# Globsnow and JULES

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# The truth?

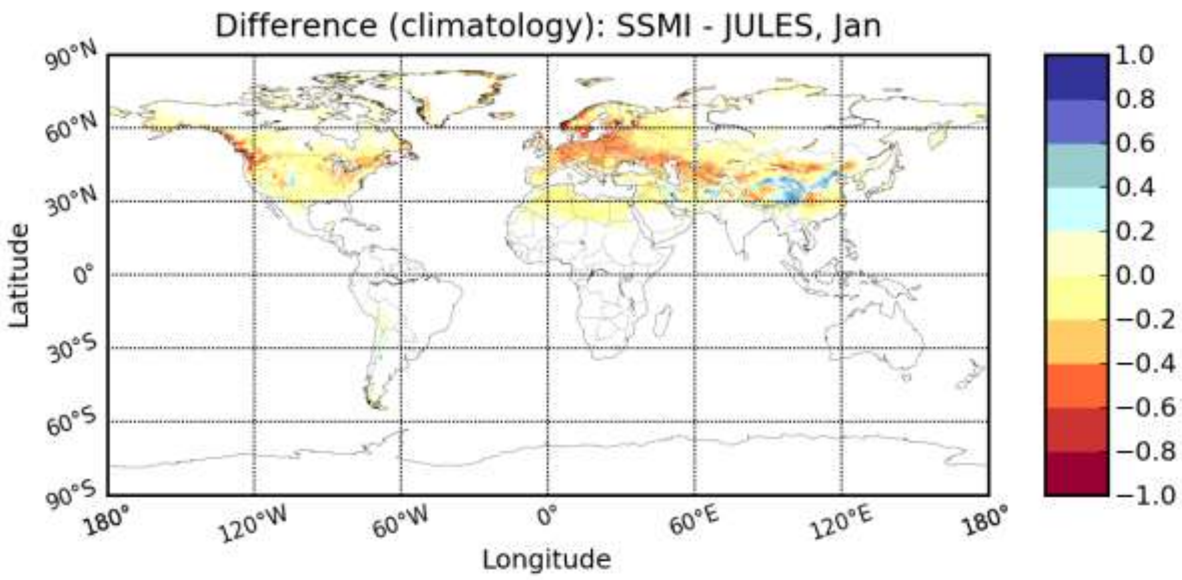
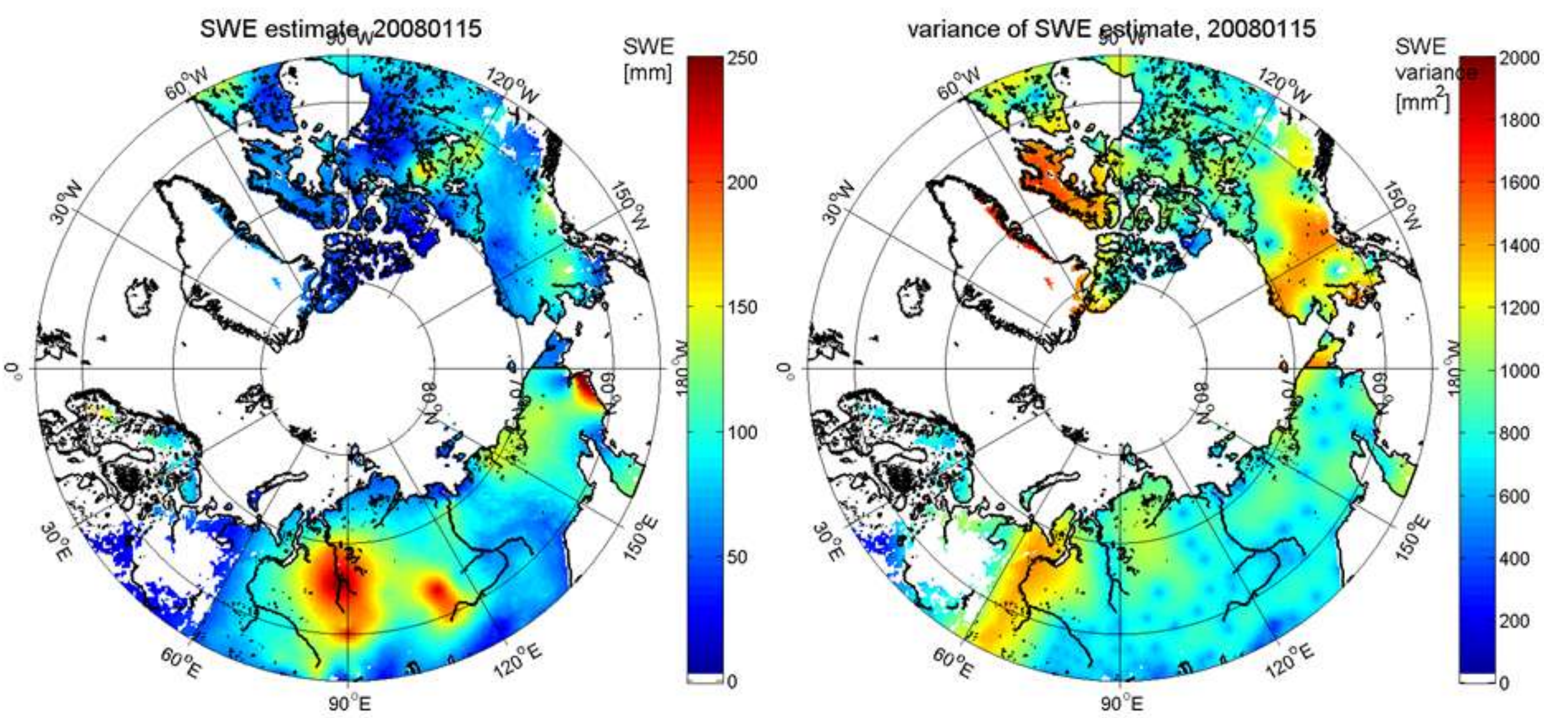
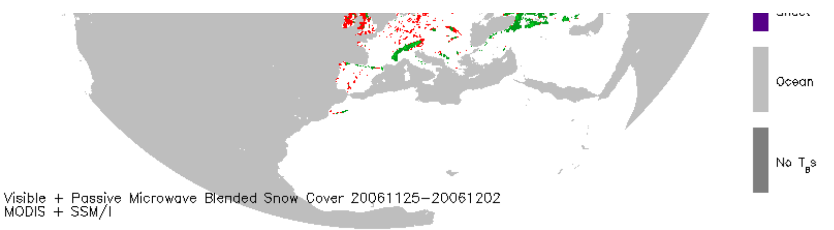



