AMSR-E Snow Algorithm Development

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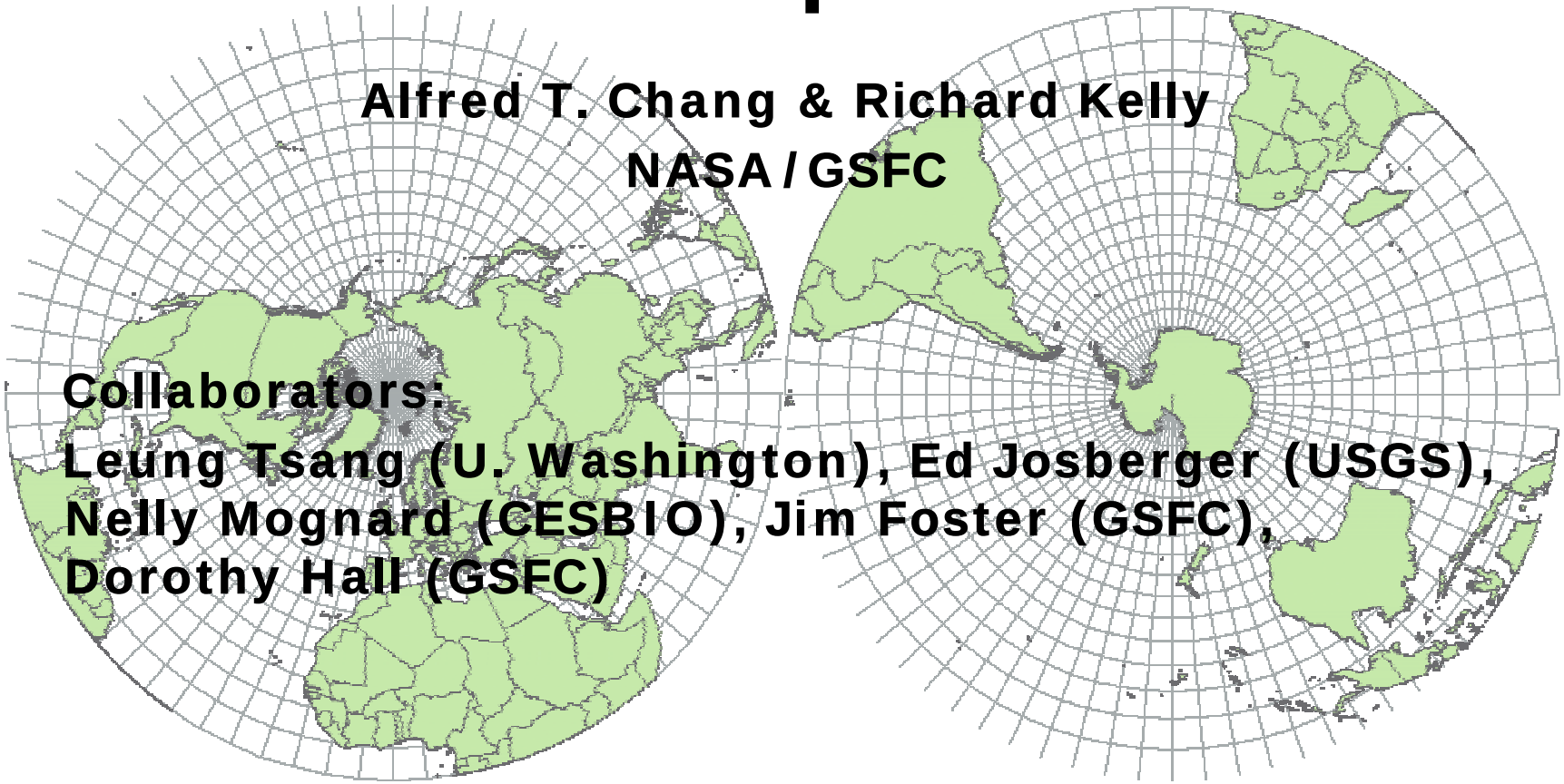
NASA/GSFC



Collaborators:

Leung Tsang (U. Washington), Ed Josberger (USGS), Nelly Mognard (CESBIO), Jim Foster (GSFC), Dorothy Hall (GSFC)

