



# Annual Greenland Accumulation from Snow Radar

Lora Koenig<sup>1</sup>, Al Ivanoff<sup>1</sup>, Patrick  
Alexander<sup>2</sup>, Marco Tedesco<sup>2</sup>, Clément  
Miège<sup>4</sup>, Ben Panzer<sup>3</sup>, Carl Leuschen<sup>3</sup>,  
John Paden<sup>3</sup> and Prasad Gogineni<sup>3</sup>

<sup>1</sup> NASA Goddard Space Flight Center

<sup>2</sup> City University of New York

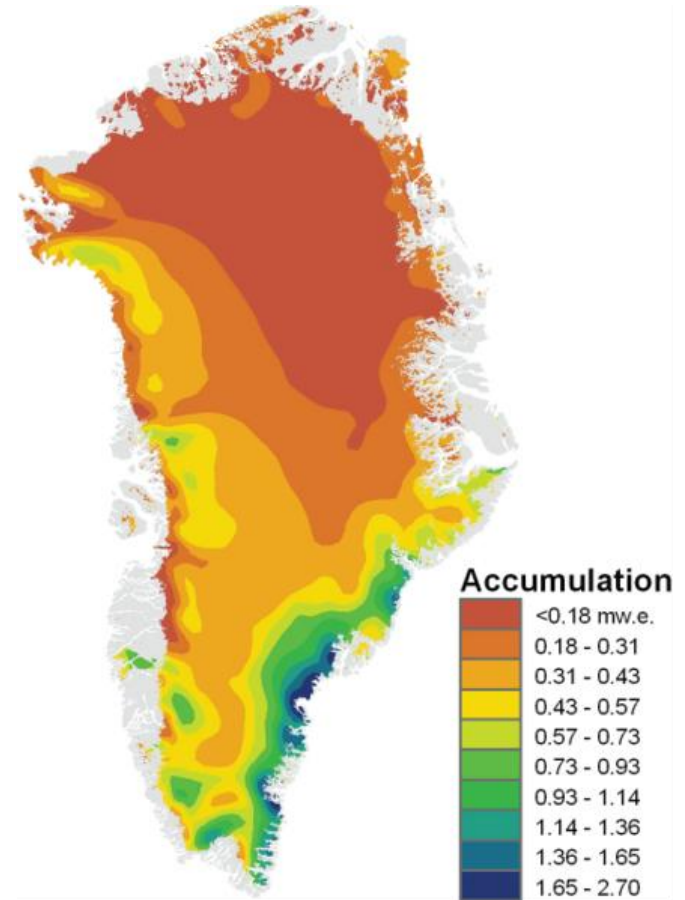
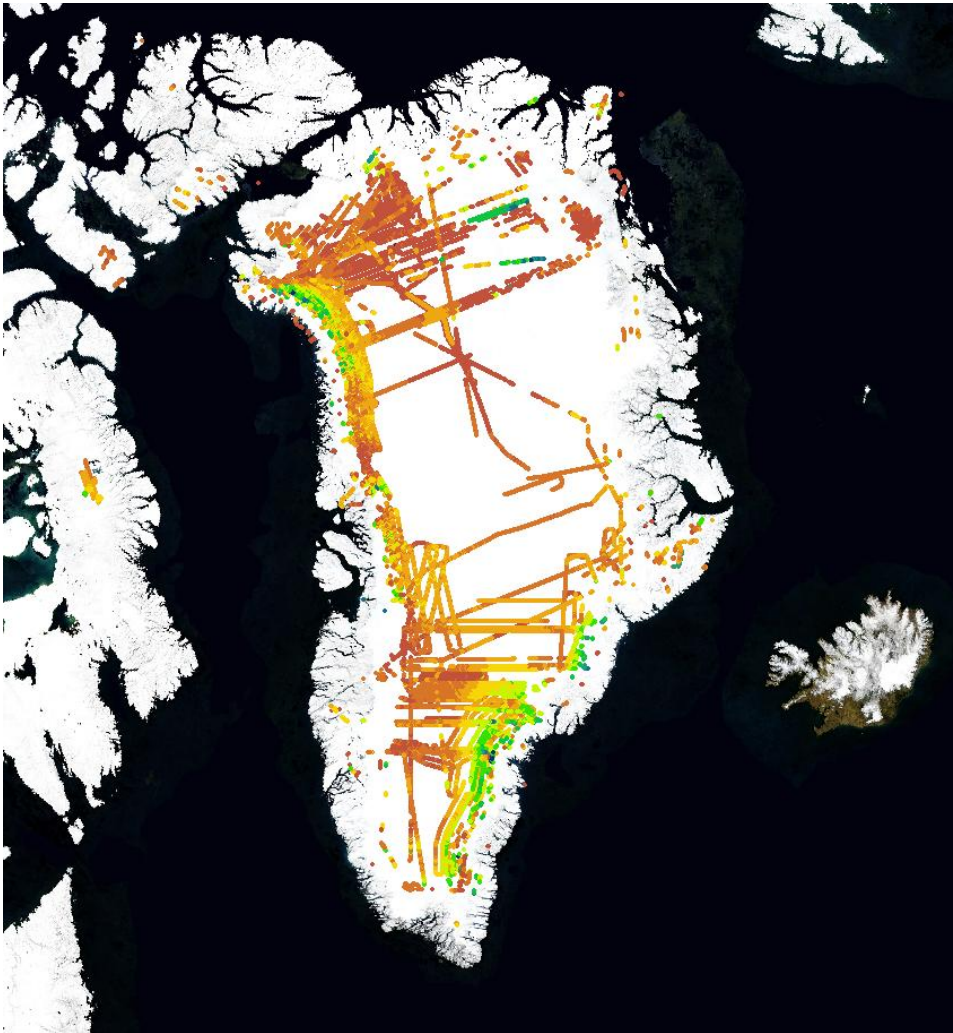
<sup>3</sup> KU Center for Remote Sensing of Ice Sheets