Figure by Martin De Kauwe of CEH Wallingford

# "True" snow

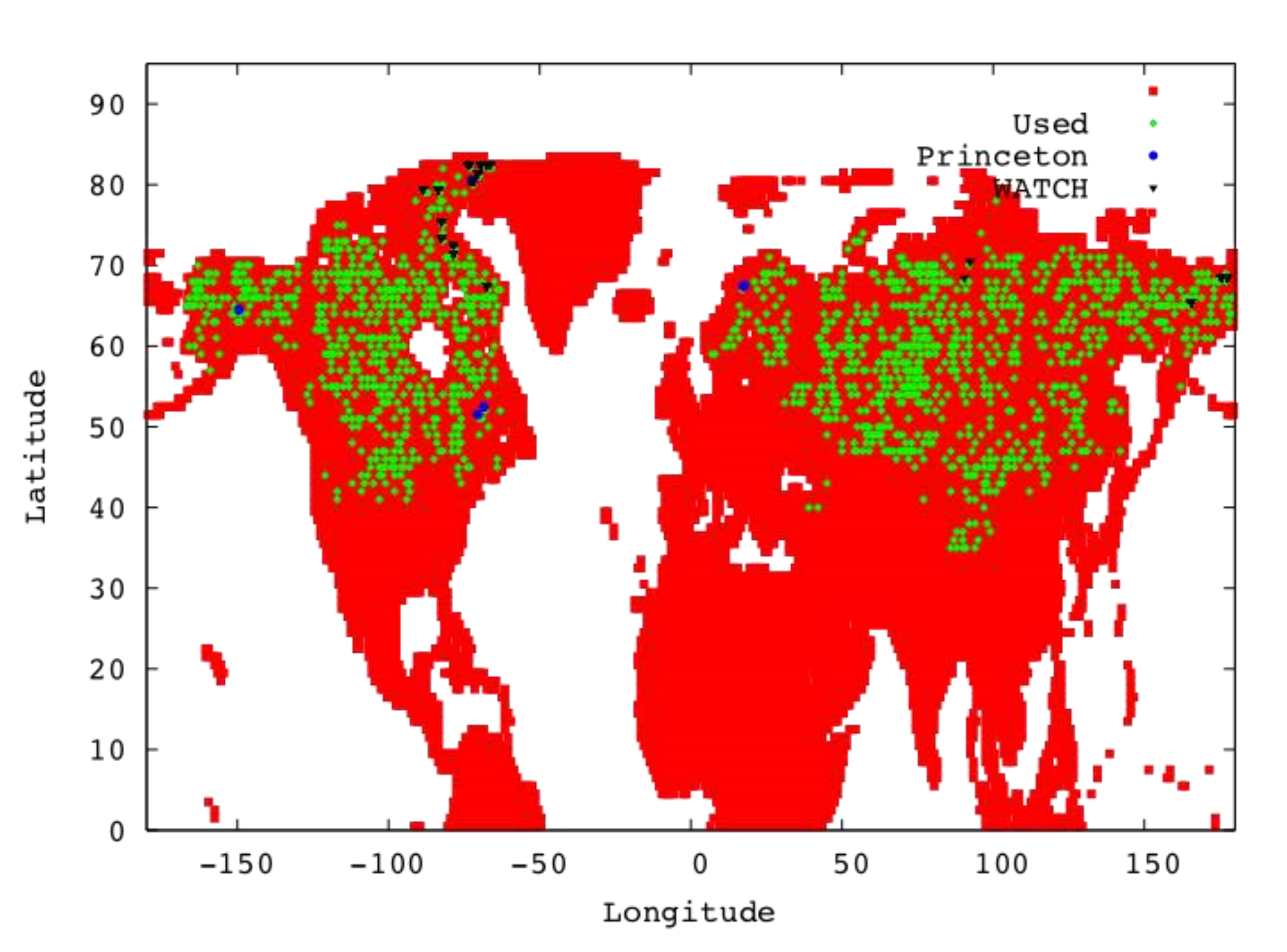
Snow water equivalent and the estimation uncertainty for 15 January 2008



# Sites

Globally representative of lat, lon, elevation, topography, peak accumulation.



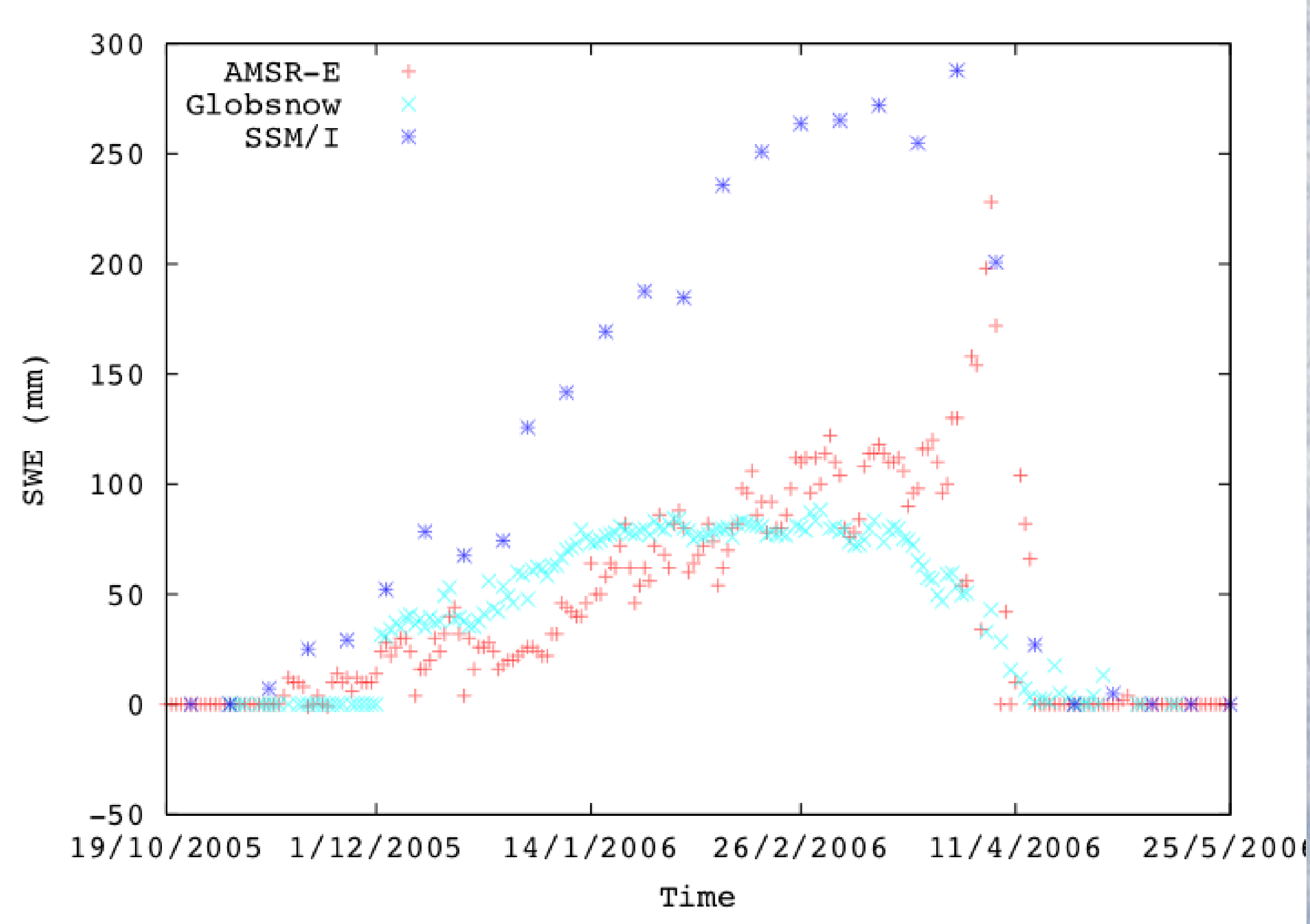
# Snow dates

Taking pure MODIS as truth.

Hardest case for microwave sensors – don’t expect too much.

