



The 1958-2008 Greenland ice sheet surface melt and the mid-tropospheric atmospheric circulation

by

X. Fettweis, Mabilie G., Epricum M. and Nicolay S.

EGU, Vienna, CL3
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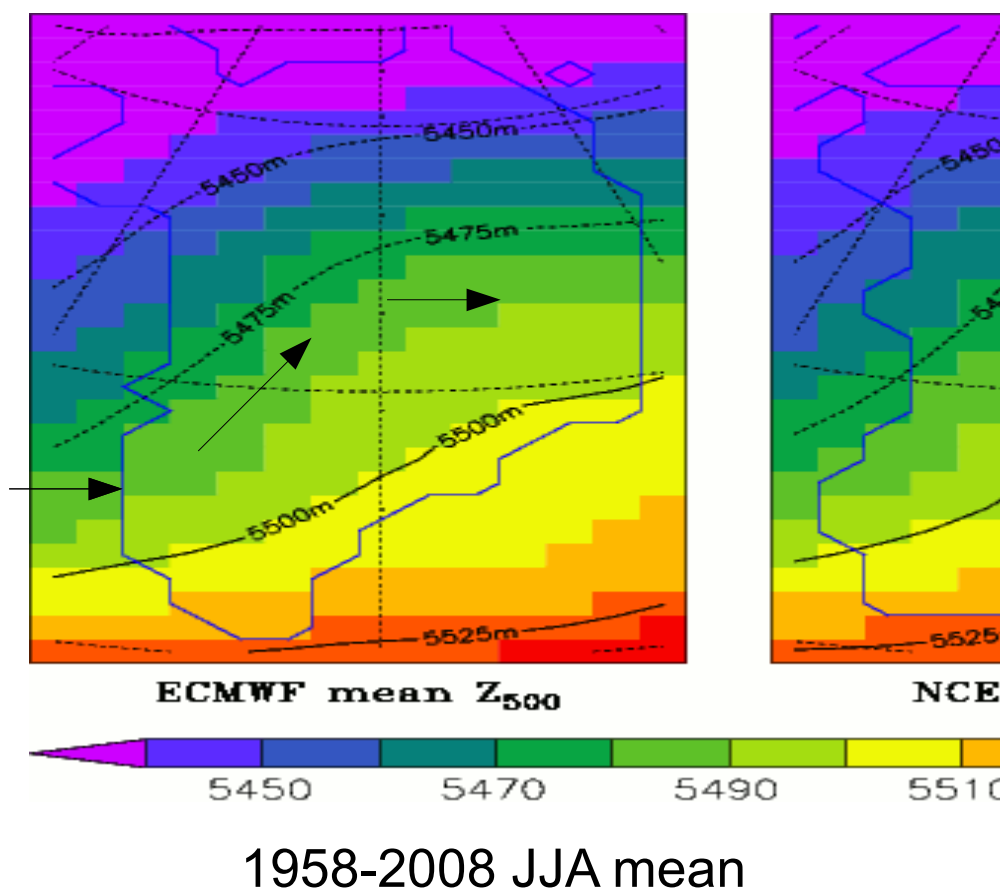
1. Circulation Type Classification (CTC)
2. CTC for 10 types with the Z500 from NCEP-NCAR
3. CTC and surfaces anomalies
4. Daily variability
5. Changes in Circulation since the 2000's

Reference:

Fettweis X., Mabilille G., Erpicum M. and Nicolay S.: The 1958-2008 Greenland ice sheet surface melt and the mid-tropospheric atmospheric circulation, *Climate Dynamics*, in preparation.

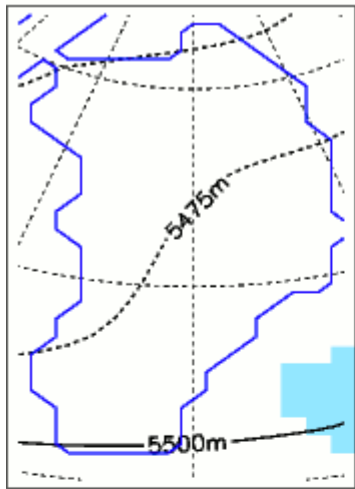
1. Circulation Type Classification (1/1)

**Correlation-based classification as Lund (1963)
over the 4692 JJA days of the 1958-2008 summers.**

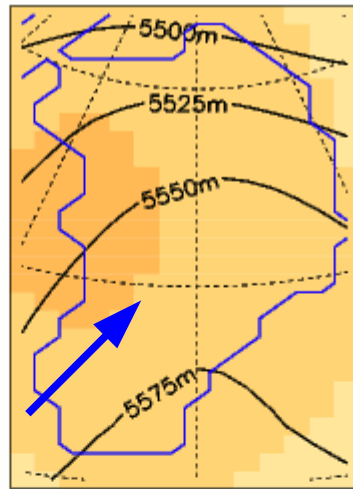


For more details, see poster **XY186**

2. CTC for 10 classes with NCEP-NCAR (1/1)



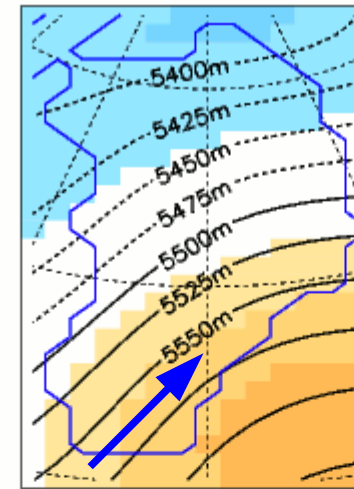
Type n°1 (23.2%)



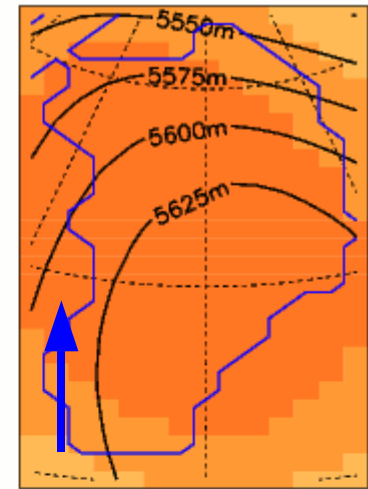
Type n°2 (20%)



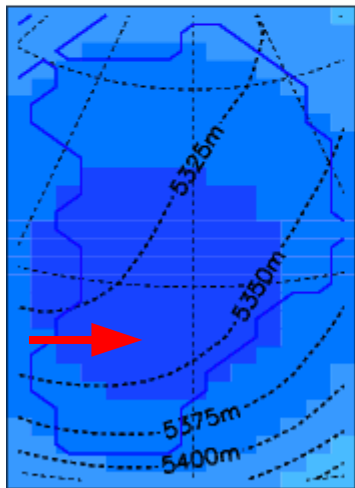
Type n°3 (21.6%)



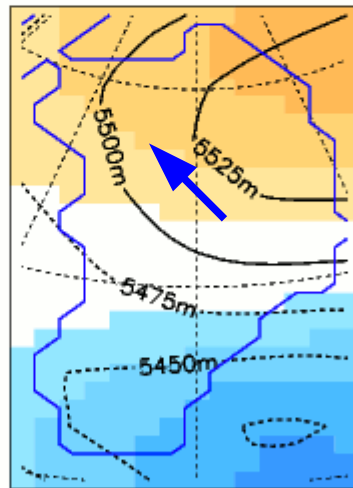
Type n°4 (9.2%)



