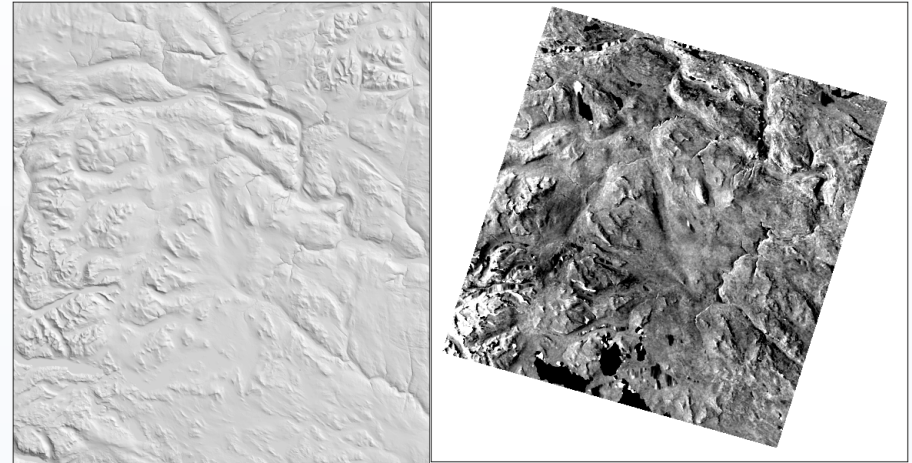
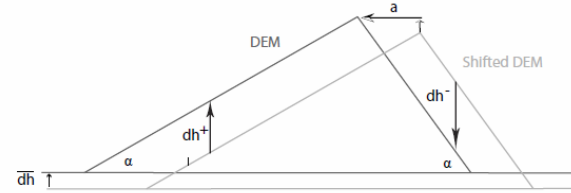


EGM702 – Photogrammetry and Advanced Image Analysis

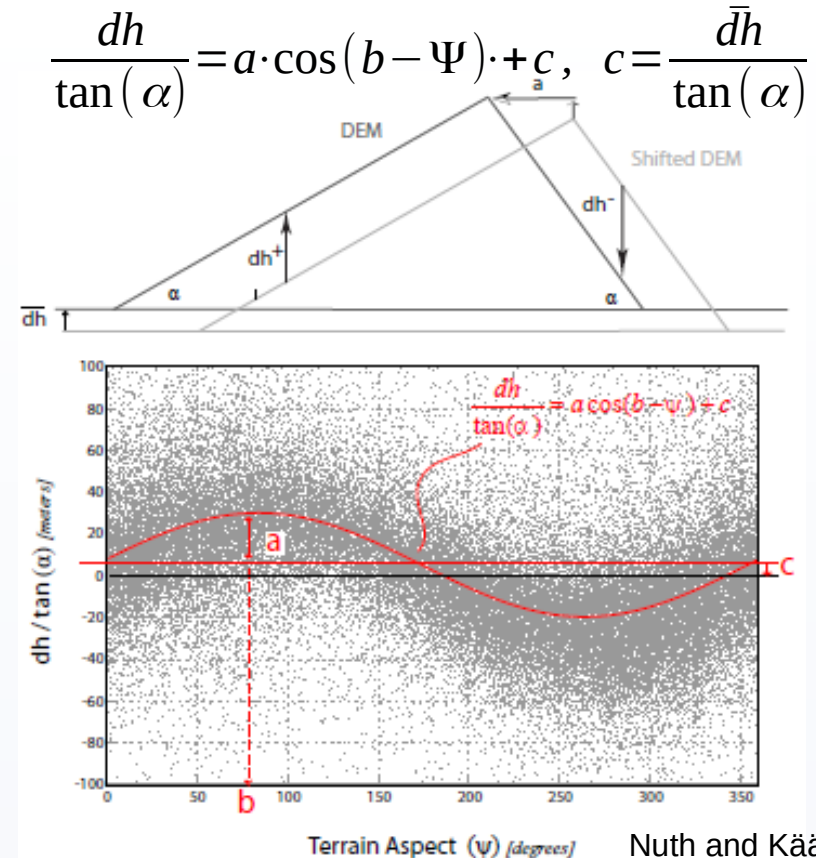
Week 2, Part 6: DEM Applications

Need for co-registration

- Small x,y shifts between DEMs lead to large differences in Z
- Shows up as hillshade-style pattern
- Leads to bias (systematic error)
- To correct, have to **co-register** the DEMs