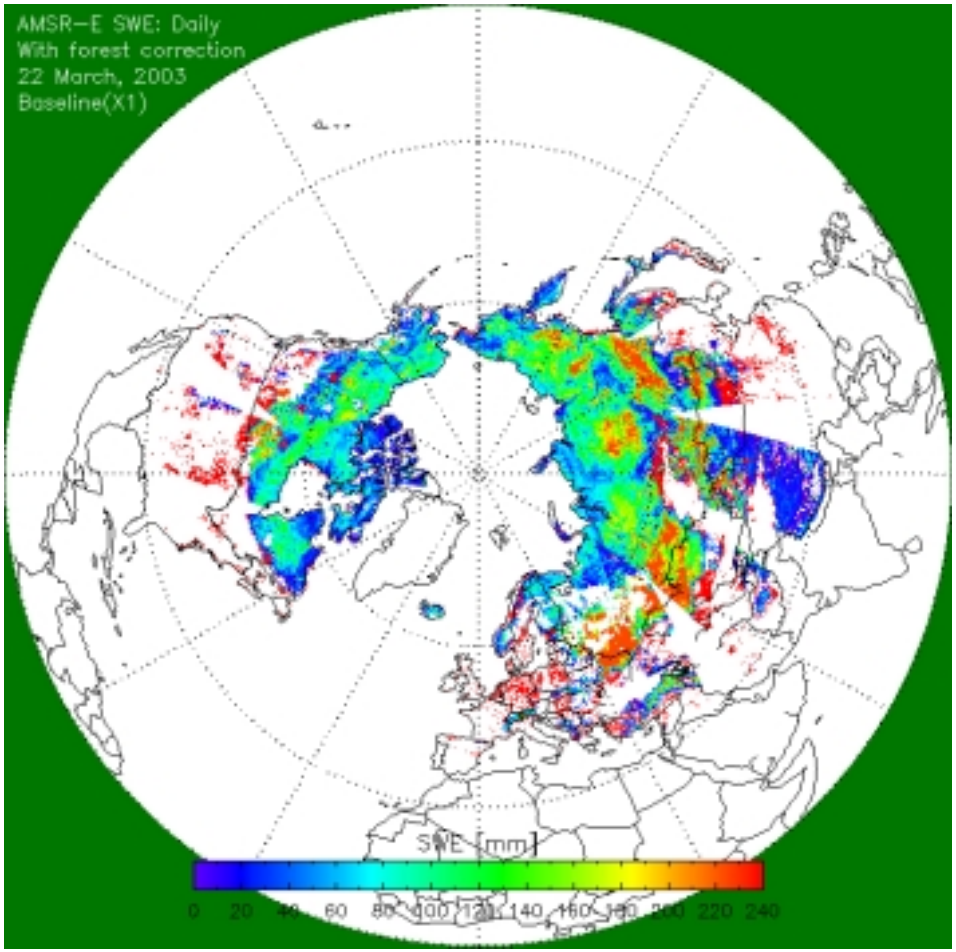
Baseline Algorithm

- **Semi-empirical, radiative transfer model approach based on Chang, Foster & Hall, 1987):**

SWE = *a* (*T18v-T36v*)/(1-ff)

  - *a*=based on global seasonal snow class parameterization (Sturm *et al.* 1995).
  - *ff* = forest fraction.

- **In Production:**
  - Daily products
  - Pentad products
  - Monthly products



Algorithm testing

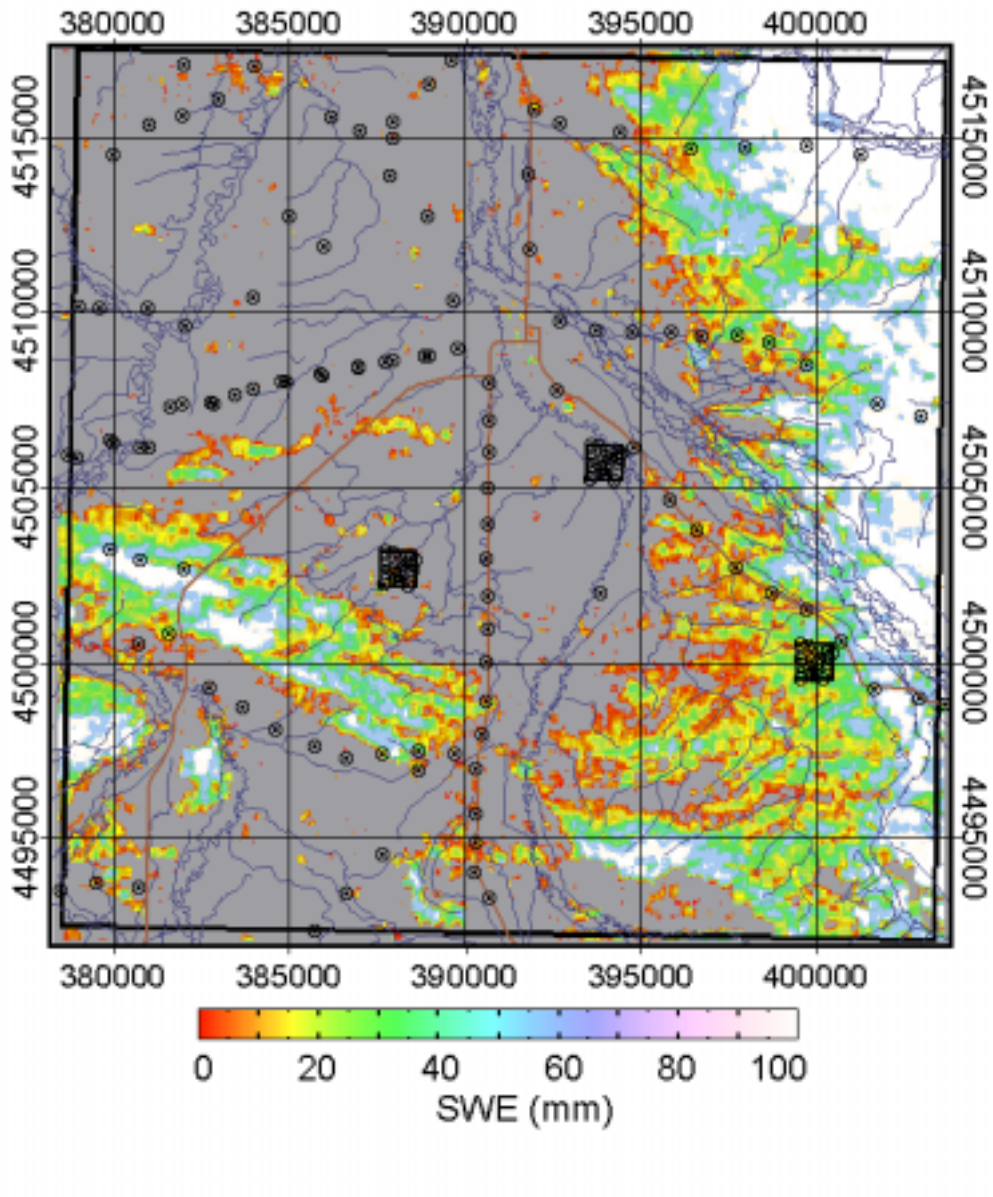
Data sets in use:

- Area data (e.g. PSR) from field experiments (CLPX)
  - *CLPX: three 25 x 25km regions in Colorado revisited twice in 2002 and twice in 2003.*
- Transect data (NOHRSC gamma surveys)
  - *USA surveys each year January to April (at least)*
- Locally intensive data (e.g. field campaigns)
  - *CLPX: nine 1 x 1km cells intensively sampled twice each year during 2002 & 2003.*
- Point data sparsely distributed (WMO GTS data)
  - *Public domain data available in non-real time (NB snow depth only)*

Area data

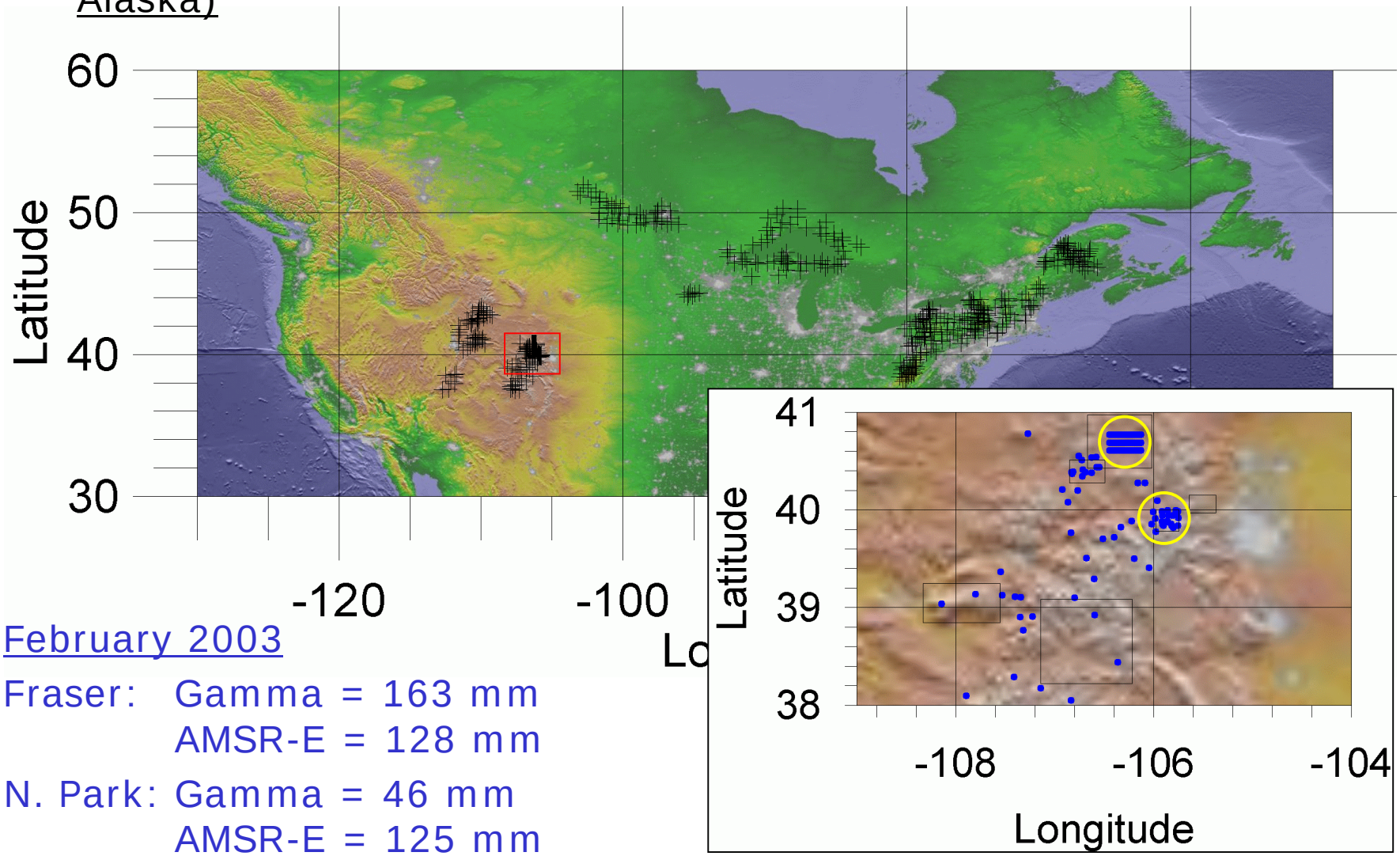
Aircraft PSR on 22 Feb.'02

- (AMSR-E not launched)
- PSR SWE = 21 mm
- SSM/I SWE = 32 mm
- Gamma = 28 mm



Transect data

Aircraft gamma (NOHRSC) locations Jan-April, 2003 (excluding Alaska)