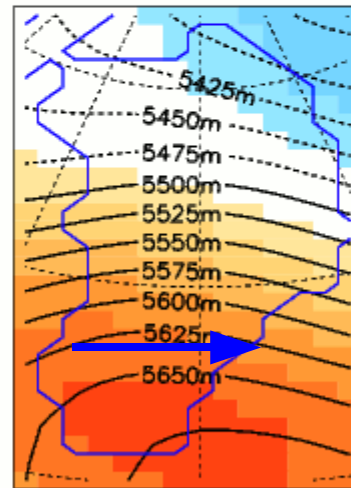
Type n°5 (8.5%)



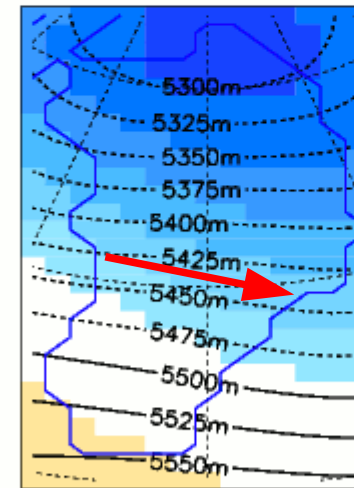
Type n°6 (6.9%)



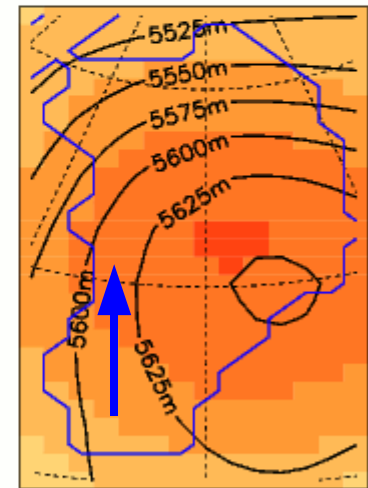
Type n°7 (5.8%)



Type n°8 (2.1%)

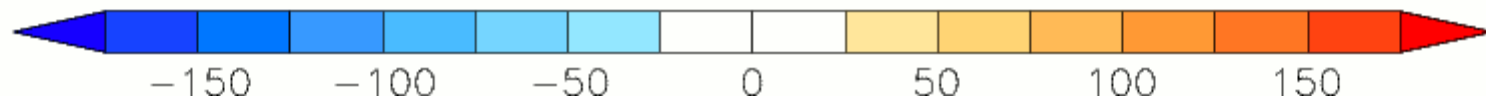


Type n°9 (1.2%)



Type n°10 (1%)

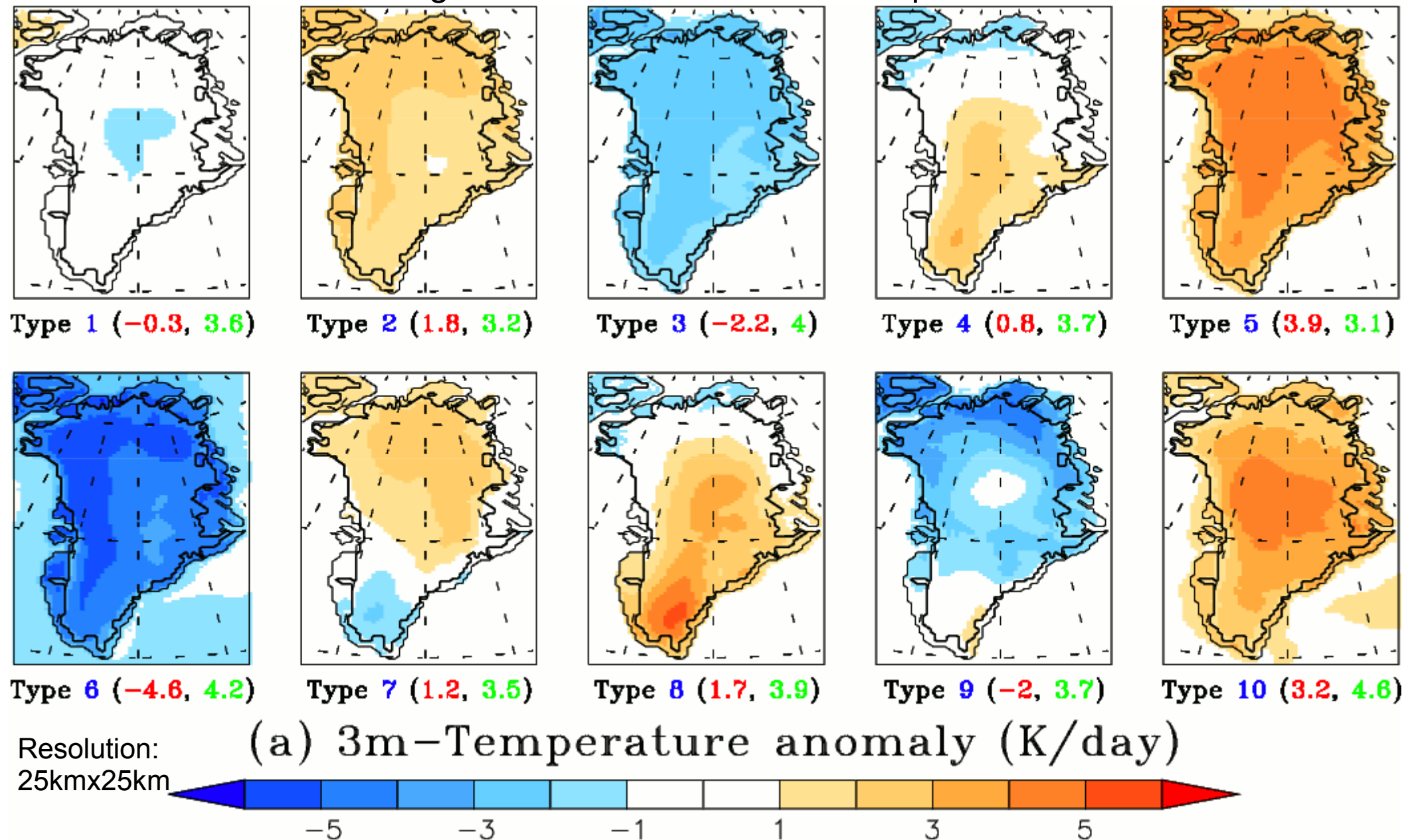
NCEP-NCAR Z_{500} anomaly (m)



