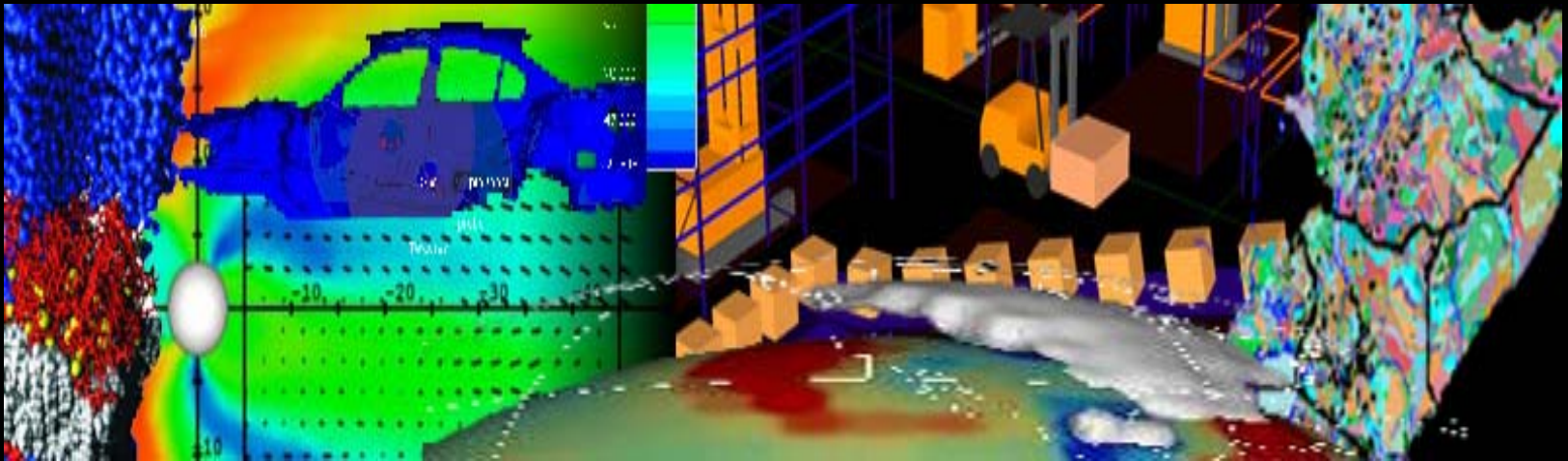


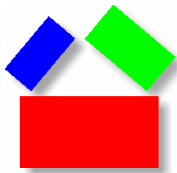
DATA CENTER

DATA CENTER

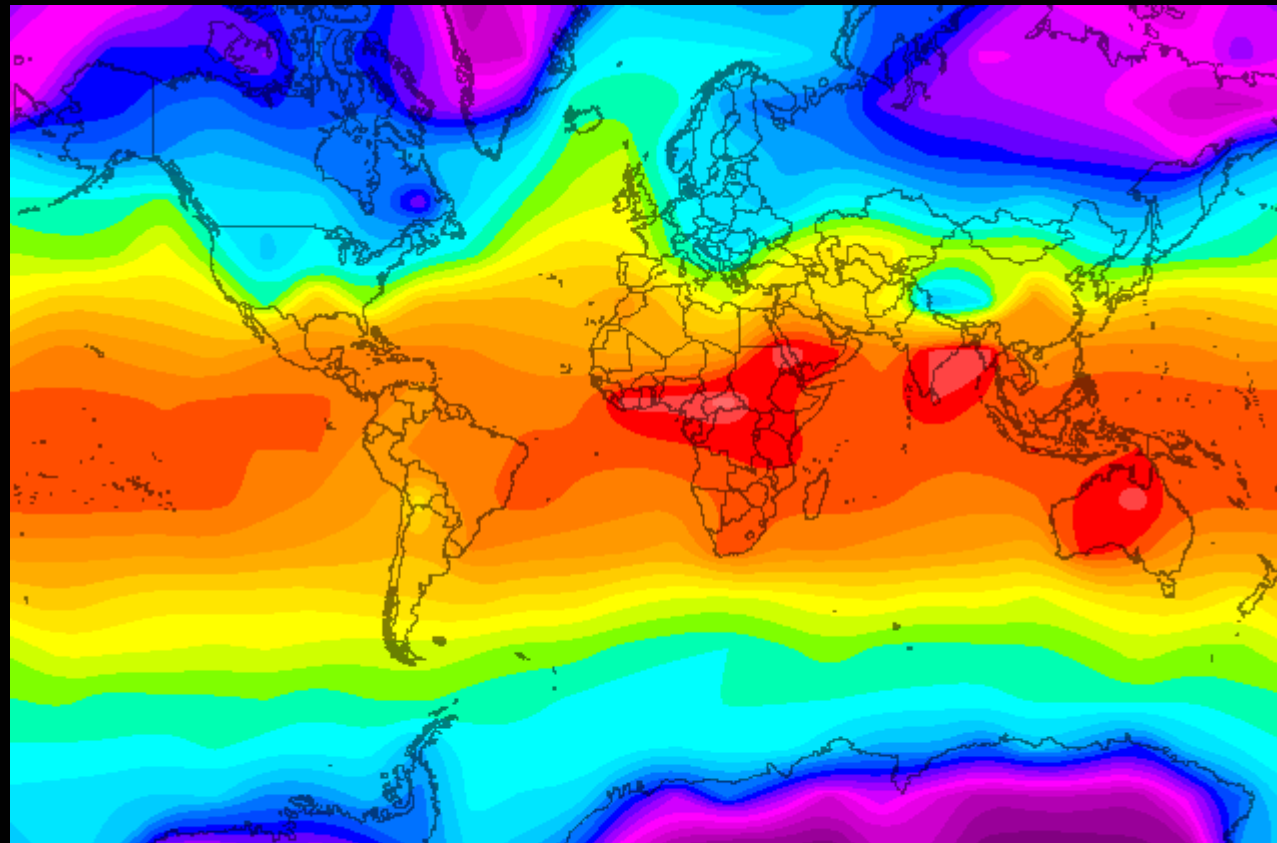
Make sense of your data



David Brock, Founder and Director
Data Center
Massachusetts Institute of Technology



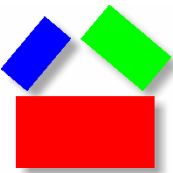
SPATIAL DATA



Today's High Temperatures

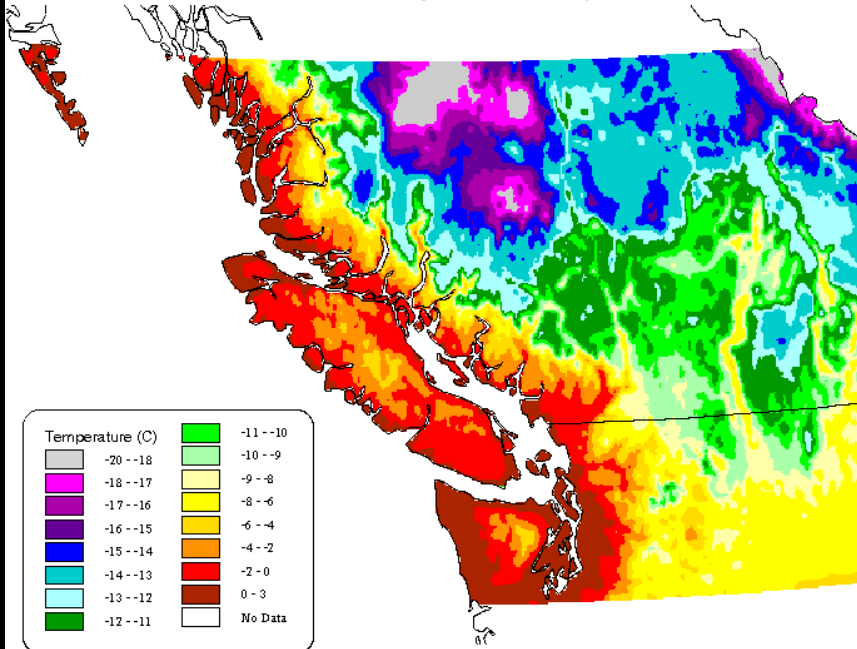
Valid: Mar 08 2006, 12:00 PM (UTC)





