

## Added Value of RCMs

# RCM Added Value

## A GCM-RCM scientists battle?

Users outside the scientific GCM/RCM community:

- „We want high resolution data!“

This is a demand right now!

GCM scientists:

- „What are RCMs worth for?“

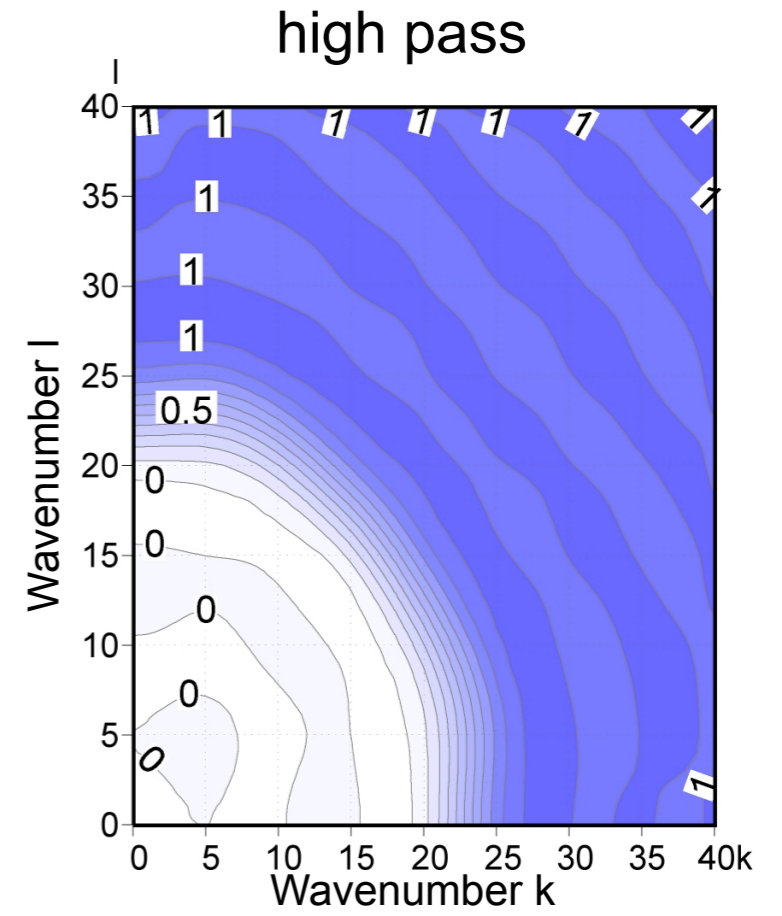
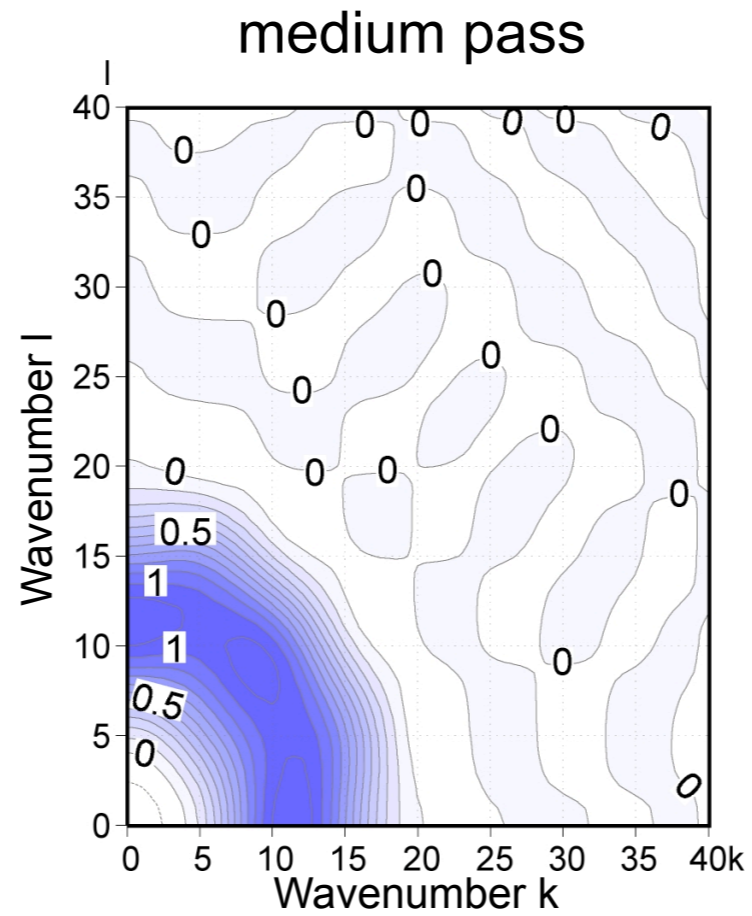
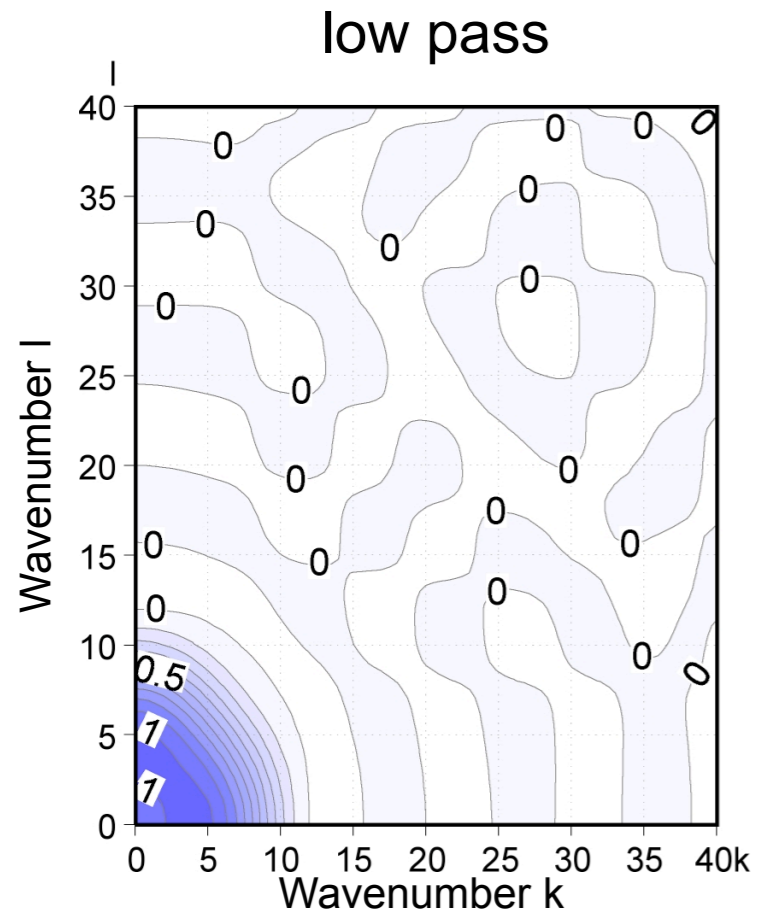
# 1. Example