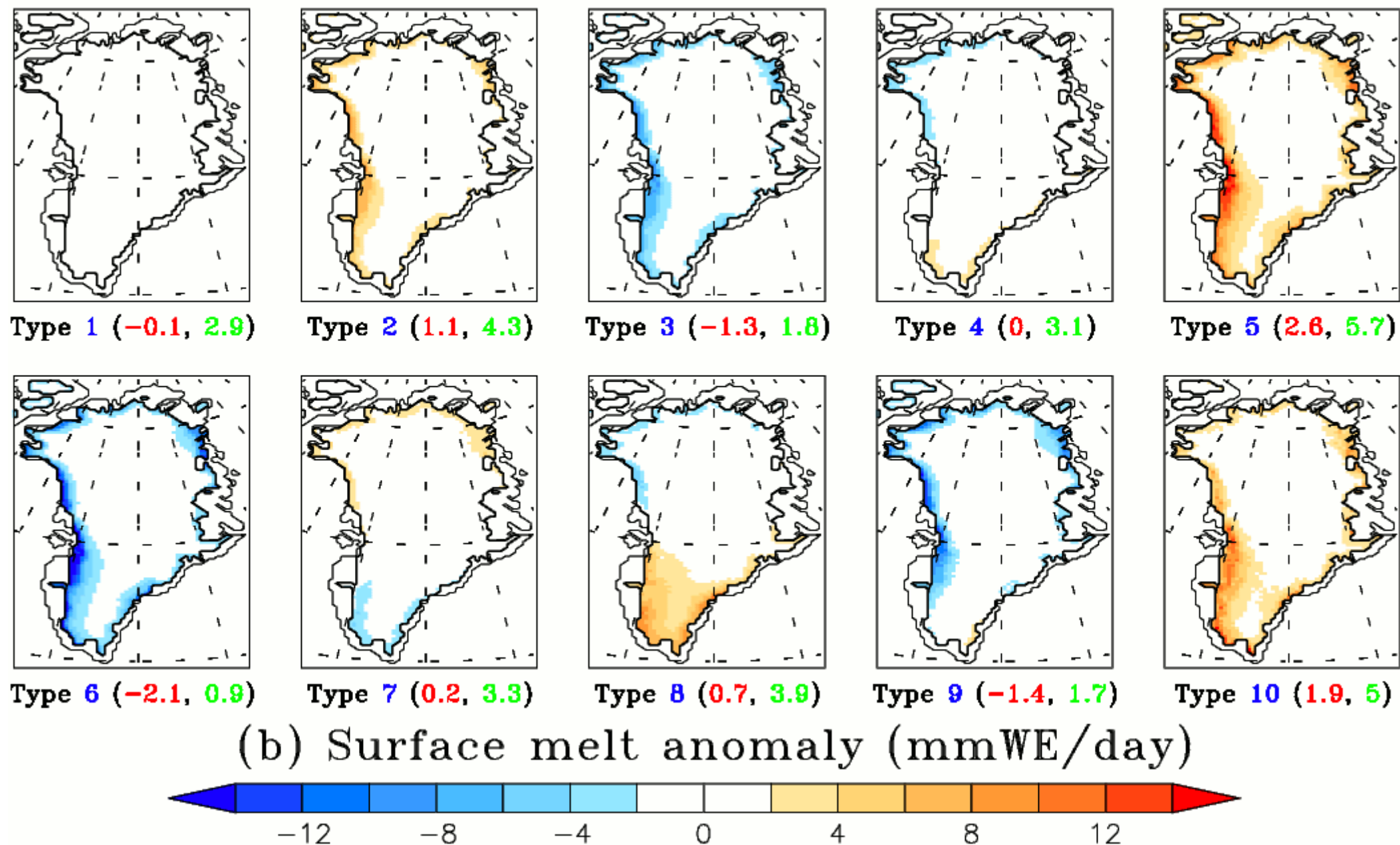
Resolution:
100kmx100km

3. CTC and surface anomalies (1/2)

Results from the regional climate model **MAR** coupled with a snow model

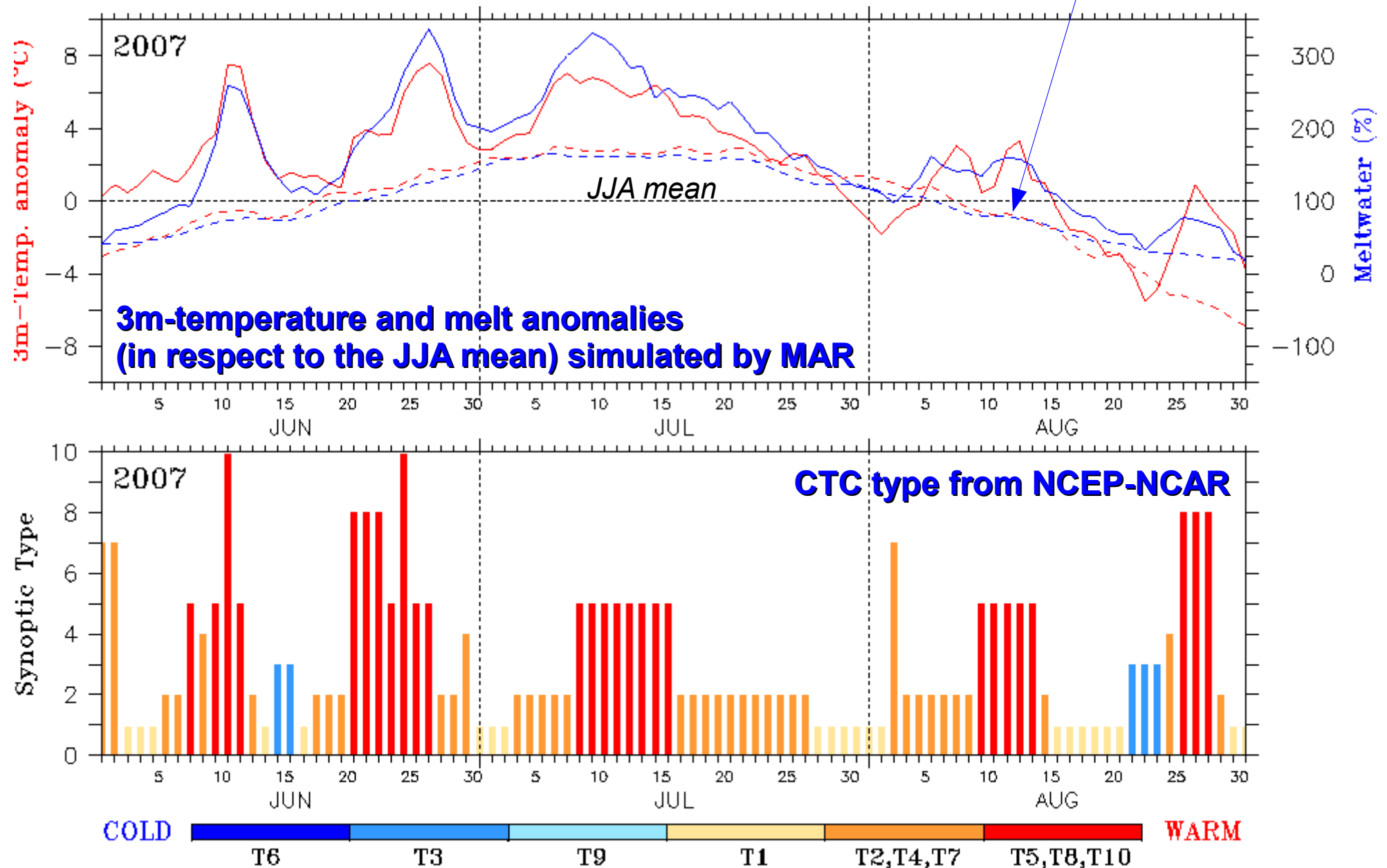