SCALE AND RESOLUTION

Mean January Minimum Temperature, Southern British Columbia

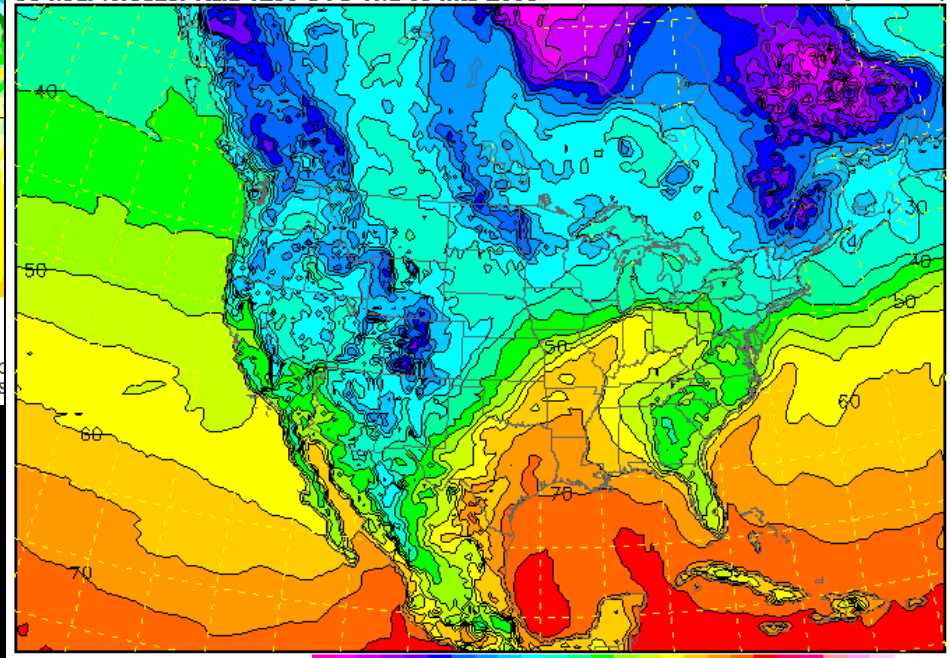


Spatial Climate Analysis Service

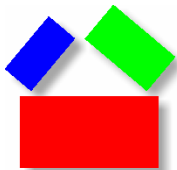
Surface (2m) Temperature (°F)

36-hour forecast valid 1200 UTC Thu 09 Mar 2006

Eta (00z 08 Mar)