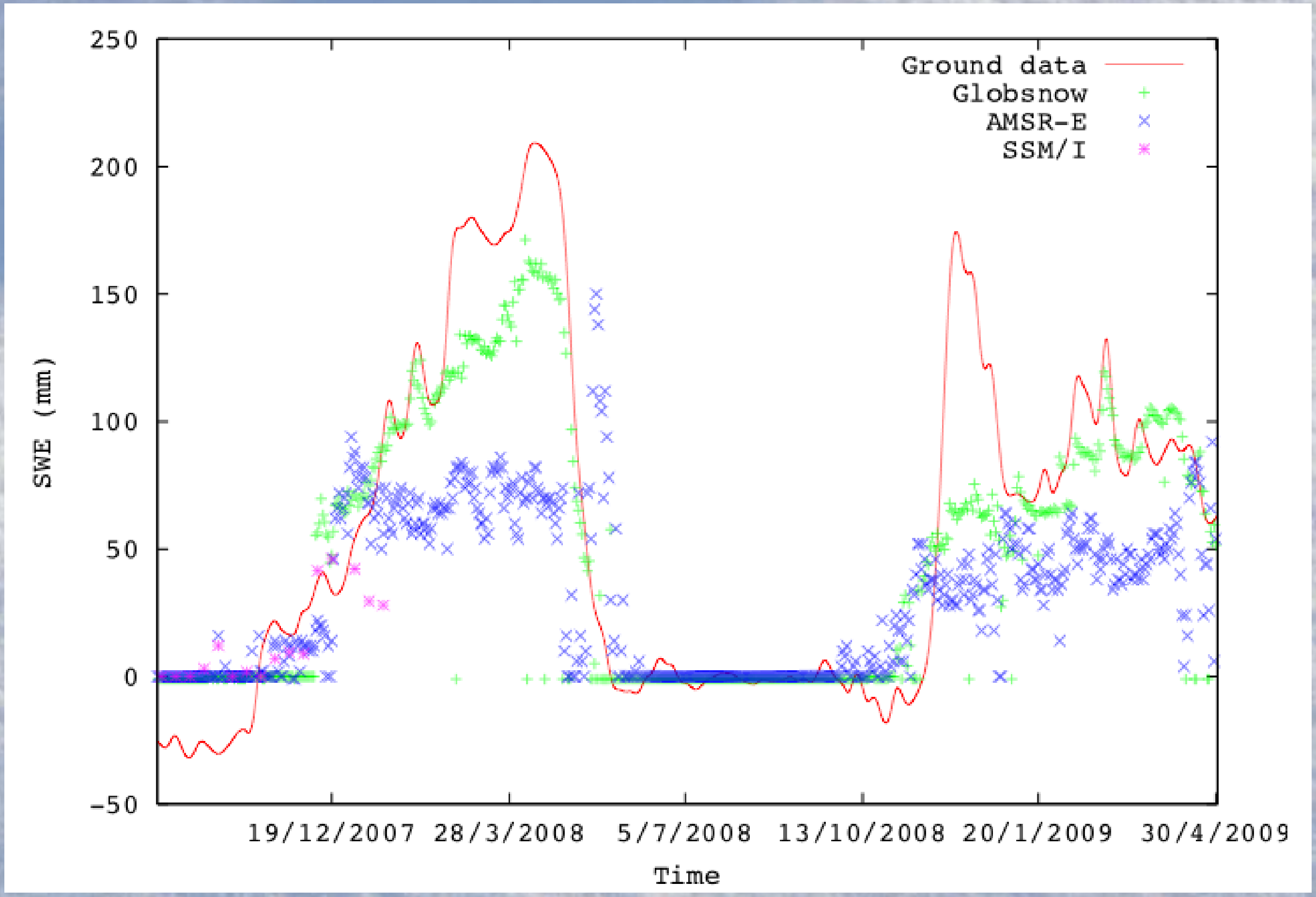
| Sensor | AMSR-E | SSM/I | Globsnow |
| --- | --- | --- | --- |
| Snow start | -26 +/- 53 | -3 +/- 40 | -38 +/- 38 |
| Snow end | 4 +/- 48 | -10 +/- 30 | 0.5 +/- 25 |

# The "truth"



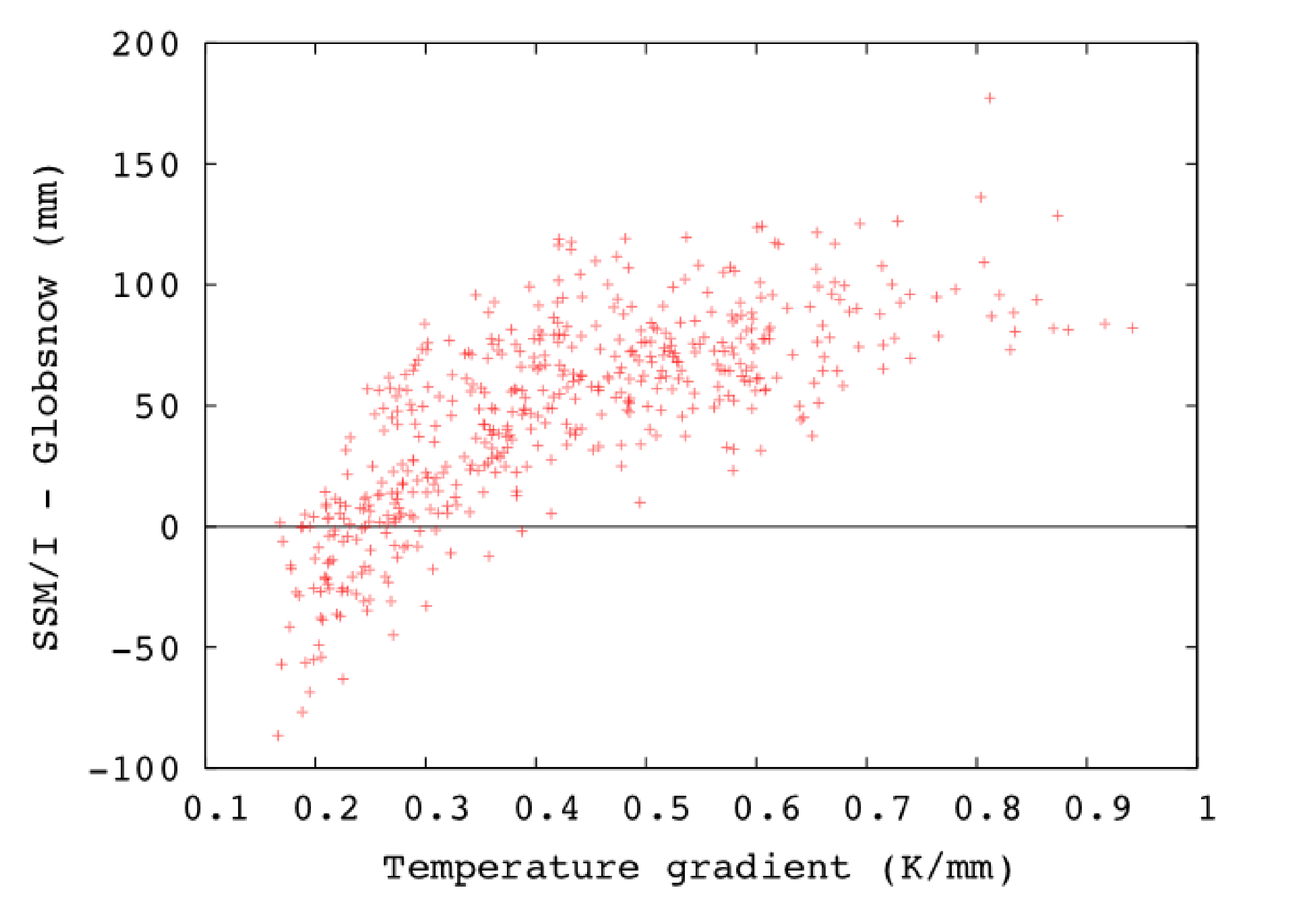

Comparison of Globsnow SWE to AMSR-E and SSM/I over Kevo, Finland and BERMS, Canada

# THE "TRUTH"




SWE from AMSR-E, SSM/I, Globsnow and ground measurements at Kevo, Finland. Ground data from Jonathan Evans.