3. CTC and surface anomalies (2/2)



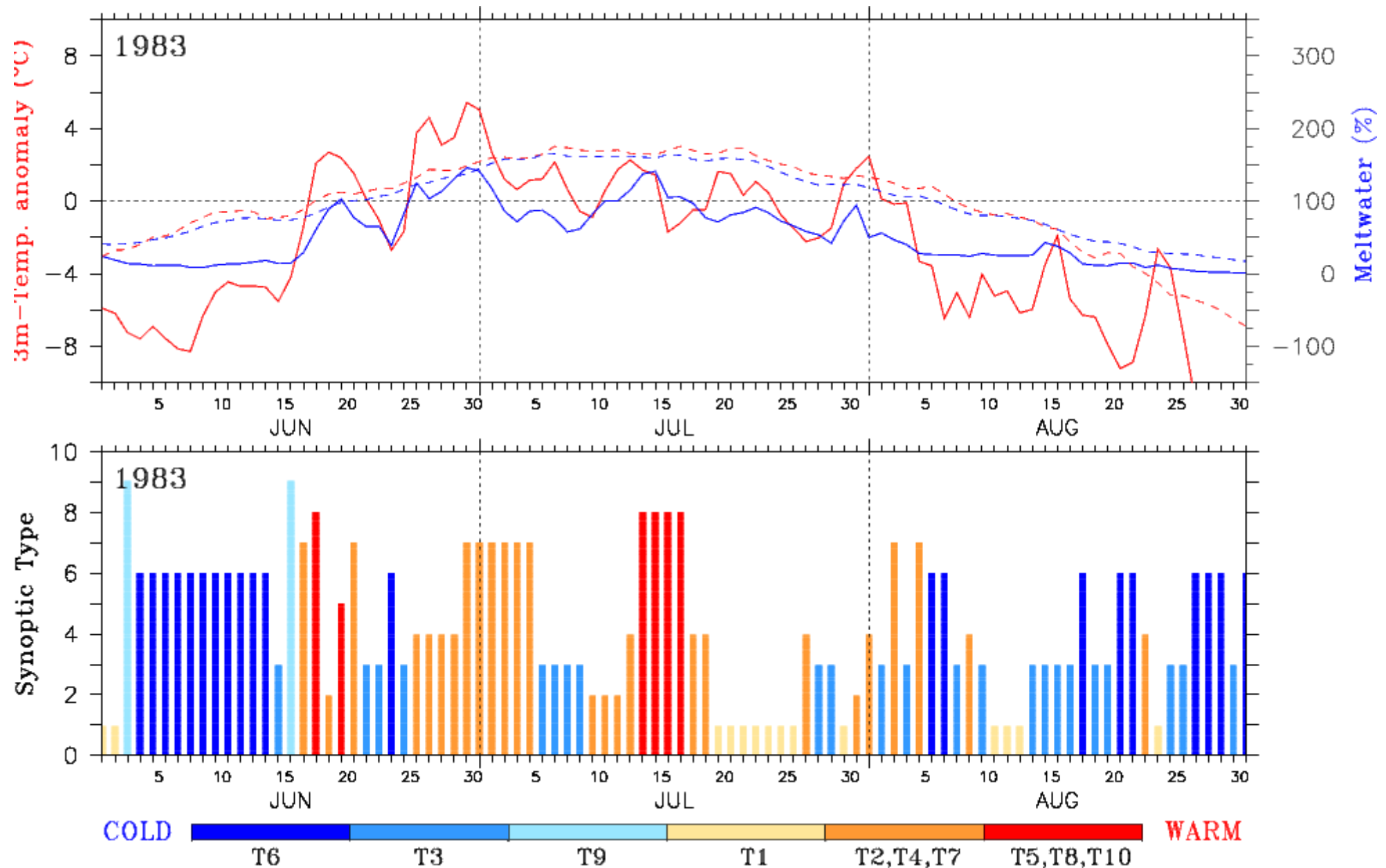
4. Daily variability (1/3)

In dash, daily 1958-2008 mean
3m-temperature and meltwater

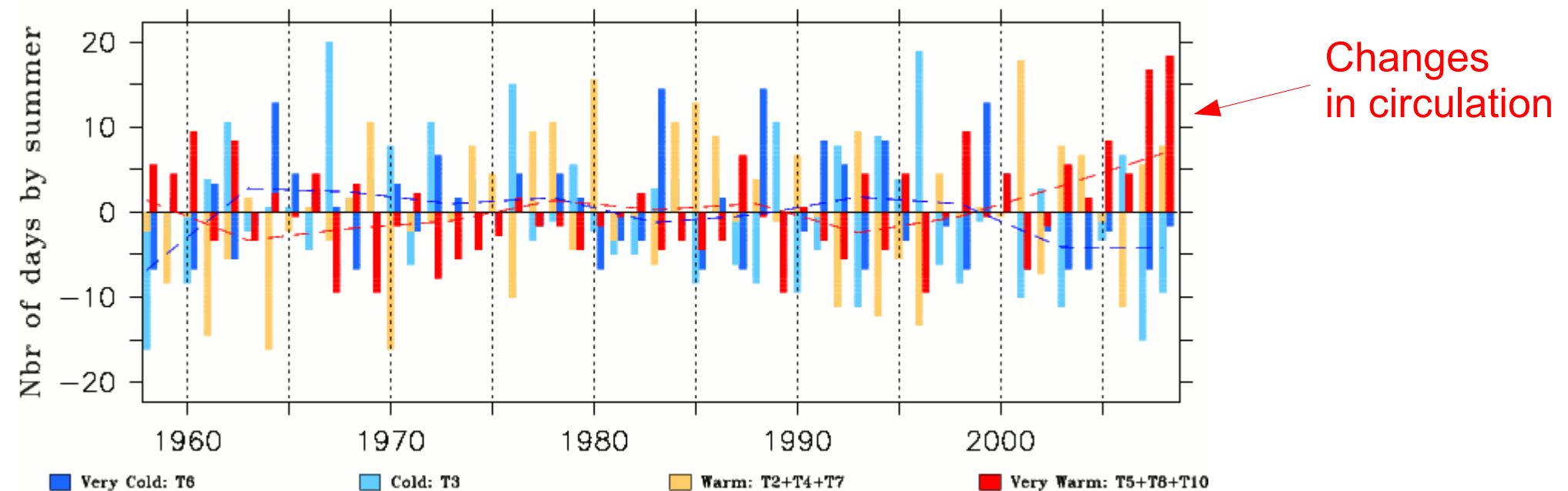
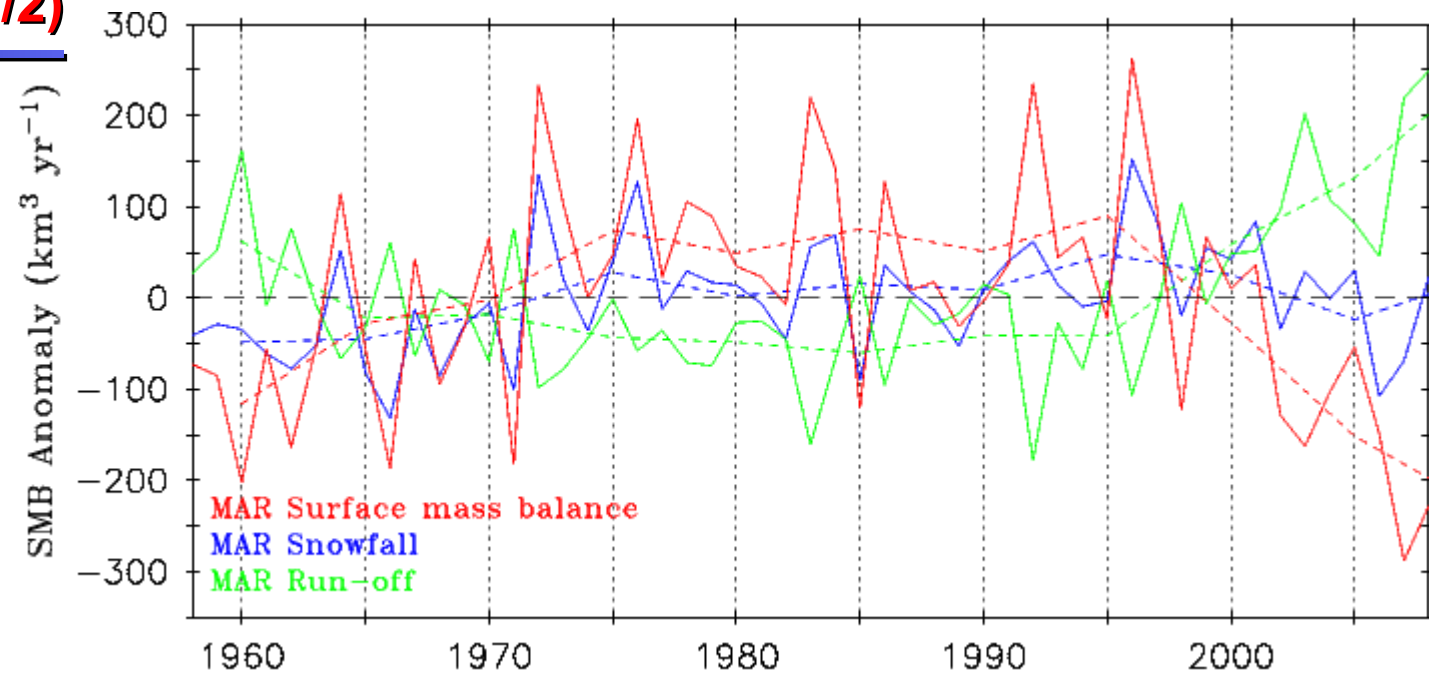


