

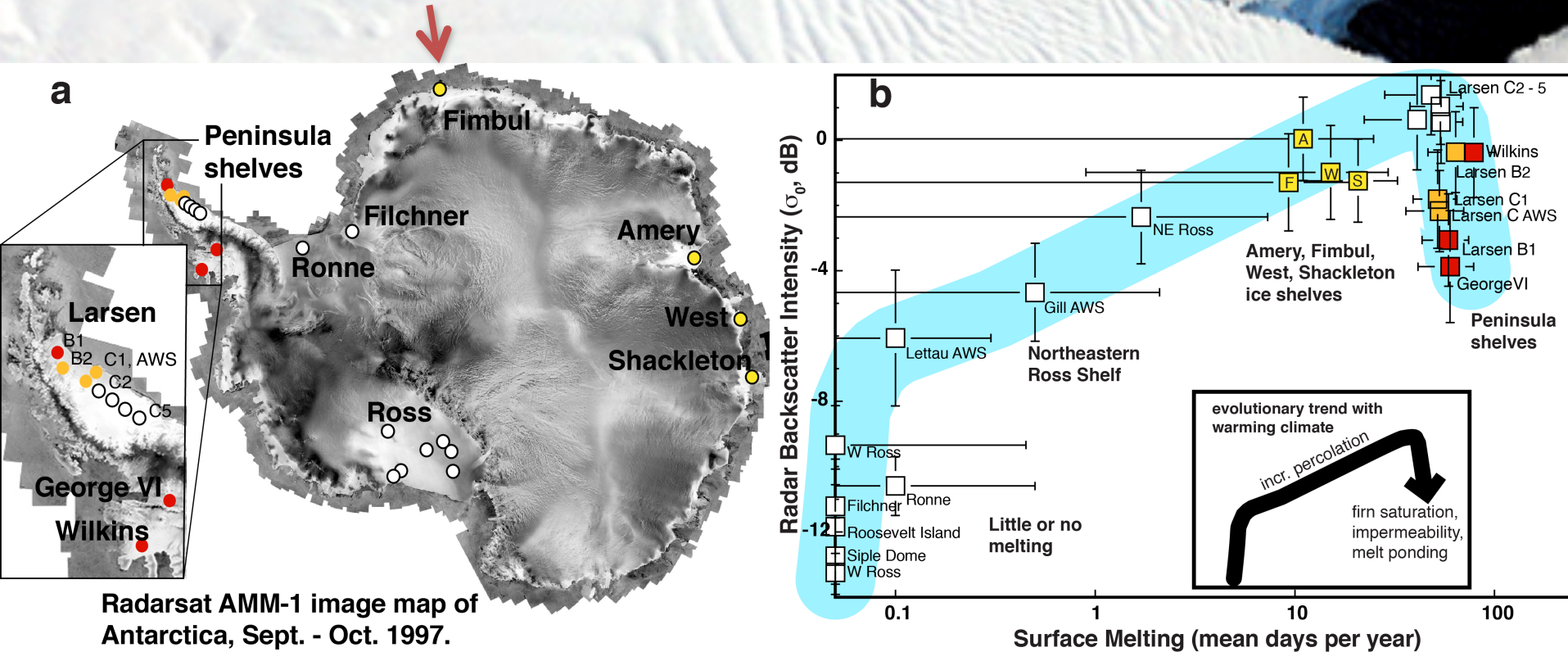
A satellite image of an Antarctic ice shelf. The ice surface shows a complex pattern of ridges and troughs. A brown outline highlights a specific region of the ice shelf. In the upper right corner, a dark blue area represents a body of water, possibly a bay or a fjord, with a rocky coastline. The overall scene is a high-altitude, high-latitude environment.

Antarctic ice shelf vulnerability to surface-melt-induced collapse

Karen Alley, Brent Butler, and
Melissa Cushing

Quick recap:

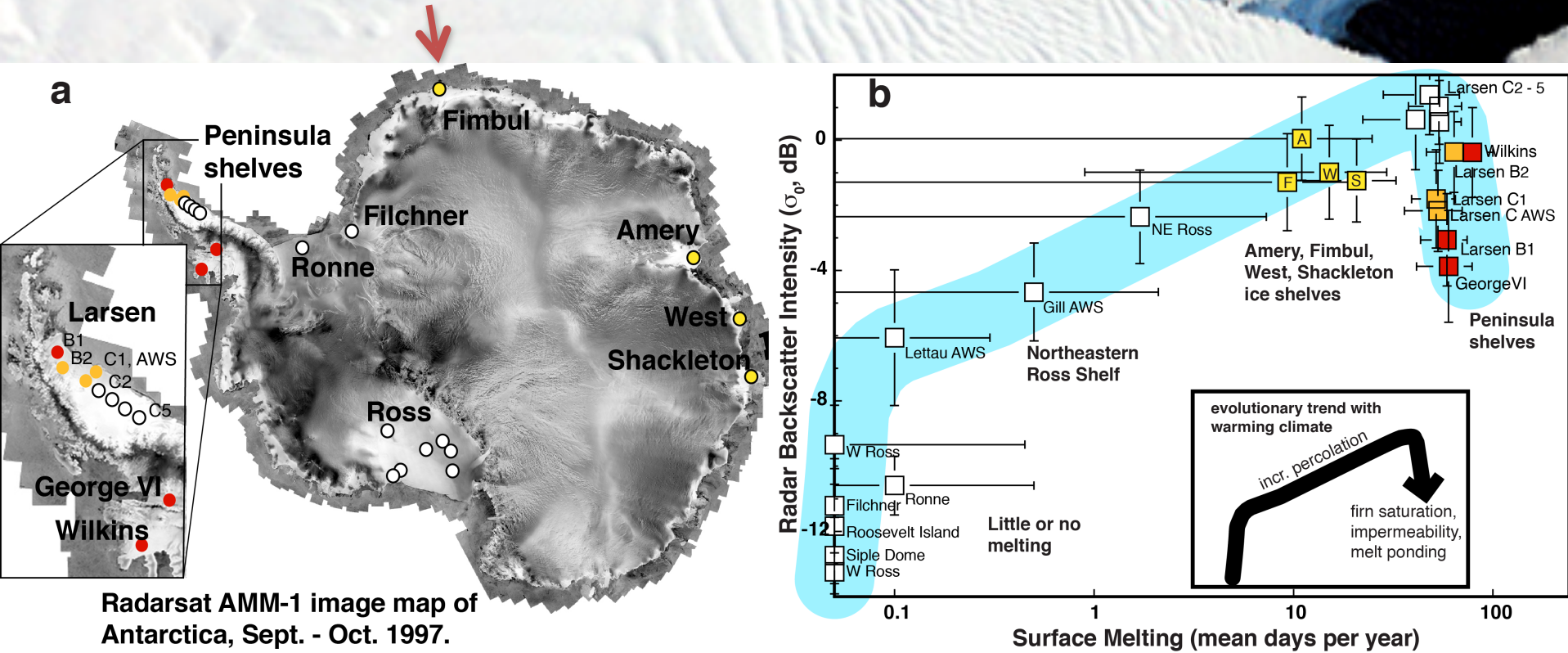
We want to take backscatter data like this