# Depth hoar


200
150
100
50
0
-50
-100
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
SSM/I - Globsnow (mm)
Temperature gradient (K/mm)

# Chang

The Chang method was originally tested over three sites.

| Site | Peak SWE (mm) | Elevation (m) | Forest cover (%) | Temperature (°C) |
|---|---|---|---|---|
| Chang Russia | 34 +/- 10 | 148 +/- 61 | 10 +/- 8 | -4 +/- 3 |
| Chang Canada | 47 +/- 13 | 706 +/- 172 | 6 +/- 11 | -11 +/- 4 |
| Chang USA | 51 +/- 7 | 723 +/- 245 | 3 +/- 3 | -11 +/- 4 |
| Global subset | 86 +/- 33 | 394 +/- 647 | 30 +/- 31 | -22 +/- 10 |

# EO conclusions

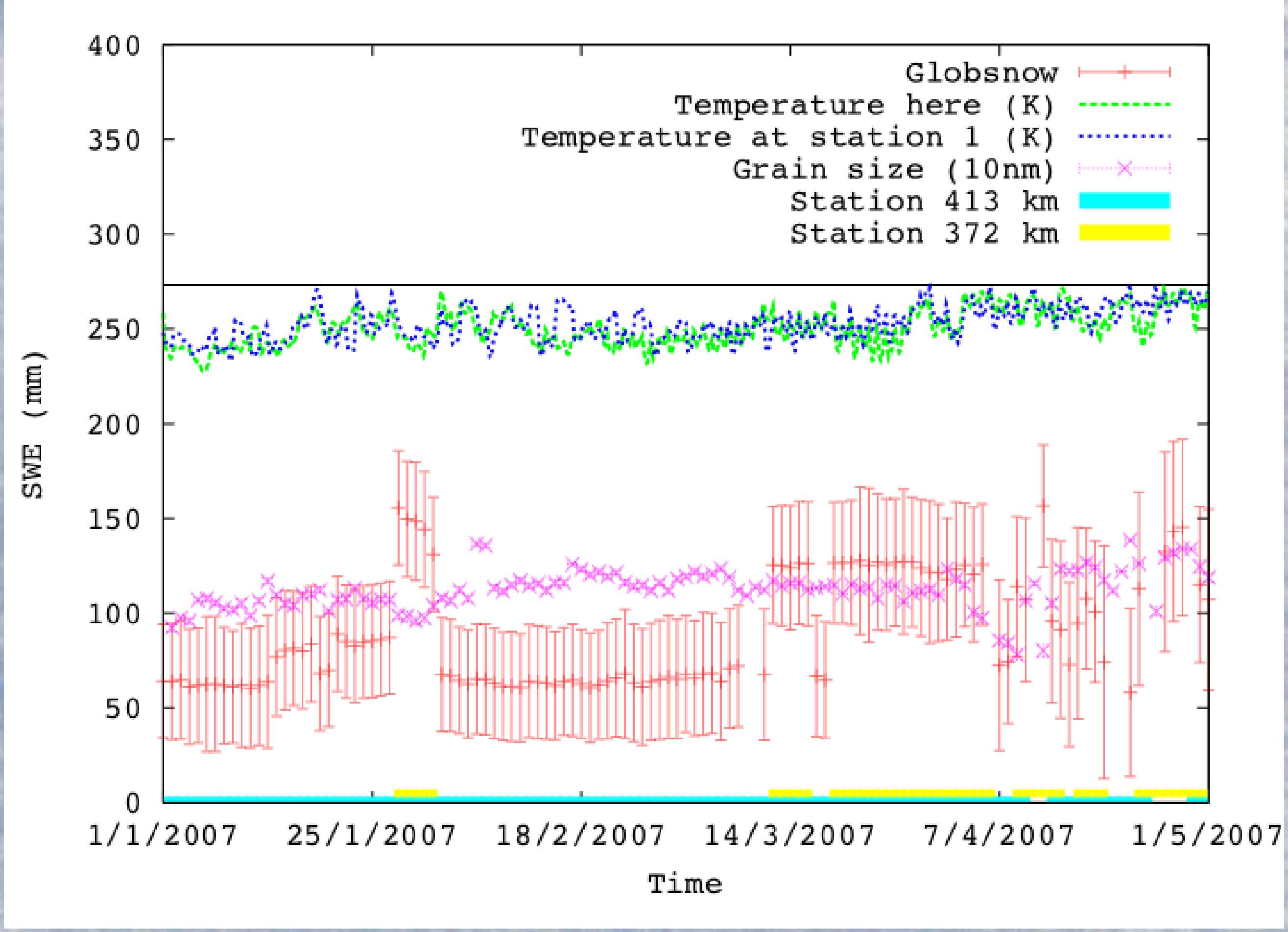
- Globsnow appears to be the best SWE product available.
  - Not collected over mountainous terrain
  - Some gaps
  - Spurious jumps (1%)

- SSM/I and AMSR-E appear to saturate and suffer from artefacts from forest correction and “depth hoar”.

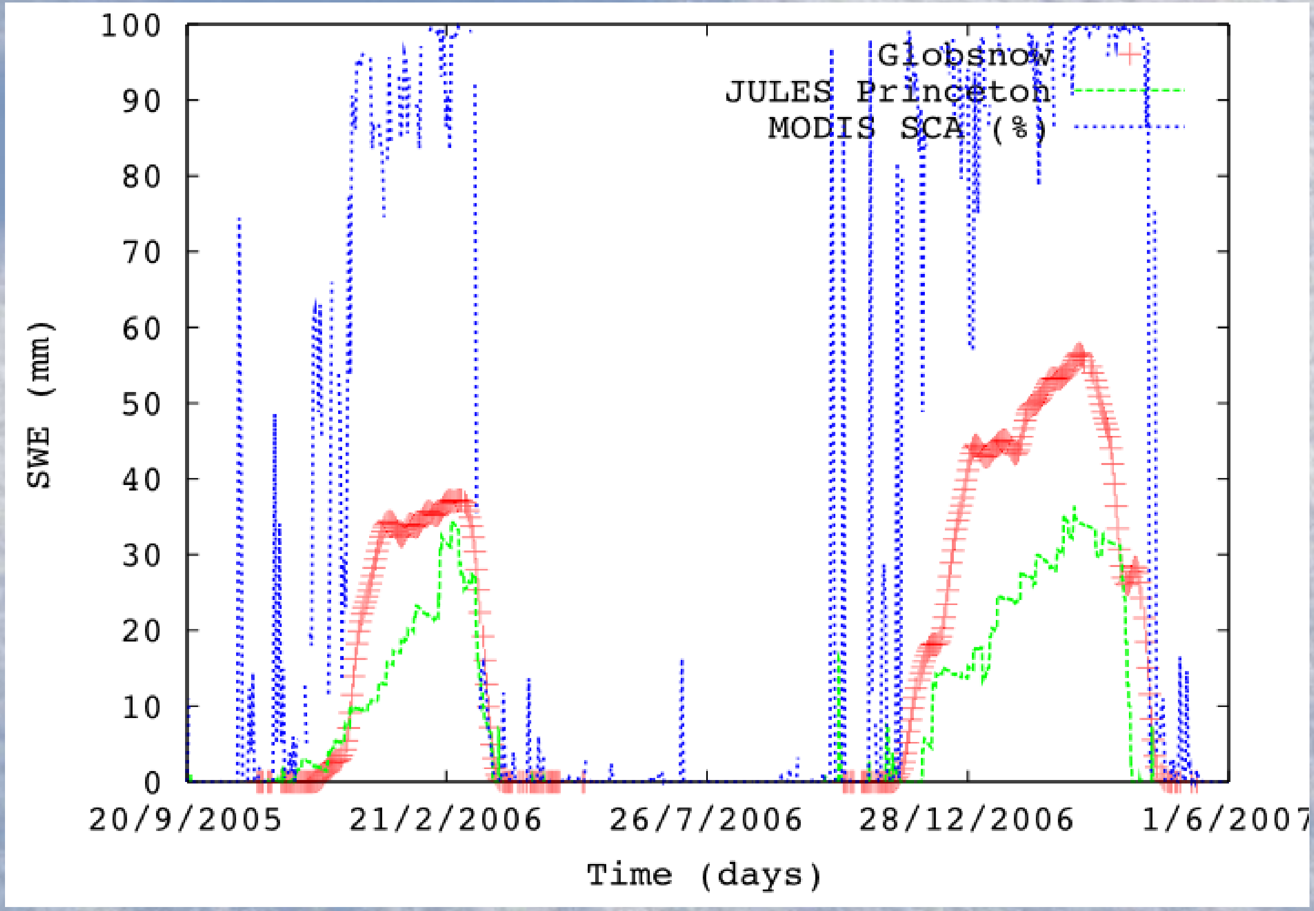
# Globsnow artefacts

About 1% of cases examined showed possibly spurious jumps.