4. Daily variability (2/3)

After the El Chichon volcano eruption ...

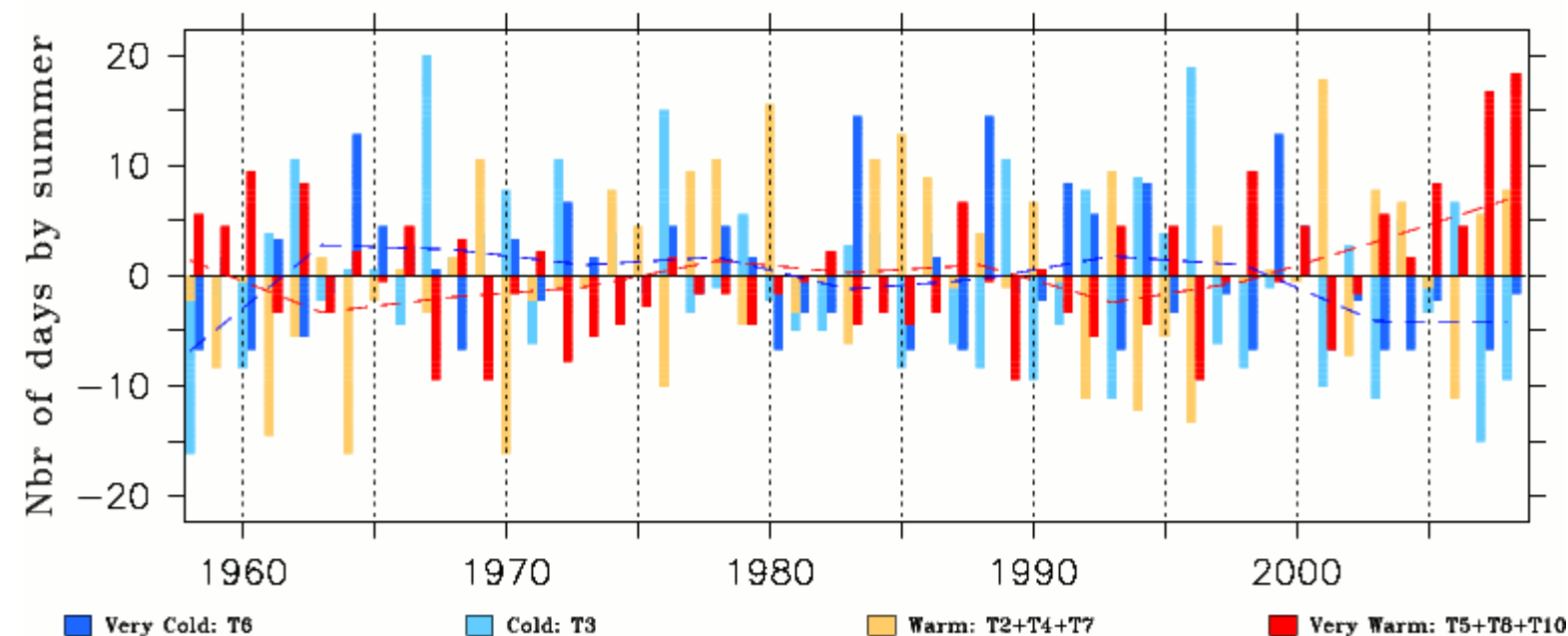
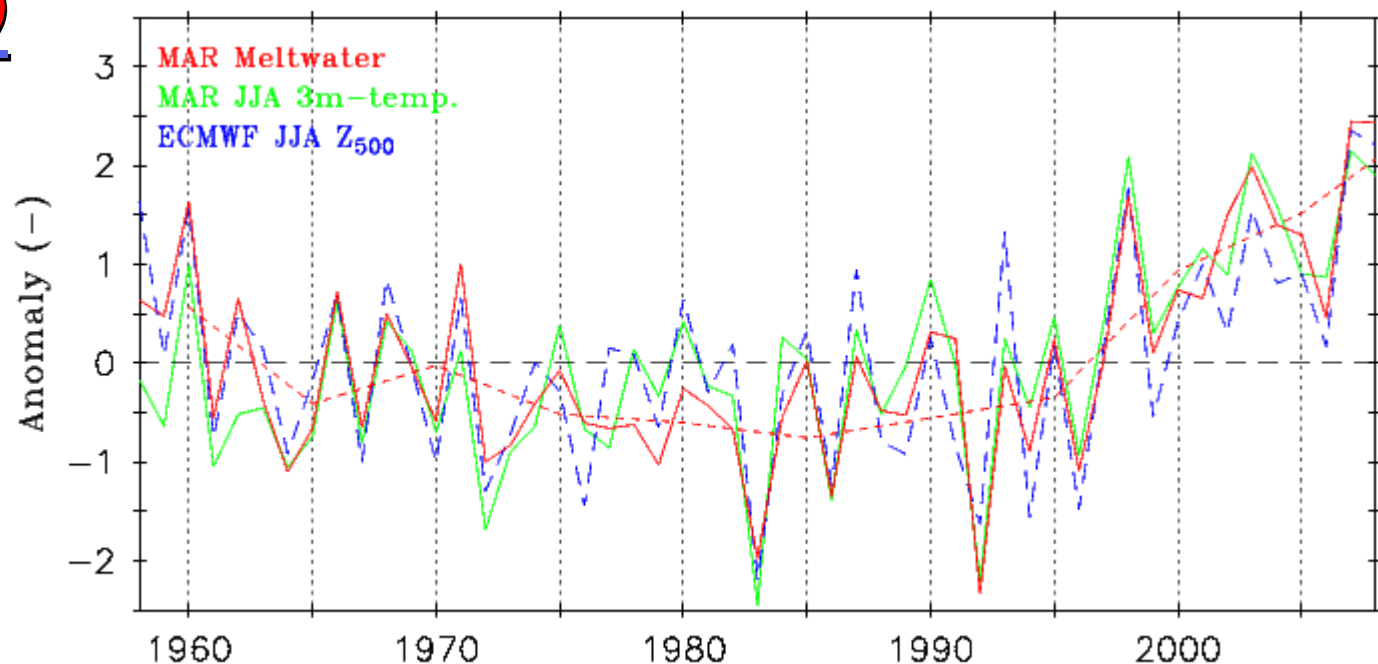