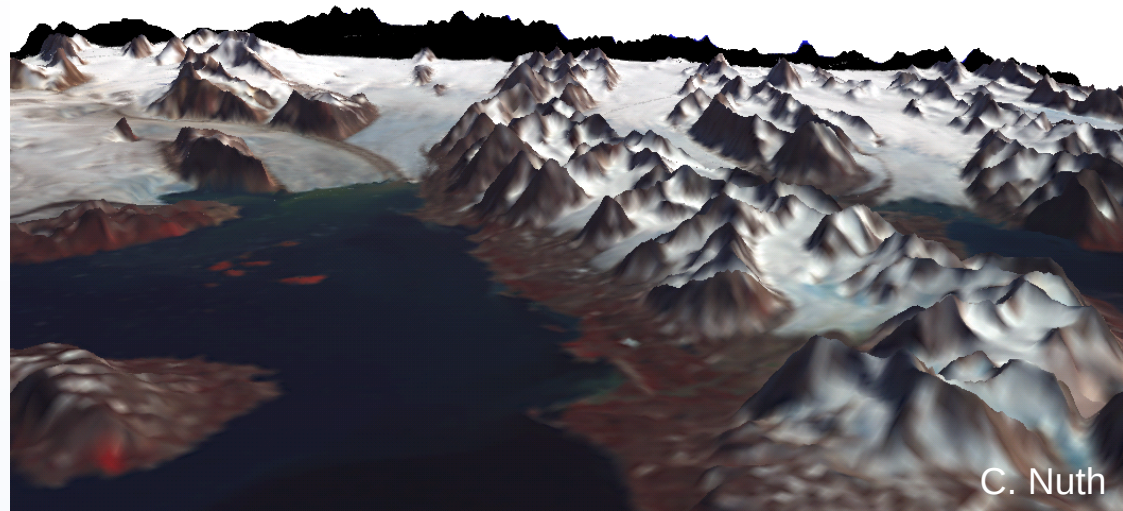


- One method: iterative co-registration
- Solve for shifts as a function of aspect:
 - a: magnitude of shift
 - b: direction of shift
 - c: mean bias, normalized by slope

