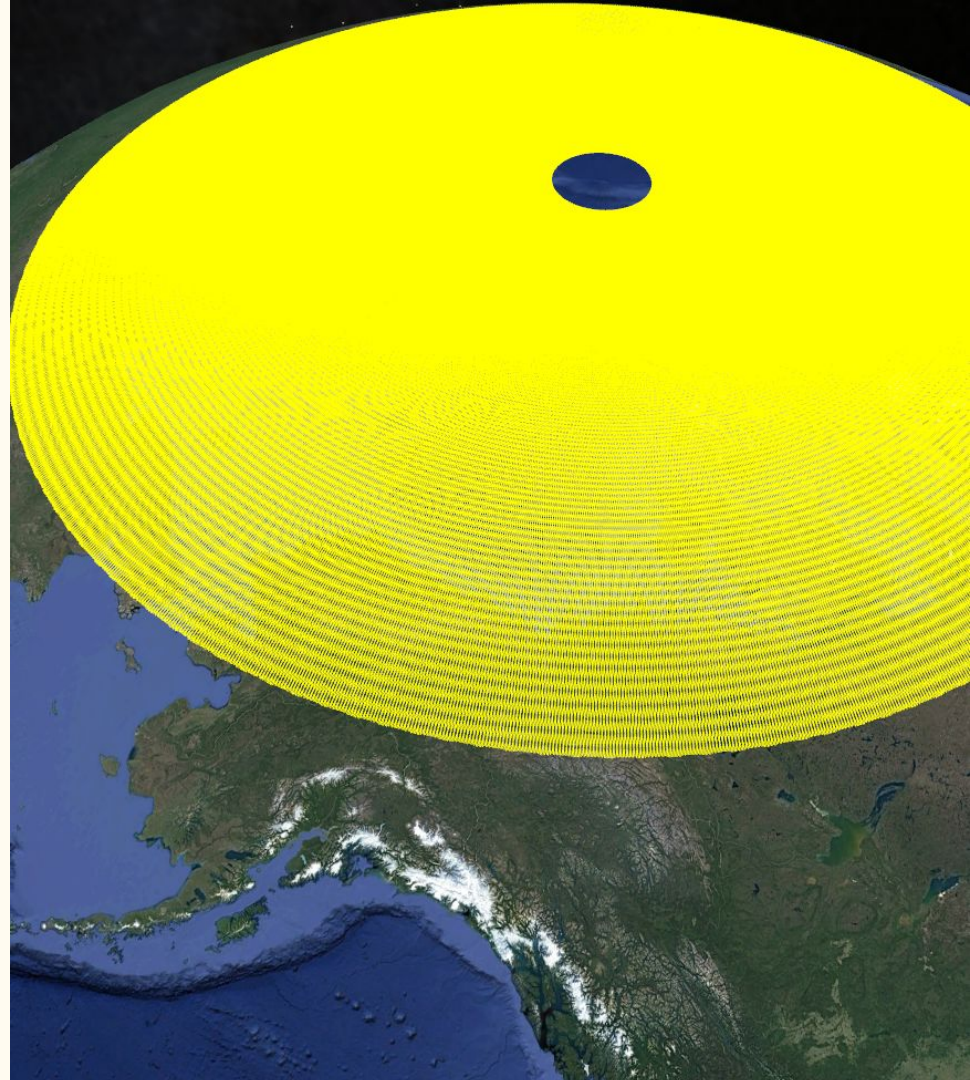


(or, what to do with
non-overlapping ICESAT-2
tracks)



In Alaska

- Largest non-polar icefields on earth
- Complex topography
- Frequently cloudy
- High seasonal mass balance amplitudes
- Operation IceBridge is ending
- And ICESAT-2 won't repeat tracks for at least 2 years

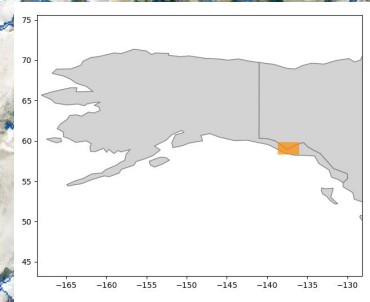


Study Area

- Grand Plateau Glacier
- Terminus retreat may re-route Alsek R.
- Major management implications for Glacier Bay National Park *and Preserve*