Scambos et al. 2003

Quick recap:

We want to take backscatter data like this



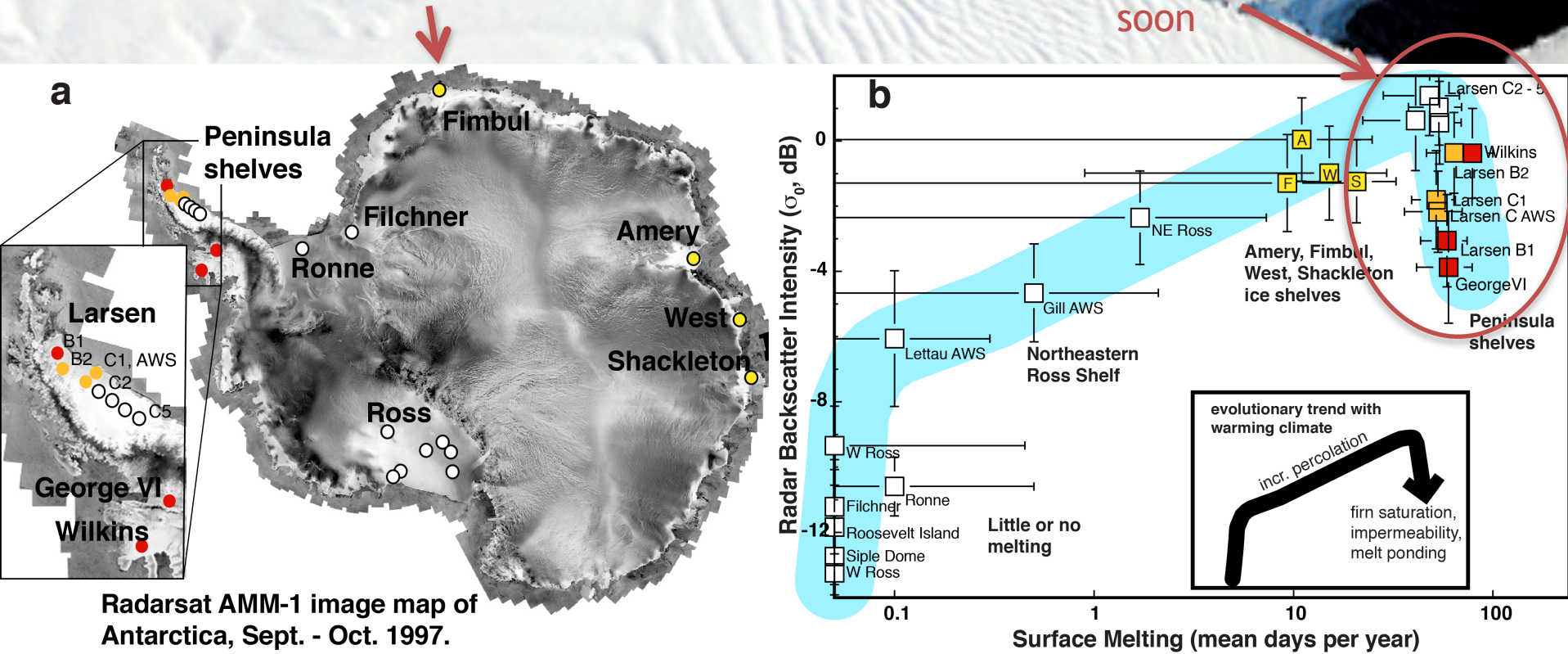
Scambos et al. 2003

And plot it with melt days data

Quick recap:

We want to take backscatter data like this

So we can find out which ice shelves might collapse soon



Scambos et al. 2003

And plot it with melt days data

Backscatter .sir files

Melt days NetCDF files

Convert data to tiffs

Calculate temporal averages

Resample to same resolution

Ice shelf
shape files

Subset based on ice shelf shape files

Plot melt days vs. backscatter

Determine vulnerability index from
plot

Map the vulnerability index

Assemble
functions
into
coherent
script

Backscatter .sir files

Melt days NetCDF files

Convert data to tiffs

Calculate temporal averages

Resample to same resolution

Ice shelf
shape files

Subset based on ice shelf shape files

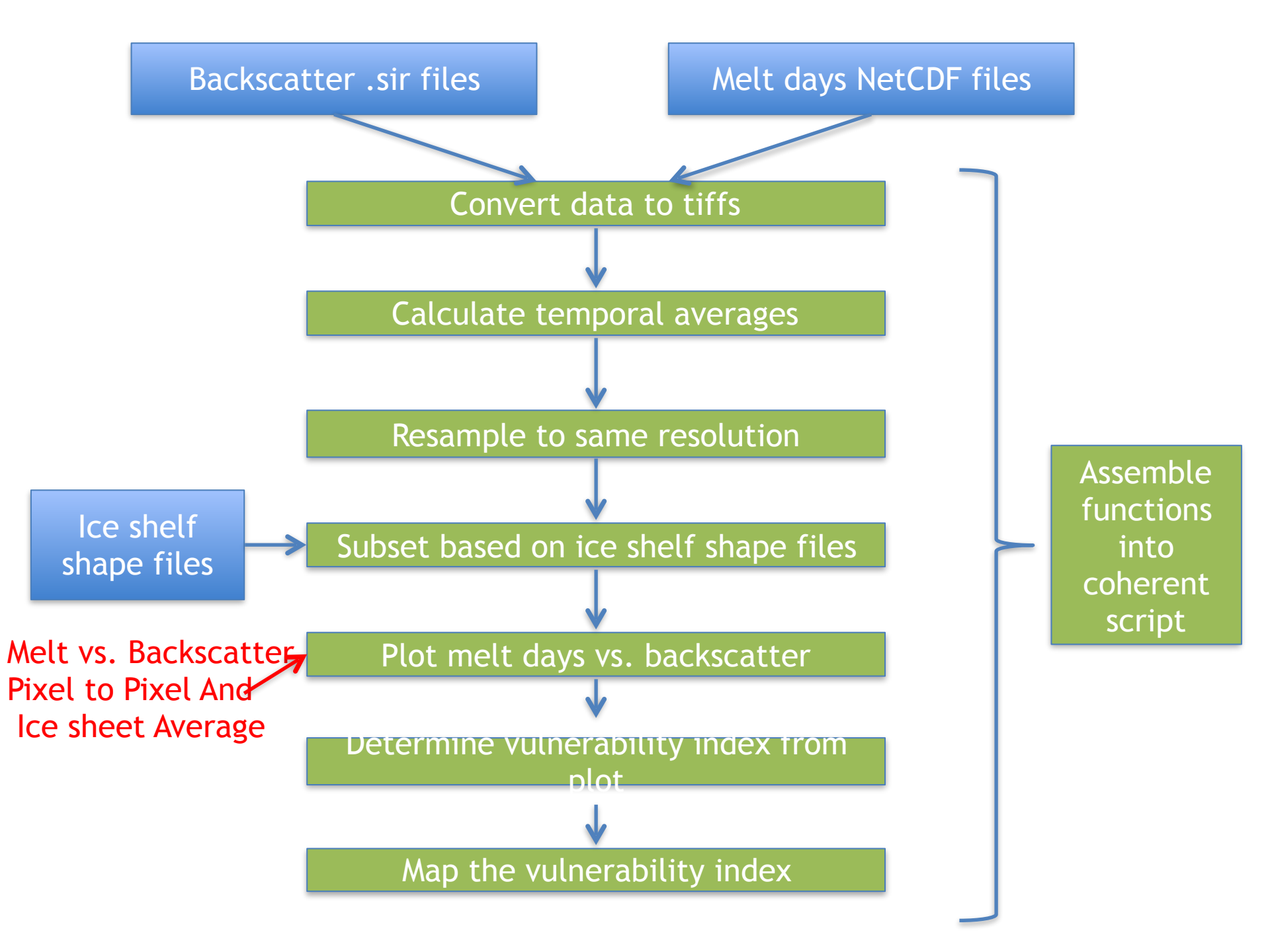
Plot melt days vs. backscatter

Determine vulnerability index from
plot

Map the vulnerability index

Assemble
functions
into
coherent
script

Melt vs. Backscatter
Pixel to Pixel And
Ice sheet Average



Backscatter .sir files

Melt days NetCDF files

Convert data to tiffs

Calculate temporal averages

Resample to same resolution

Ice shelf
shape files

Subset based on ice shelf shape files

Plot melt days vs. backscatter

Mathematical
expression