Use with caution

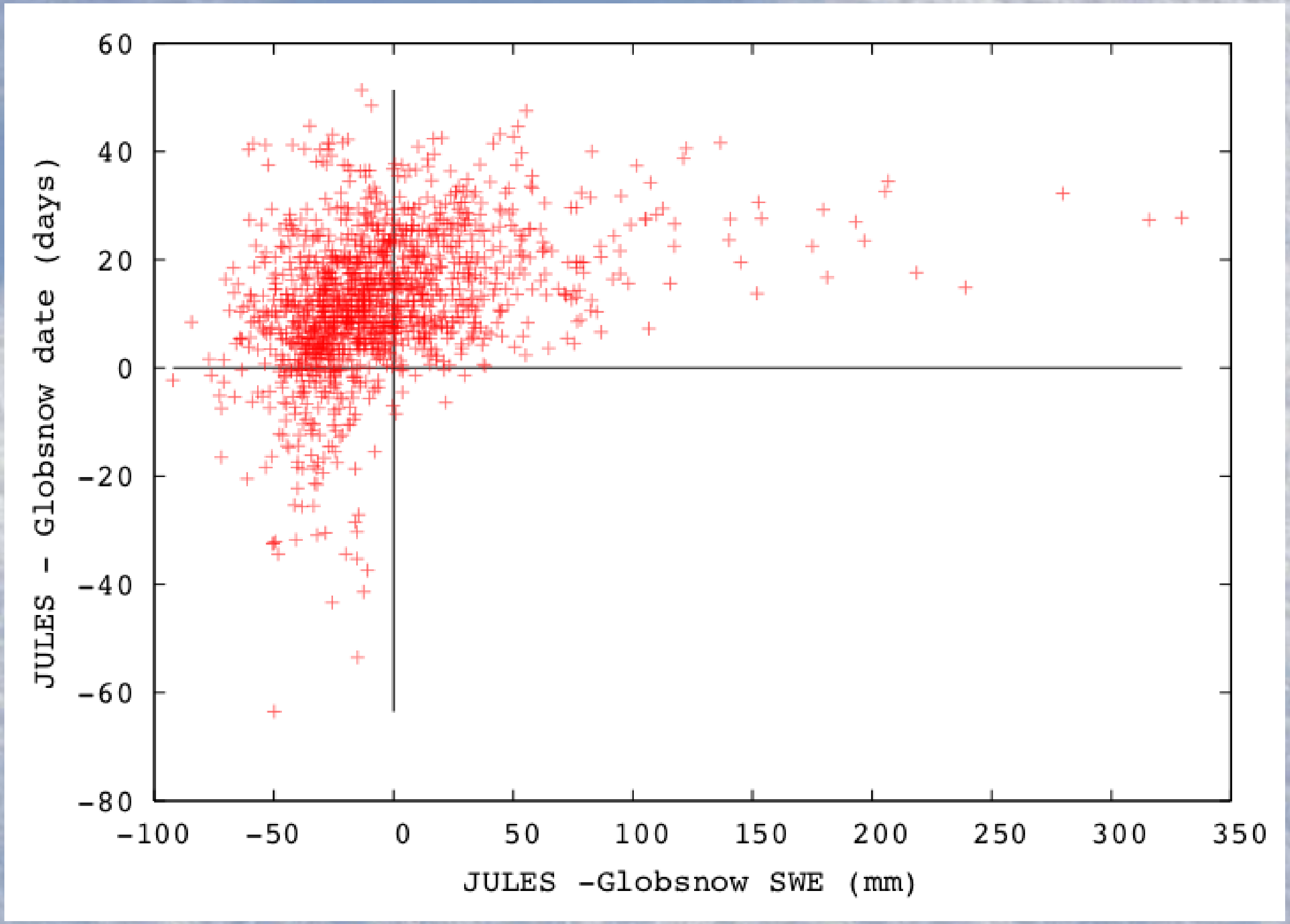


# JULES RUNS (v2.1.2)




55.5ºN 64.5ºE

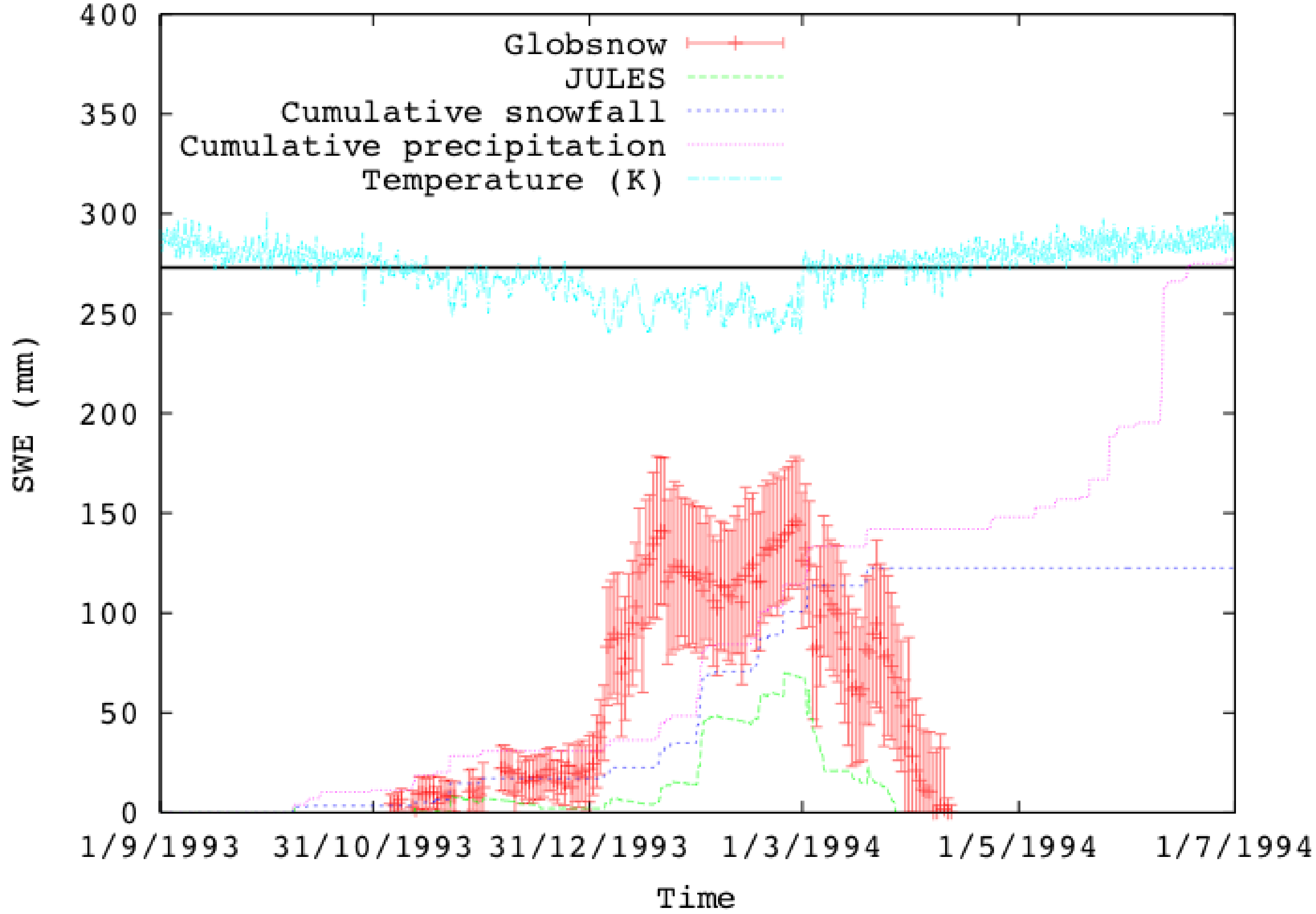
# Early melt?