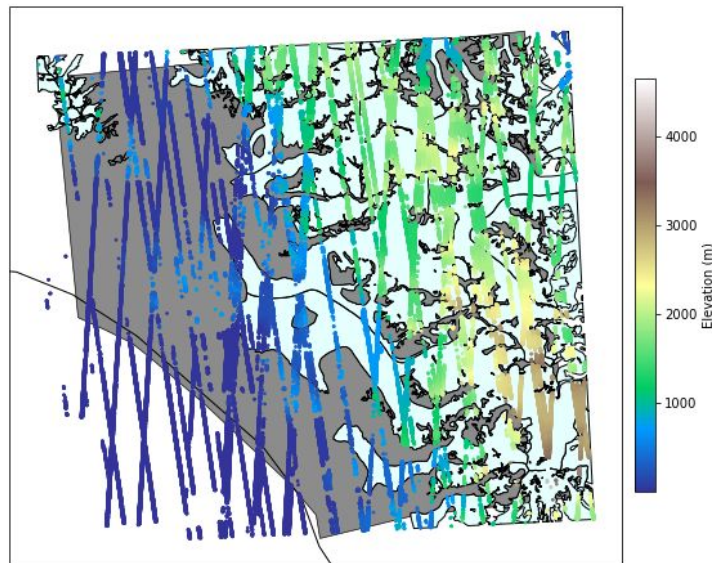


Glacier Bay

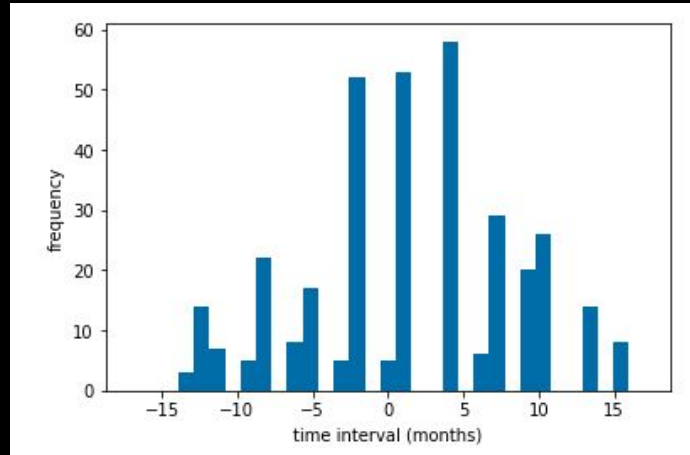
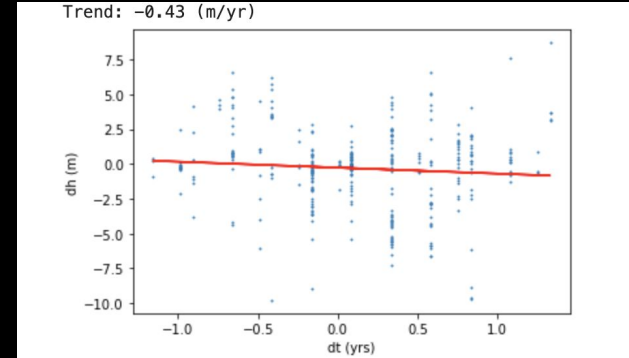
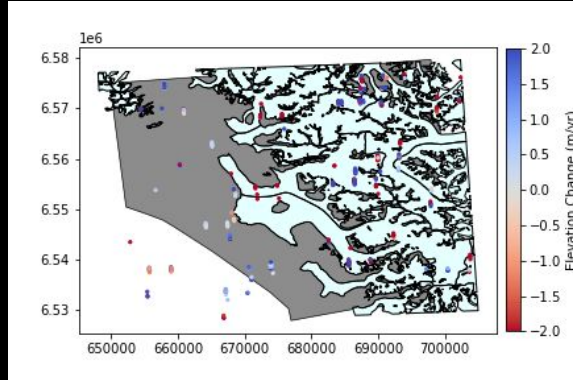


(Technical) Objectives: Explore tools for measuring dh/dt on Alaskan glaciers

- Approach:
 - Crossover comparisons
 - Remove topography with Arctic DEM and create time series
 - DEM resolution: 100m
 - Remove topography using track data (topofit.py) and create time series
 - Surface resolution: 1 km
- Data: ATL06 tracks from the entire operation period (October 2018-present)
- Flow: download data (icepyx) >>> jupyter notebook, using functions from hackweek to read in, filter, and plot (cptoolkit, Johan's tutorial)>>> analysis