<sup>4</sup> University of Utah

GSFC OIB Workshop  
1/29/2014



# Greenland Annual Accumulation

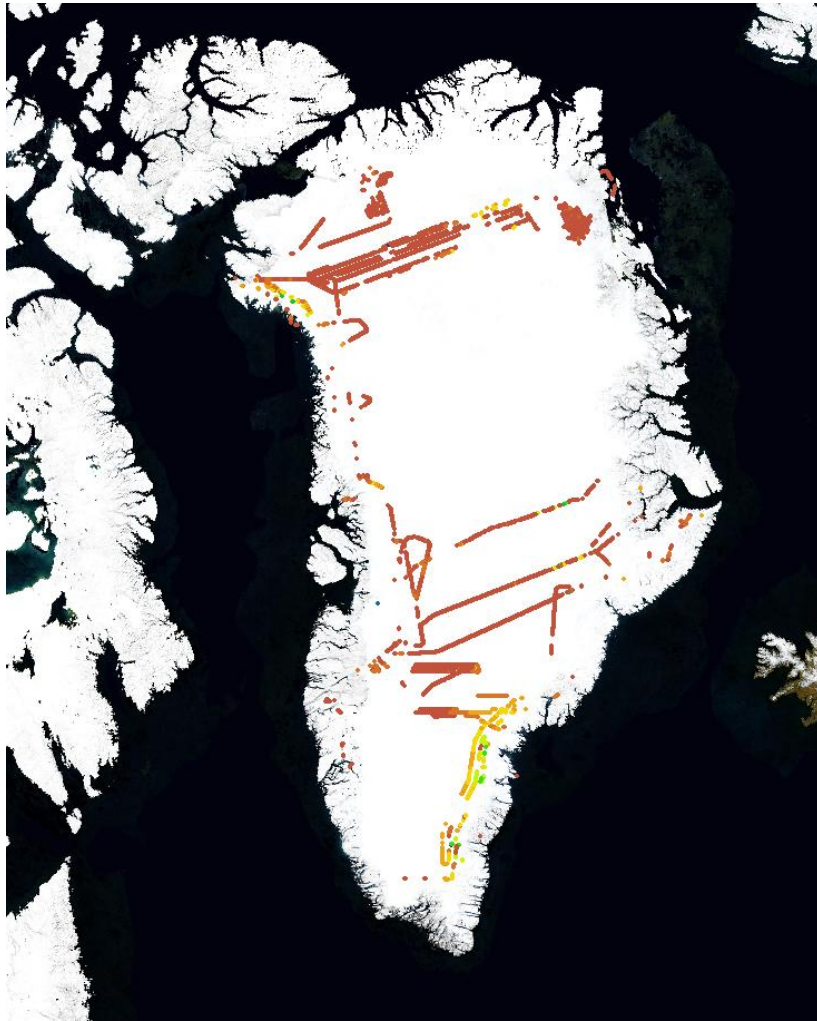


Burgess et al., 2010

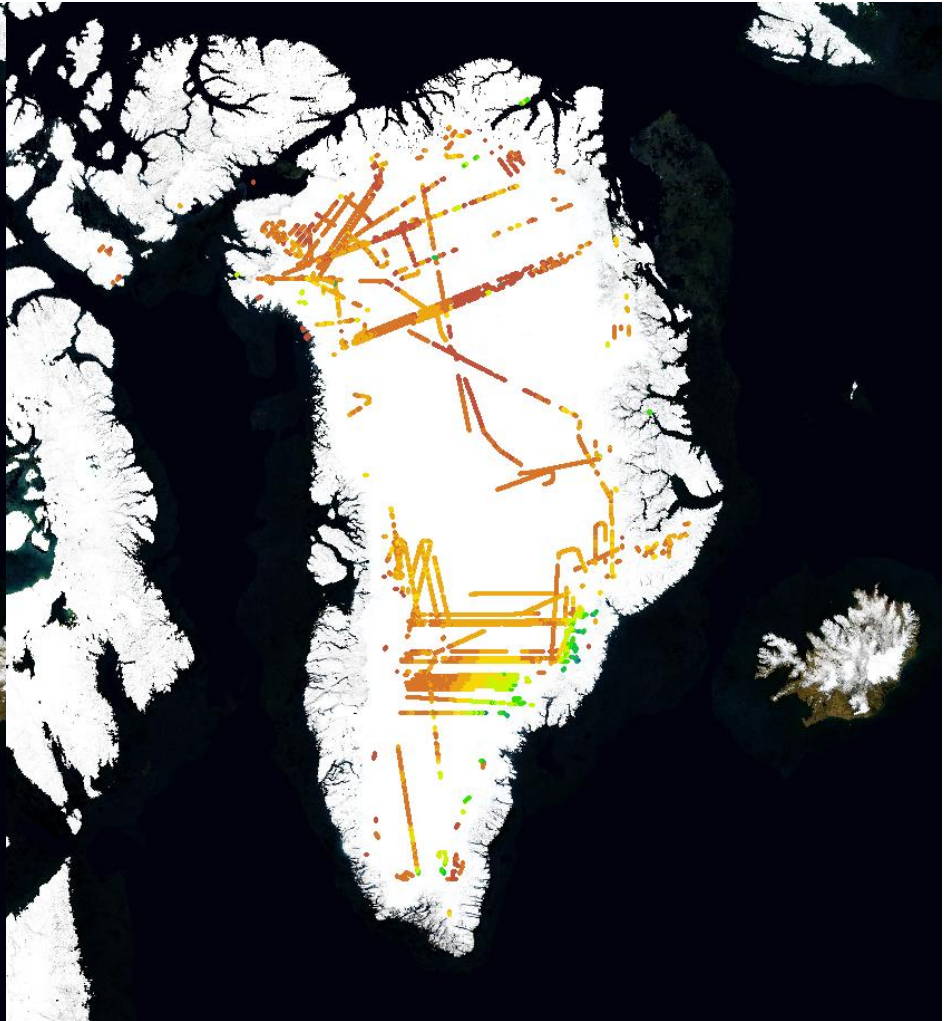
Accumulation Compilation (2010-2012)