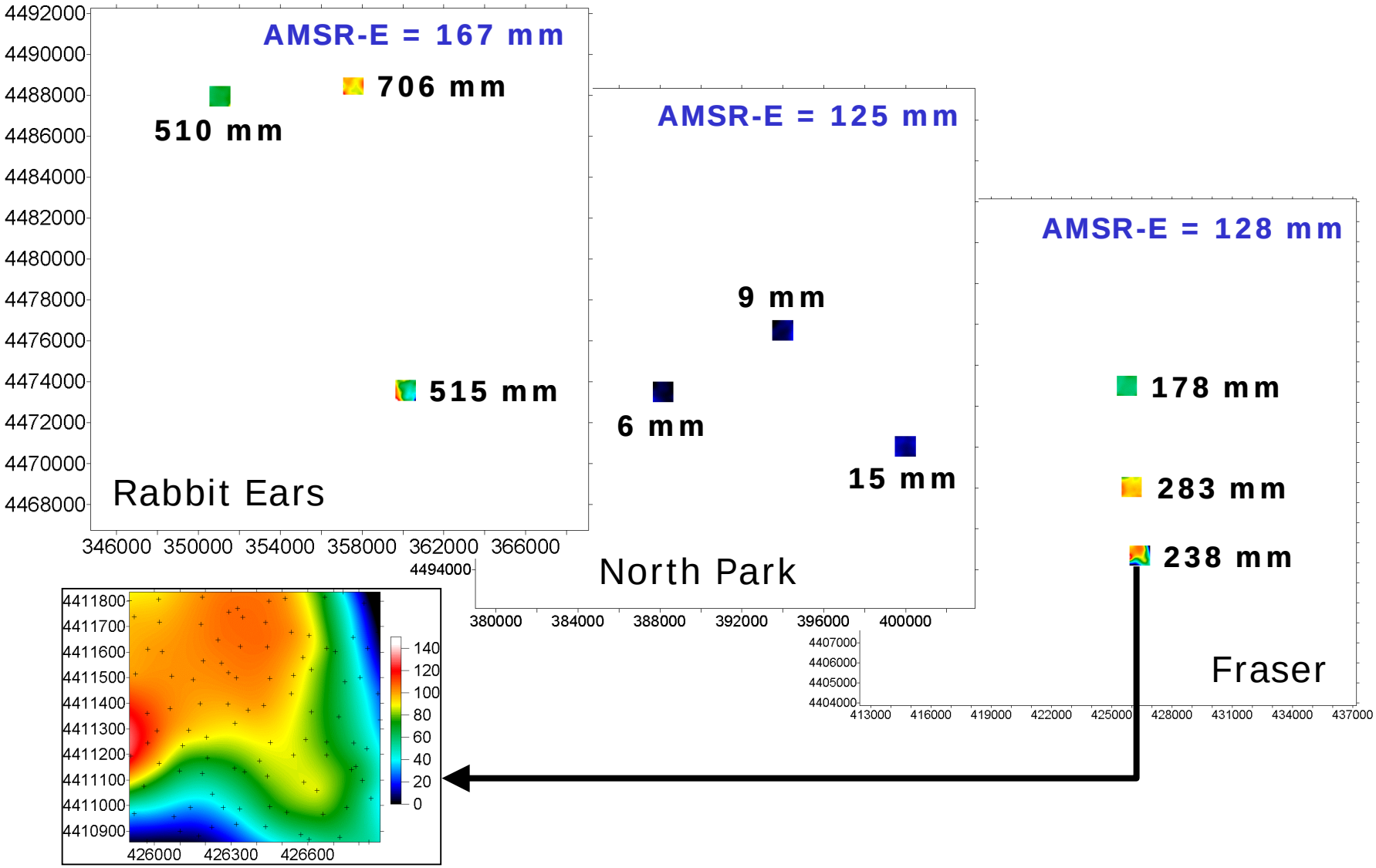
February 2003

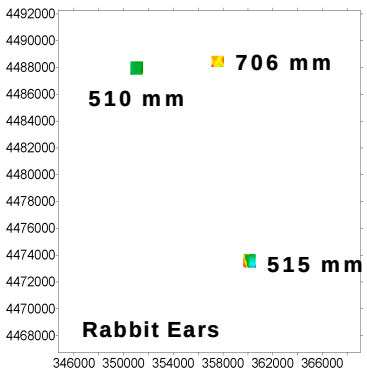
Fraser: Gamma = 163 mm
AMSR-E = 128 mm

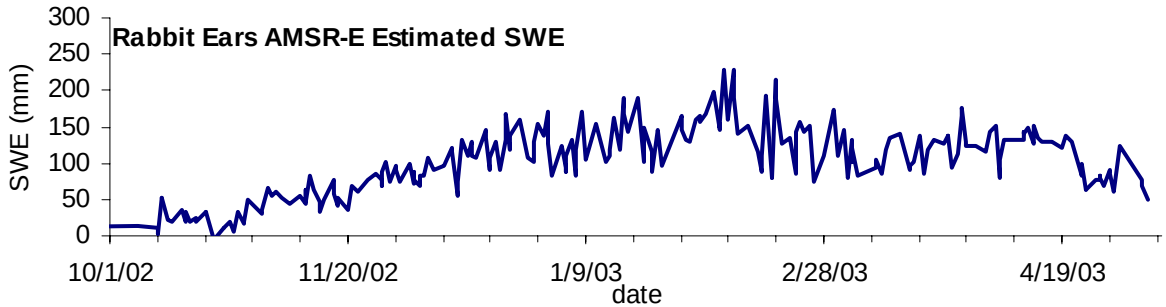
N. Park: Gamma = 46 mm
AMSR-E = 125 mm

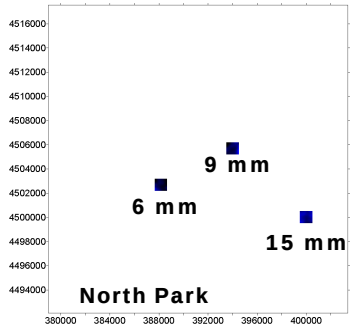
Locally intensive data

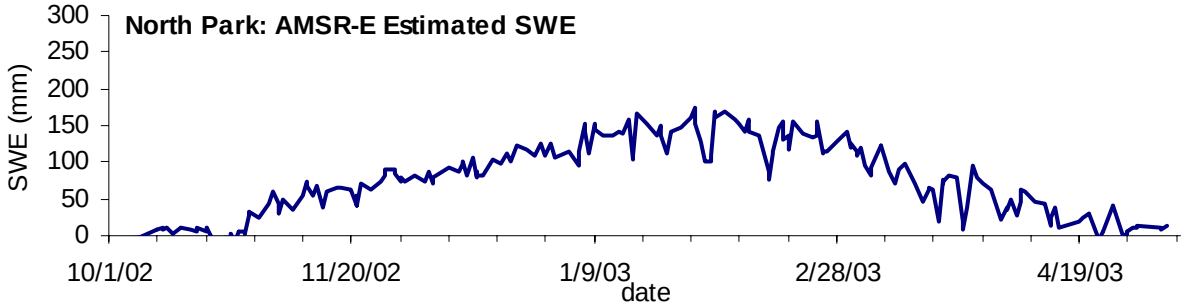