Feser, F., 2006: Enhanced Detectability of Added Value in Limited-Area Model Results Separated into Different Spatial Scales, *Mon. Weather Rev.*, **134**, 2180 - 2190

Application of a 2D digital filter to separate model results into different spatial scales by filtering certain wavenumber ranges.

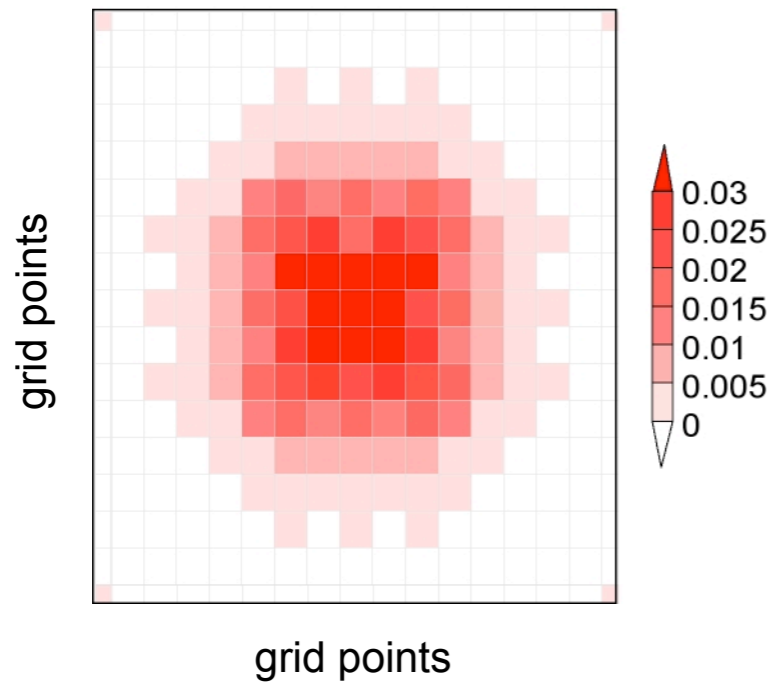
(Feser, F., and H. von Storch, 2005: A spatial two-dimensional discrete filter for limited-area-model evaluation purposes. *Mon. Wea. Rev.*, 133, 1774–1786.)