-30 -20 -10 0 10 20 30 40 50 60 70 80 90 100 110 °F

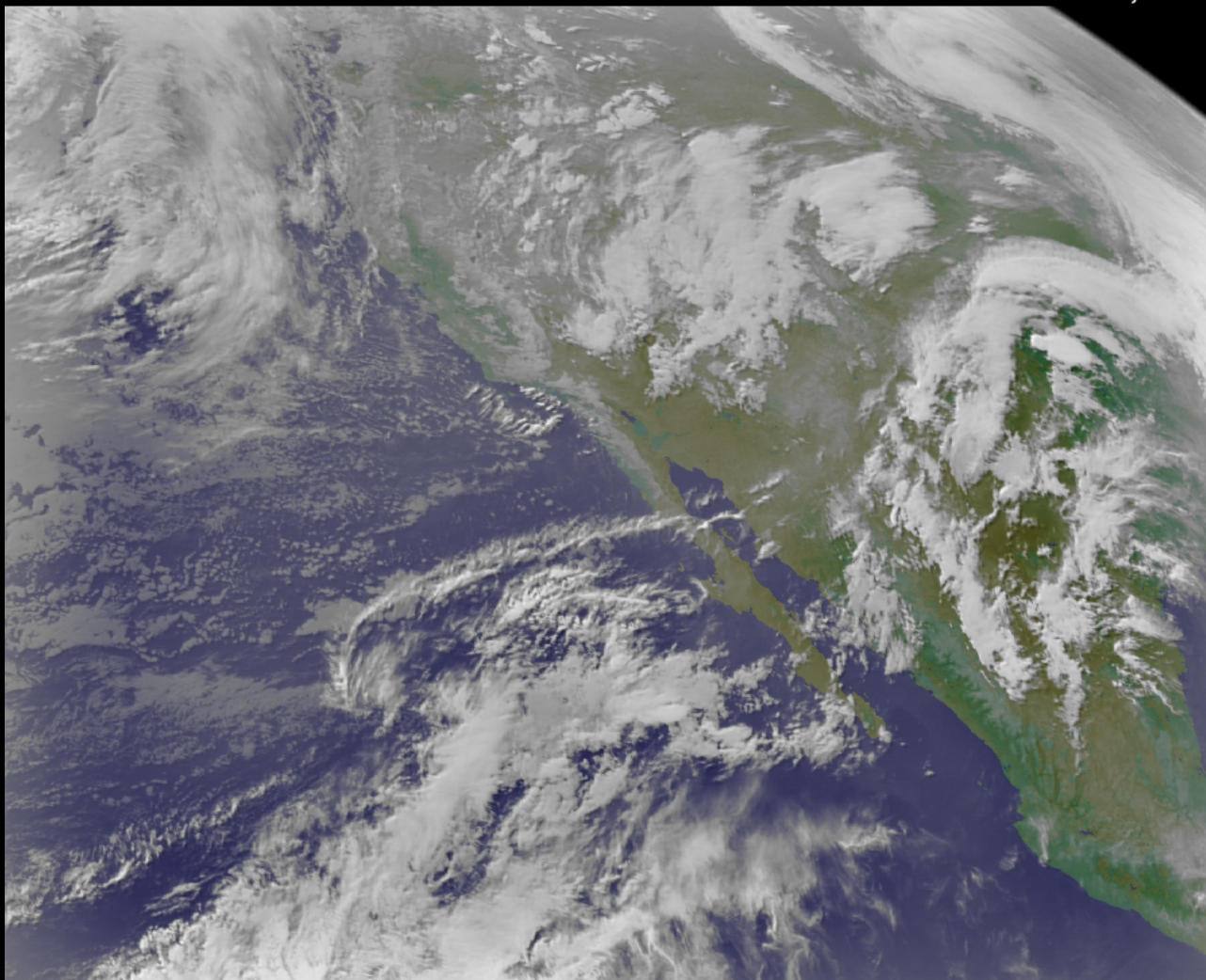


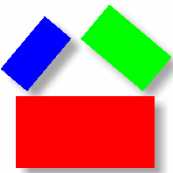
PROJECTIONS AND TRANSFORMATIONS

NOAA GOES 10

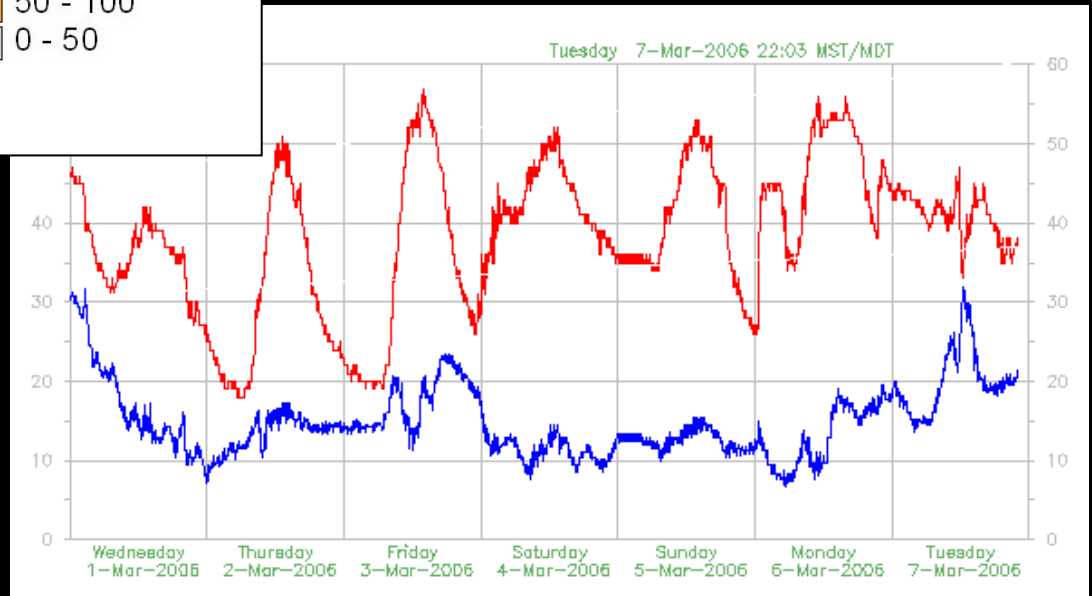
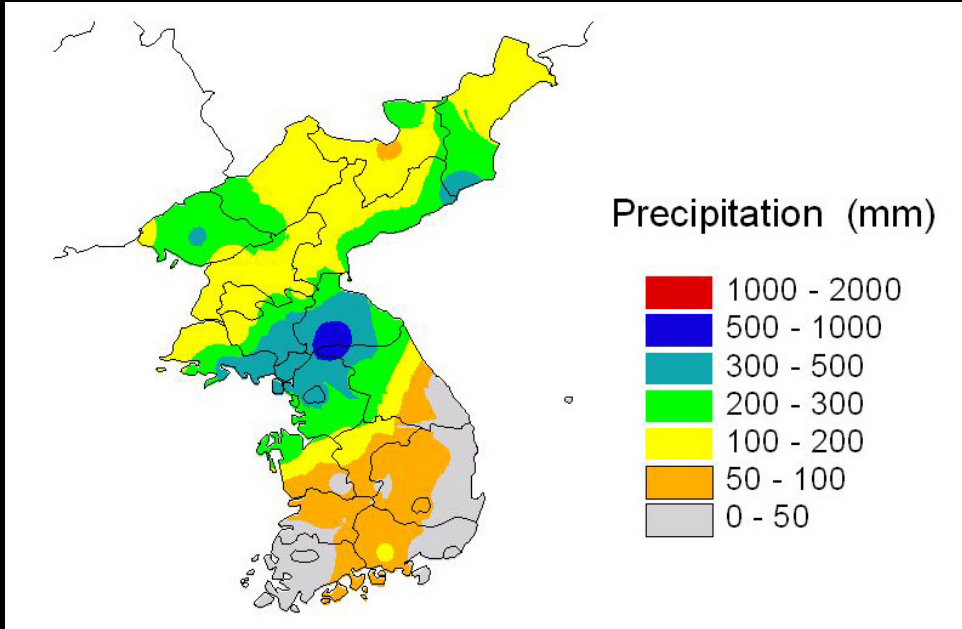
2006-03-08 0400 UTC

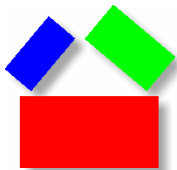
NASA GSFC GOES Project



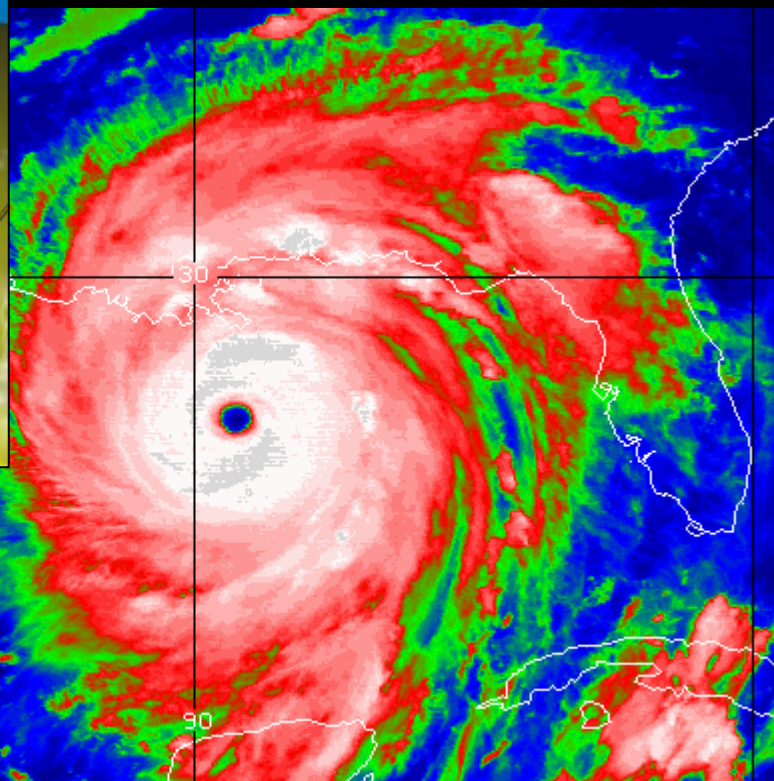
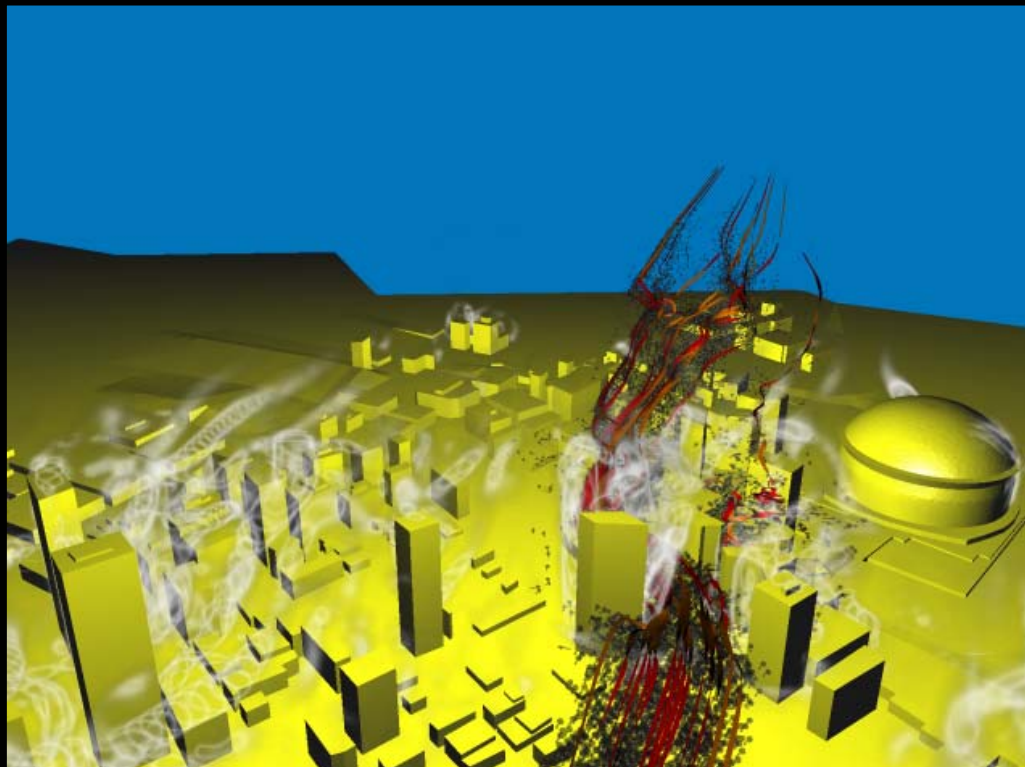


