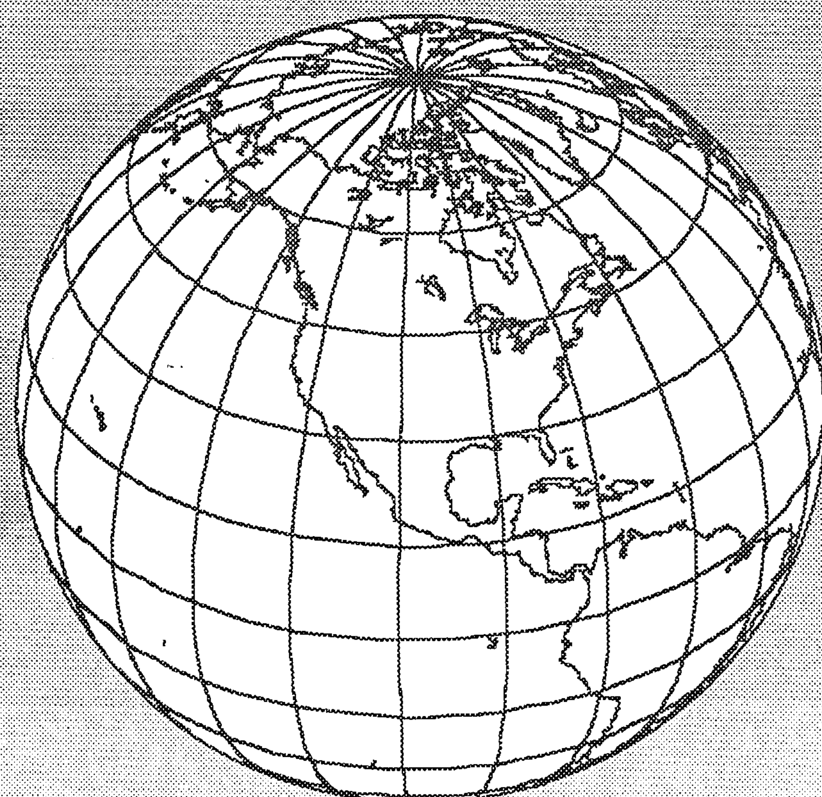
- record only phenomenon of interest
- represent location
- consistantly represent all locations

2-D Image mapping harmful

- resampling loses location/precision
- increases data volume
- introduces errors in area/distance/direction
- creates incompatiable data sets