Determine vulnerability index from
plot

Map the vulnerability index

Assemble
functions
into
coherent
script

Backscatter .sir files

Melt days NetCDF files

Convert data to tiffs

Calculate temporal averages

Resample to same resolution

Ice shelf
shape files

Subset based on ice shelf shape files

Plot melt days vs. backscatter

Determine vulnerability index from
plot

Reclassify with
raster math

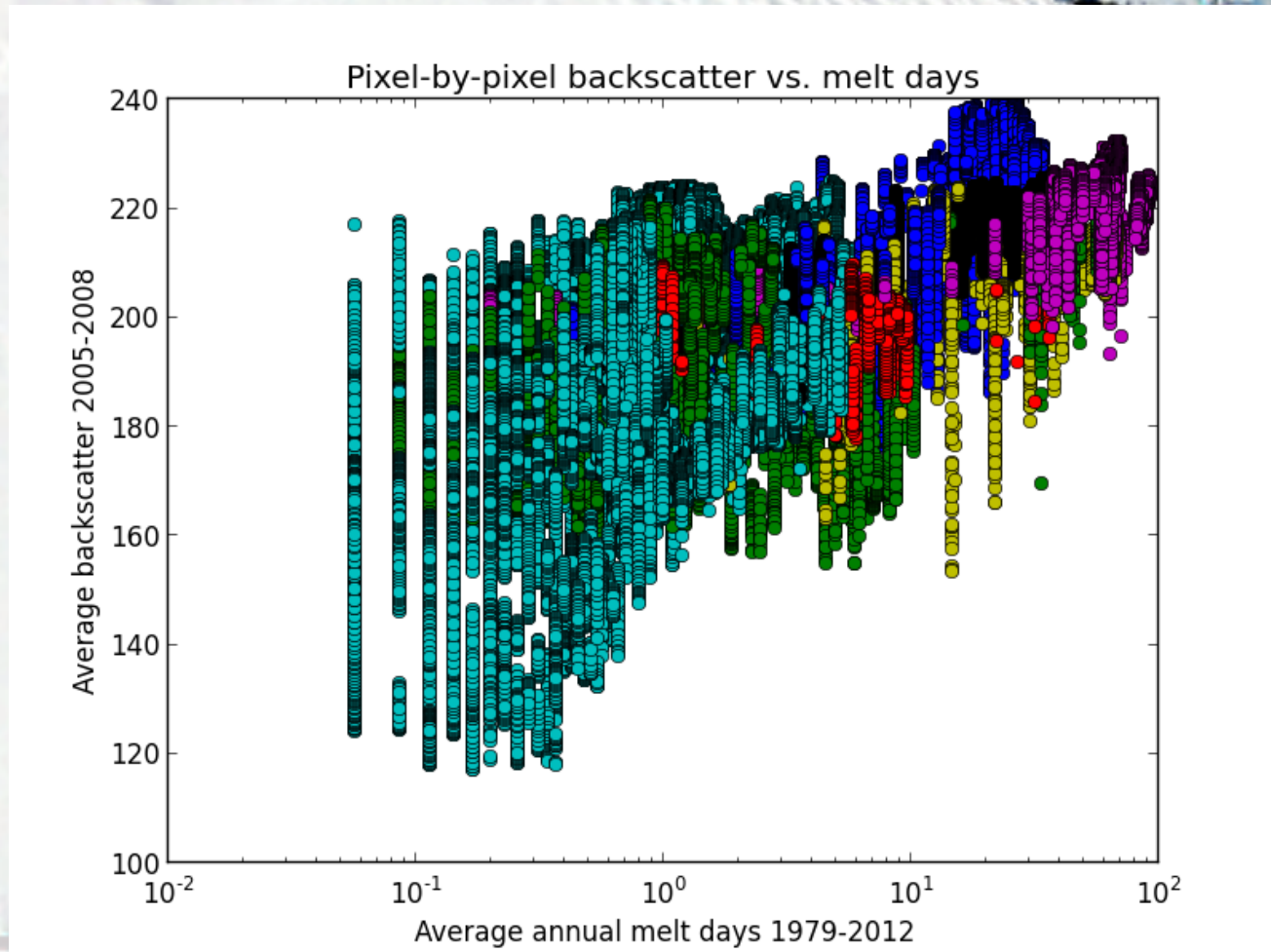
Map the vulnerability index

Assemble
functions
into
coherent
script

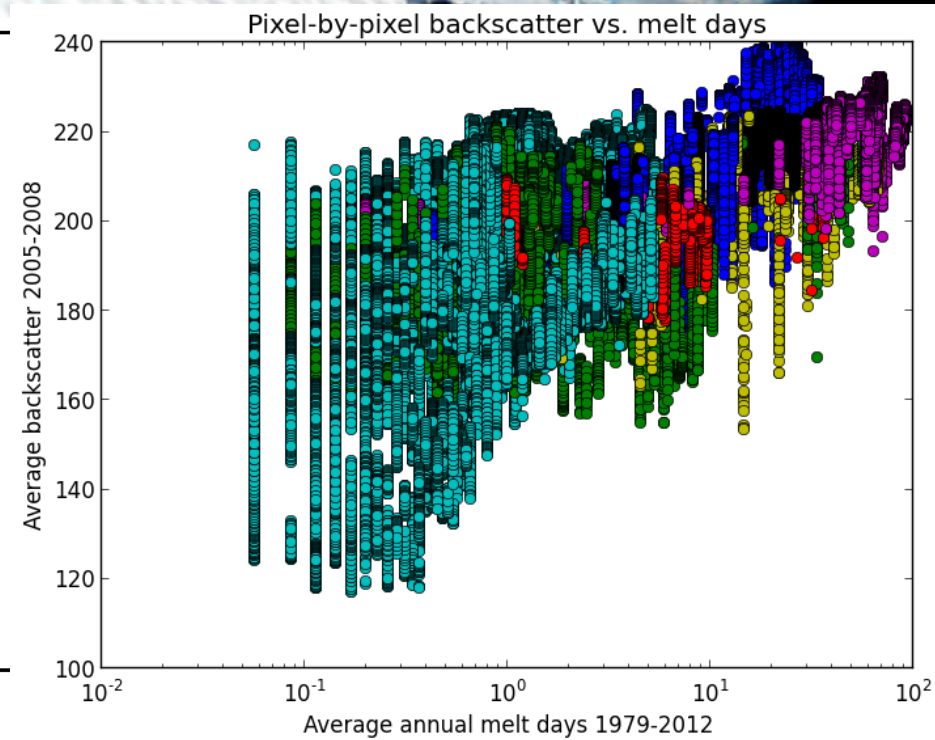
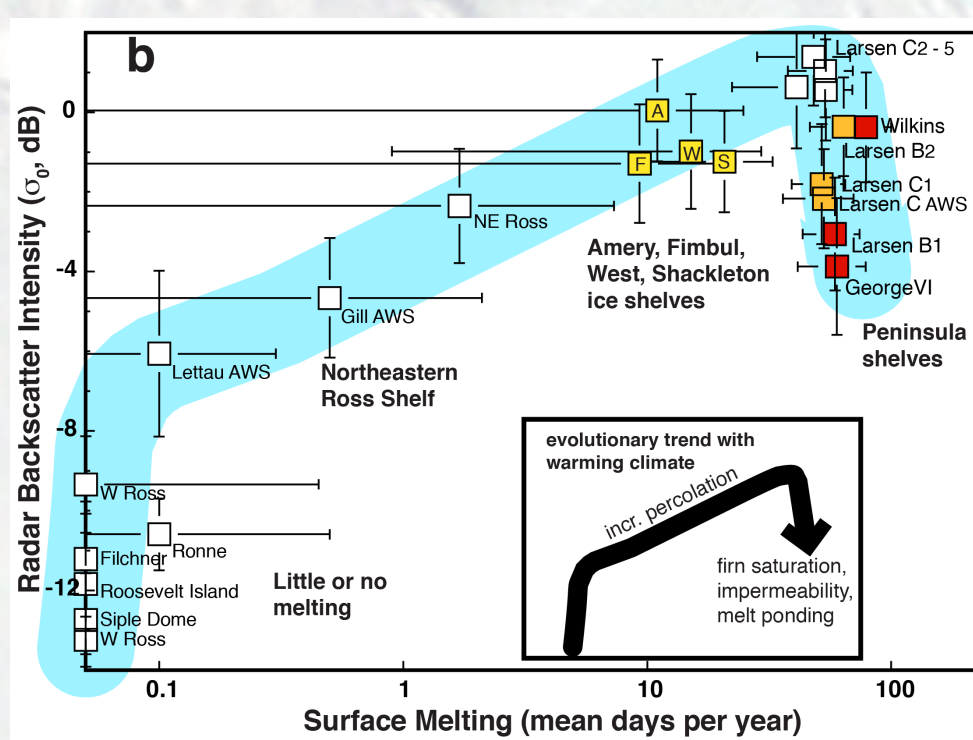
An aerial photograph of a coastal area. The image shows a large body of water on the right side, with a dark, irregular shape that could be a bay or a large inlet. The surrounding land is light-colored and appears to be a mix of sand and vegetation. A prominent brown outline is drawn on the land, highlighting a specific region that is roughly rectangular with some irregular edges. The text "Results and discussion:" is overlaid in the center of the image.

Results and discussion:

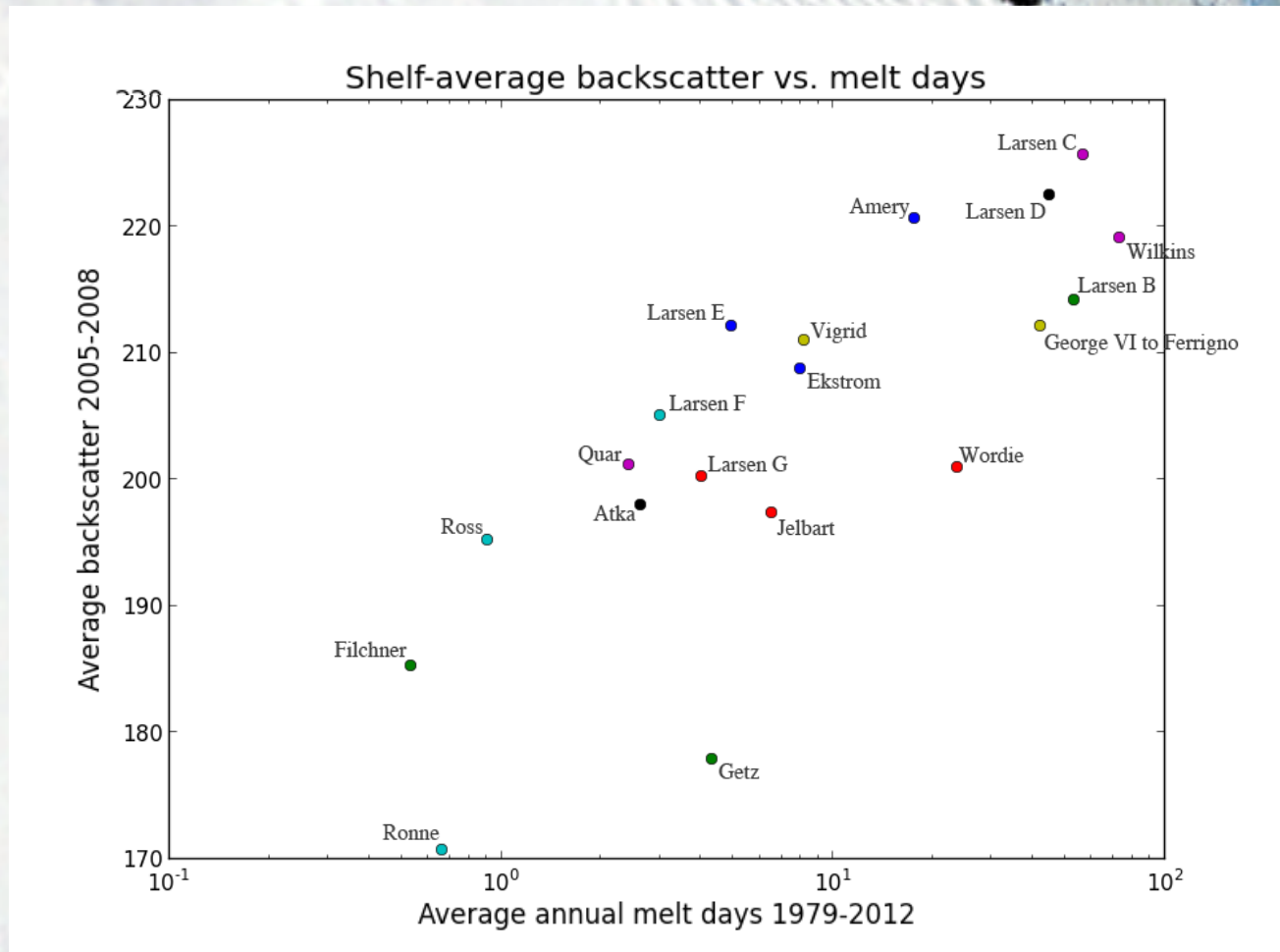
Results: pixel-by-pixel plot of melt days (1979-2012) vs. backscatter (2005-2008)