Yenisey - WATCH

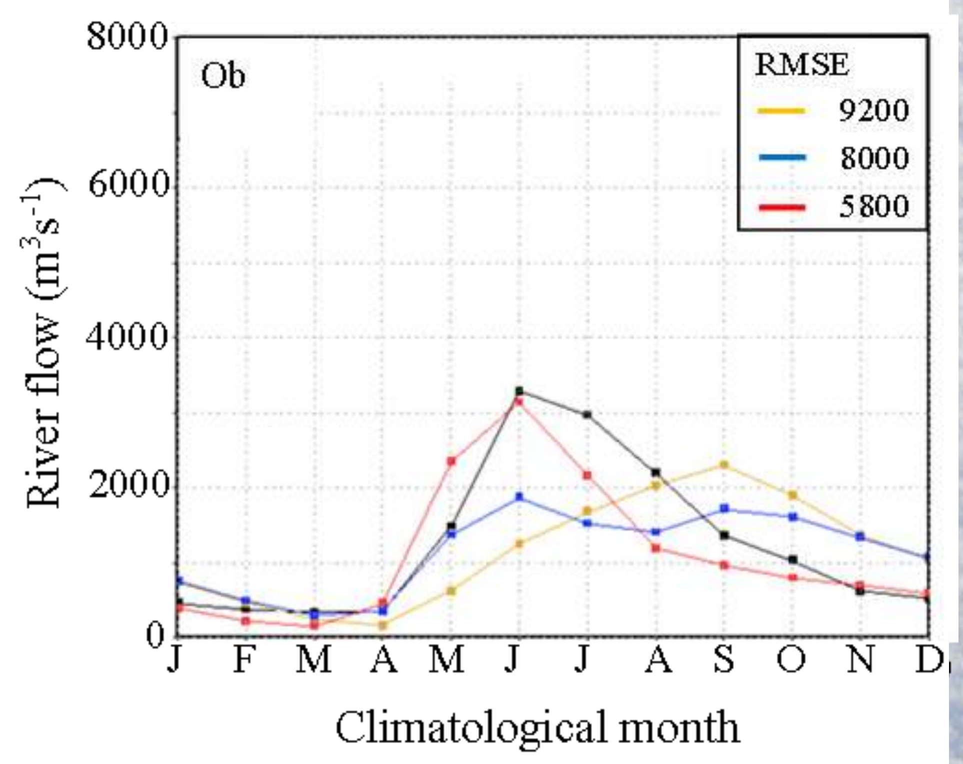
Repeating with MOD10C1

# Snowfall


Globsnow
JULES
Cumulative snowfall
Cumulative precipitation
Temperature (K)
SWE (mm)
400
350
300
250
200
150
100
50
0
1/9/1993
31/10/1993
31/12/1993
1/3/1994
1/5/1994
1/7/1994
Time

# Runoff – D. Finney

Using Globsnow, it was estimated that there should be an additional 35% snowfall on average over the Ob basin.




**Observations**

**Standard JULES**

**JULES with TOPMODEL**

**JULES with Niu/Yang parameterisation**

- Using this adjustment all models showed a reduced RMSE
- The new model with Globsnow adjusted snowfall demonstrates the best similarity of all runs

Using a spatially dependent adjustment factor could lead to even better results.

*Produced by D L Finney*

# WINTER MELT

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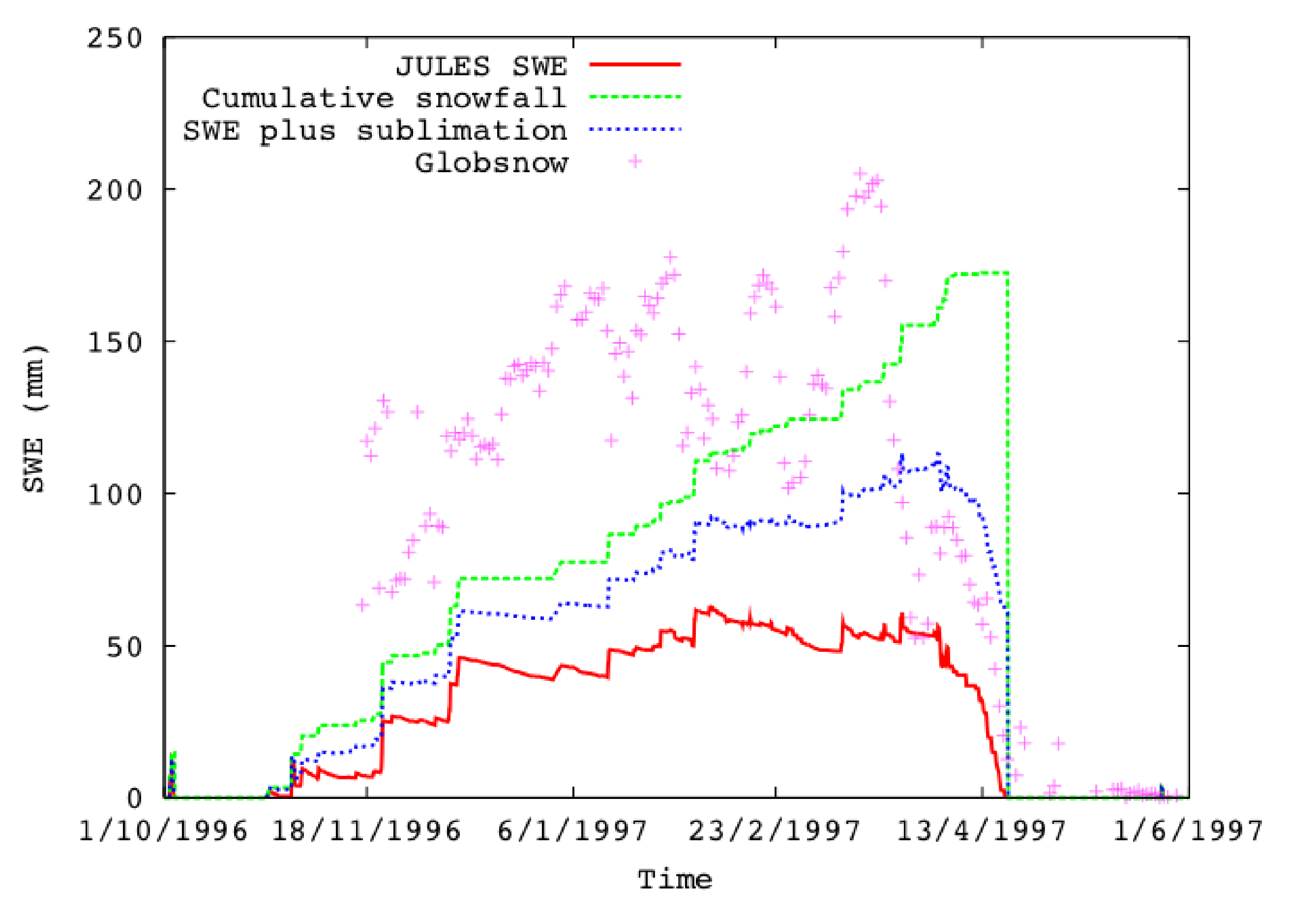