Context

The Earth is a Sphere



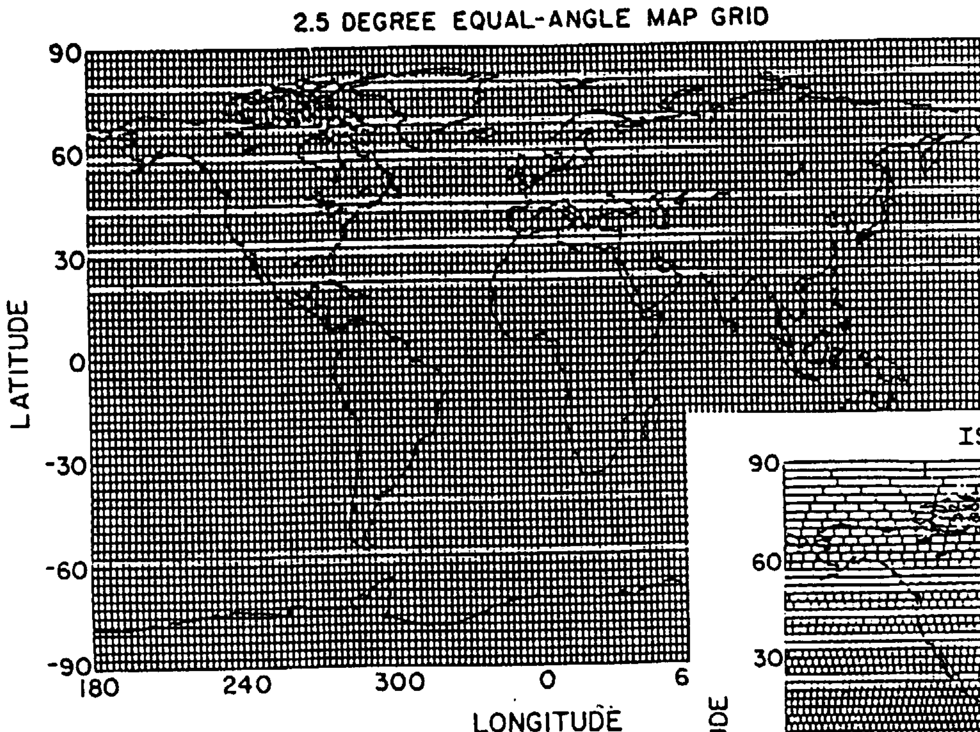
Probems with Projections

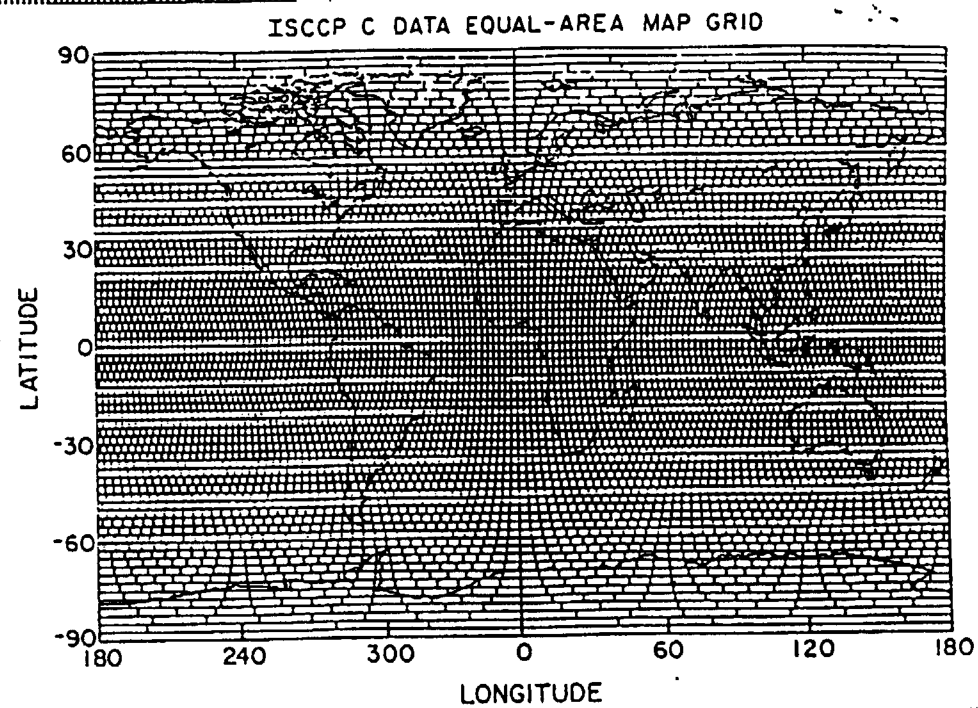
- **Mensuration Errors**
  areas
  distance
  direction

- **Data Base Problems**
  null data
  boarder match
  multi-projections
  multi-resolutions

- **Mapping Problems**
  forward versus inverse
  observation re-sampling

ISCCP





Geography
UMCP

Current Methods

- **Sensor Observation Geographic Coordinates**
  - **Platform/Sensor Model**
  - **Control Point Empirical Fits**

- **Geo-located Observations Mapped to 2-D Array**
  - **One or more Map Projections**

Solution

DELETE STEP 2

- Sensor Observation Geographic Coordinates
  Platform/Sensor Model
  Control Point Empirical Fits