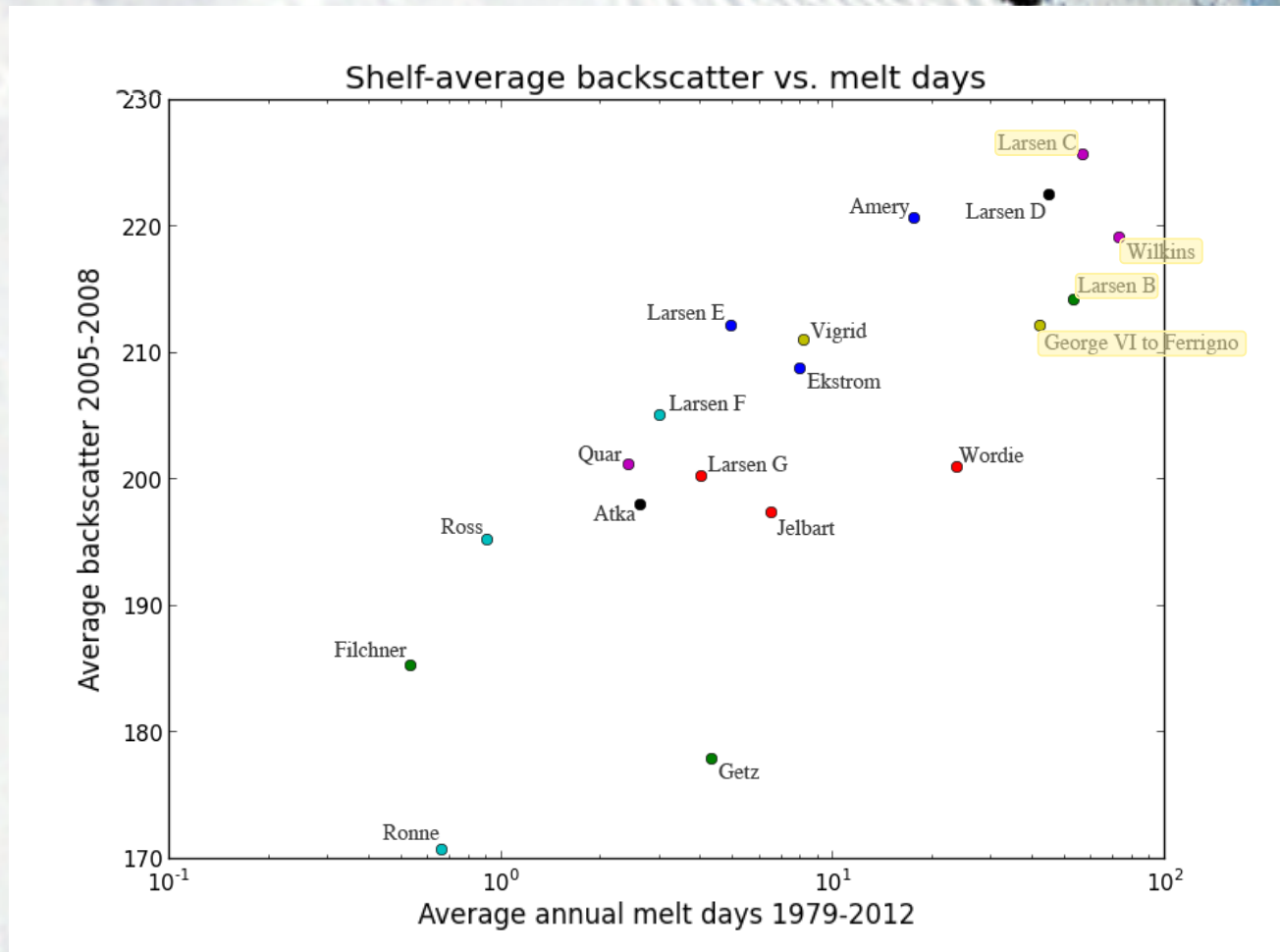
Compare with expected results



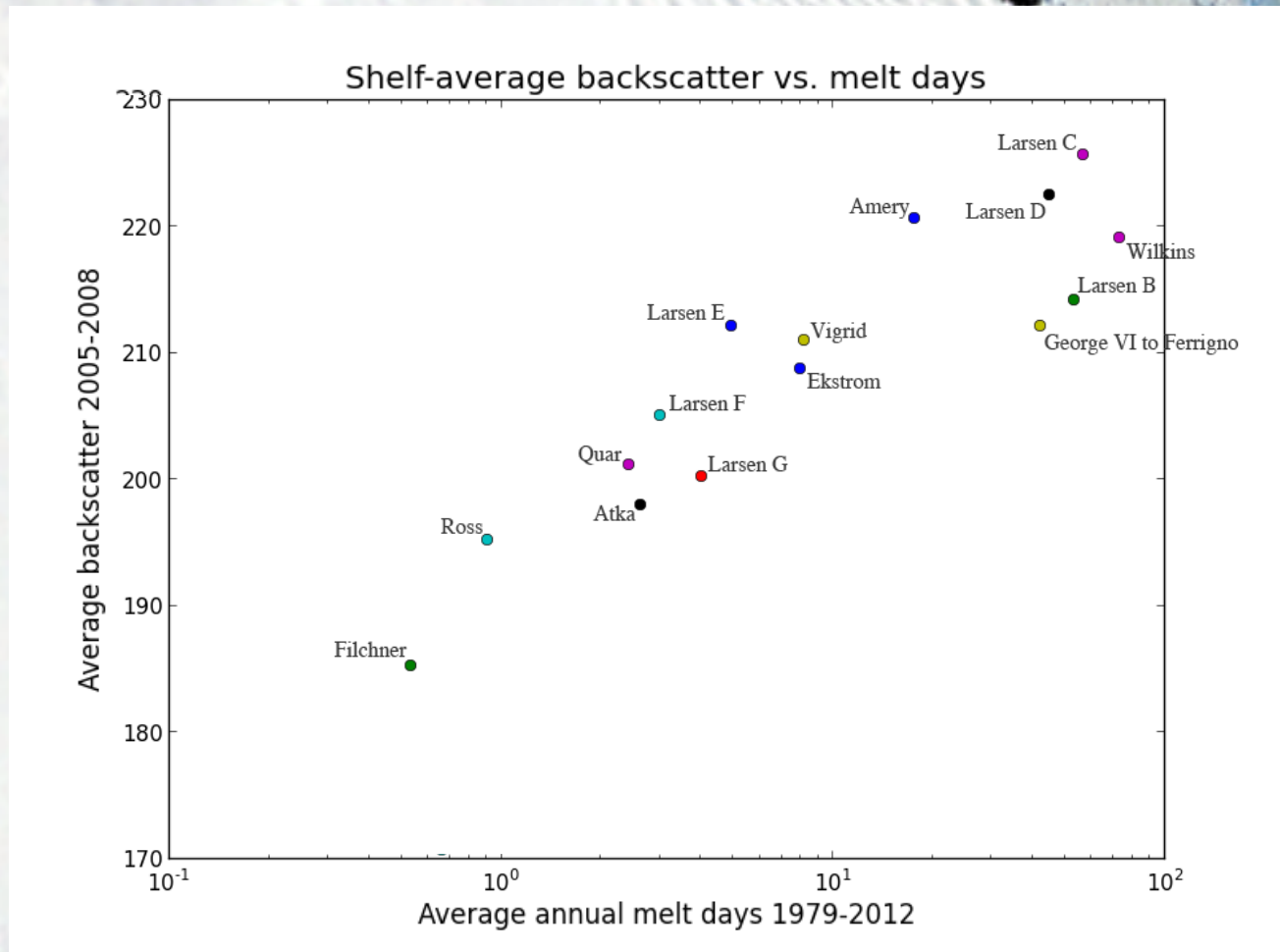
Results: plot of melt days vs. backscatter averaged over each ice shelf



