Geospatial Data Fusion

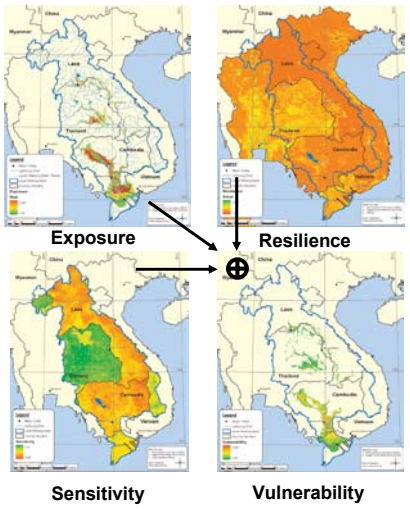
Integration Challenges

Global Spatial Data and Information Workshop
21 –23 September 2004

Richard Cicone, ISciences, LLC

Sustainability Projects

- Sustainability Transitions
- Food Security in Africa
- ***Mekong Flood Vulnerability***
- Roots of Conflict in India
- Global Fresh Water
- Insurgency Risk
- China Environmental Outlook



Geospatial = Geographic + Geostatistical + Geotextual

The New York Times
nytimes.com

September 19, 2004

Tropical Storm Jeanne Kills at Least 90 in Haiti

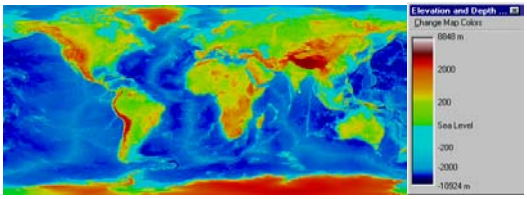
By THE ASSOCIATED PRESS

Filed at 3:35 a.m. ET

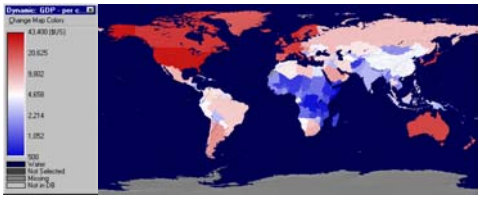
GONAIVES, Haiti (AP) -- Tropical Storm Jeanne brought raging floodwaters to Haiti, killing at least 90 people and leaving dozens of families huddled on rooftops as the storm pushed further out into the open seas on Sunday, officials said.

Floods tore through the northwestern coastal town of Gonaives and surrounding areas, covering crops and turning roads into rivers. U.S.-backed interim Prime Minister Gerard Latortue and his interior minister toured the area in a U.N. truck Sunday, but were not able to reach many areas because of washed out roads.

``We don't know how many dead there are,'' Latortue said. ``2004 has been a terrible year.''



USGS ETOPO2 and GTOPO30 Elevation and Depth



CIA World Factbook 2002 GDP per capita

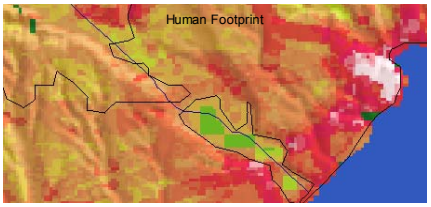
Its Not Just Overlaying Maps

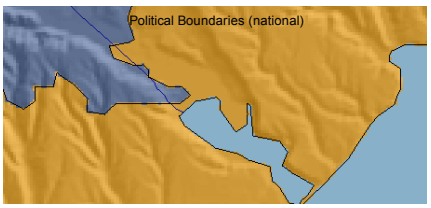
- Integration of geospatial information elements is central to understanding the problem
  - Reporting (Geotextual data)
  - Location (Where are the island states?)
  - Units and Scale
  - Resolution (spatial, temporal)
  - Measurement standards and quality
  - Mixed modalities: raw, conditioned, surrogates, Indicators
  - Aggregation and dissagregation
  - Temporal, spatial, “spectral” resampling
  - …

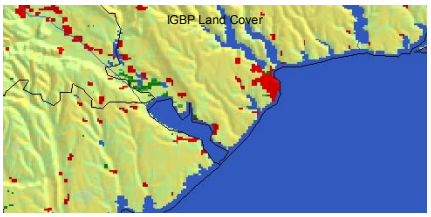
Working with Maps

Different maps include different natural features.