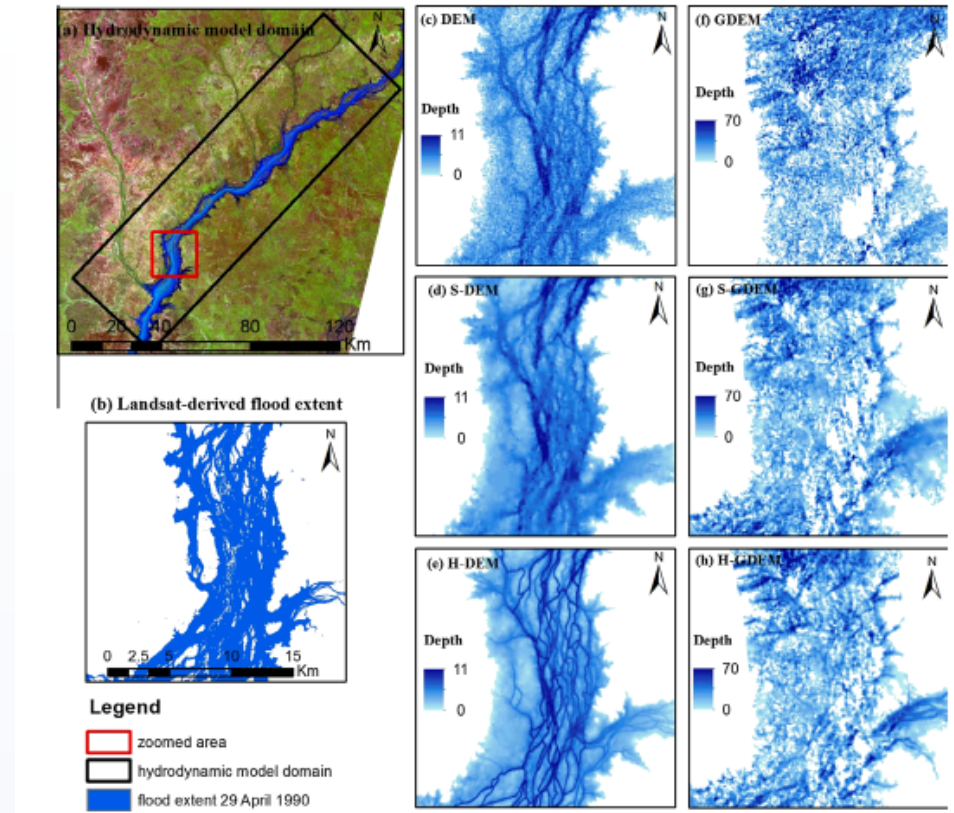


Nuth and Käab, 2011

- Geometrically correct satellite images
- Visualization
 - Shaded relief/Hillshade
 - Draping
- Topographic parameters:
 - Solar illumination
 - Viewshed
- Change Analysis

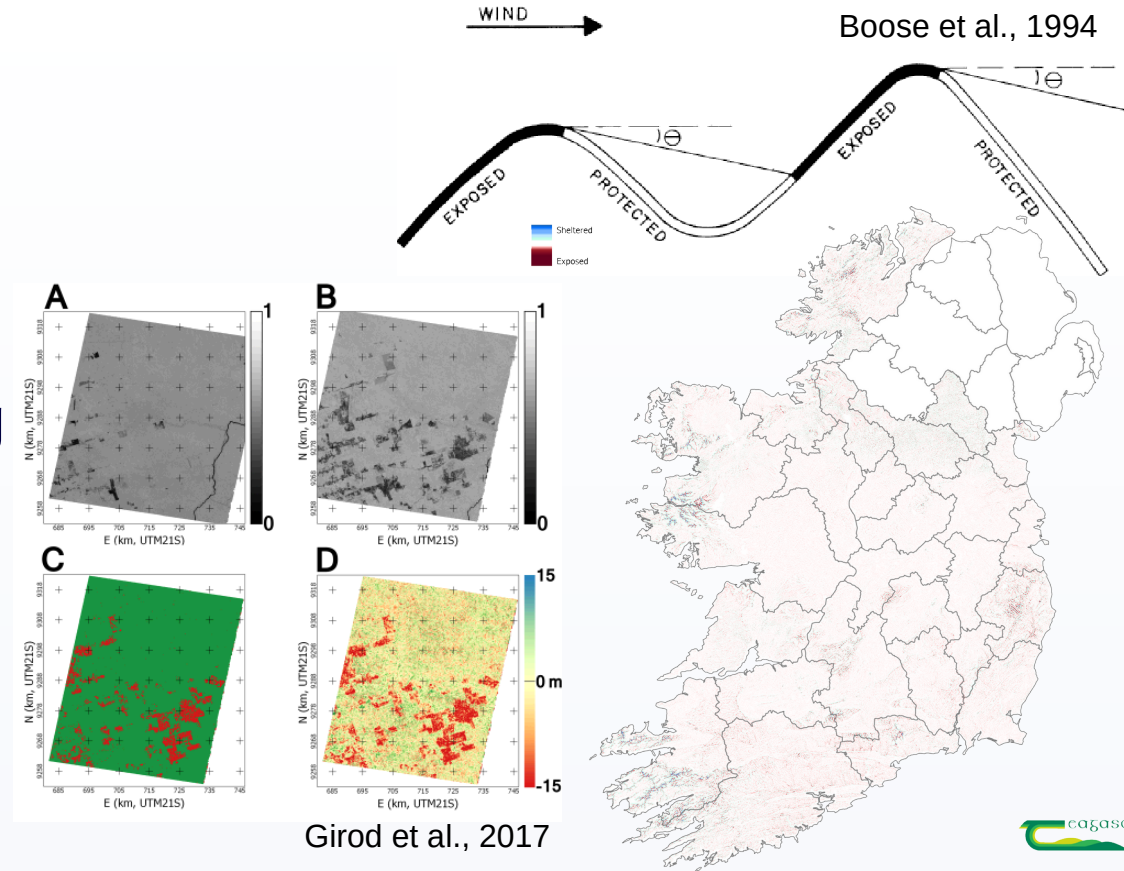


- Flow modelling using slope, aspect
- Delineate watersheds
- Map river/stream networks
- Mapping flood depth, extent