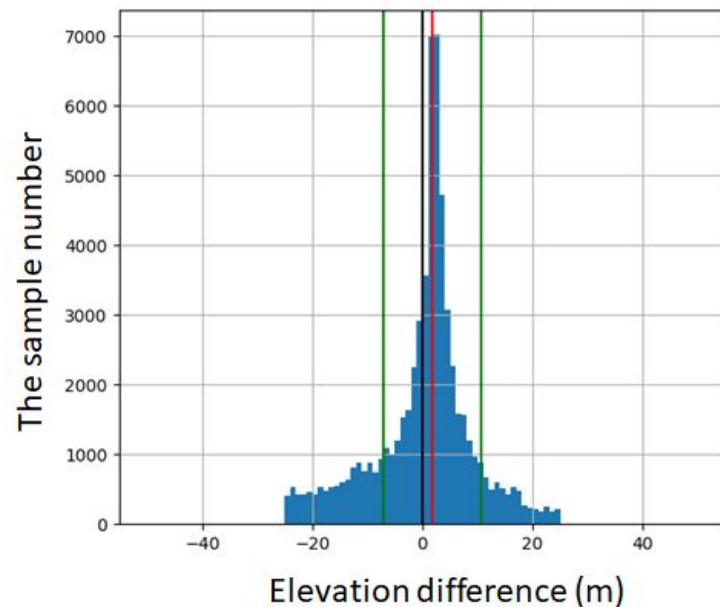
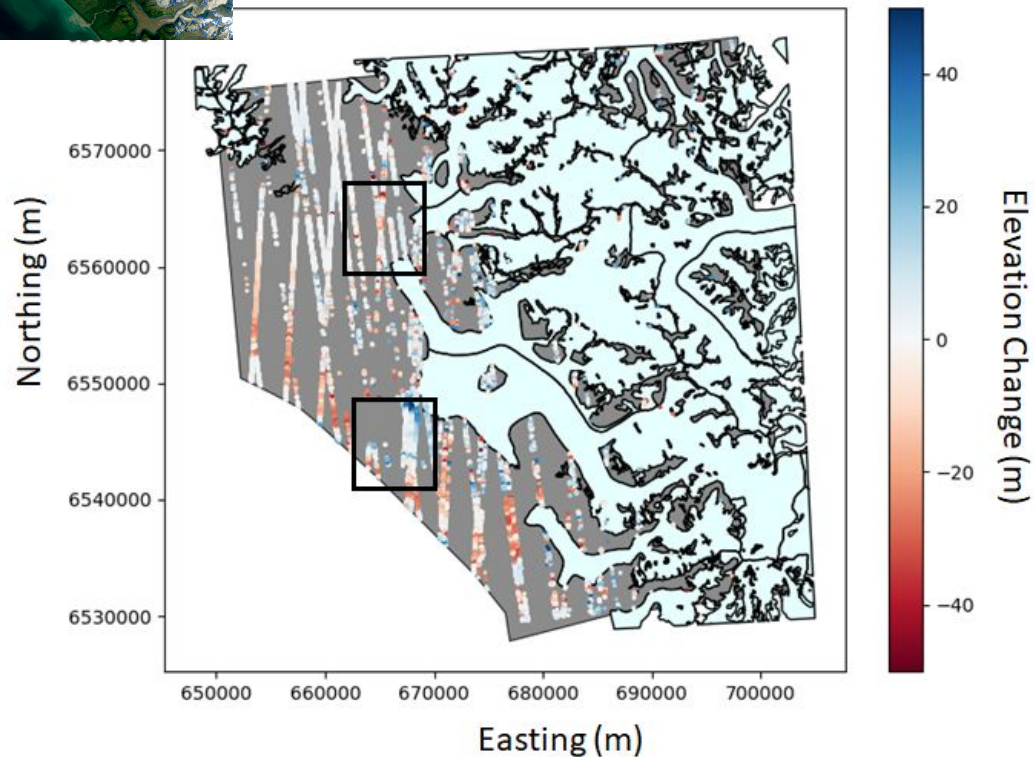
Crossovers



- Some, but not very dense crossover coverage
- Lack of short-time interval crossovers makes bias assessment difficult
 - Would need to use geography to locate points where we expect no changes over time