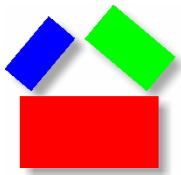
TEMPORAL AND SPATIAL





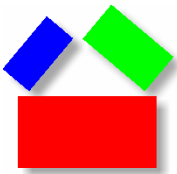
MULTI-DIMENSIONAL DATA





CURRENT STANDARDS

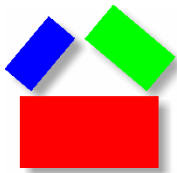
Current Standards



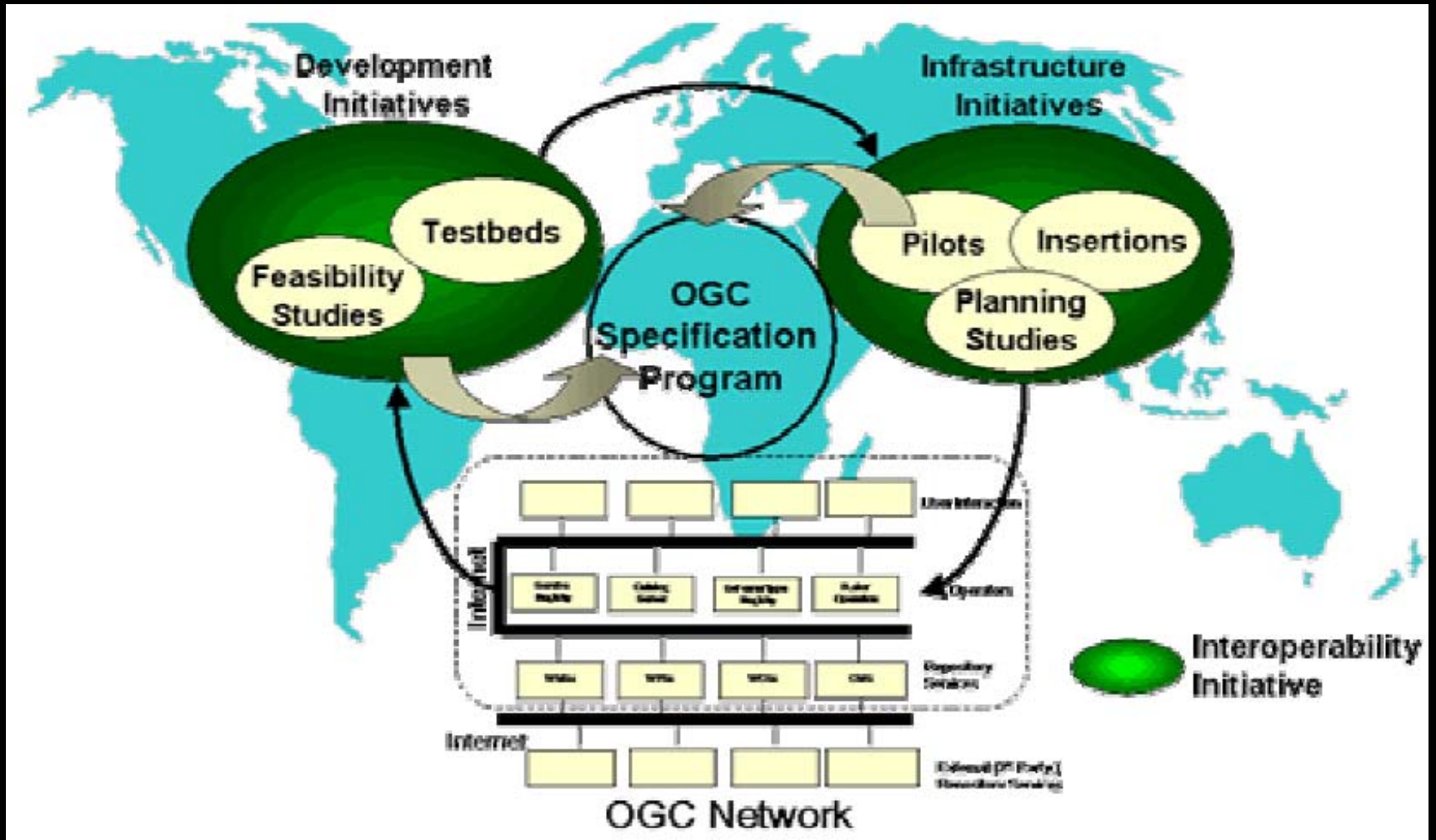
ESRI Shape Files

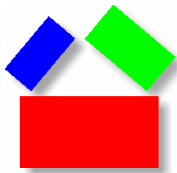
The ESRI shapefile format is used for vector data in a GIS environment. They consist of a minimum of three files: main file (.shp), index file (.shx), and a database file (.dbf).

```
LON 2.910000  
LAT 1.030000  
DATE 01/09/2004  
TIME 09:57  
DIR 217.0000  
SPD 1.1000  
DISPDIR -217.0000  
SPDKTS 2.1
```

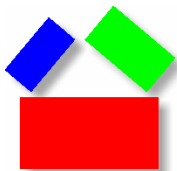
Open Geospatial Consortium (OGC)





