EGM702 – Photogrammetry and Advanced Image Analysis

Week 4, Part 1: Introduction to Change Detection

Week 4 Outline

1. Introduction to change detection
2. Visual analysis
3. Change vector analysis
4. Multi-temporal classification
5. Time series analysis

Mapping Change

- So far, mostly considered individual images
- With multiple images, can observe differences over time

Change detection

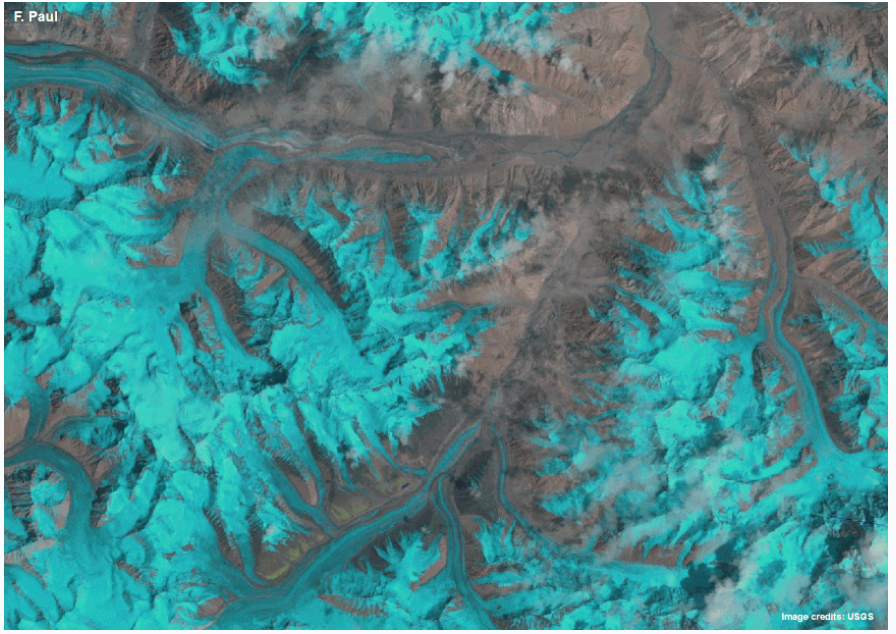
- Analysing changes over time:
  - Growth of urban areas, changes in landcover
  - Changes in burned area
  - Landslides, other hazards
- Looking for quantitative analysis
  - e.g., % area change, # of landslides
  - Spatial distribution
  - Accuracy assessment

Change detection considerations

- Time
  - Time period, change rate, time of year
- Remote sensing data:
  - Resolution(s)
  - Sensor characteristics
- Geometric/radiometric correction

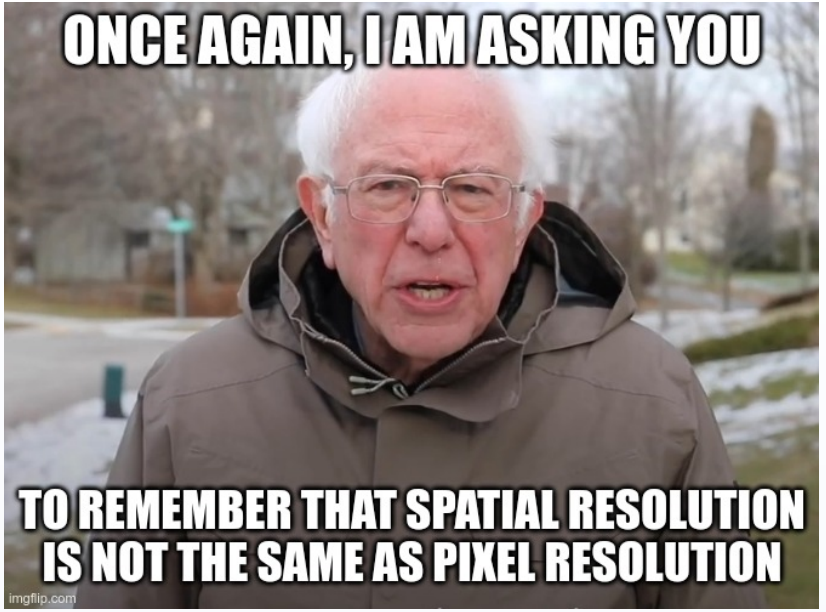
Time

- How “big” is the change?
  - Relative to image data
- How quickly does change happen?
- Is the change seasonal?
- Time of year (sun angle, seasonal differences)
- Tidal differences (in coastal areas)