# Greenland Annual Accumulation



2009-2010 Accumulation

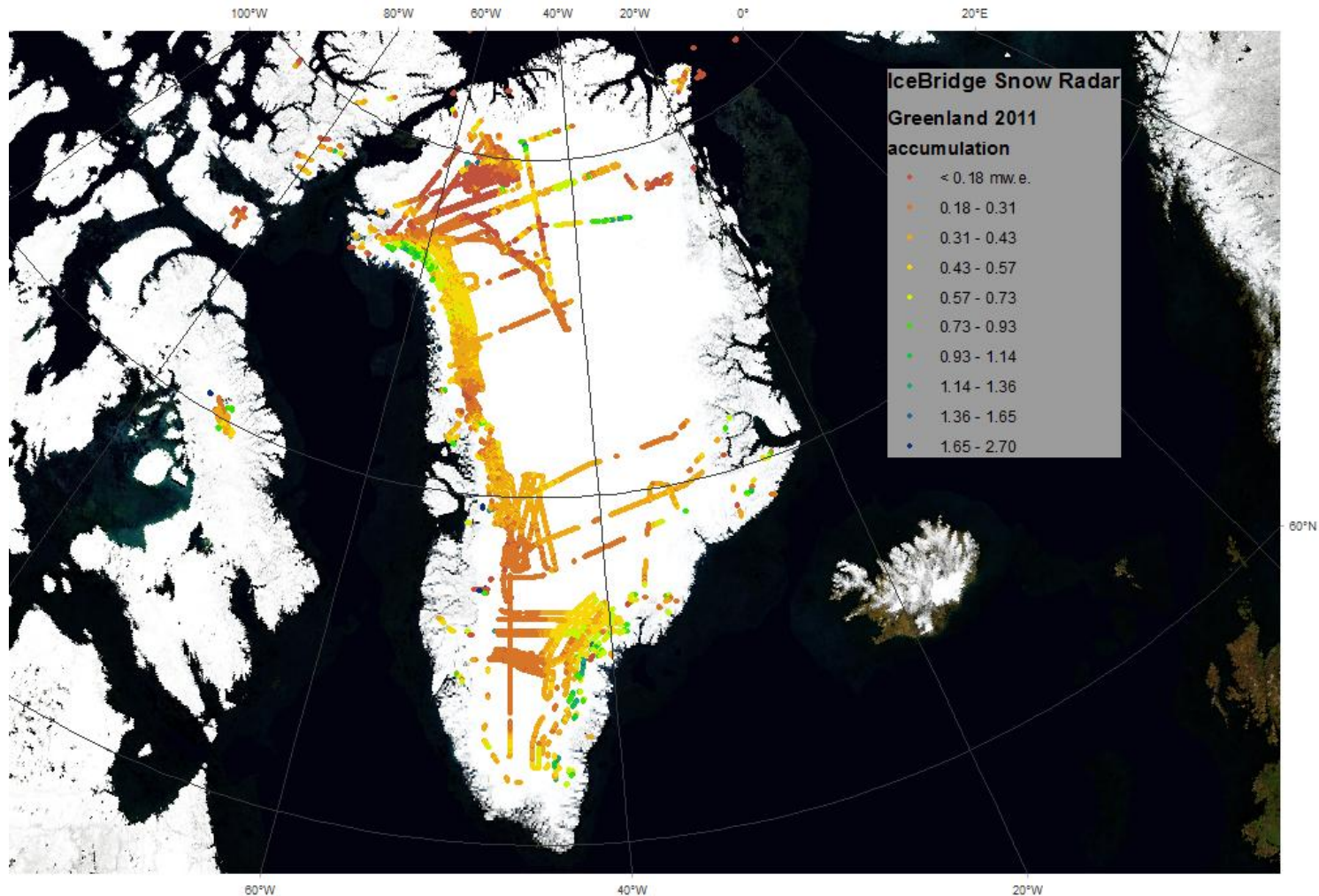


2011-2012 Accumulation

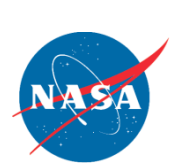




# Greenland Annual Accumulation



2010-2011 Accumulation



# Semi-Automated Approach

## Land Ice Algorithm Characteristics:

- Surface pick is 4 times air noise ( $> \text{Mean } 1000 \text{ bins} * 4$ ).
- Difference in filters is used to determine peaks (5x5 filter 50x5 filter).
- $\frac{1}{4}$  of the peak width is used as the pick, segments connected and layer picked using leading edge.
- ~50 m along track resolution.

## Conversion to Accumulation:

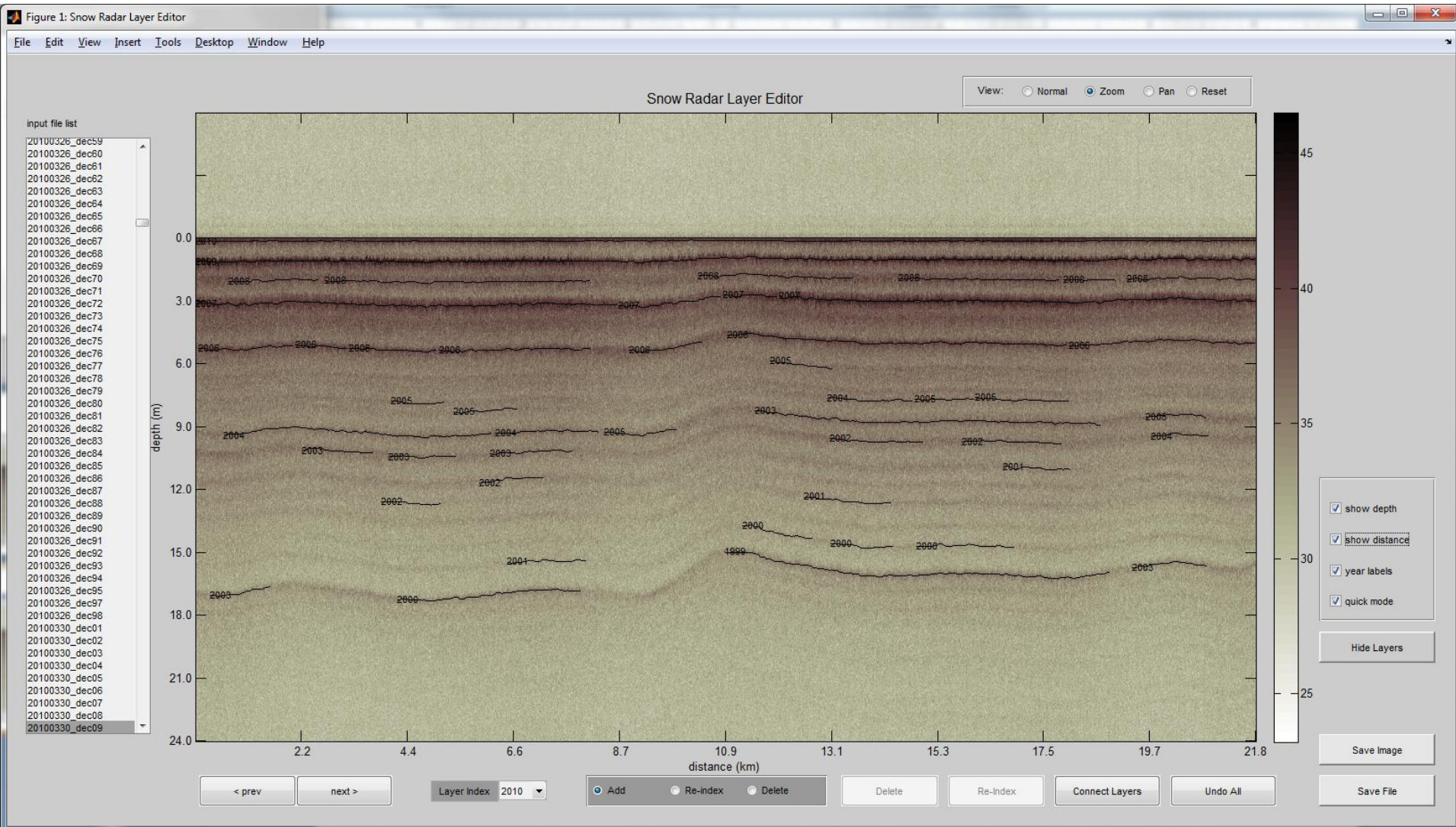
- Takes into account layering
- Density from MAR

Contact me if you are interested in Matlab Code including GUI. It will be posted on NASA Cryosphere website in final version with a users manual ~June 2014.



