Work Session 1: Production and Use of Geostatistics from the Global Perspective

Methods of Reconciling Geographic Boundaries in Integrated Research

Kytt MacManus
Geographic Information Specialist
Columbia University CIESIN

Considerations for Global Data Production

- Data inputs come from many sources
  - Census Offices
  - Departments of Cartography
  - Departments of Natural Resources
- Data interoperability can be problematic
  - Within a country
  - Across countries

Low Elevation Coastal Zone Project

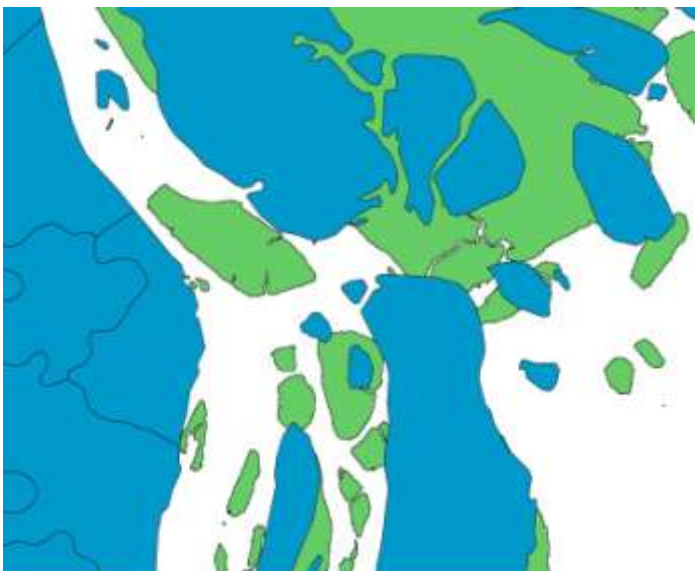
- Global evaluation of population affected by Sea Level Rise Scenarios
  - 1m, 3m, 5m, 7m, 9m, 10m, 12m, 20m SLR Scenarios
- SRTM Void filled elevation data (90m resolution)
  - Pre-processed to exclude cells non-contiguous to coast
- GRUMPv1 Population estimates
  - Based on census inputs and Urban/Rural classifications
  - For more information on GRUMPv1 see http://sedac.ciesin.columbia.edu/data/collection/grump-v1

The Problem: Coastlines do not Match

GRUMP Medium Resolution Coastline

SRTM High Resolution Coastline

A simple overlay highlights the boundary mismatch



The medium resolution coastline (GRUMP) is clipped to the higher resolution geometry (SRTM). In this step we have discarded areas where GRUMP says there is land, but SRTM says there is water; which is reasonable because the SRTM data has an assumed higher accuracy.

Original GRUMP

GRUMP Clipped to SRTM

A symmetrical difference is calculated between the clipped GRUMP boundaries and the original SRTM boundaries.

We have now isolated the areas where SRTM says there is land, but GRUMP says there is water.

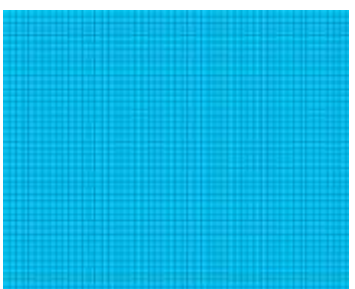
We believe that there is actually land where SRTM says there is because the data is higher resolution than GRUMP.

GRUMP Clipped to SRTM

Areas where SRTM shows Land, but GRUMP shows water

Areas where SRTM shows Land, but GRUMP shows water

30 ArcSecond Fishnet



We create a 1km fishnet (the same resolution as the SRTM data) and run an intersect operation to impose the geometry on our symmetrical difference polygons.

Intersect Feature Class

In this step we generate a point layer for each polygon segment based on the calculated centroids.

The reason for this is that we desire the polygon segments to take the attributes of the closest administrative unit to their geometric center. ie the unit to which the majority of their surface area is closest.

We spatially join the attributes from the clipped GRUMP boundaries generated in step 2 onto the centroids.

We do this in order to get a name or unique identifier of the administrative unit we are seeking to rectify.

GRUMP Clipped to SRTM

Attributes

Symmetrical Difference Points

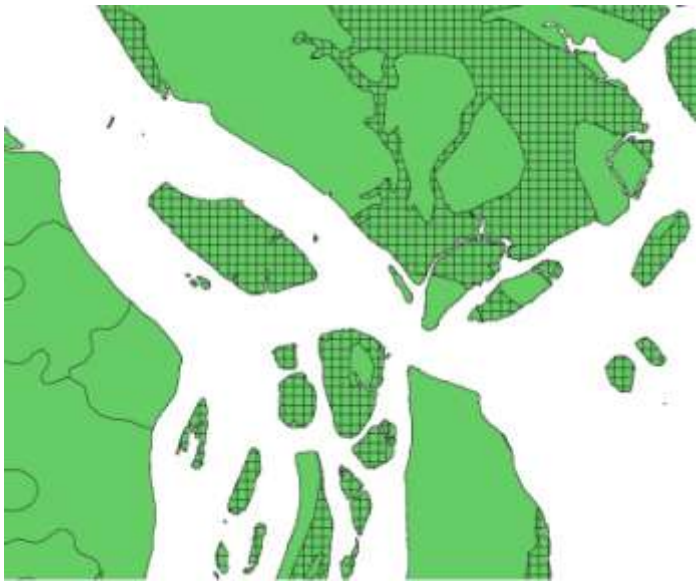
In this step we join the attributes from our clipped GRUMP administrative boundaries from the symmetrical difference points to the symmetrical difference fishnet created in steps 3 and 4.