Remote Sensing Data

- Resolution:
  - Spatial
  - Spectral
  - Radiometric
  - Temporal
- Look Angle
- Type of sensor (e.g., optical vs. microwave)

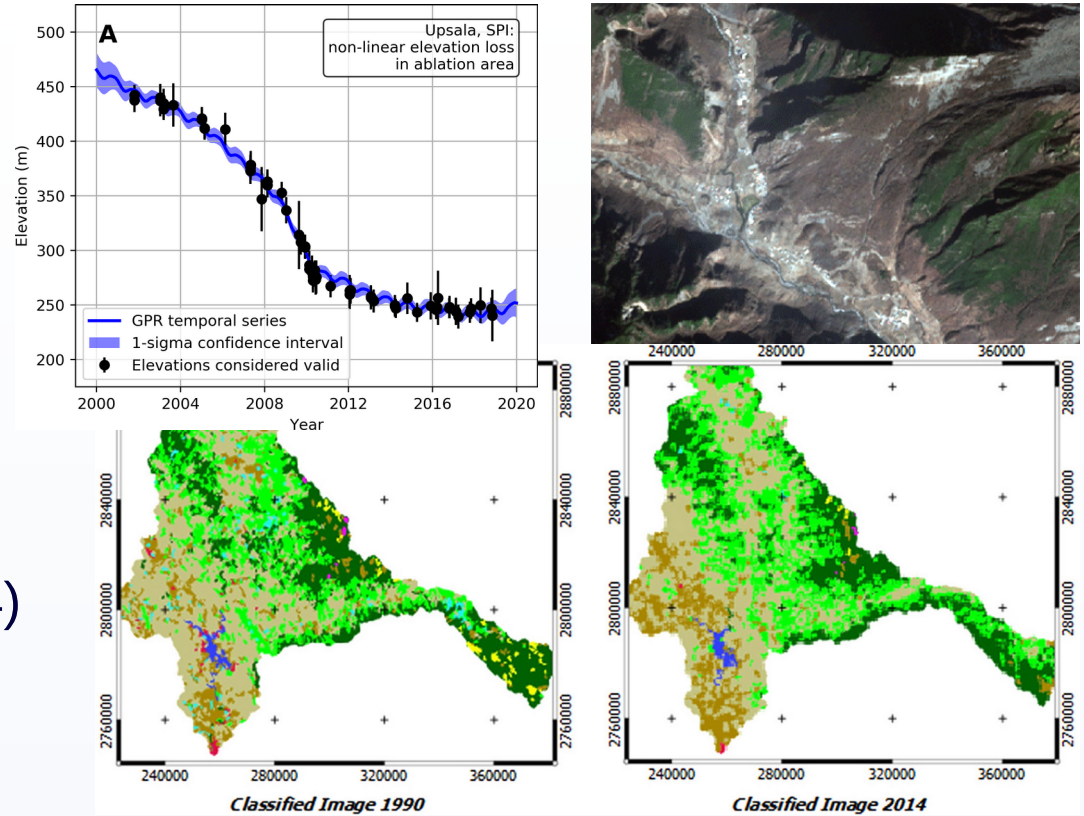


Geometric/Radiometric Correction

- Geometric correction
  - Want differences to represent actual change
  - Want accurate length, area measurements
  - Images should be (co-)registered
- Radiometric correction
  - Atmopsheric, environmental conditions vary
  - Need depends on application

Some change detection techniques

- Visual analysis (Part 2)
- Data transformation
  - Principal Component Analysis
  - Normalized Difference Index
  - Band Algebra
- Classification comparison
- Change vector analysis (Part 3)
- Multi-temporal Classification (Part 4)
- Time Series Analysis (Part 5)



Sanhouse-Garcia et al., 2017

Summary

- Often, we want to analyse changes in time:
  - Before/after an event (e.g., landslide, hurricane)
  - Over time, at two or more points
- Have to consider both the change and the available data
- Visual analysis can be either a first step, or a way to analyse changes
- Many of the techniques we've covered can be adapted to analyse temporal change

Additional resources

- Lillesand, Kiefer & Chipman – Chapter 7
- Jensen – Chapter 12
- Lu et al., 2004 [Int J Remote Sensing]
- Earth Observatory [NASA]
- Change Detection using Landsat 8 [GeoDelta Labs]
- Change Detection Using Landsat Imagery [VGE]