# Automated Pick and GUI

## The Good

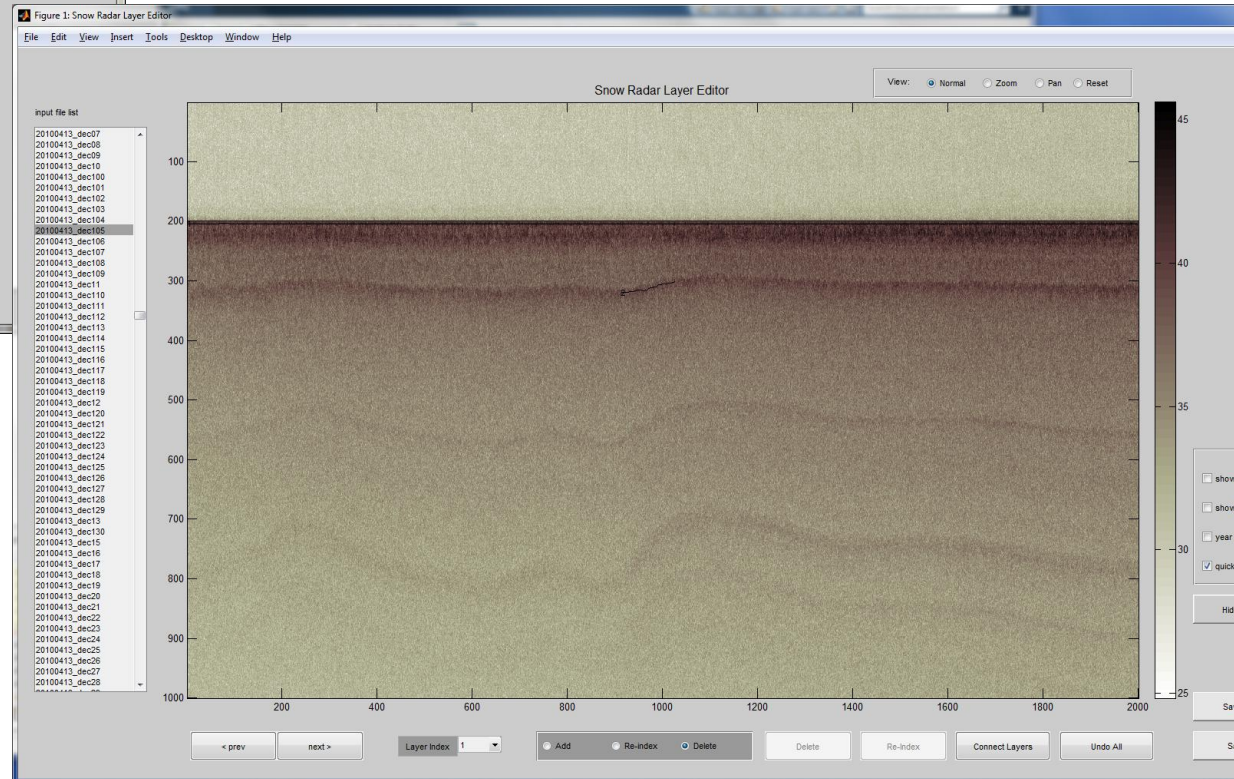
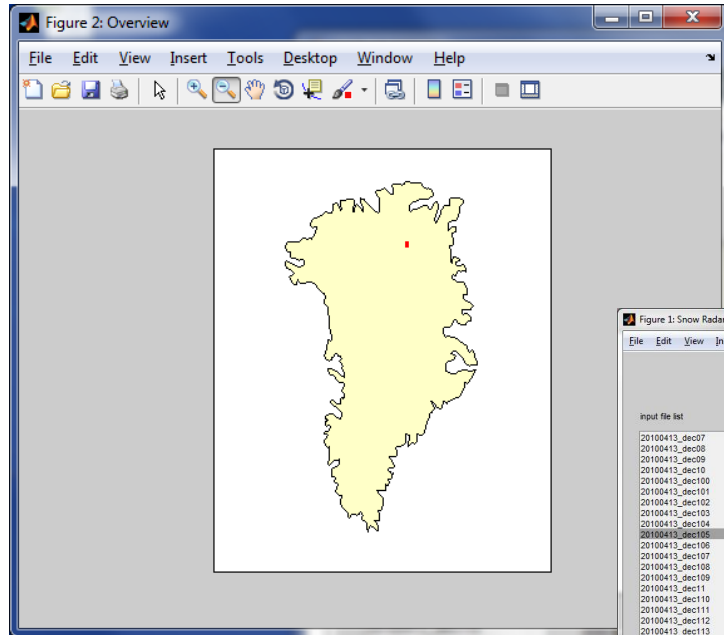