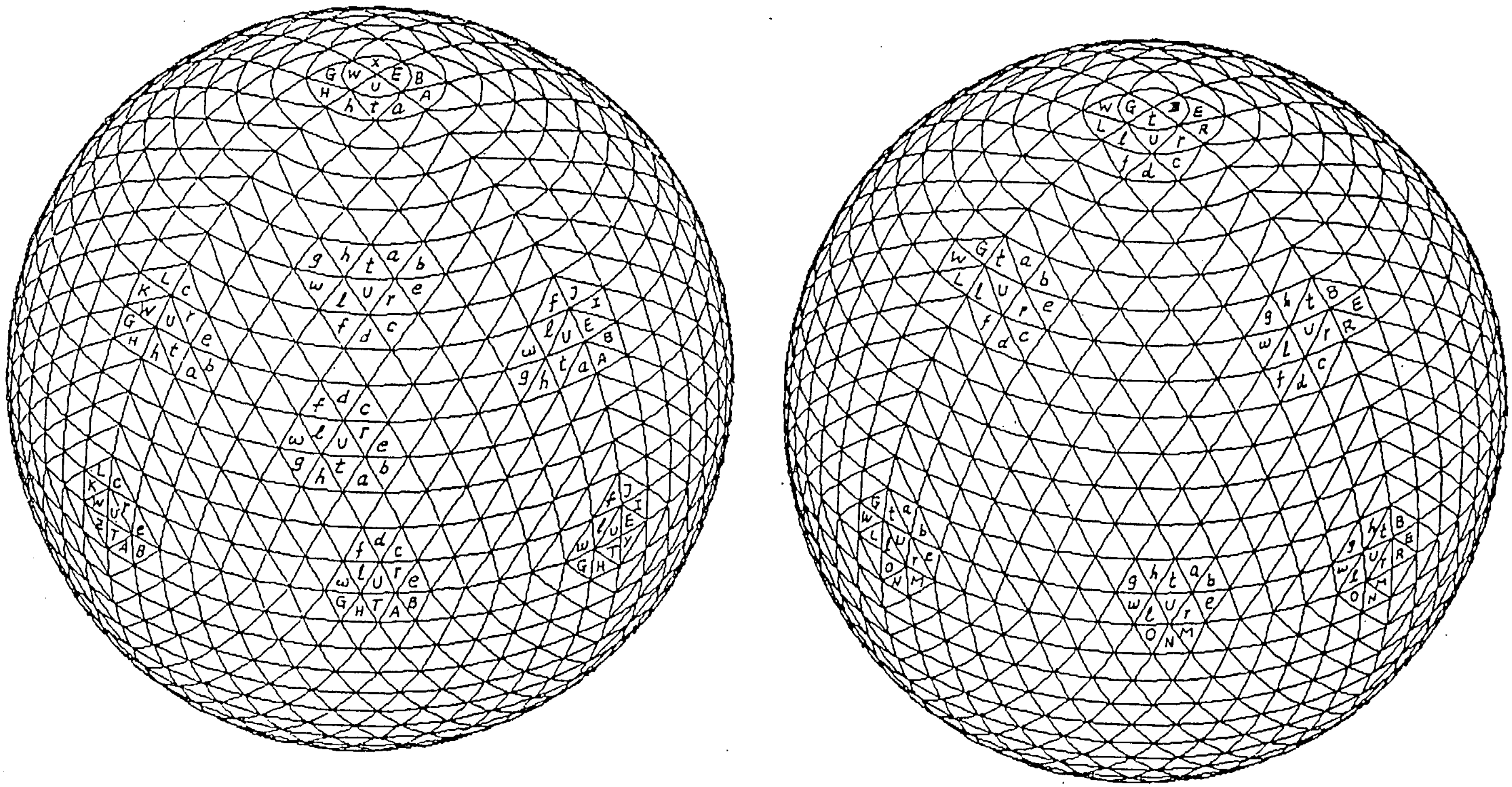
- ~~Geo-located Observations Mapped to 2-D Array~~
  One or more Map Projections

Spherical Data Structures (Tesselations)

Trixals (Dutton Goodchild, NCGIA)

Quadrilateralized Spherical Cube (White & Stemwedel NASA/GSFC)

ZOT (Zenithal Orthotriangular) and Ochahedron Projections (Huang and Shibasaki, U. Tokyo)