5. Changes (1/2)



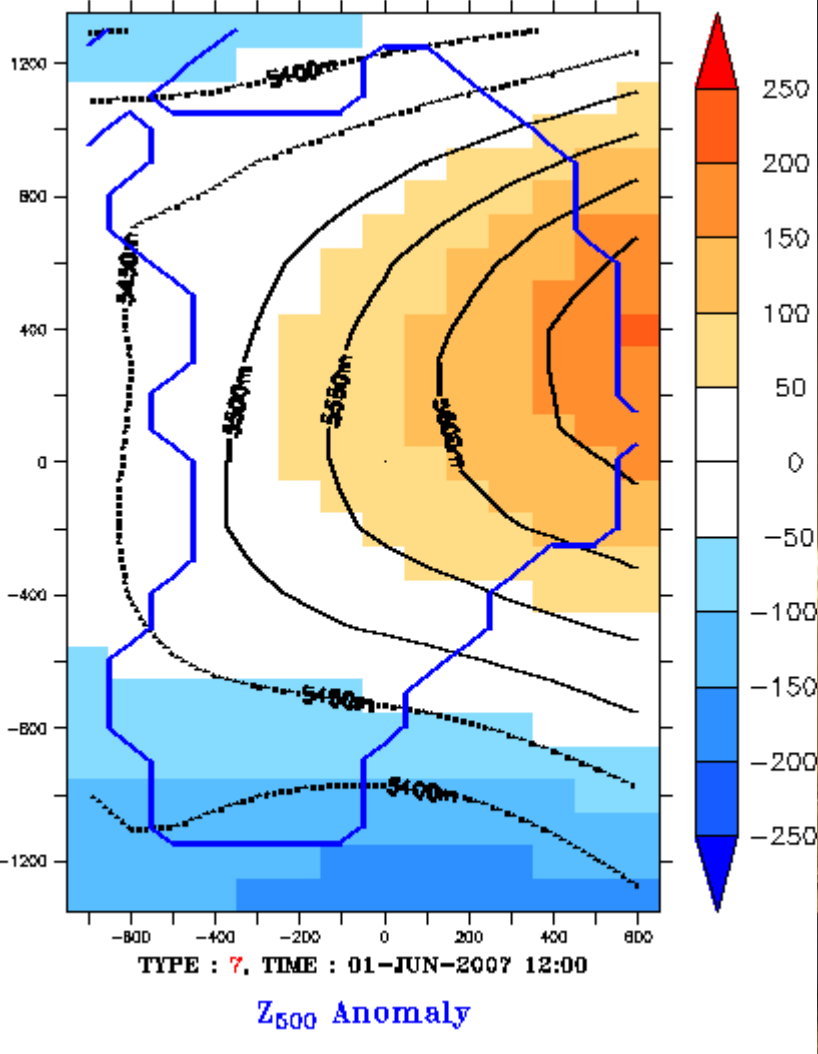
NCEP-NCAR reanalysis with 10 classes

5. Changes (2/2)



**More circulations
favouring warm events**

NCEP-NCAR reanalysis with 10 classes

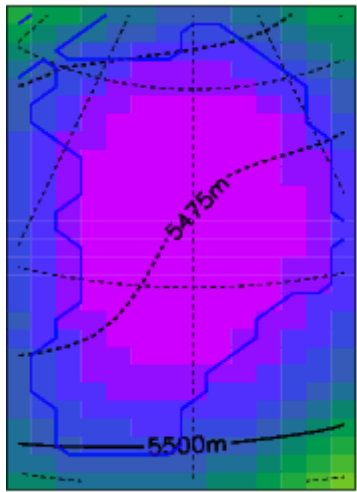


***Thanks for
your attention !***

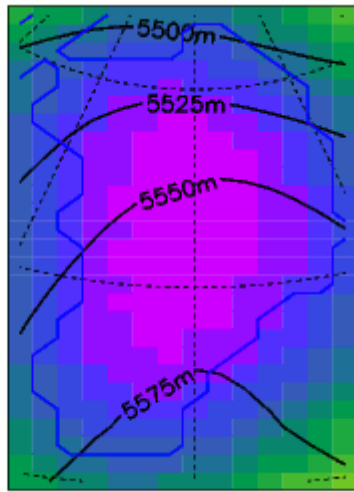
Poster **CL3-XY186** (Hall XY, 23 Apr 17:30-19:00): Franco B., Fettweis X., Epricum M. And Nicolay S.
Greenland ice sheet surface mass balance projections from IPCC AR4 global models

Poster **CR6.1-XY330** (Hall XY, 24 Apr 13:30-15:00) Fettweis X. and Franco B.
The 1958-2008 Greenland ice sheet surface mass balance variability simulated by the regional climate model MAR

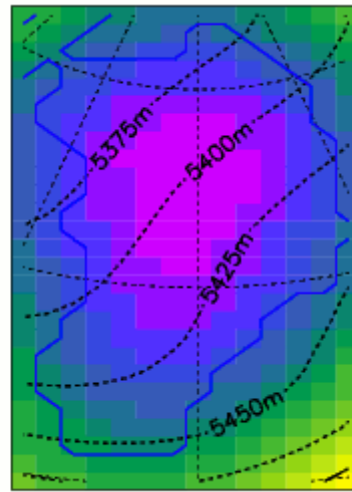
2. CTC for 10 classes with NCEP-NCAR (2/2)



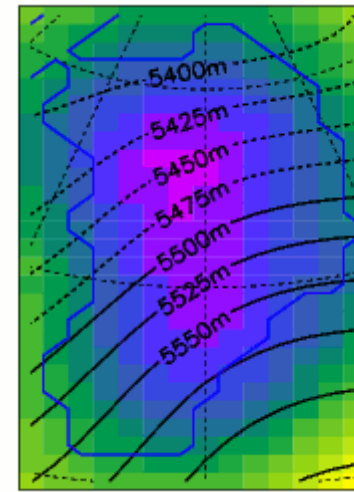
Type n°1 (41m)



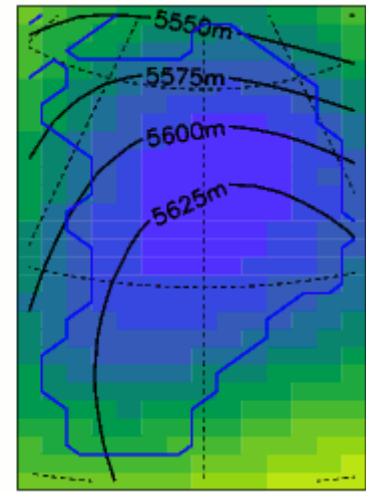
Type n°2 (44m)



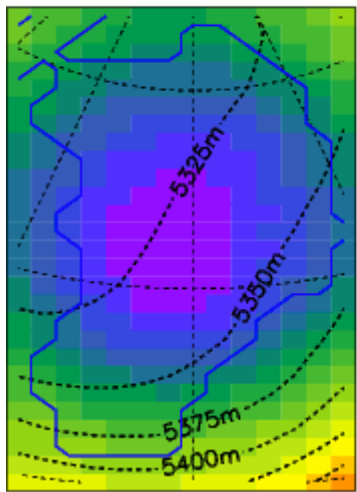
Type n°3 (48m)