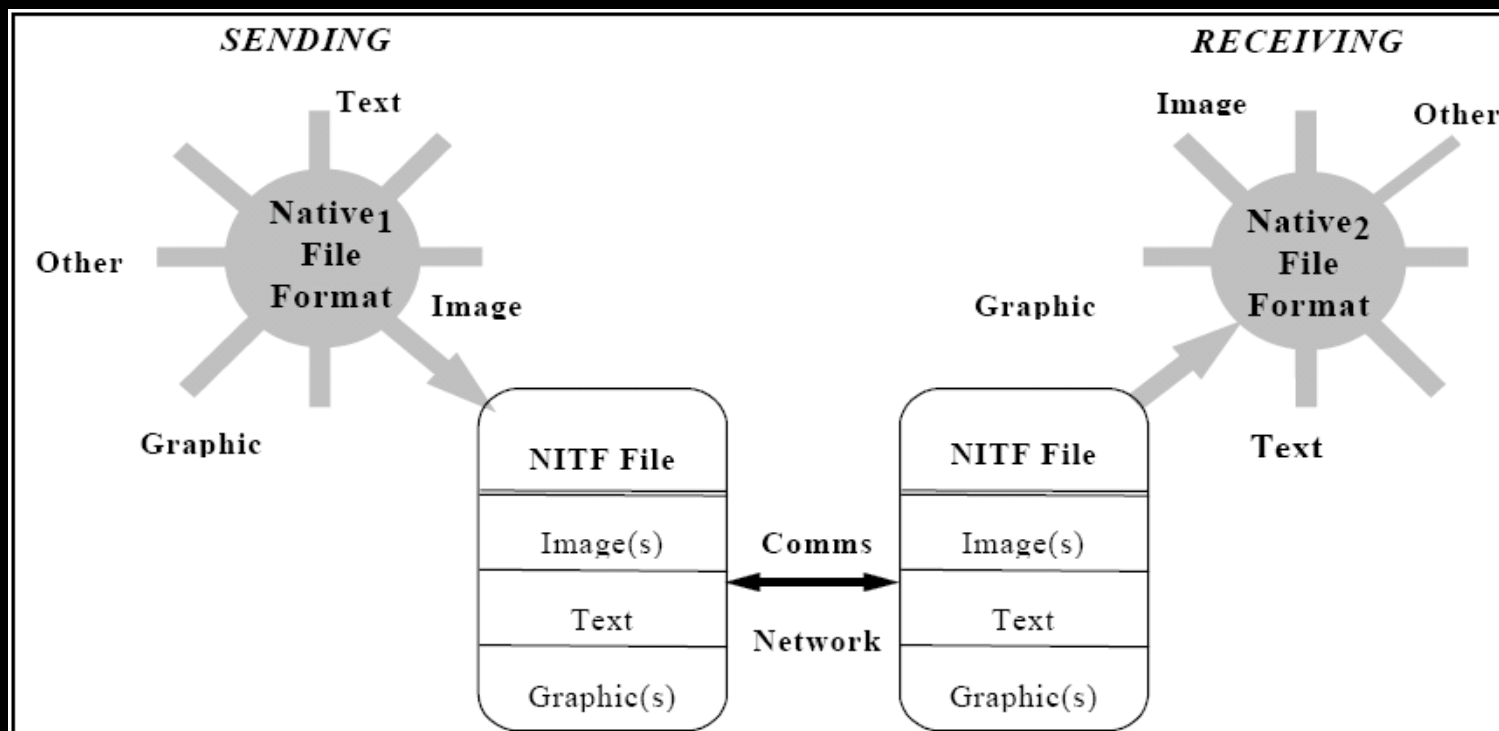
Open Geospatial Consortium (OGC)

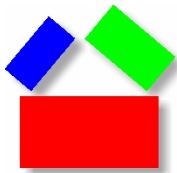
- OGC Reference Model - a complete set of reference models.
- WMS - Web Map Service
- WFS - Web Feature Service
- WCS - Web Coverage Service
- CAT - Web Catalog Service
- SFS - Simple Features - SQL
- GML - Geography Markup Language



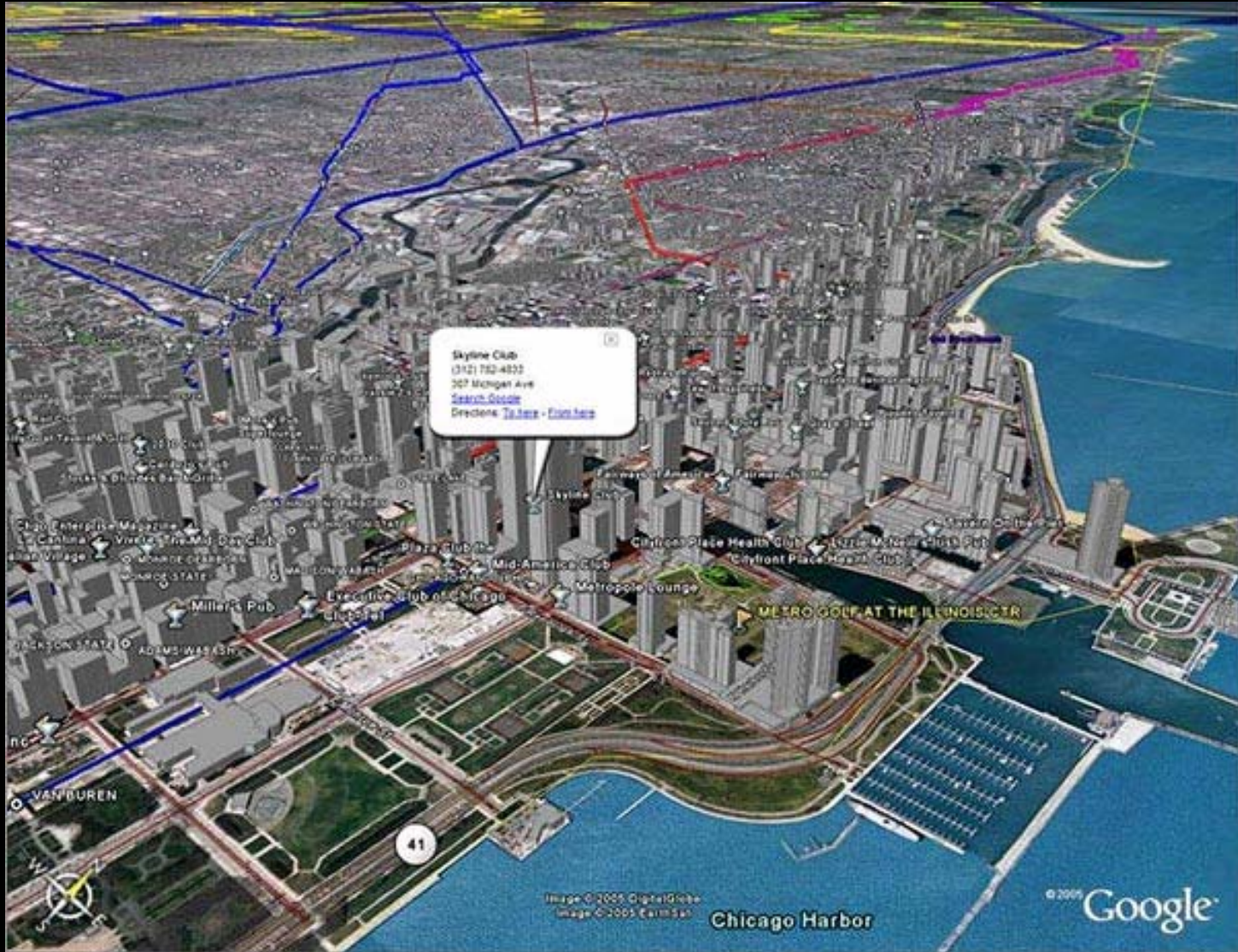
National Imagery Transmission Format (NITF)

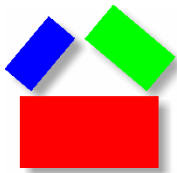
National Imagery Transmission Format (NITF) standard was developed in 1994 with the purpose of providing interoperability in spatial data among various government agencies. The NITF standard (MIL-STD-2500B1998) provides for efficient transmission and storage of electronic imagery among Department of Defense (DOD) and Intelligence Community (IC).