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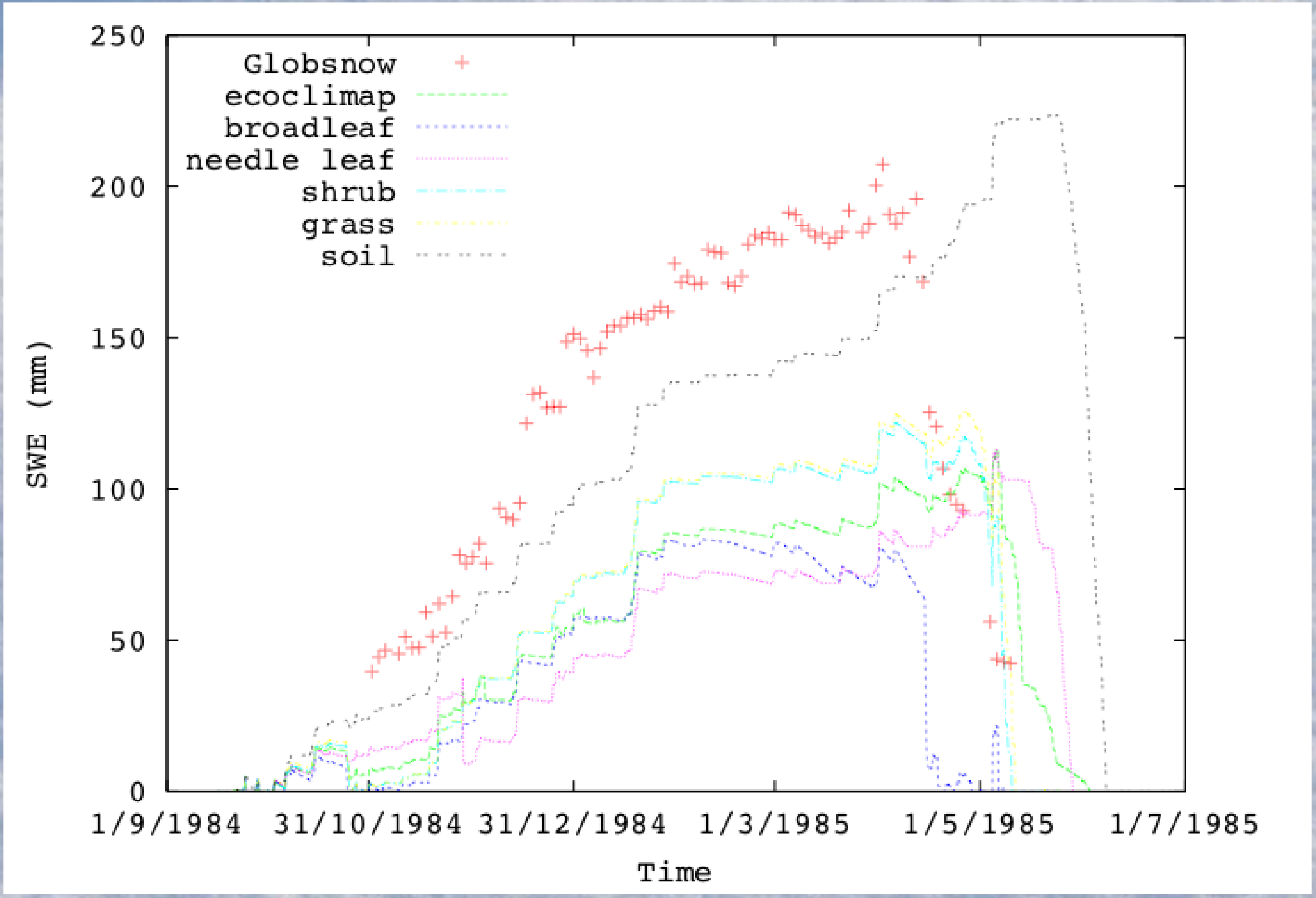
# LAND COVER



Globsnow
ecoclimap
broadleaf
needle leaf
shrub
grass
soil
SWE (mm)
250
200
150
100
50
0
1/9/1984
31/10/1984
31/12/1984
1/3/1985
1/5/1985
1/7/1985
Time

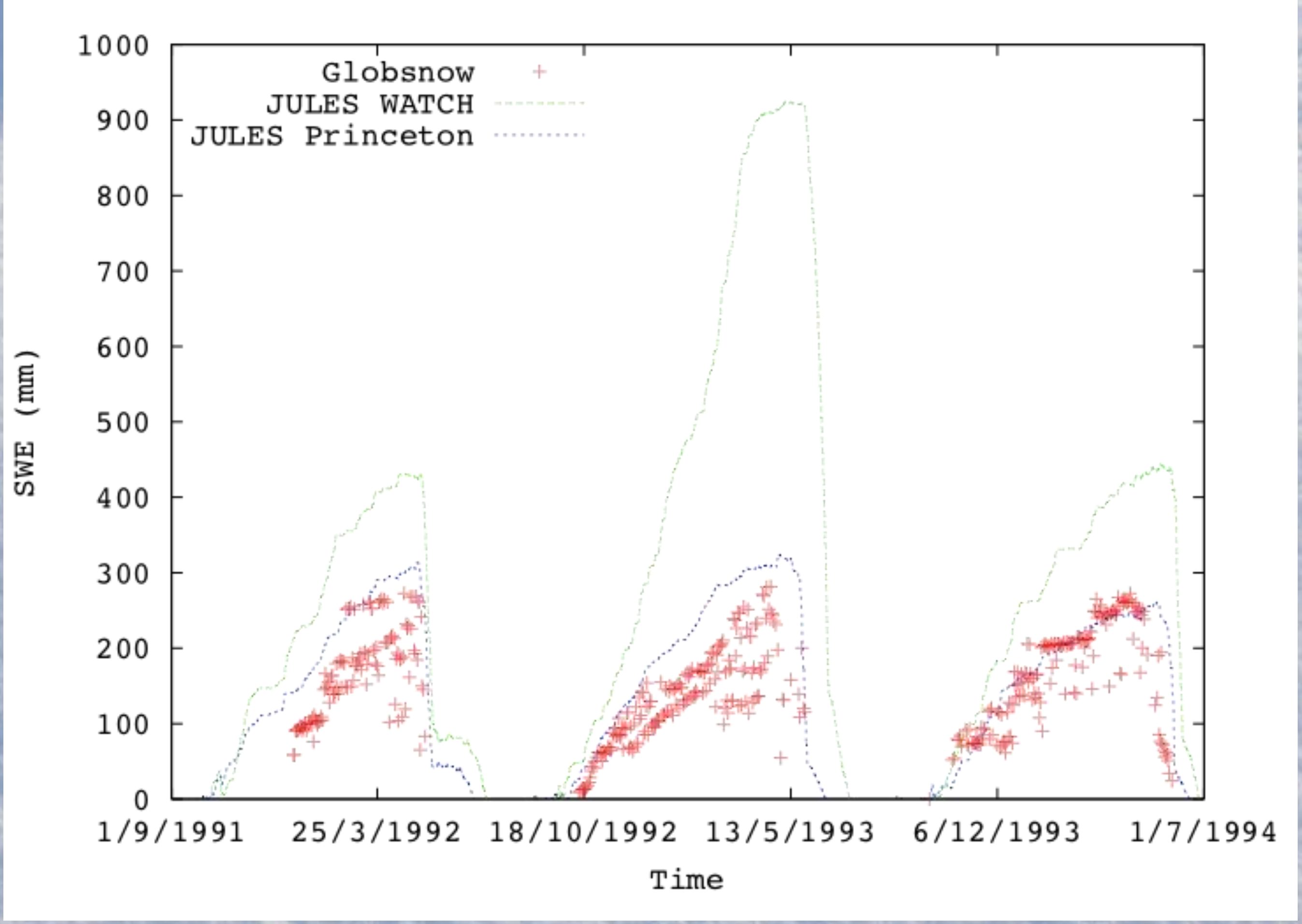
# Future work

- Initial results suggest that driving precipitation is the limiting factor of model accuracy.
  - Use Globsnow to achieve correct peak accumulation – in progess
- See if that improves melt date, runoff and vegetation green-up.
- If not test sensitivity to land cover and temperature.