Map at right doesn't include water body near Odessa,so it has human impact data in the middle of water.





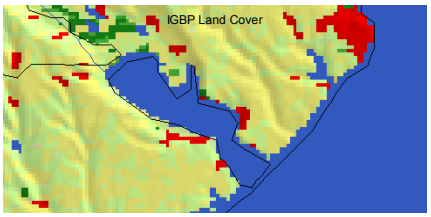


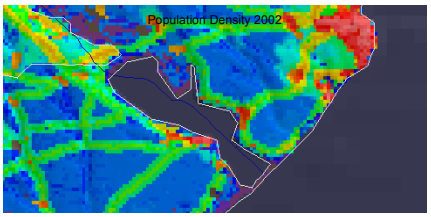
More Map Challenges

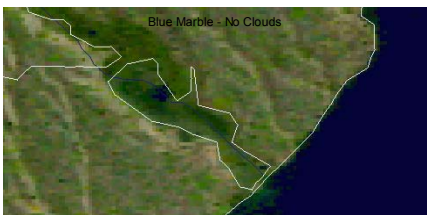
Maps are created using different vectors for features such as coastlines.

Landcover map classifies area as water, while population map has people living there.

Software uses a different set of shapes to identify coastlines (which matches 'blue marble')





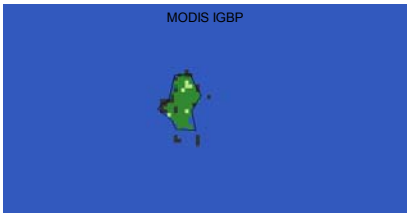


Special Case of Island States

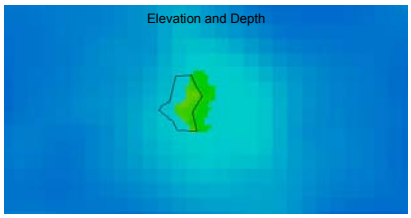
Data for islands need to be geo-referenced when added to a global dataset

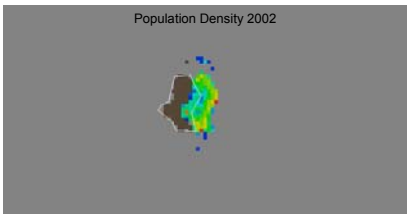
Shorelines are often defined by an independent water mask

The resulting position and shape varies from one dataset to another



Wallis Island of Wallis and Futana (13 17S, 176 12 W)





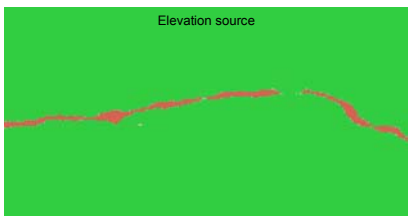
The SRTM 30 arc second Story

Local areas in SRTM data had voids that were filled in from GTOPO30

GTOPO30 had differences in feature heights and locations

Resulting SRTM 30 map has elevation steps where the source of the data switched from the SRTM pixels to the GTOPO30

Congo river, with the center of the river elevated by 50 to 70 meters



Working with Geostatistical Datasets

- Matching countries in different datasets
  - No standard “standard” (name, or code), so person is needed during import phase to resolve issues
  - Have to match countries with names in map shape files to create an integrated GIS system.
- Subnational entities may be in political dispute (e.g., Taiwan)
- Entity may change during span of time-series data
  - Example: Germany, Yugoslavia
  - Do you combine, divide based on % area or population, or just ignore?

More Geostatistical Challenges

- Inconsistencies in defining units of time-series
  - Example: HIV cases for Russia have data for: “Pre-1995”, 1996, 1997, 1998, 1999, “First 6 months of 2000”
  - Difficult to do multi-variable analysis when time periods don’t match.
- Aggregating countries varies from dataset to dataset (and sometimes variable to variable)
  - Example: “Developing nations”, “Rest of Southeast Asia”
  - Difficult to normalize and compare variables
- Meta-data and footnotes are often incomplete and scattered in separate documents.
- The sum of subnational parts may not match the total provided by a different source., do you adjust?