Exercise 1 (October 23, 2013)
Glacier mapping and inventory parameter

Goals

1. Create outlines and the central flow lines of four glaciers in the Indian Himalaya based on Landsat ETM+ data.
2. For the mapped glaciers, derive the following inventory parameters: area, minimum-, maximum-, mean-elevation and mean slope.

Preparation

Download the glacier_mapping.zip, this folder contains all the data and files you need for this exercise (look at it in ArcCatalog)

Download link: http://www.geo.uzh.ch/~alinsbau/ihacp/level2/ex1_glacier_mapping/

- aster_gdemV1 ASTER GDEM (version 1)
- aster_gdemV2 ASTER GDEM (version 2)
- etm_321.tif Lansat ETM+, band combination RGB:321 (true color)
- etm_543.tif Lansat ETM+, band combination RGB:543 (false color)
- flow_lines.shp Empty line-shapefile for your flow lines
- glaciers.shp Empty polygon-shapefile for your glacier outlines
- srtm_cgiar SRTM DEM, void-filled version from CGIAR
- to_digitize.shp Point-shapefile indicating the glaciers of interest

Open a new empty document in ArcMap and load all the data layers. Make sure that the Spatial Analyst extension is loaded (Customize > Extensions…)

1. Mapping of glacier outlines and central flow lines

Start an Editing session and digitize the outlines of the four glaciers indicated by the dots of to_digitize.shp. Digitize the central flow line for each of these glaciers and derive their lengths, which should be stored in the attribute table.

Note: In addition to the satellite data, you can also use the DEM for these tasks. Create hillshade views and contour lines. You can also find this region on Google Maps or Google Eartch. Search for Manali (Himachal Pradesh, India), the study region is about 35 km north of this town.

2. Parameter for glacier inventories

Obtain the area and the topographic parameters minimum, maximum, and mean elevation for these glaciers. Use the tools 'zonal statistics' or 'zonal statistics as table' to do so. Add the derived parameter to the attribute table of the glacier shapefile. Do the same for mean slope.

3. Questions to answer

Answer the following questions with a few short sentences and store the text (together with your name and initials) in a file called 'ex1_glacier_mapping_XY.doc/pdf'.

1. What are the main challenges in mapping glacier outlines?
2. What are the sources of uncertainties? Why and where do they occur?
3. Imagine a change assessment from two inventories from two points in time, based on different source data, mapped by different analysts... Which challenges have to be considered and what are the uncertainties?
4. What are the differences between the parameters obtained from the different DEMs?
5. What are the differences between the DEMs? Which DEM is better suitable for obtaining inventory parameters and why?

4. Deliverables

Rename the two shapefiles with the glacier outlines and the central flow lines to glacier_XY.shp and flow_lines_XY.shp with XY and your initials or group name/number. Then create a zip folder containing these two files and send it to andreas.linsbauer@unifr.ch. Send me also the file with your answers to the questions (latest until 28/10/2013).

The mapped glacier outlines have to be handed in at the end of the class on 23/10/2013 at 17.30h.