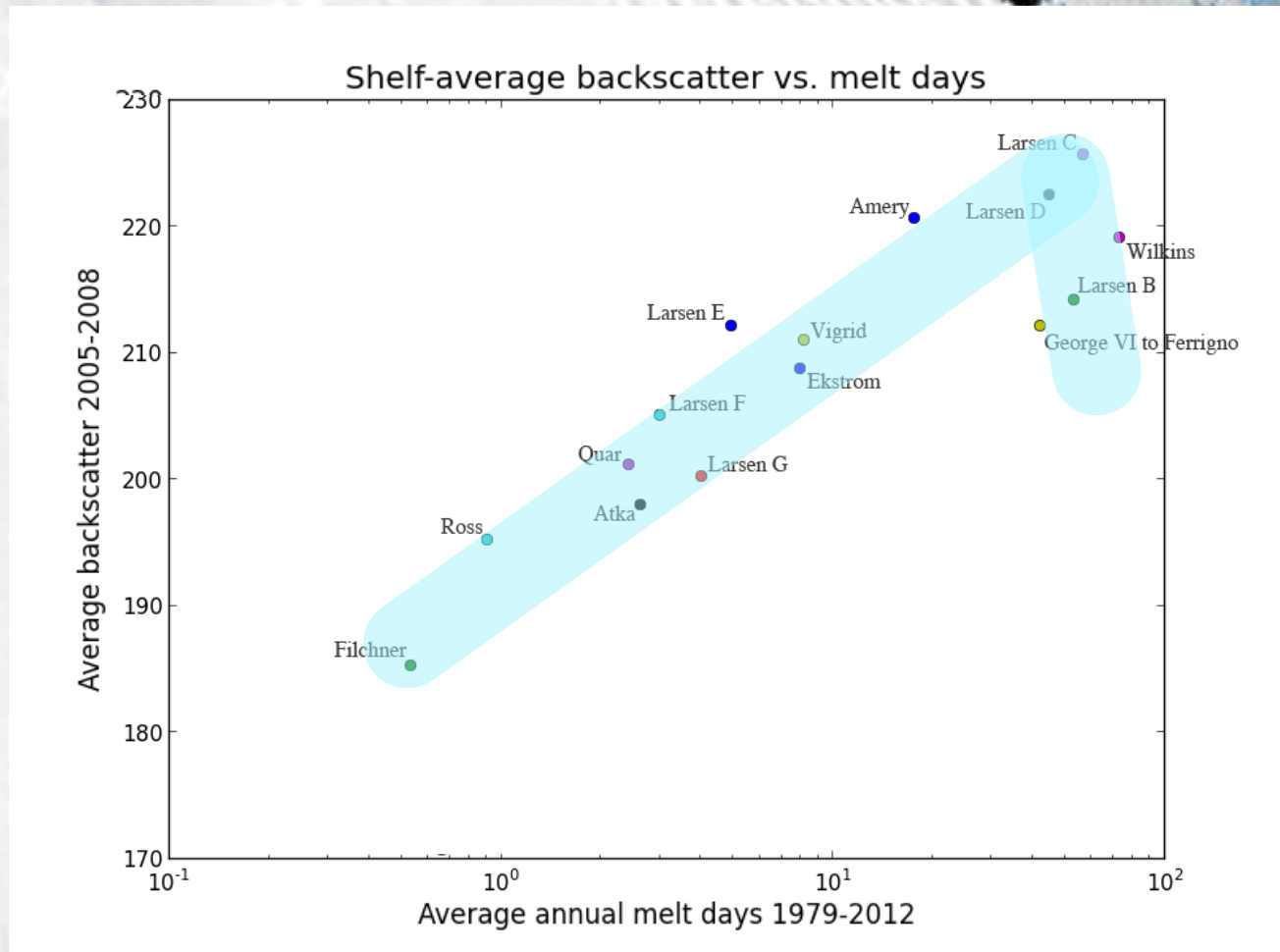
Results: plot of melt days vs. backscatter averaged over each ice shelf



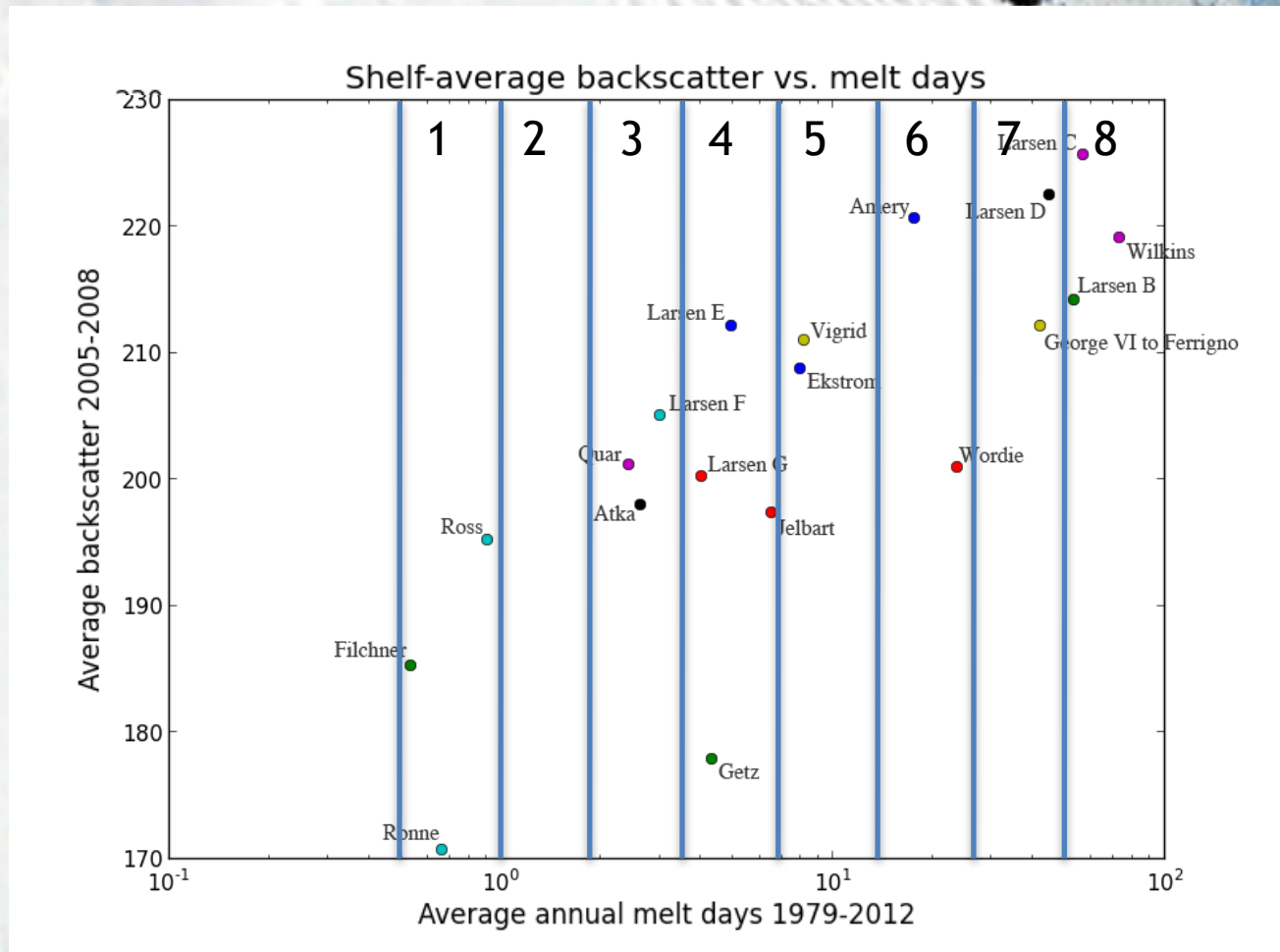
Results: plot of melt days vs. backscatter averaged over each ice shelf