(a). The neighbors of inside, edge and corner triangles

(b). The neighbors of sub-edge and sub-corner triangles

Figure 3. The neighbors of a triangle when it is in different locations

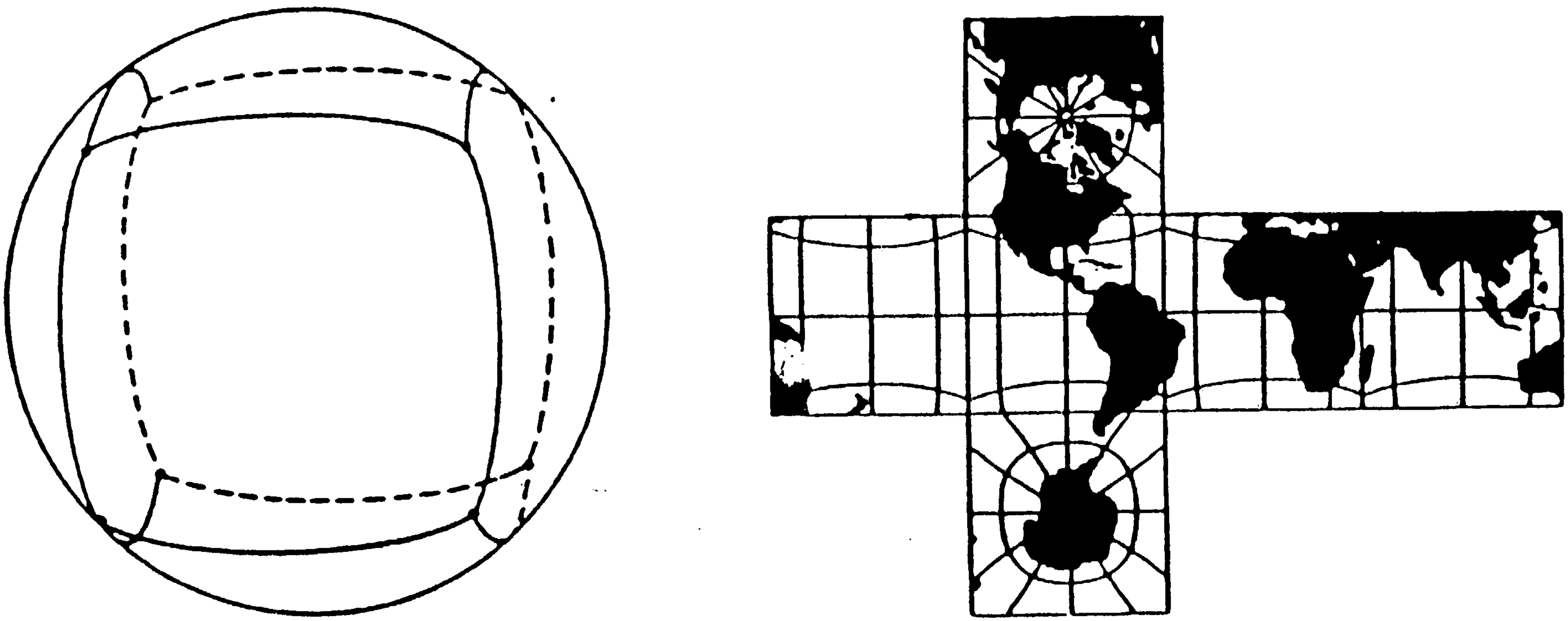
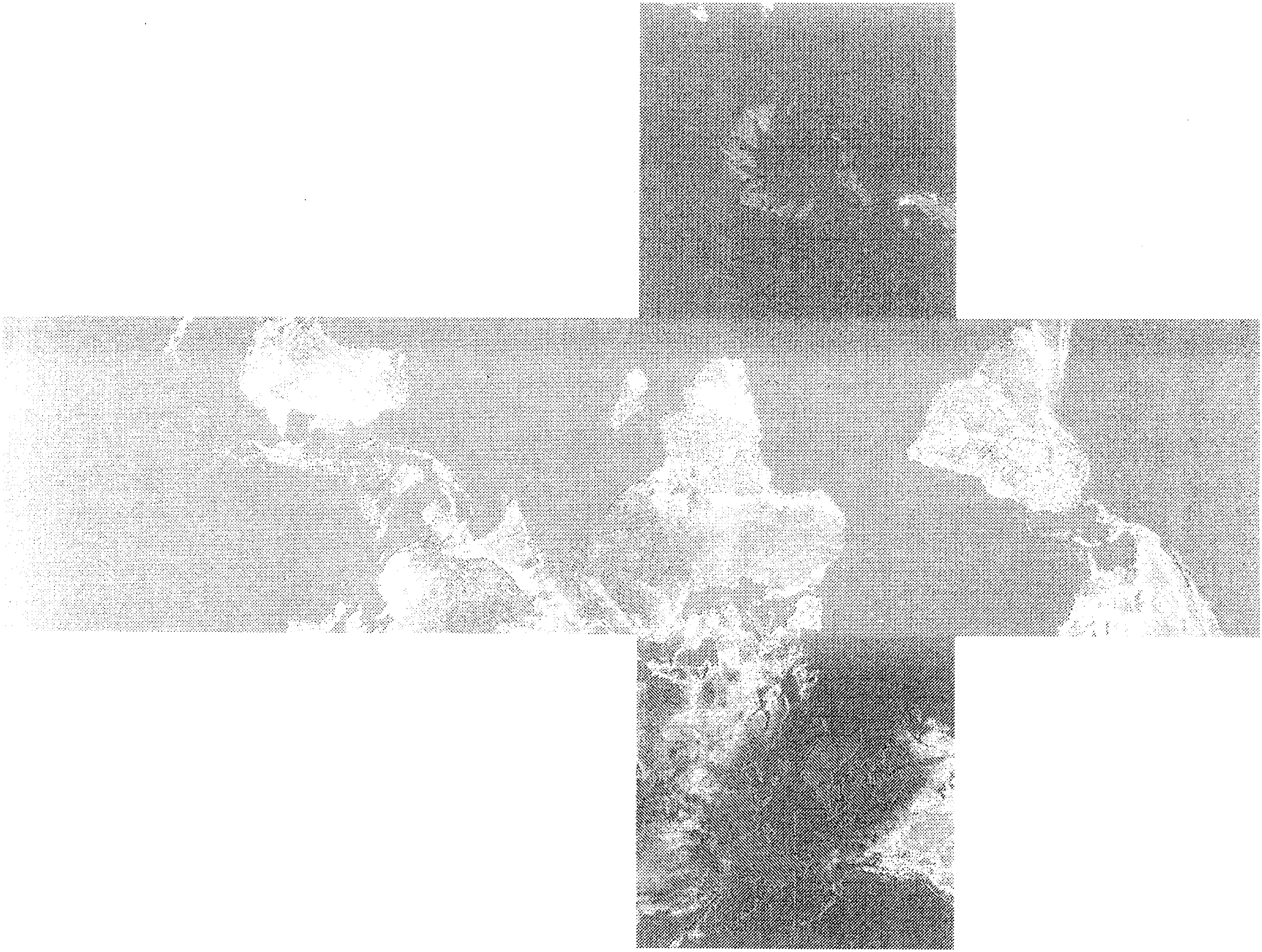
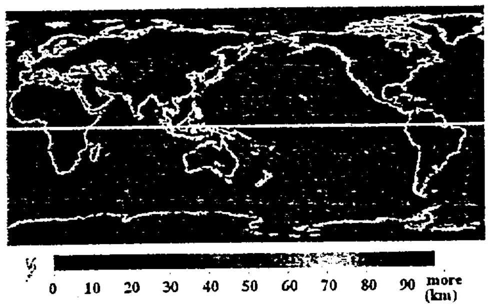
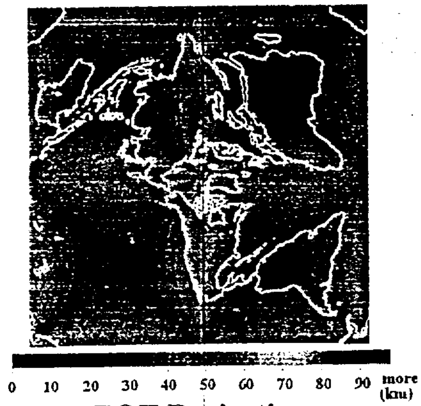