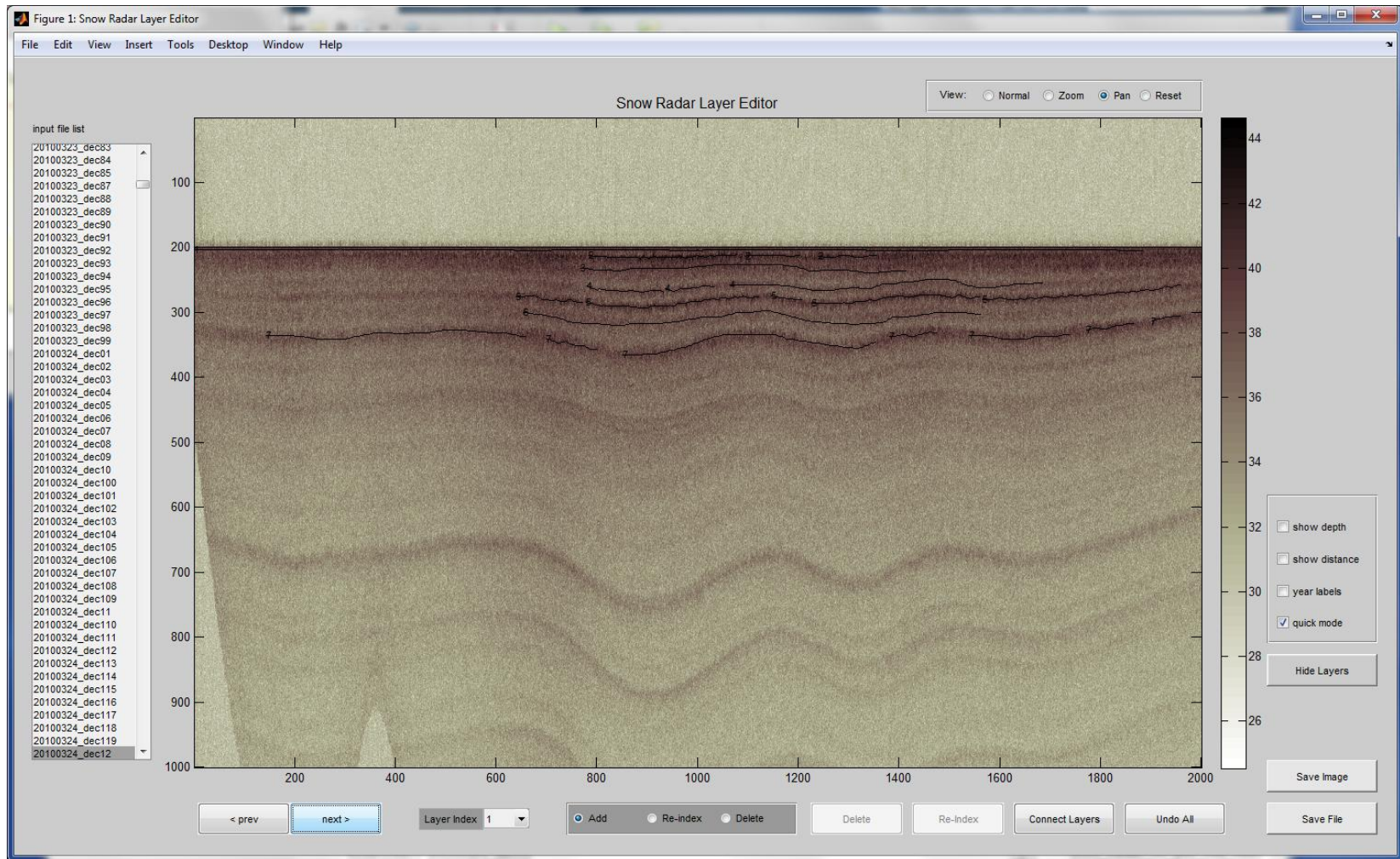
# Automated Pick

## The Bad

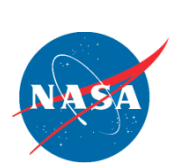




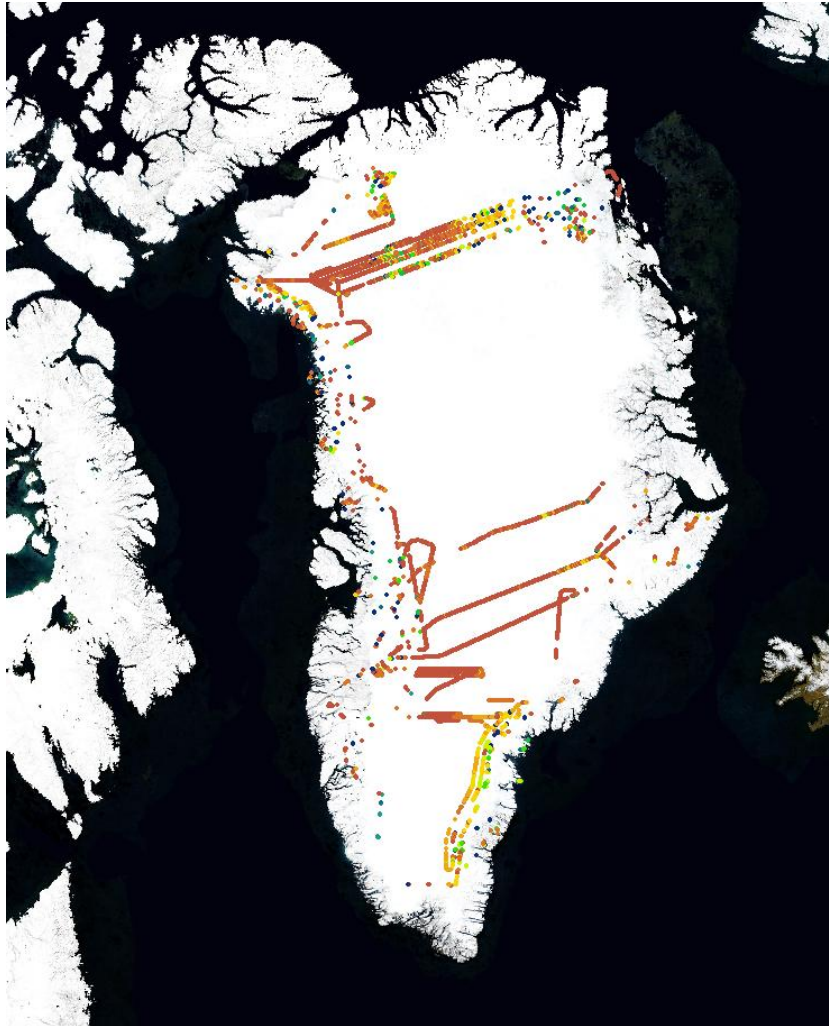
# GUI for Quick Manual Picking