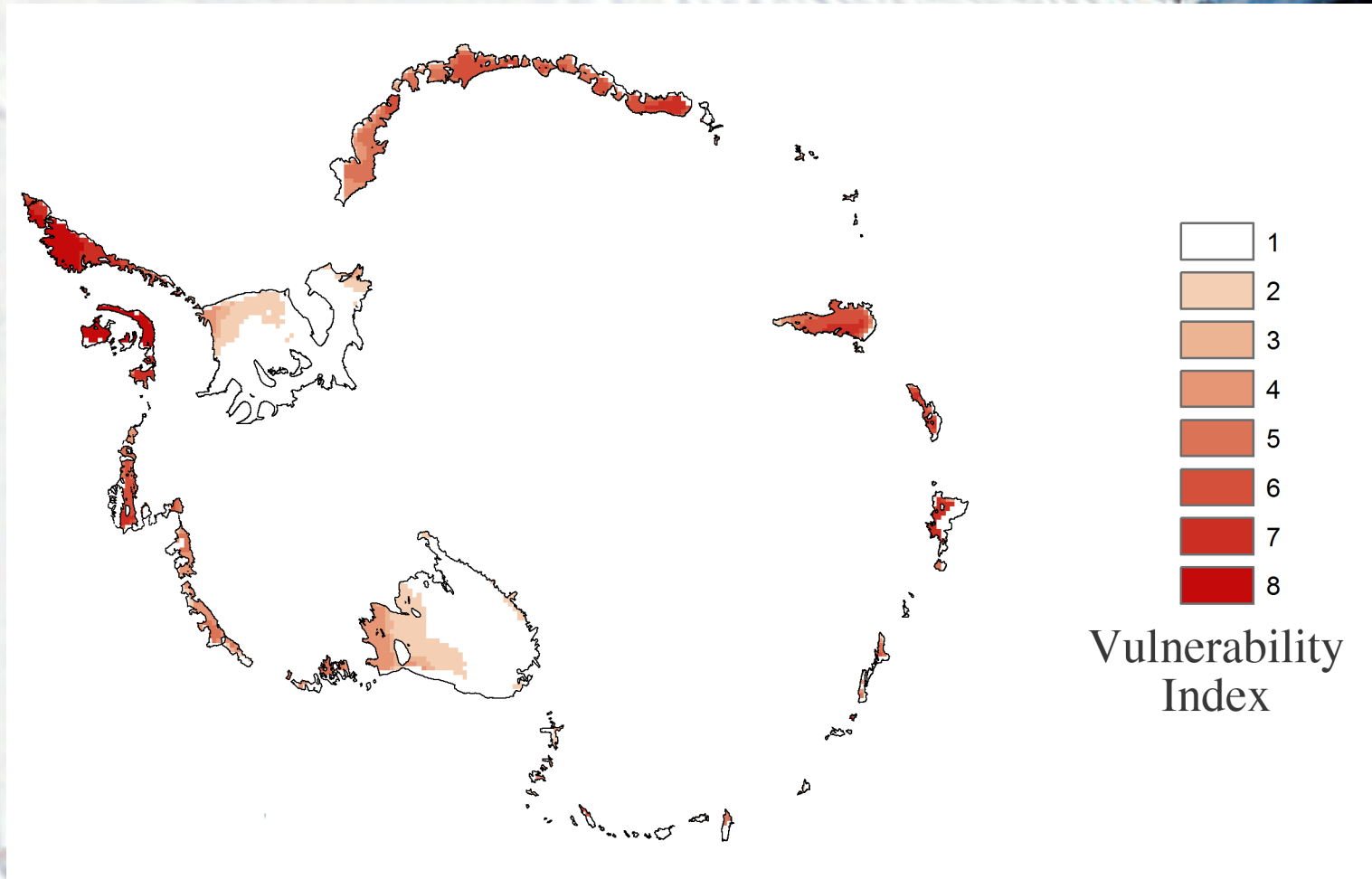
Results: plot of melt days vs. backscatter averaged over each ice shelf