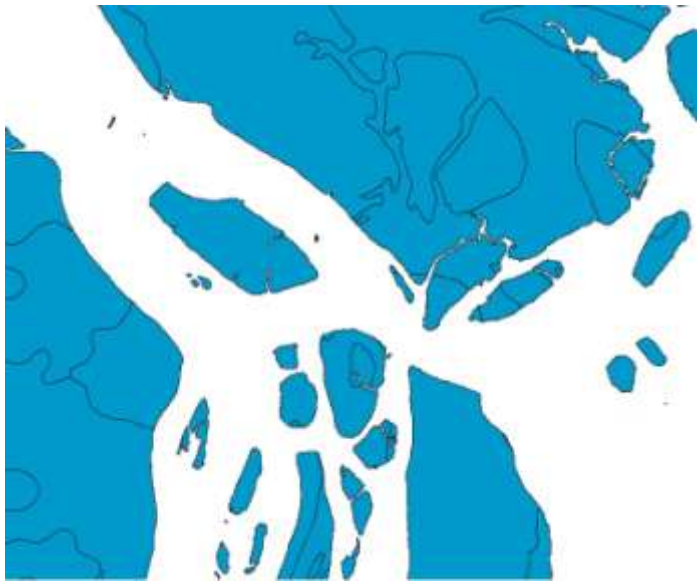
We do this in order to get a unique identifier onto the geometries that we are seeking to update, from their closest polygonal neighbor.

GRUMP Clipped to SRTM Symmetrical Difference Points Symmetrical Difference Fishnet

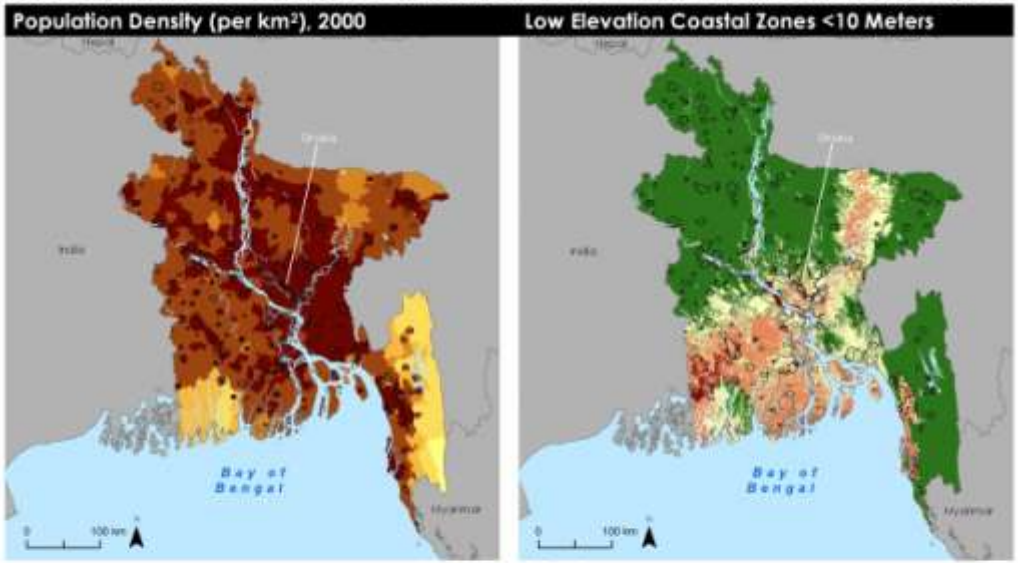
We then Merge the symmetrical difference shapefile to the clipped GRUMP boundaries and produce a vector that contains geometries covering the same exact area as the input SRTM coastline.

Finally, we dissolve the merged dataset by Administrative Name (or some other unique identifier) to complete the process and produce a shapefile with the SRTM coastline and GRUMP internal boundaries.





BANGLEDESH POPULATION DENSITY AND LOW ELEVATION COASTAL ZONES



Low Elevation Coastal Zones

Country Population and Land Area Counts

Result Filters

Elevation Zone Filter	(All)
Country Filter	Bangladesh
Urban-Rural Designation Filter	(All)
~~GeoRegion Filter~~	~~(All)~~
~~GeoSubregion Filter~~	~~(All)~~
~~Income Group Filter~~	~~(All)~~
~~Lending Category Filter~~	~~(All)~~

Initial Filter Setting

Filter Activated

Filter is invalid or redundant due to other activated filters

Click to Reset All Result Filters

	Population 1990 (persons)	Population 2000 (persons)	Population 2010 (persons)	Population 2100 (persons)	Land Area (km2)
Asia					
Bangladesh					
Total National Population	104018188	128881130	148691142	274375472	135015
Rural	84830296	103126448	118977768	218033280	123890
Urban	19187892	25754682	29713374	56342192	11125
Elevations ≤ 1m	1539021	1886415	2176368	4165415	1942
Rural	1299507	1571418	1812953	3491996	1877
Urban	239514	314997	363415	673419	66
Elevations ≤ 3m	3169856	3942238	4548186	8695464	4542
Rural	2629926	3218254	3712920	7137505	4296
Urban	539931	723983	835266	1557959	246
Elevations ≤ 5m	9399838	11494307	13261065	25109601	13011
Rural	7737940	9264376	10688376	20328284	12138
Urban	1661898	2229931	2572689	4781317	873
Elevations ≤ 7m	22224642	27339069	31541288	59926521	27671
Rural	17569914	20979740	24204482	46135712	25653
Urban	4654728	6359329	7336806	13790809	2019

Additional Considerations for Global Data

- In addition to coastlines, internal international borders often vary by source.

Solution

1. Select international standard for Administrative Level 0.
2. Match coastlines to international Admin 0 boundaries.
3. Match higher resolution boundaries (Admin1, 2,…) to the international Admin 0 coastline adjusted data.