# JULES BUG?

- Outputting “snowGrCanMeltT” causes a seg fault
  - in both v2.1.2 and v3.0

# WATCH BUG?



Globsnow
JULES WATCH
JULES Princeton
SWE (mm)
1000
900
800
700
600
500
400
300
200
100
0
1/9/1991
25/3/1992
18/10/1992
13/5/1993
6/12/1993
1/7/1994
Time

AMSR-E

2002 – 4$^{th}$ October 2011

# "TRUE" SNOW COVER

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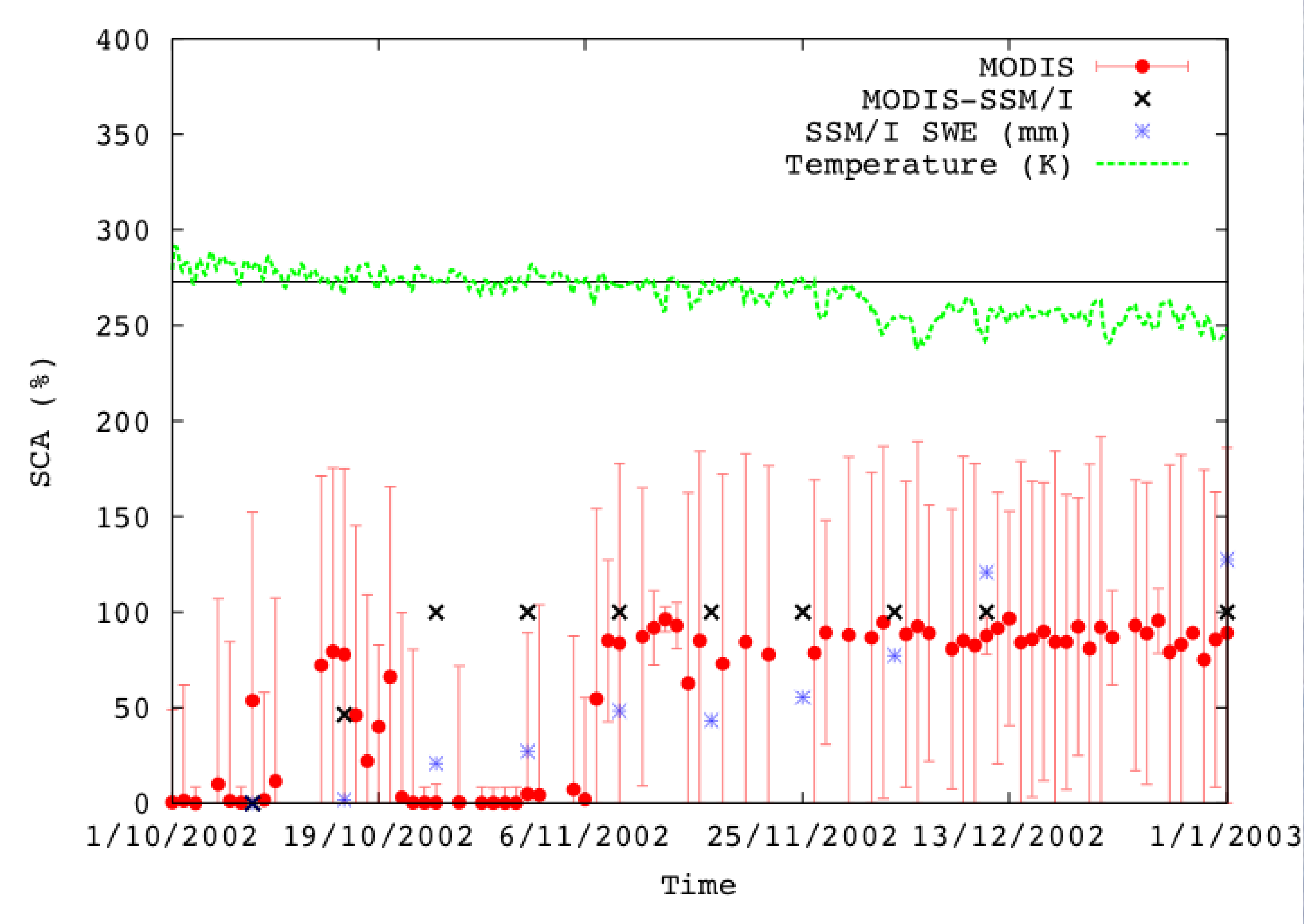
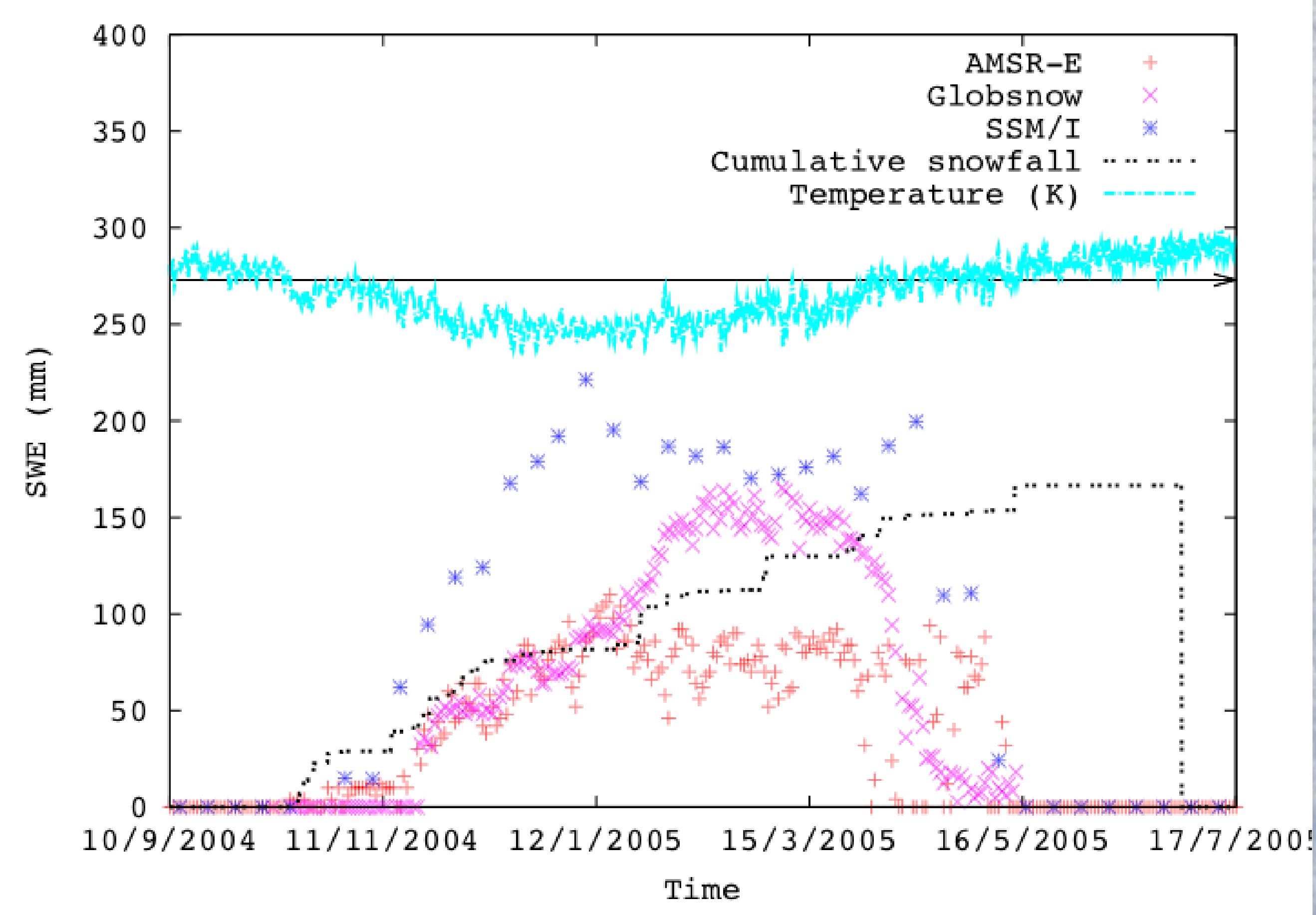



Durham University

# THE "TRUTH"




Comparison of Globsnow, AMSR-E and SSM/I SWE to Princeton meteorological data for Kevo and BERMS.