Prototype vulnerability index

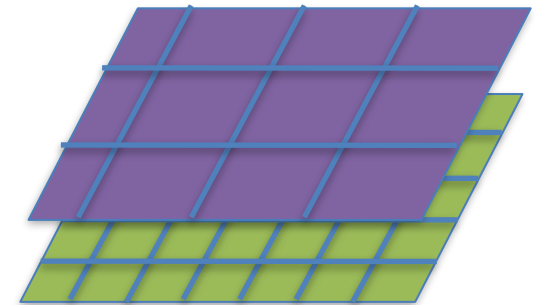


Results: mapping the prototype vulnerability index

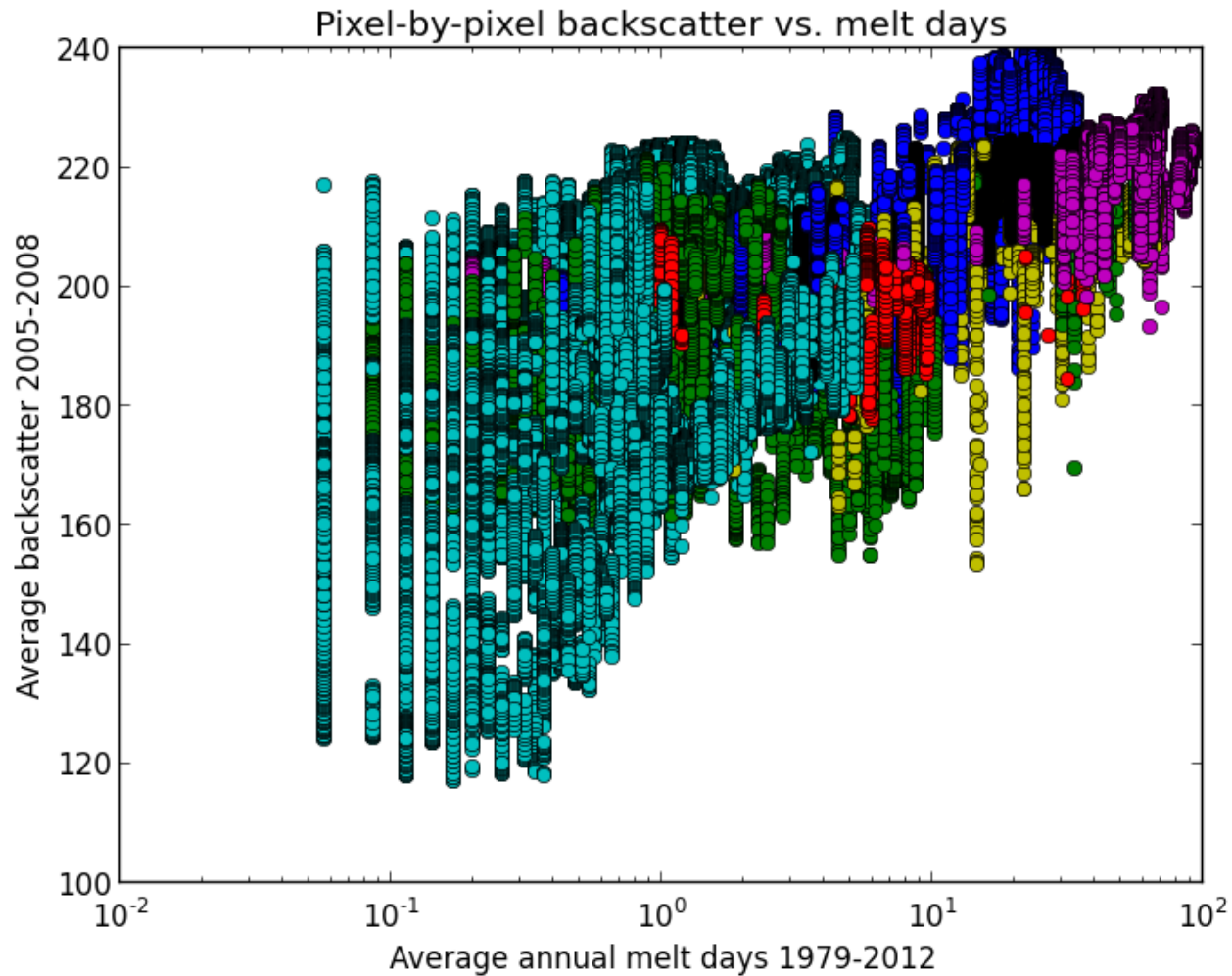


Limited by Resolution

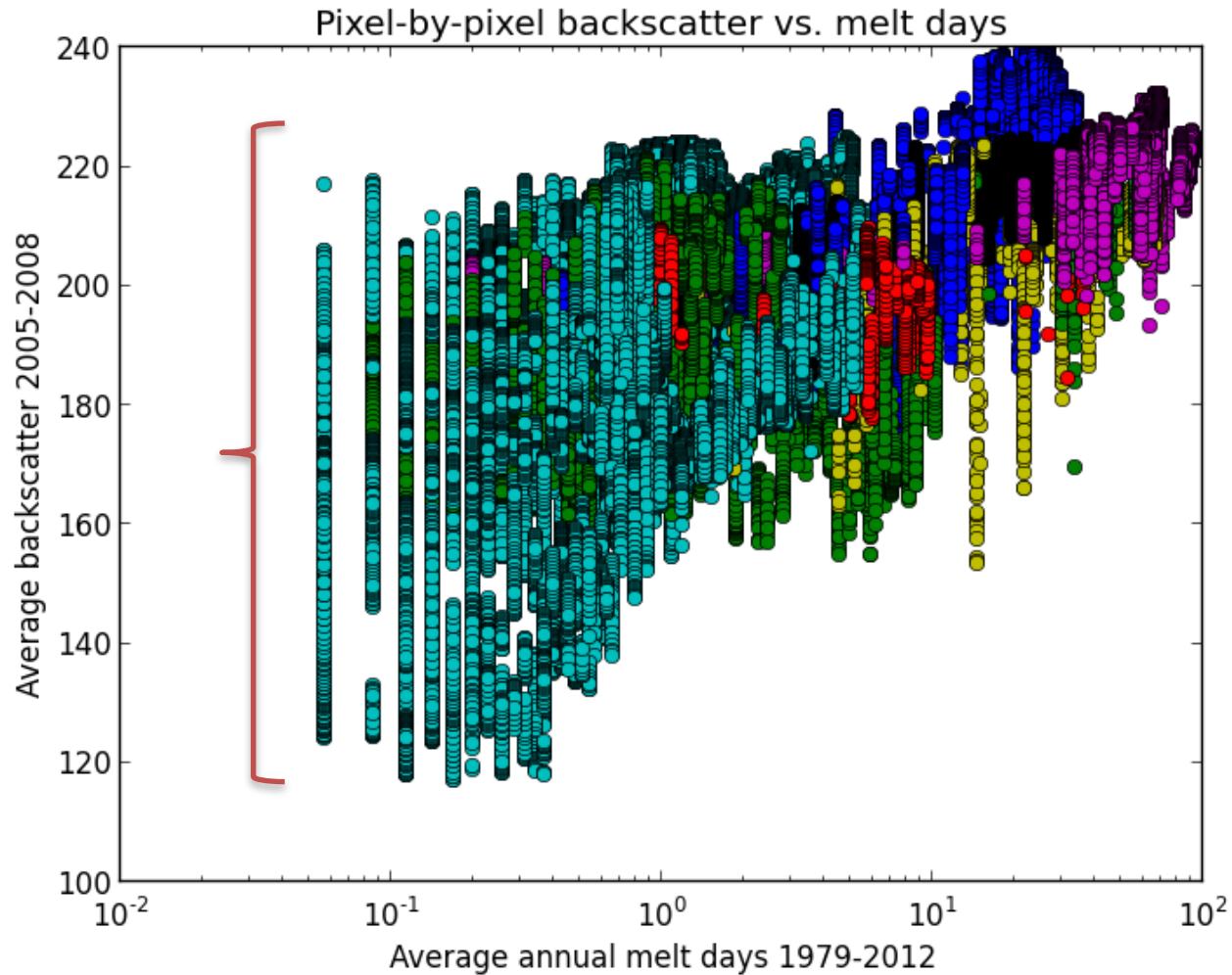
- Backscatter in 2.25 Km Resolution
- Melt days in 40 km resolution



Uncertainty from large variability



Uncertainty from large variability



Conclusion