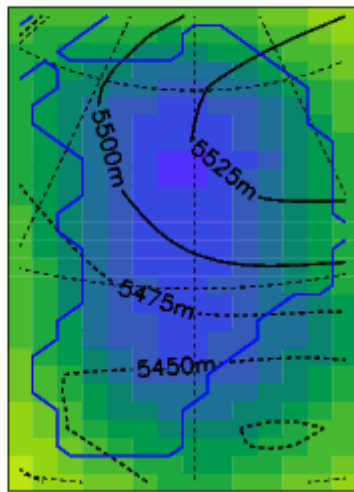
Type n°4 (53m)



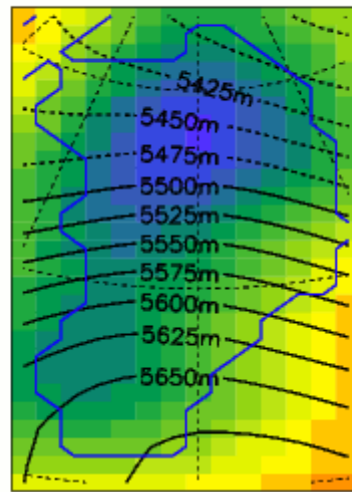
Type n°5 (57m)



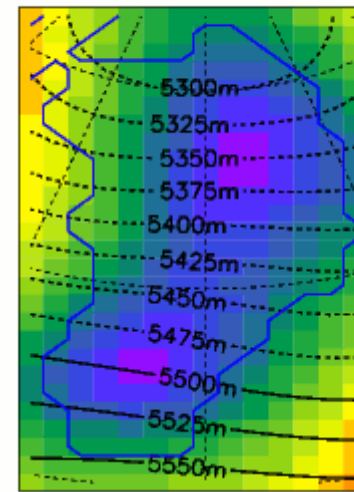
Type n°6 (57m)



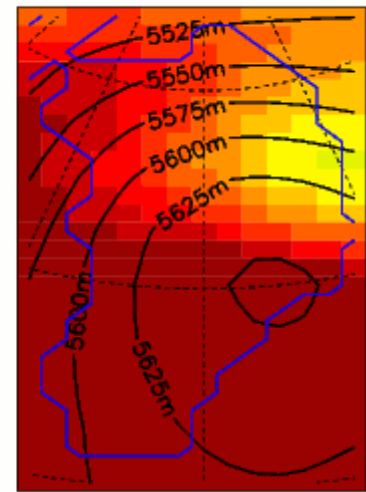
Type n°7 (62m)



Type n°8 (72m)



Type n°9 (61m)



Type n°10 (144m)

NCEP-NCAR Z_{500} standard deviation (m)



45

55

65

75

85

95

105

115

125

135

1. Circulation Type Classification (1/1)

Correlation-based classification as Lund (1963).

1. Let $Z500(d)$ be the 500hPa geopotential height surface at 12h TU at day d .

There are 4692 Jun-Jul-Aug
Days from 1958 to 2008.

$$\forall i \in [1, N], \forall j \in [1, M]: STDEV_{Z500}(i, j) = 1$$

$$i(\text{day}_1, \text{day}_2) = 1 - \frac{1}{2} \cdot \frac{\sum_{i,j=1}^{N,M} |Z500(i, j, \text{day}_1) - Z500(i, j, \text{day}_2)|}{N \cdot M}$$

Similarity index

2. The class C_k contains all days d such that:

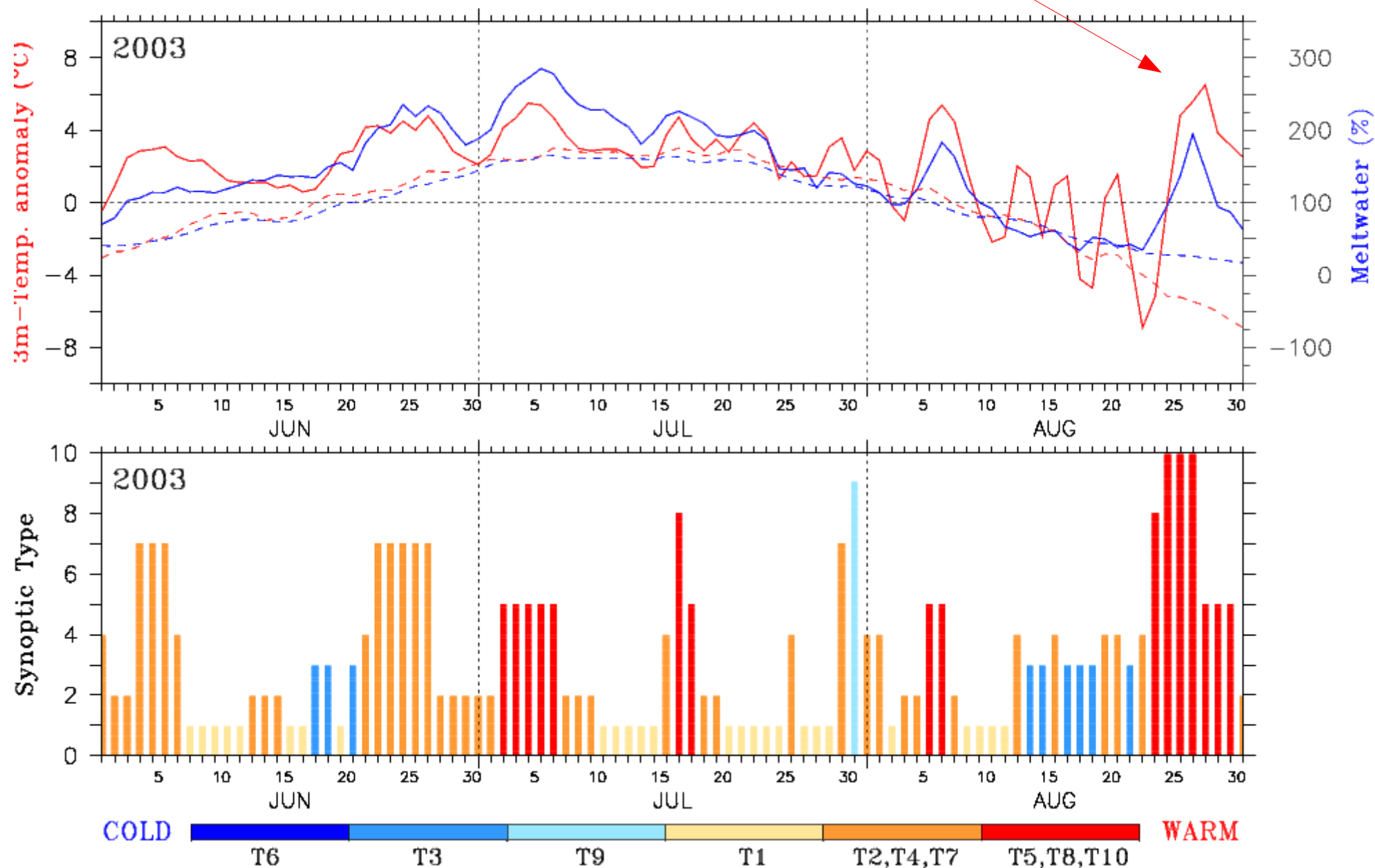
$$i(\text{day}_k, d) \geq i_c - \epsilon \cdot (k-1), k \in [1, K]$$