Ground measurements (CLPX) in 25 x 25 km AMSR-E “Pixels”

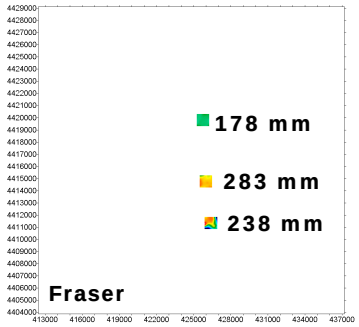


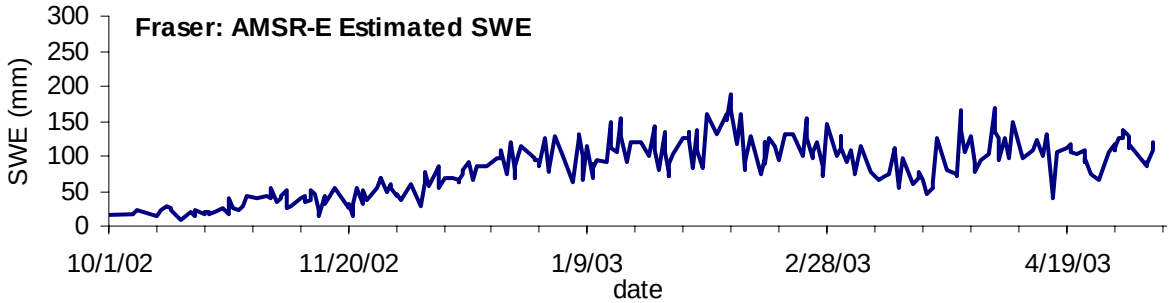

706 mm
510 mm
515 mm
Rabbit Ears


Rabbit Ears AMSR-E Estimated SWE
SWE (mm)
300
250
200
150
100
50
0
10/1/02
11/20/02
1/9/03
2/28/03
4/19/03
date