FIGURE I The sphere is subdivided into six equal sections. The earth is projected onto the 6 cube faces.

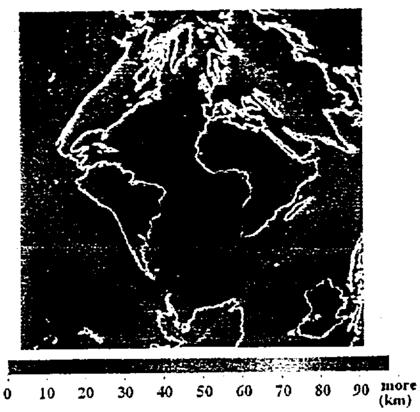




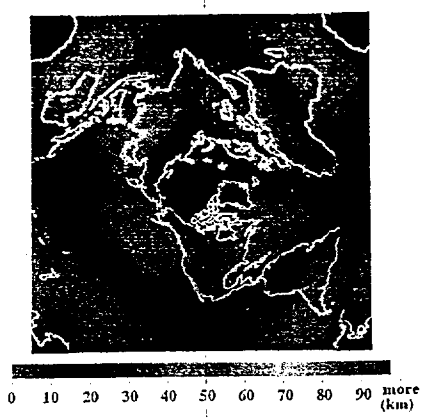
Equal Div. of Lat./Long. System



ZOT Projection

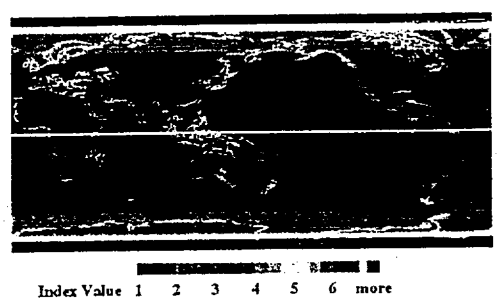


North-Up Equal_Area ZOT Projection

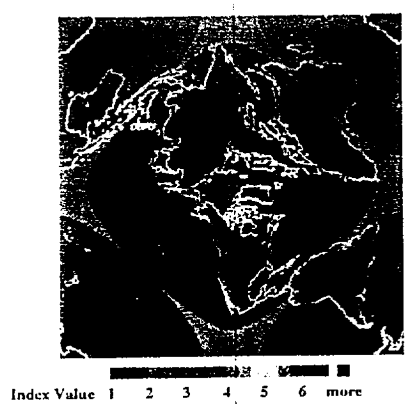


Octahedron Projection

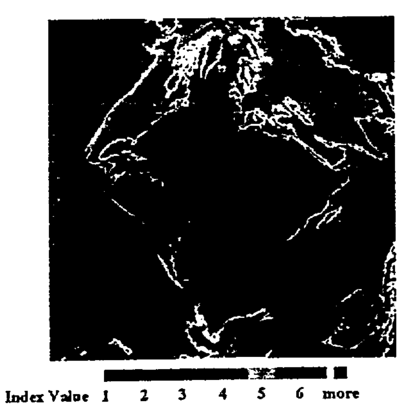
Figure.11 Distortion of Sampling Interval --- Maximum Distance to Four Neighbouring Pixels



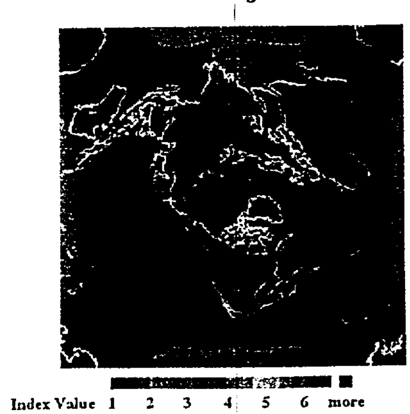
Equal Division of
Latitude-Longitude Coordinate System



ZOT Projection



North-Up ZOT Projection



Octahedron Projection

Figure.12a Local Distance Distortion to Neighbouring Pixels

“On-Demand” Systems

UMCP GEOG/UMIACS ,- NSF Grand Challenge (Townshend/Davis-UMCP)

Pathfinder Interuse - NASA (M. Botts-U Alabama)

Sequoia - UCSB etc. ???

Others??

What to Do?

Computer Technology for "on-demand" marginal: high end (remote sensing?) users

National/International (CEOS) agreement on spherical exchange media (e.g. EOS sphere) - then develop GIS tools

Insure that map projection software reliable and available (e.g. USGS code)