Reference day

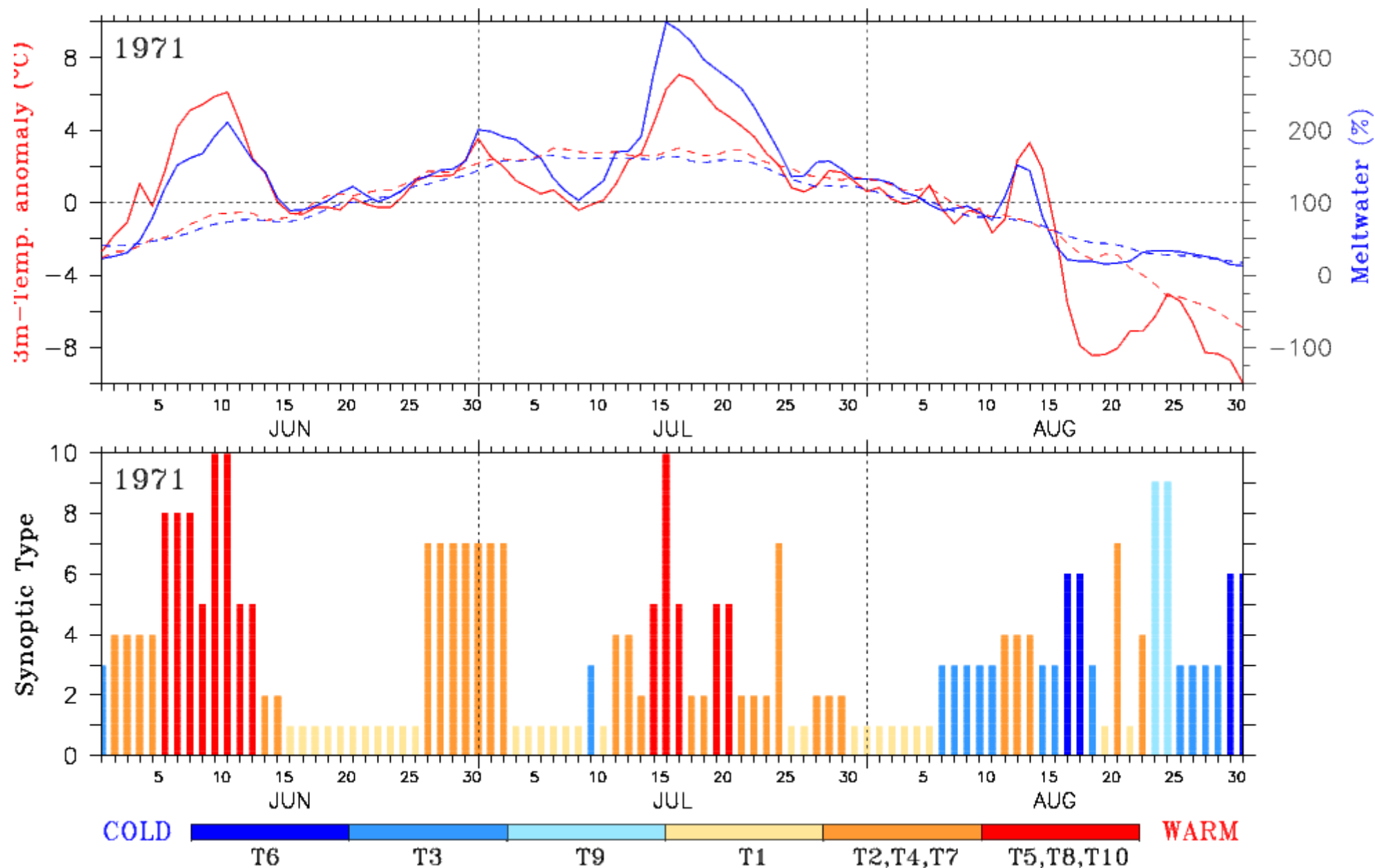
The parameters are computed to
minimise the within-class variability.

4. Daily variability (3/3)

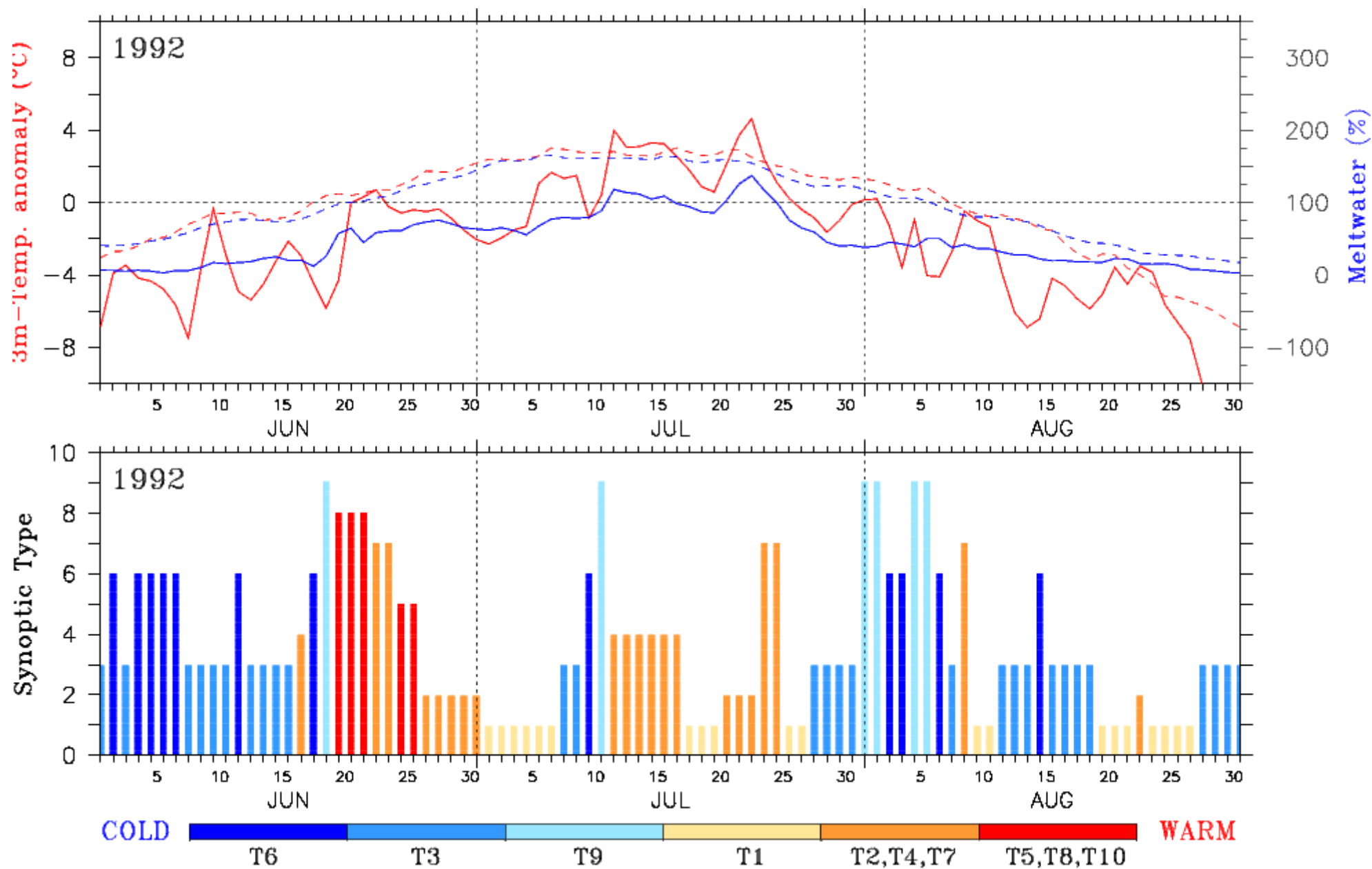
Record temperature anomalies



1. Method (1/3)



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