9 mm
6 mm
15 mm
North Park

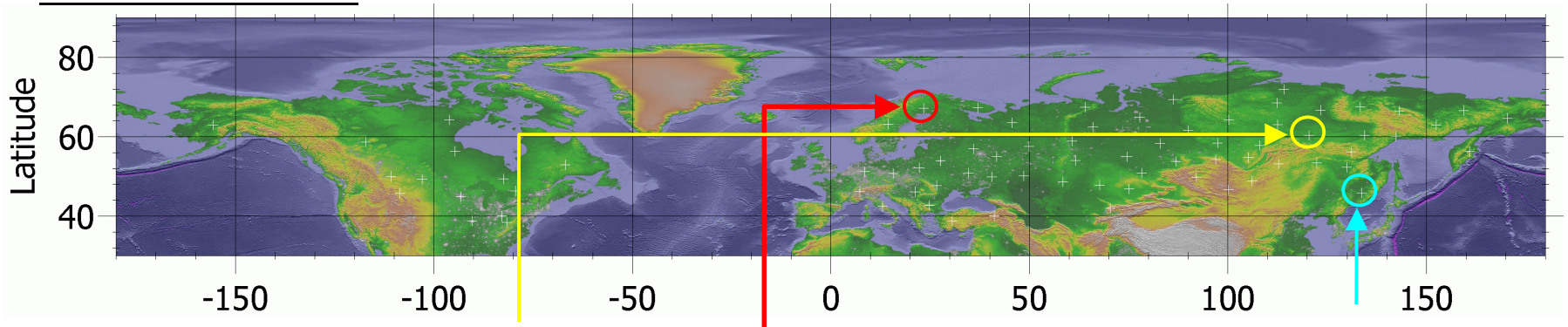

North Park: AMSR-E Estimated SWE
SWE (mm)
300
250
200
150
100
50
0
10/1/02
11/20/02
1/9/03
2/28/03
4/19/03
date


178 mm
283 mm
238 mm
Fraser

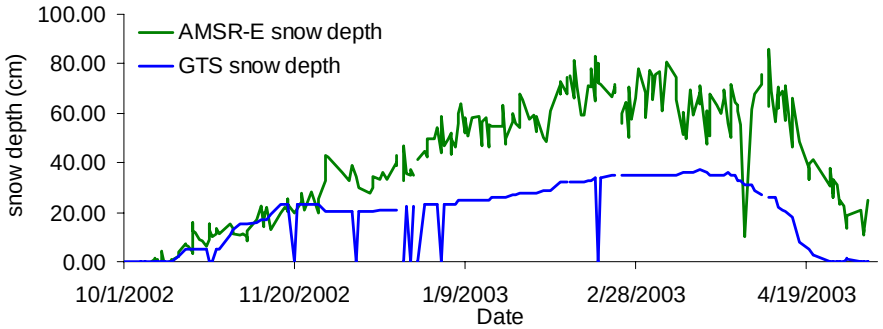

Fraser: AMSR-E Estimated SWE
SWE (mm)
300
250
200
150
100
50
0
10/1/02
11/20/02
1/9/03
2/28/03
4/19/03
date

Sparsely distributed data

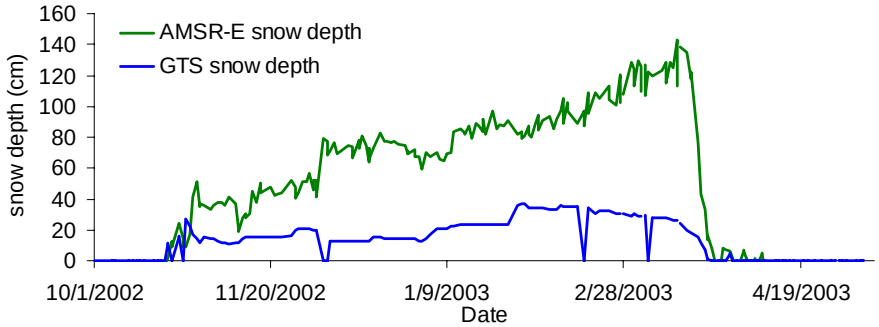
WMO GTS data



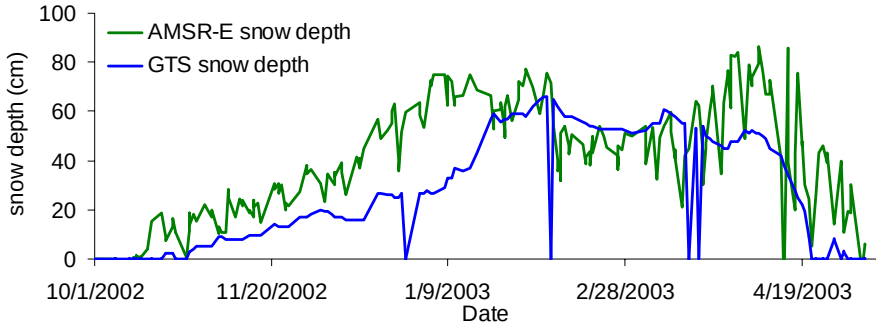
AMSR-E snow depth at GTS Station 24944 (forest fraction = 91%)