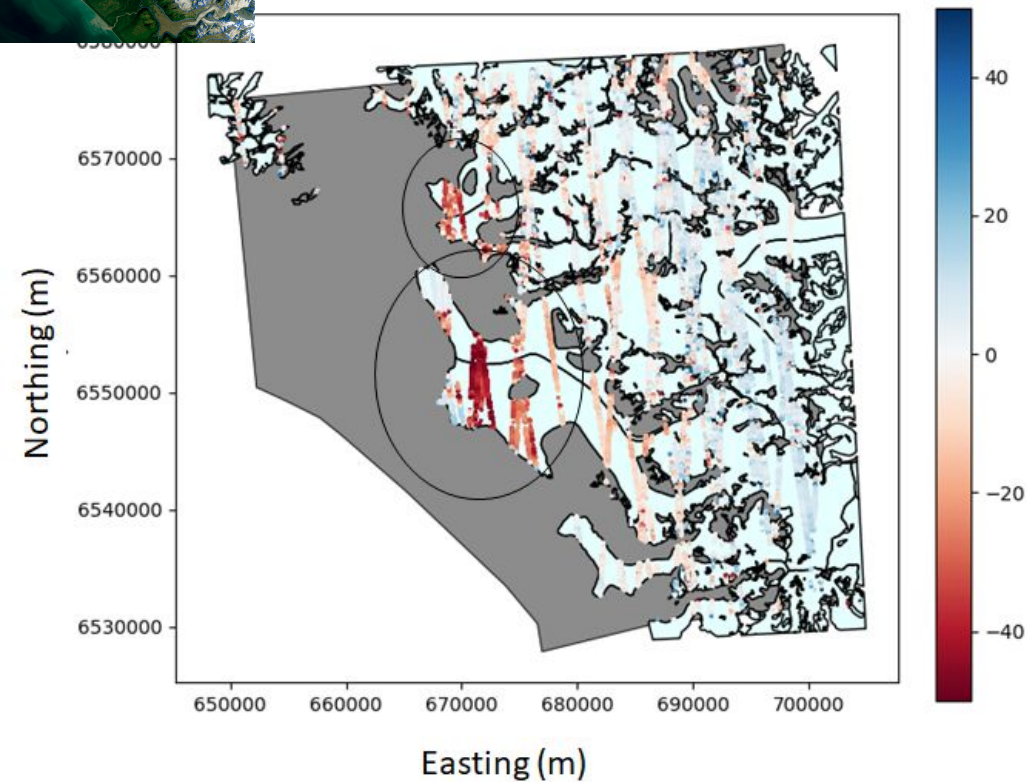
Icesat2 - ArctiDEM



Ice free area
Mean 1.77 m
Std = 8.9 m

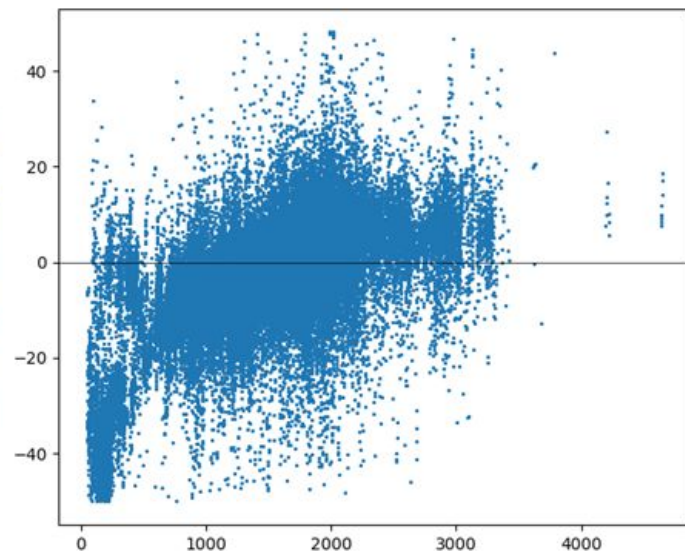


Icesat2 – ArctiDEM (After correction)



Elevation Change (m)

Elevation change (m)

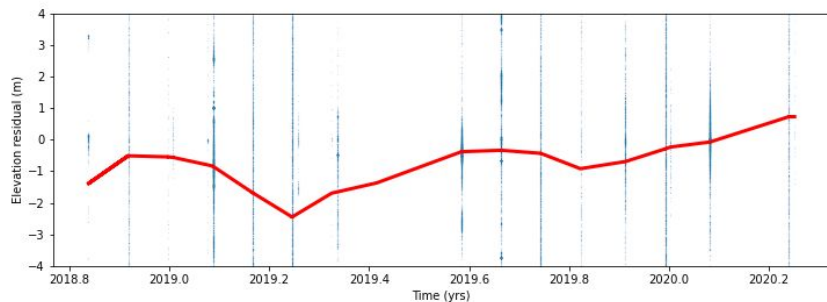


Elevation (m)