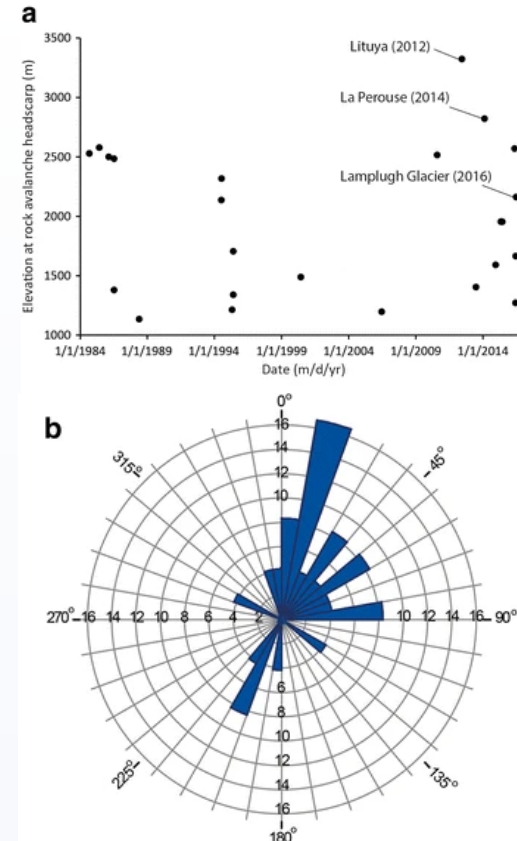


Jarihani et al., 2015

- Topographic Exposure (TOPEX)
 - Estimate location's protection from wind
 - Can help guide replanting efforts
- Tree height, structure
- DEM Differencing

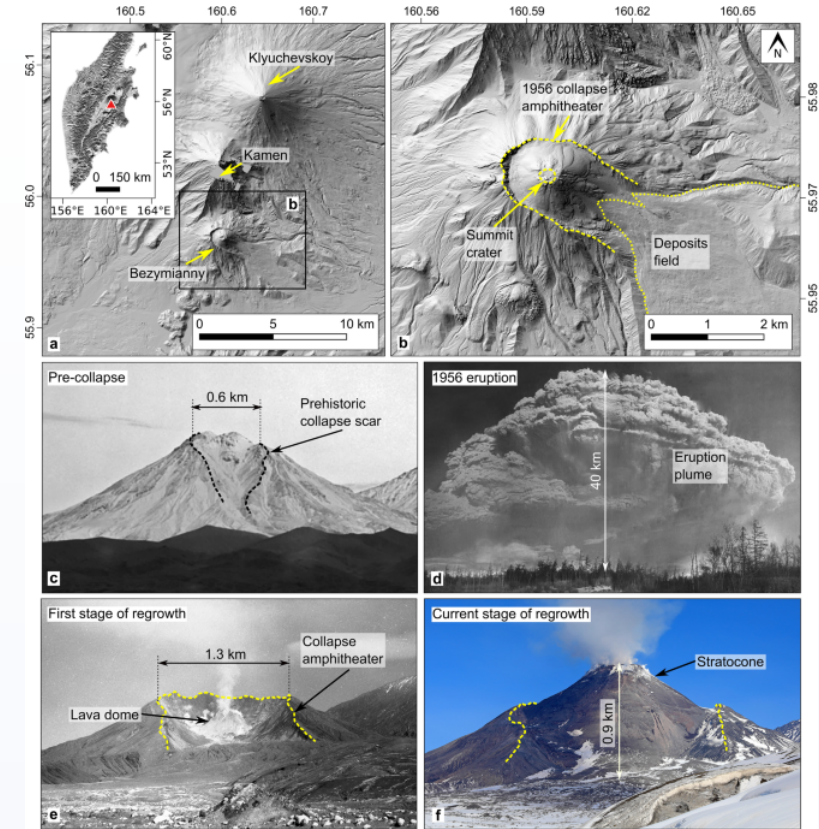


- Classified rock avalanche/landslides since 1984 in Glacier Bay, Alaska
- DEM to calculate headscarp, runout, aspect
- Aspect, temperature record suggests increased rock-permafrost degradation
- Can also use DEMs to model runout, other effects