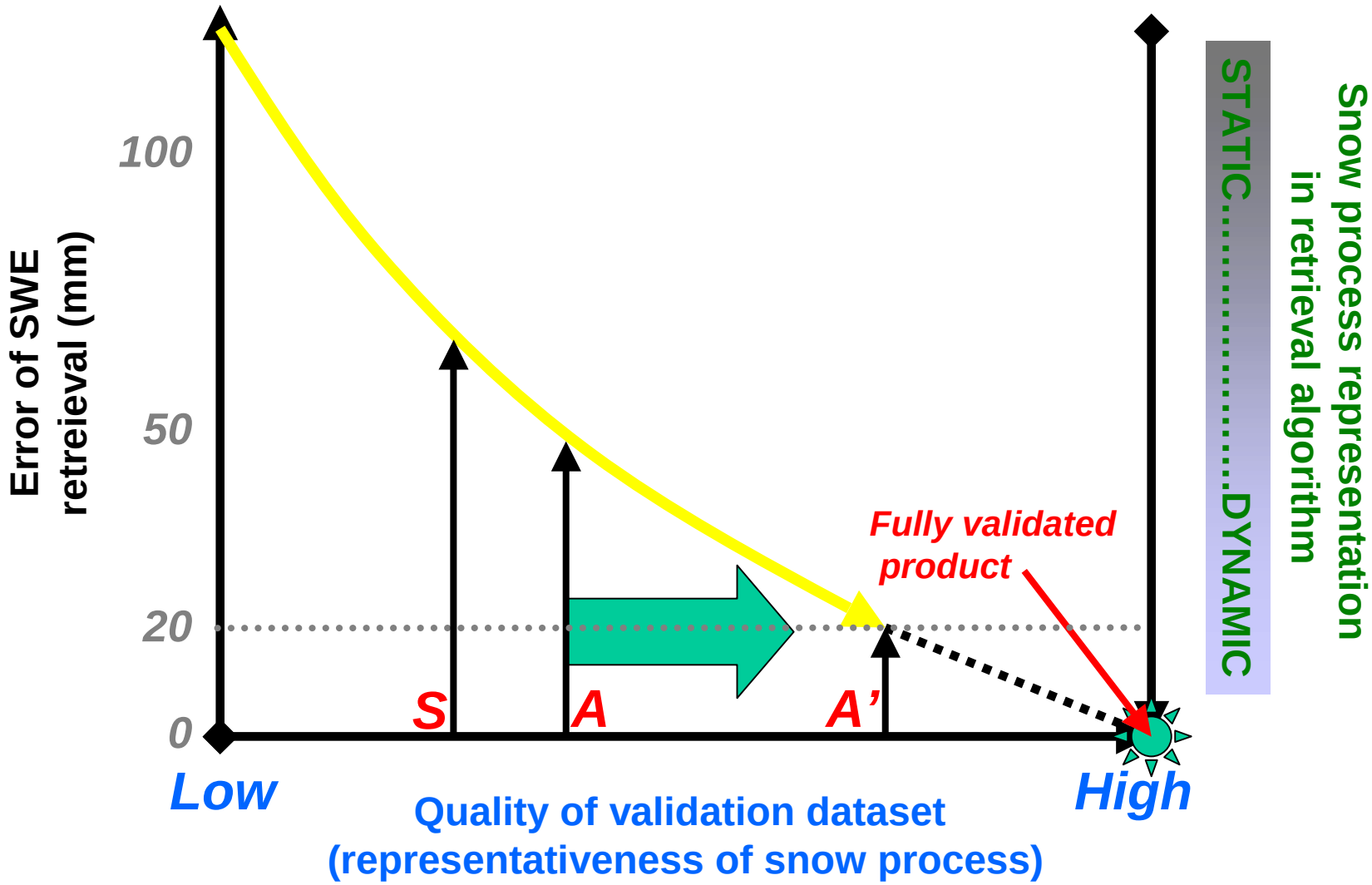
AMSR-E snow depth at GTS Station 31873 (forest fraction = 76%)



AMSR-E snow depth at GTS Station 2096 (forest fraction = 89%)