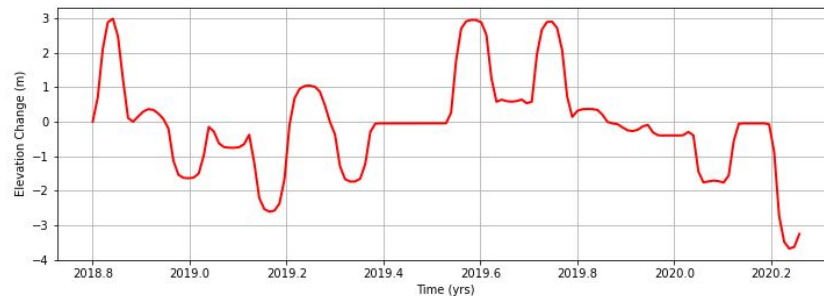
Mean -1.21 m

Time Series: toposfit vs Arctic DEM

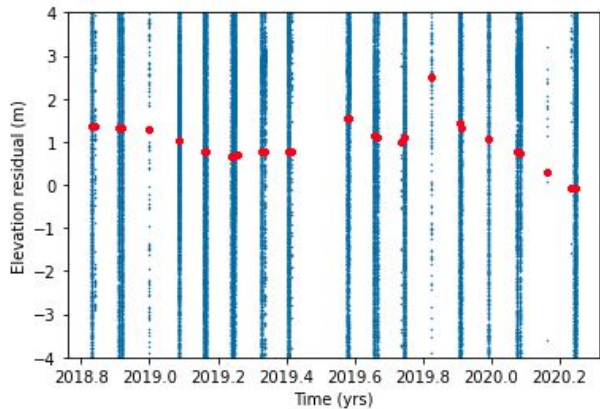
1-month Binned height residuals (topofit, 1 km)



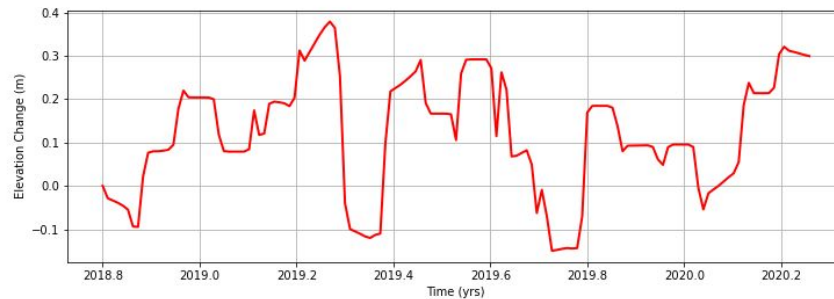
2 week, 3km Gaussian interpolation (topofit)



1-month Binned height residuals (ArcticDEM, 100m)

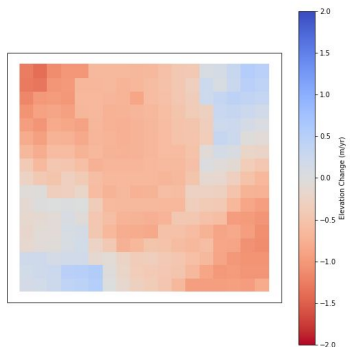


2 week, 3km Gaussian interpolation (ArcticDEM)