Google Keyhole Markup Language (KML)

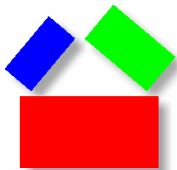




Google Keyhole Markup Language (KML)

KML (Keyhole Markup Language) is an XML-based language for managing three-dimensional geospatial data in the program Google Earth

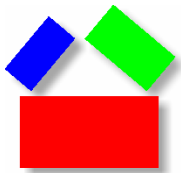
```
<?xml version="1.0" encoding="UTF-8"?>
<kml xmlns="http://earth.google.com/kml/2.0">
<Placemark>
  <description>New York City</description>
  <name>New York City</name>
  <Point>
    <coordinates>-74.006393,40.714172,0</coordinates>
  </Point>
</Placemark>
</kml>
```

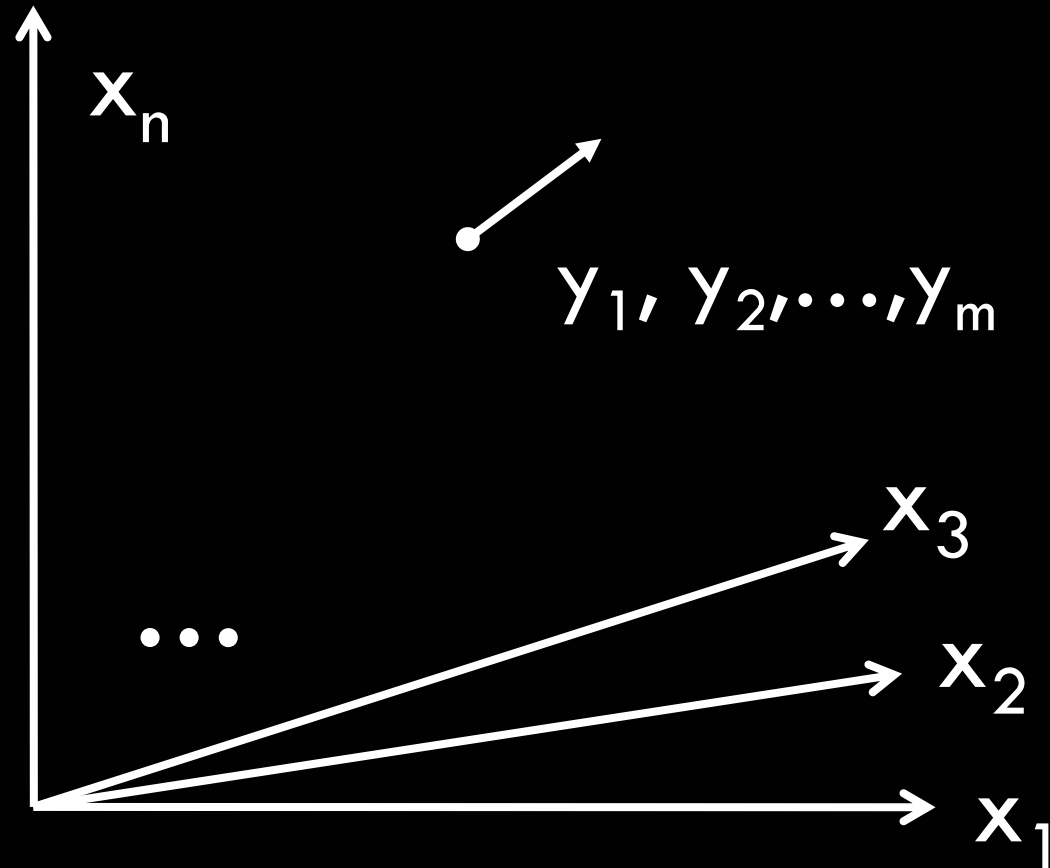
M

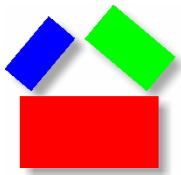
M

A Modeling Language

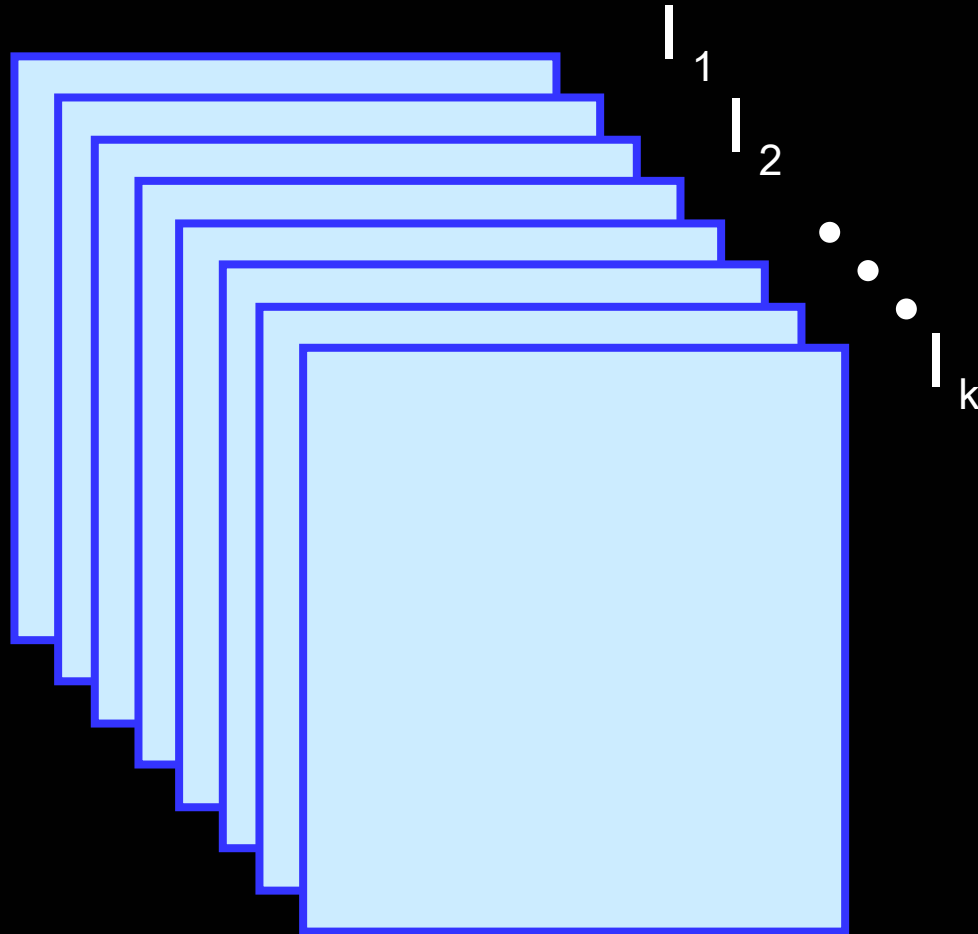


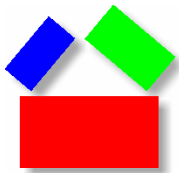
M - Spatial Data Representation



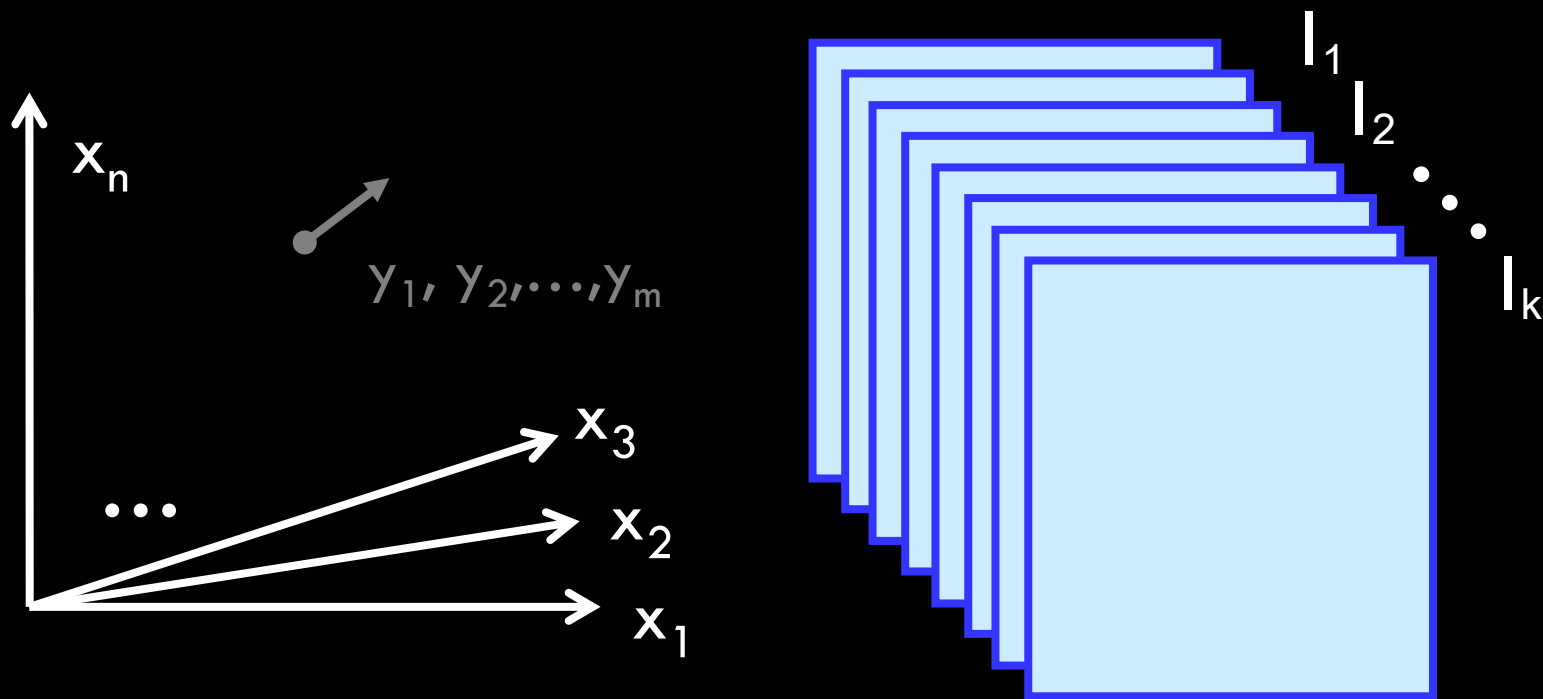


M - Spatial Data Representation

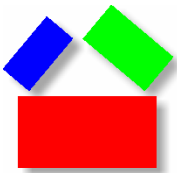




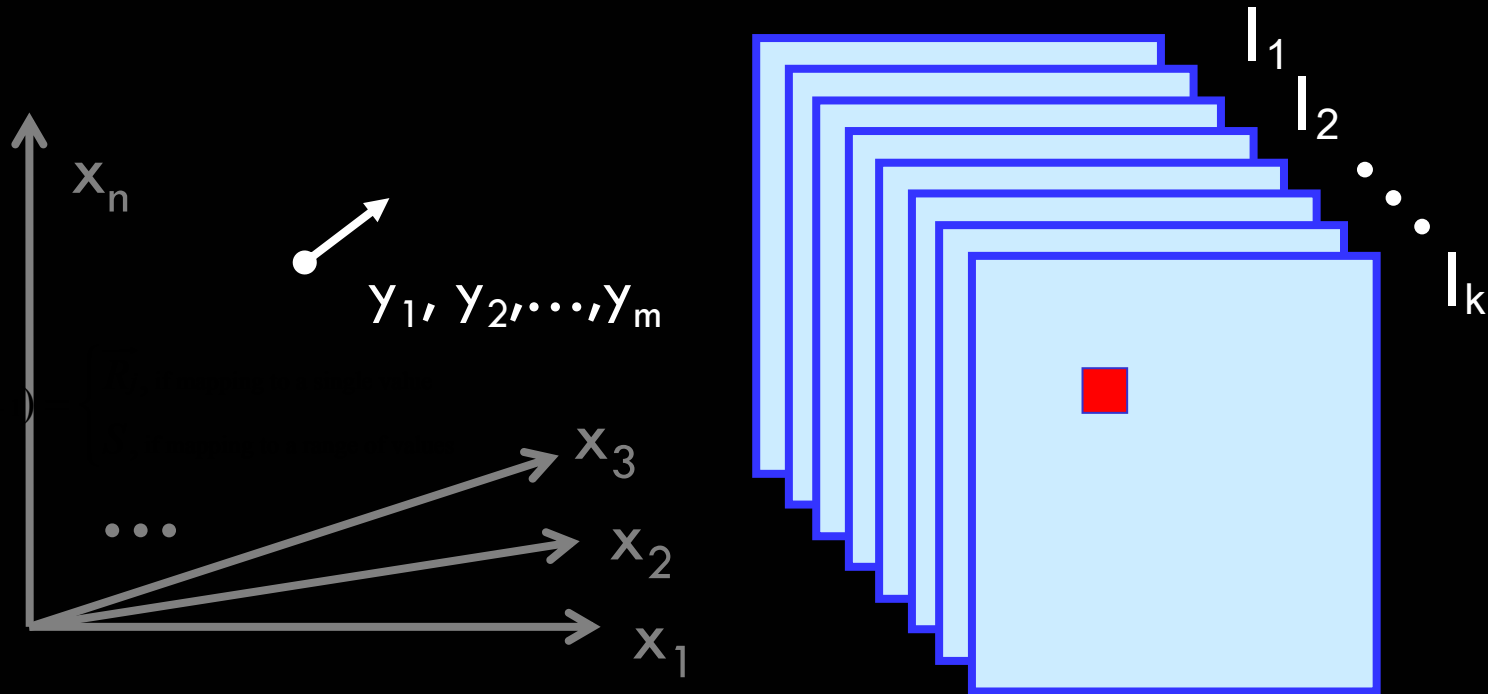
M - Spatial Data Representation



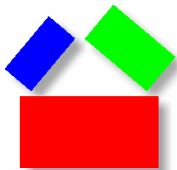
$$f(x_1, x_2, \dots, x_n) \rightarrow l_1, l_2, \dots, l_k$$