Relationship between validation data quality and validation

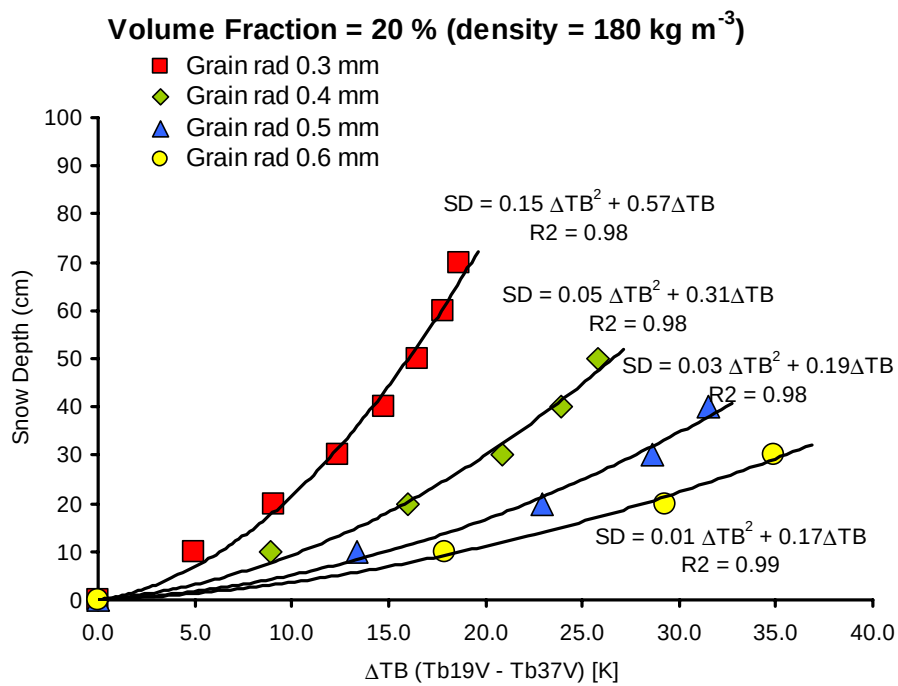


Algorithm Refinement Activity

SNOWPACK PROPERTY DYNAMISM

From DMRT experiments, SD = $a\Delta TB^2 + b\Delta TB$ [cm] where:

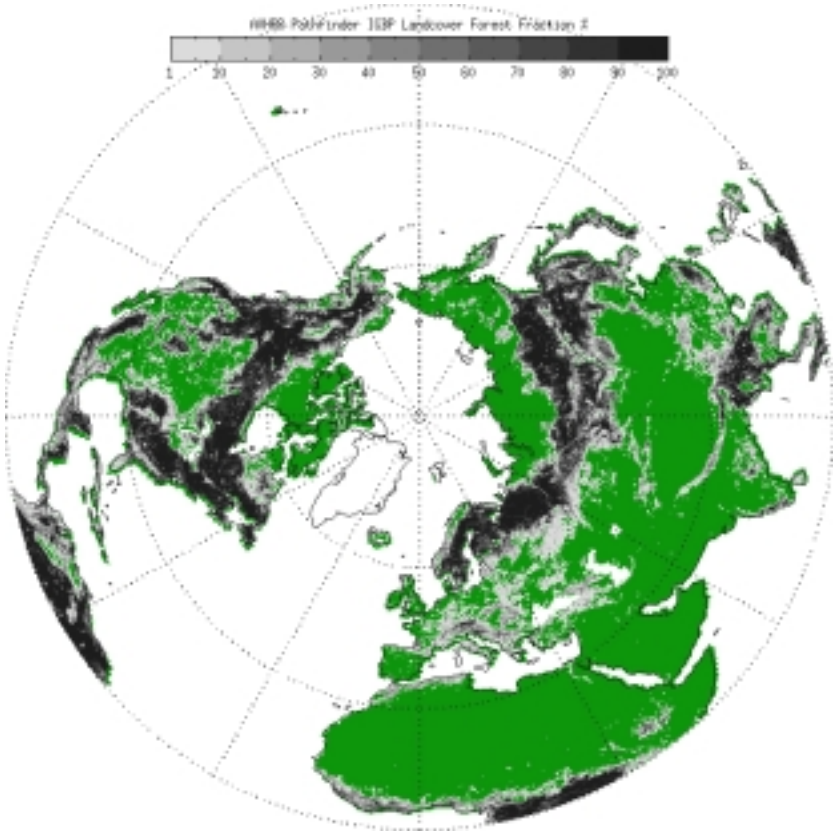
- ΔTB = Tb18H-Tb36H [K]
- *a* & *b* are parameterized by grain size and density model estimates.



FOREST/VEGETATION CORRECTION

IGBP-based Forest Fraction Data (%)

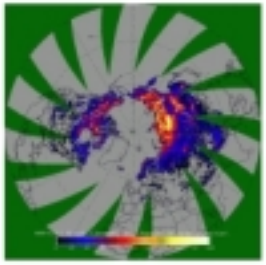
(MODIS/AVHRR Data)



snow depth & snow water equivalent
the AMSR-E snow project

Science | Field Experiments | Publications | People | MODIS snow mapping | AMSR-E | EOS - Aqua

Snow cover has a set of unique signatures when observed at microwave wavelengths (0.3 - 0.003 m). The Advanced Microwave Scanning Radiometer-EOS (AMSR-E) snow project is developing tools that will enable us to monitor snow cover (area extent, snow water equivalent and depth) more effectively at global and regional spatial scales and at daily, 5-day and monthly time scales.



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http://amsre-snow.gsfc.nasa.gov