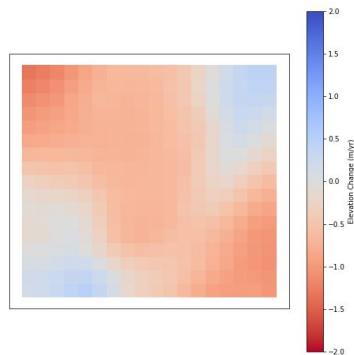


Spatial Interpolation

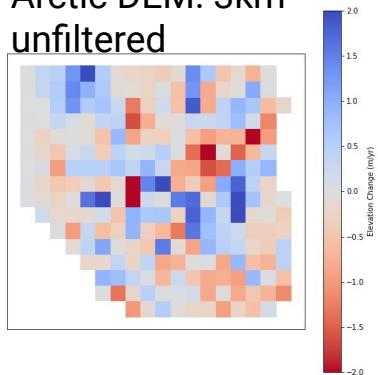
Topofit: 3km unfilter



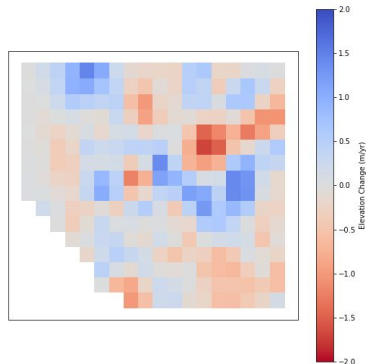
Topofit: 3km filter



Arctic DEM: 3km unfiltered



Arctic DEM: 3 km filtered

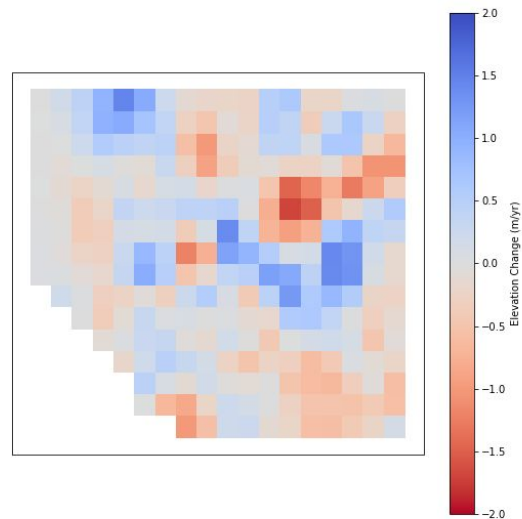
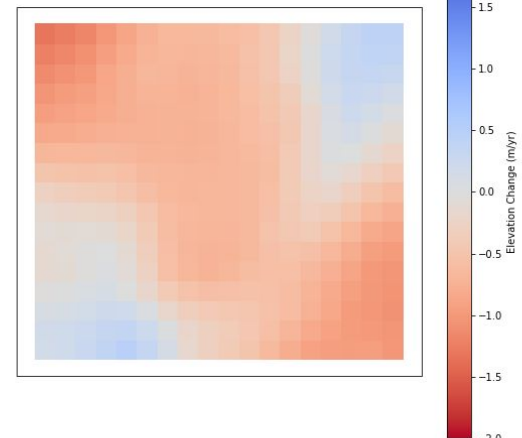
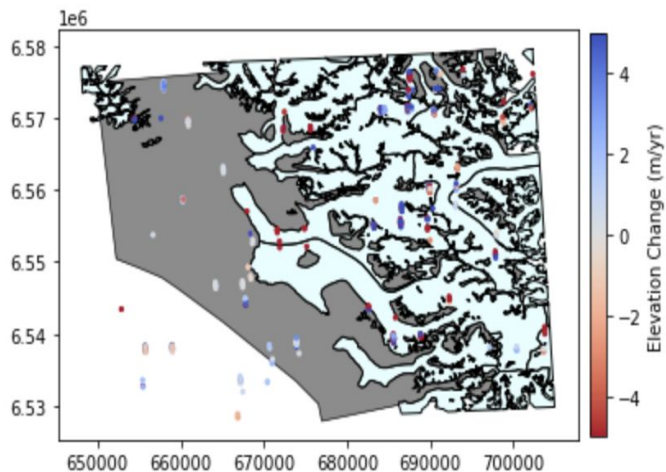


- Large scales patterns: some mass loss in glacier/snow downstream regions (a high peak in a bigger converging place) and some gain in accumulation zone
- Arctic DEM fitting shows smaller-scale patterns due to higher resolution of fitting surface



Elevation comparison from 3 methods

- Bottom left: crossover
- Top right: topofit
- Bottom right: ArcticDEM



Discussion/Takeaways

- Crossovers give point-wise estimates, but limited by spatial/temporal coverage
 - Need enough points for bias evaluation
- Estimates based on height anomalies from a reference surface are very dependent on the surface used, limited by resolution of the surface
- Future work:
 - Separate by surface type
 - quantitative comparison of crossovers vs gridded dh/dt estimates
 - Vary model parameters for topofit
 - Vary spatial interpolation methods
- Hopefully can get guidelines on when these different techniques are useful for small glaciers without repeat tracks