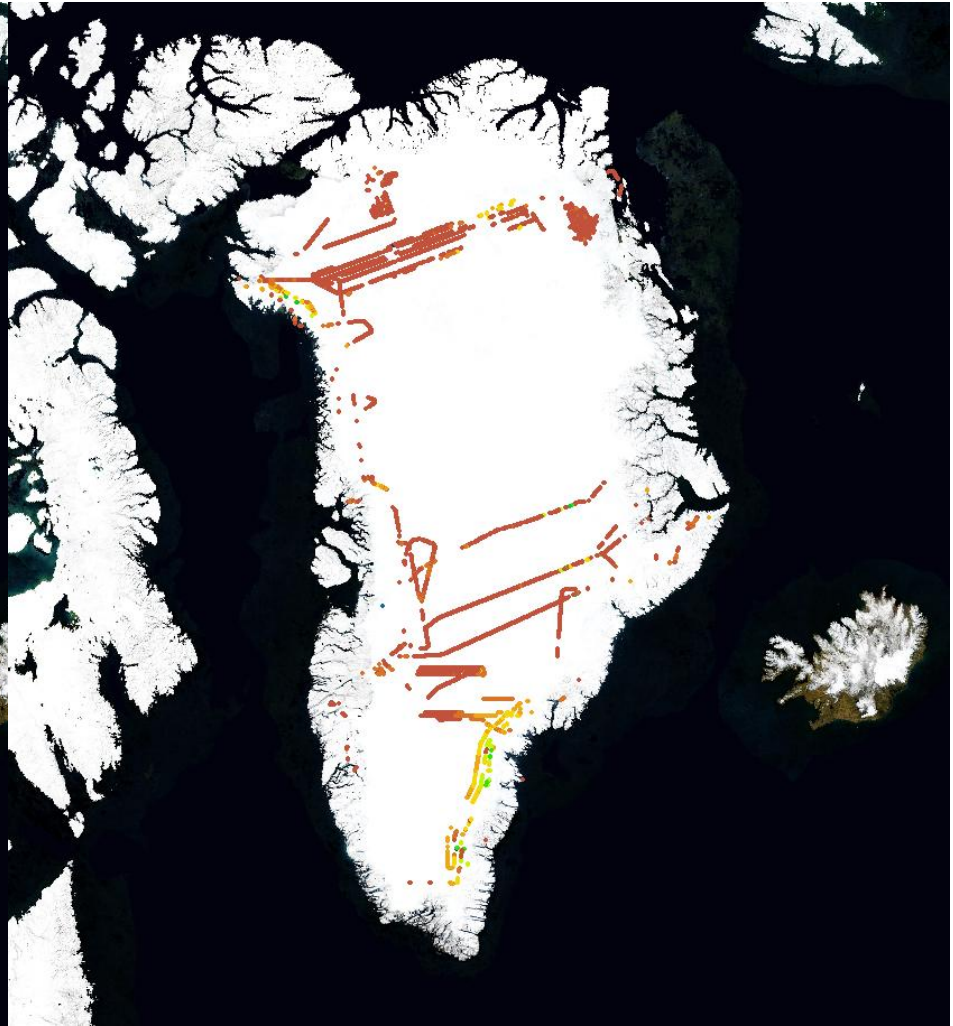




# Before and After Manual Picks



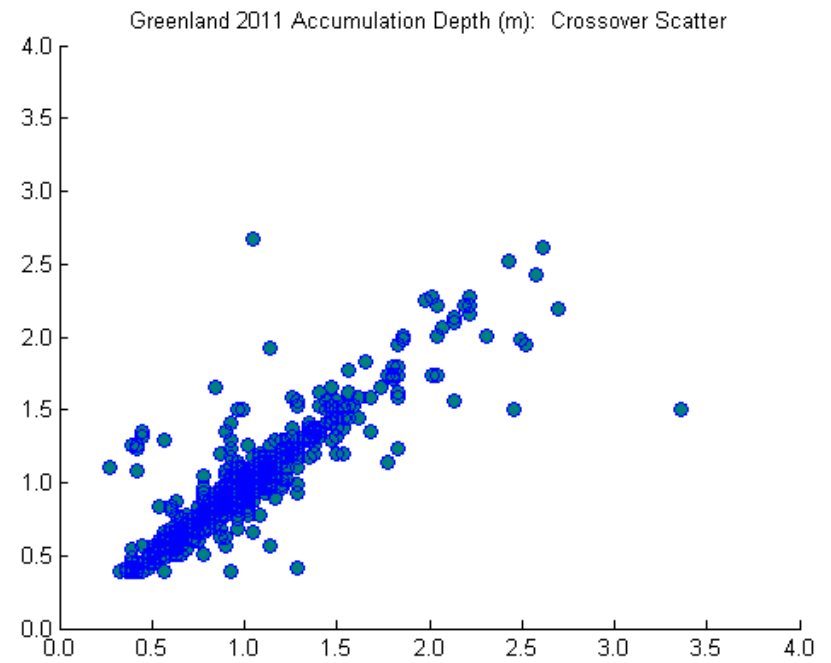
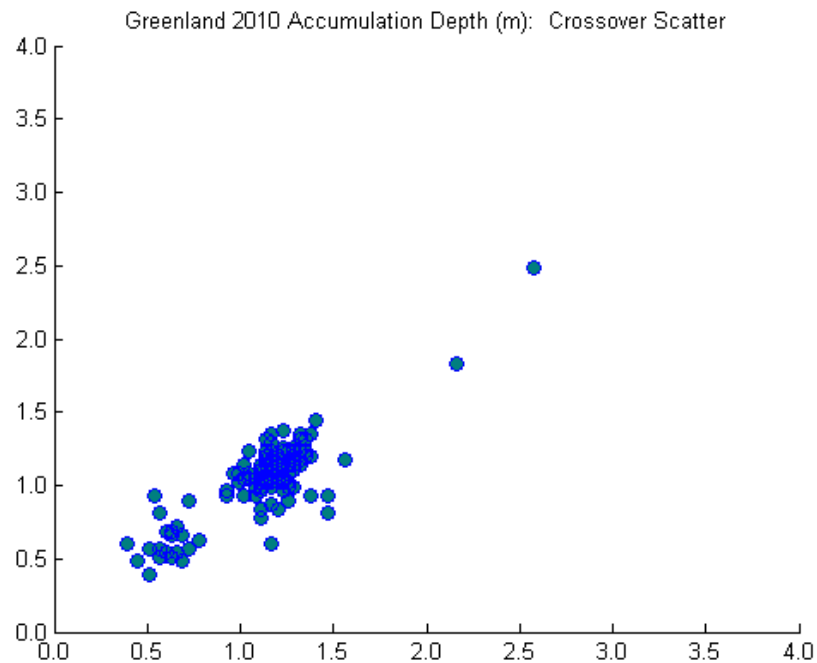
2009-2010 Automated Picks