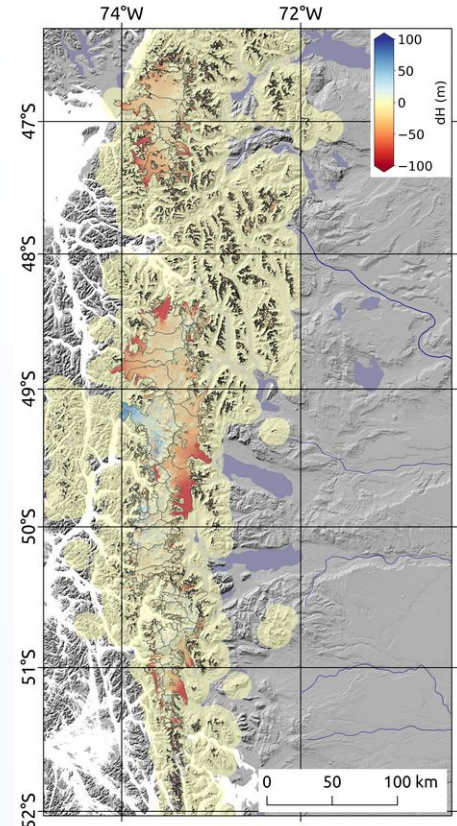
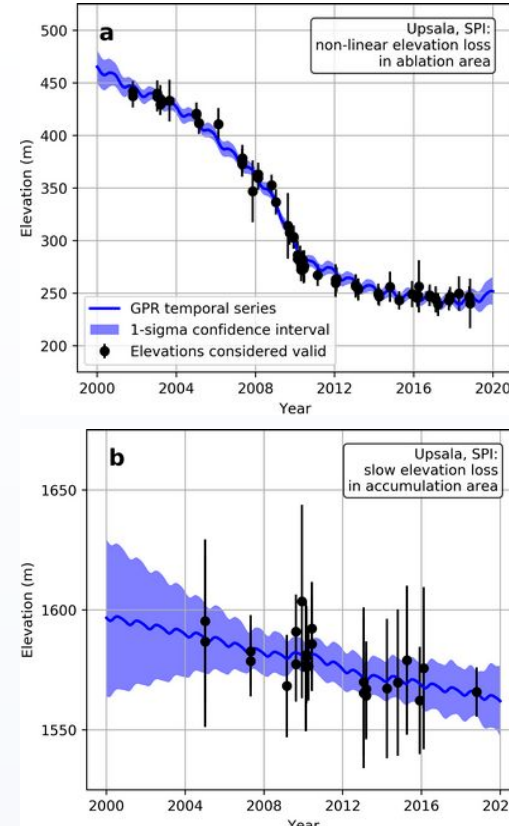
Coe et al., 2017

- Repeat DEMS:
 - Lava/pyroclastic flow depth, volume
 - Landslides, flank collapses
 - Dome building
- DEMs can be used to model lava flows



Shevchenko et al., 2020

- DEMs:
 - Model surface mass balance
 - Model/estimate ice flow, ice thickness
- Repeat DEMs:
 - Volume change
 - Elevation change time series



Hugonnet et al., 2021

- Before comparing DEMs, they must be co-registered
- Many, many applications of DEMs in remote sensing & geo/environmental sciences
- Necessary input for many types of modelling
- Change analysis applications

- Nuth and Kääb, 2011 [[The Cryosphere](#)]
- Jarihani et al., 2015 [[J. of Hydrology](#)]
- Girod et al., 2017 [[Remote Sensing](#)]
- Coe et al., 2017 [[Landslides](#)]
- Shevchenko et al., 2020 [[Comms. Earth & Env.](#)]
- Using DEMs to Map Changes in Topography [[USGS](#)]
- An overview of the hydrology toolset [[ESRI](#)]