M - Spatial Data Representation



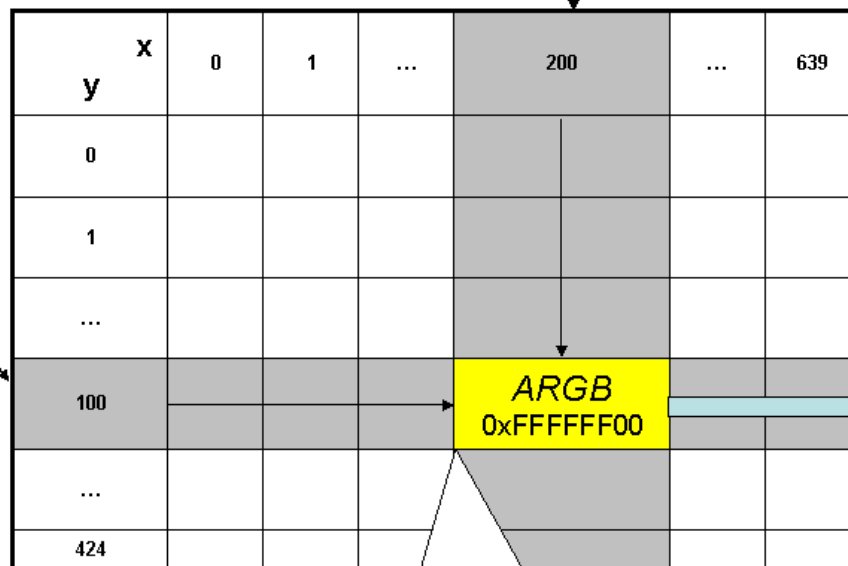
$$g(ARGB_{i,i+1}) = \begin{cases} \vec{R}_j, & \text{if mapping to a single value} \\ S, & \text{if mapping to a range of values} \end{cases}$$



M - Spatial Data Representation

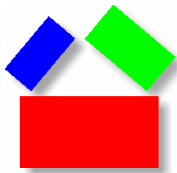
Latitude (i) $\approx 45^\circ\text{N}$

Longitude (j) $\approx 109^\circ\text{W}$



Temperature
50°-55°F

0x FF | FF | FF | 00
A R G B



M - Spatial Data Representation

```
<?xml version="1.0" encoding="utf-8" ?>
<!-- Color-Temperature map -->
<spatial.1_data.1_descriptor.1>
  <image.2_function.7_url.1>
    http://localhost/TemperatureMapF/Service1.asmx?WSDL
  </image.2_function.7_url.1>

  <color.4_temperature.1_map.1>
    <color.4_temperature.1_pair.3>
      <color.1>FFFF00FF</color.1>
      <temperature.1>-12.5</temperature.1>
    </color.4_temperature.1_pair.3>
    <color.4_temperature.1_pair.3>
      <color.1>FFBF00FF</color.1>
      <temperature.1>-7.5</temperature.1>
    </color.4_temperature.1_pair.3>

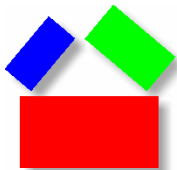
    ...

  </color.4_temperature.1_map.1>
  <Image.2>

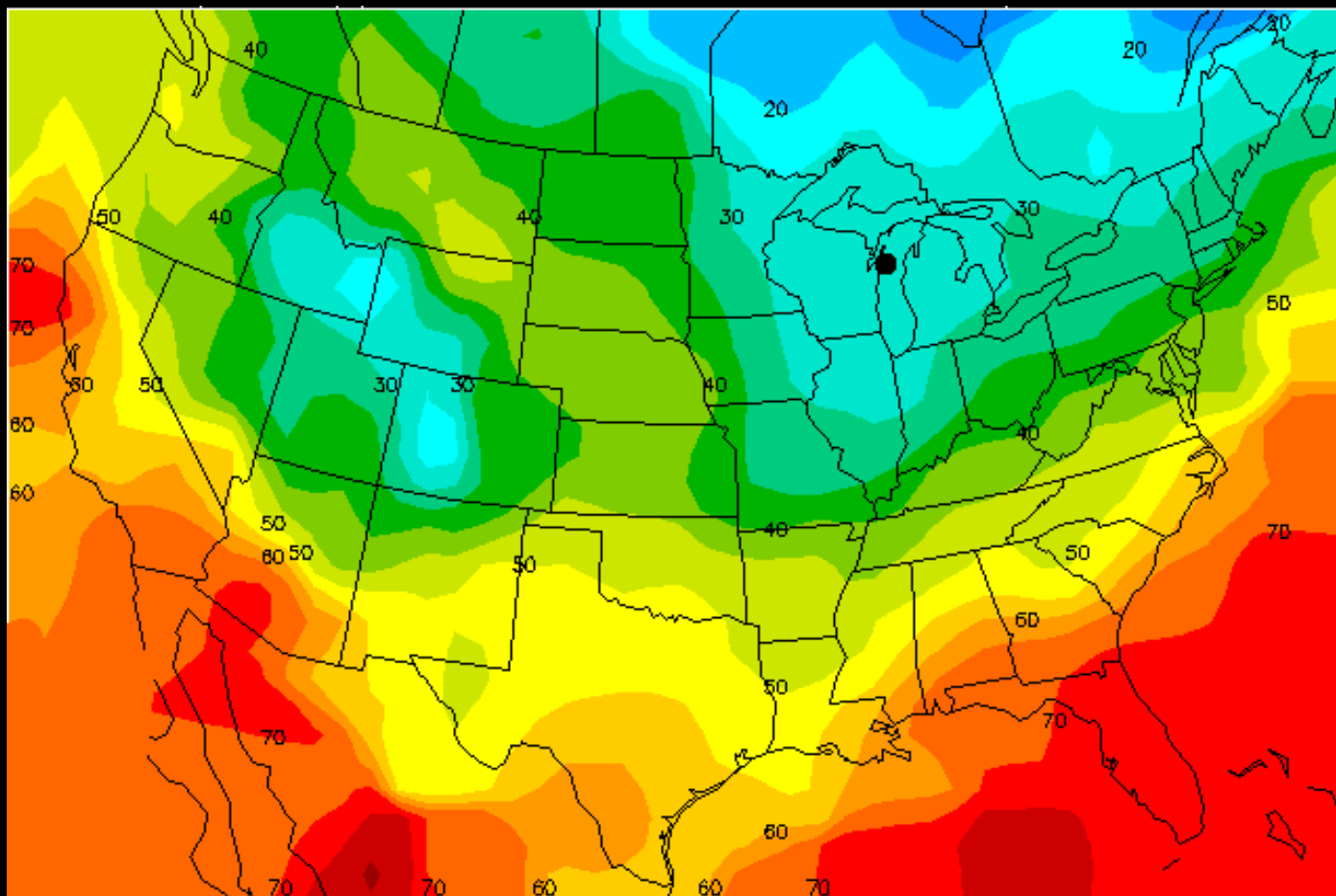
  <url.1>http://localhost/temperatureMapF/other/sfc\_con\_temp\_m
  </url.1>
  <width.1>640</width.1>
  <height.1>425</height.1>
  <begin.7_latitude.2>48.07</begin.7_latitude.2>
  <begin.7_longitude.1>-
  133.34</begin.7_longitude.1>
  <end.8_latitude.2>21.35</end.8_latitude.2>
  <end.8_longitude.1>-72.32</end.8_longitude.1>

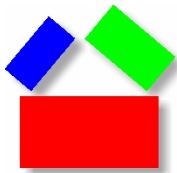
  <date.5_time.6>03/04/2006:17.0.0.0</date.5_time.6>

  <map.1_projection.4>Mercator</map.1_projection.4>
```



M - Spatial Data Representation

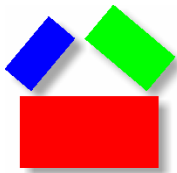




M - Spatial Data Representation

50% Drop in semiconductor yield
March 2006





M - Spatial Data Representation

Form3

Yield Data Root Cause Analysis

Date	Yield
A1	25
A2	26
A3	28
A4	25
A5	24
A6	26
A7	12

March 7, 2006

Root Cause Analysis

Root Cause found!
Concentration of PM2.5 exceeded norms and was 20 on March 7.
Possible solution: upgrade micron filters

OK