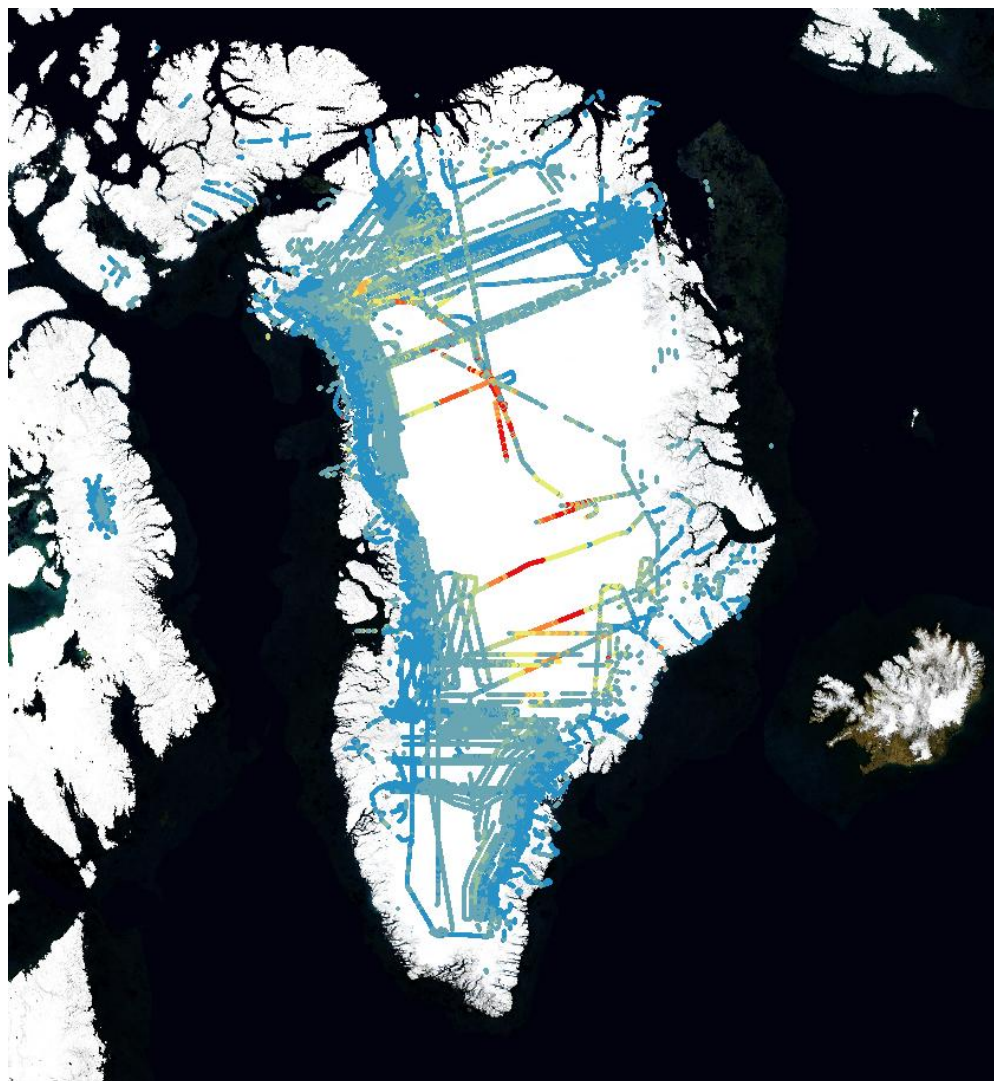
2009-2010 Automated/manual Picks



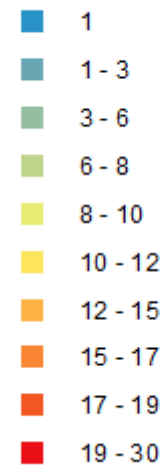
# Crossovers



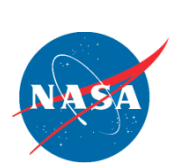
# Detected Layers



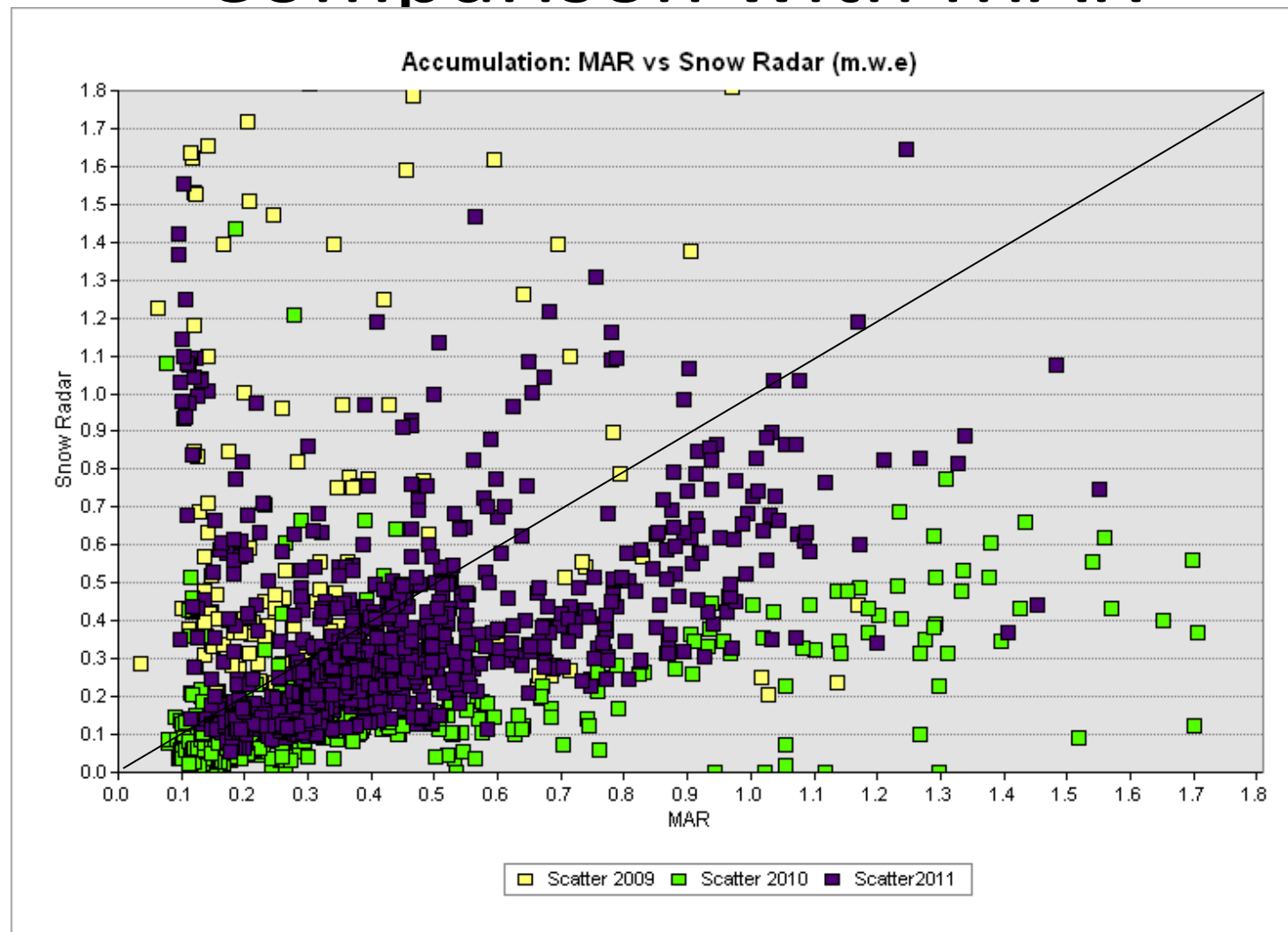
## # Detected Layers





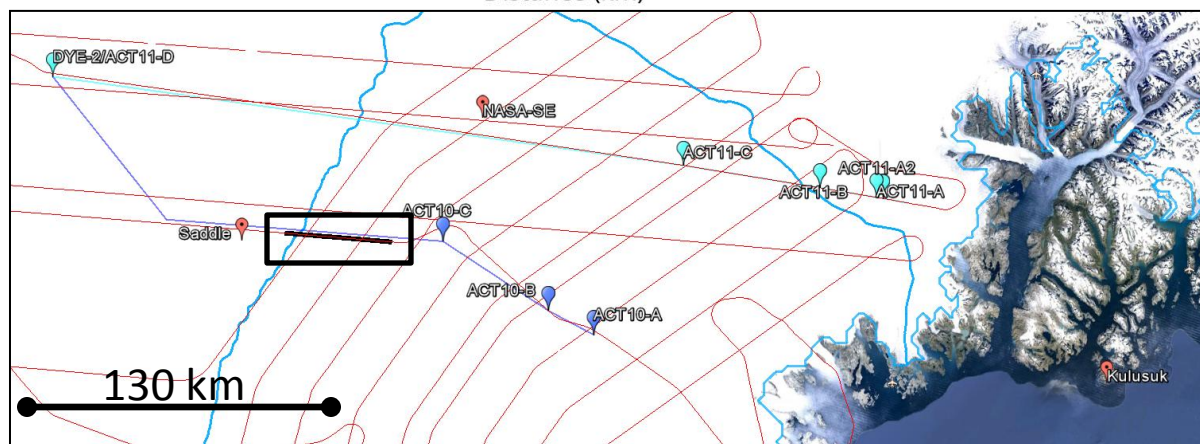
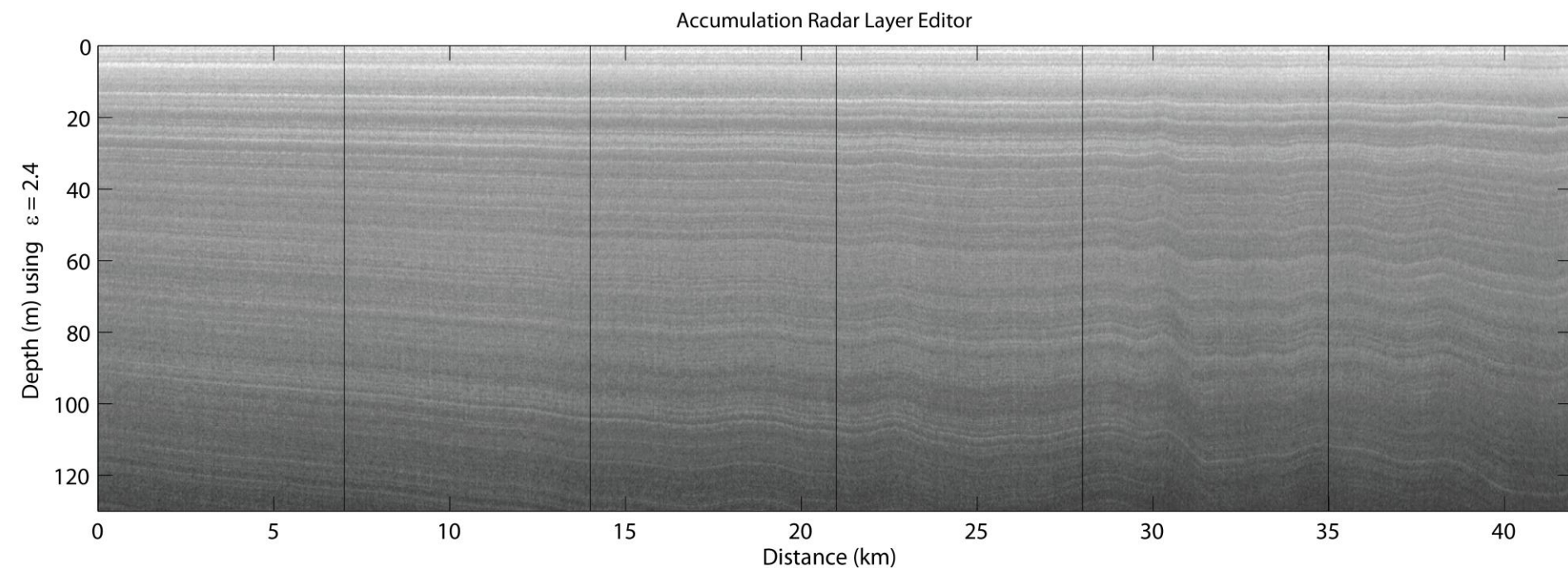


# Comparison with MAR

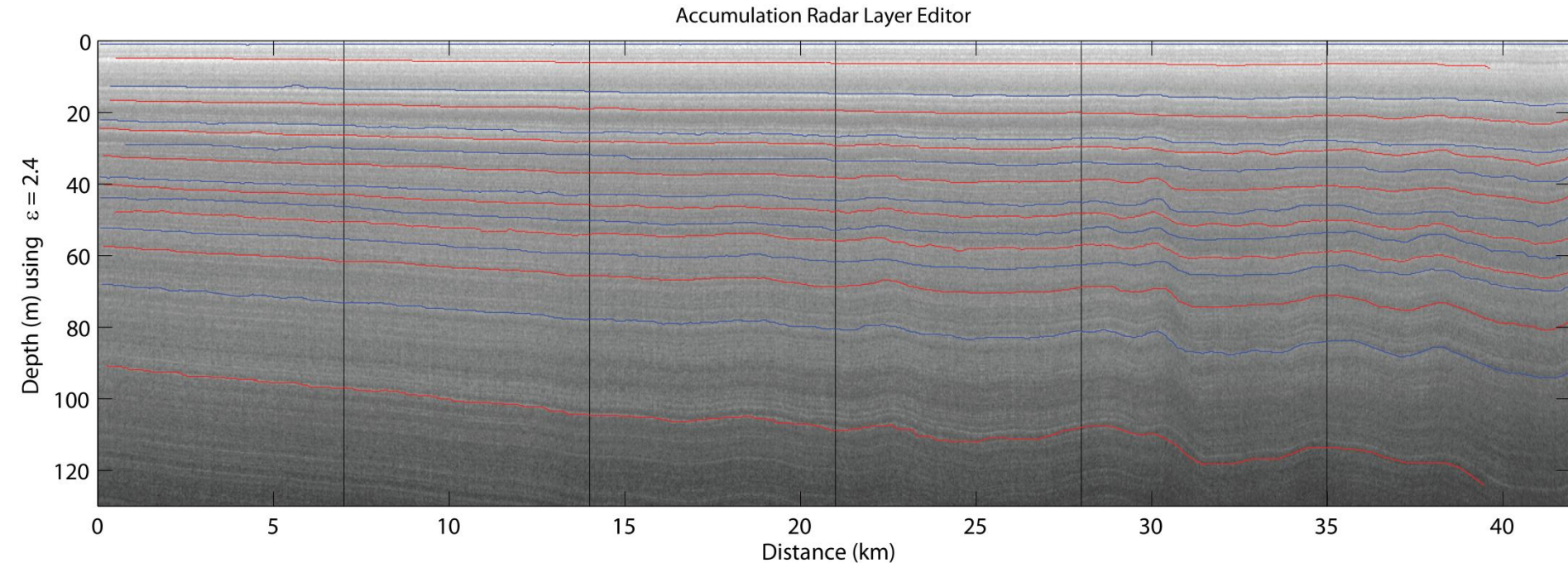


Mean Difference 2010: 0.23 m.w.e. 2011 0.03 m.w.e

# Performance of the NASA layer picker with Accumulation radar



# Performance of the NASA layer picker with Accumulation radar



- The picker is able to pick the main horizons for the first 60m in the firn
- Not an annual signal...
- More layers are observed but are often discontinuous -> not being processed for now



# Future Work

- Annual Data to be released June 2014.
- Will be processing OIB data for the next 3 years. Focus on top 5 layers.
- GUI and code available now, without help files, just ask.
- MacGregor/Koenig Tool merge for Accumulation Radar in the works.