# Response Function

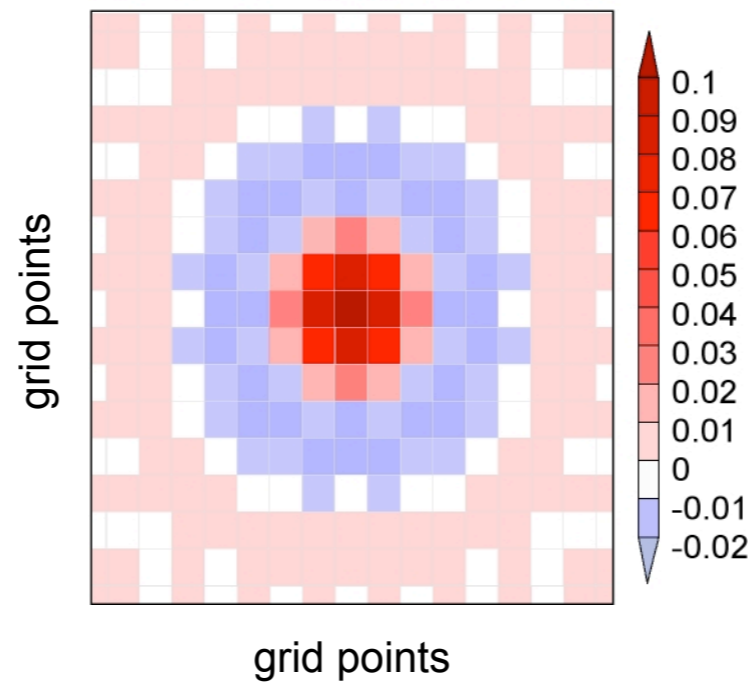


# Filter weights

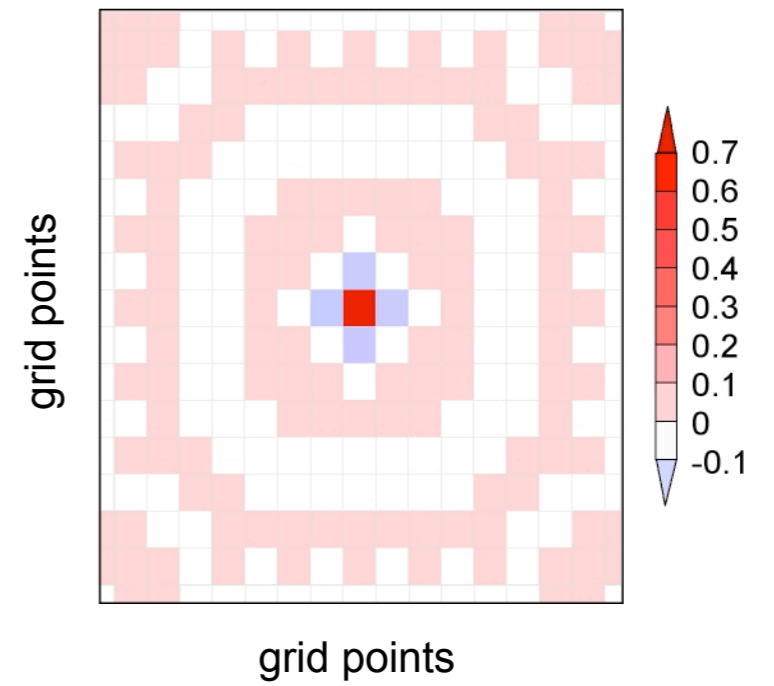
## low pass



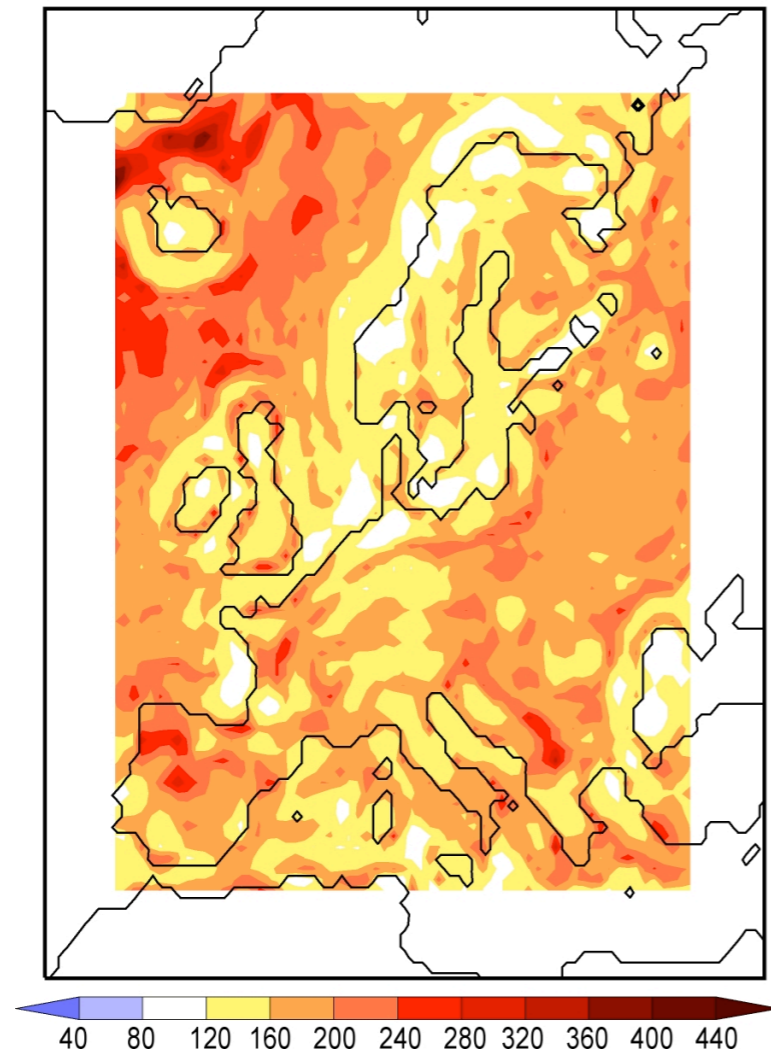
## medium pass



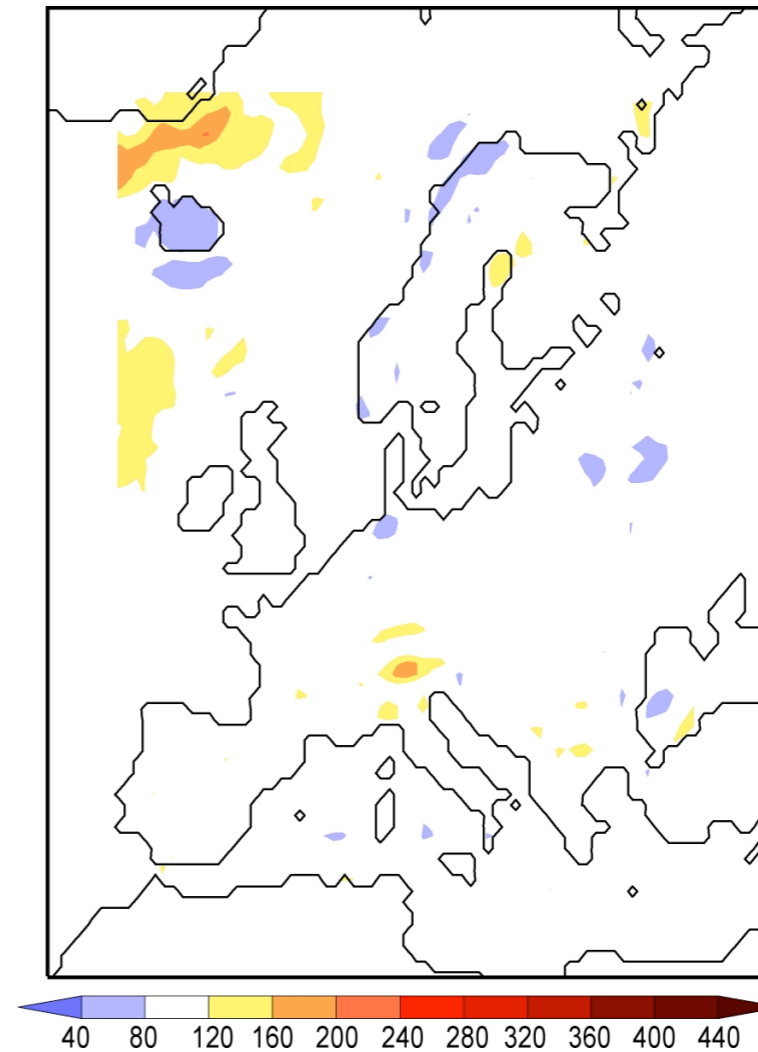
## high pass



## Added Value



Relation in standard deviation of 2m-temperatures  
**DWD-Analysis / NCEP Reanalysis [%],**  
JJA 1992 – 1999,  
on the regional scale (band pass filter).



Relation in standard deviation of 2m-temperatures  
**DWD-Analyse / RCM hindcast [%],**  
JJA 1992 – 1999,  
on the regional scale (band pass filter).

## Musterkorrelationskoeffizienten [PCC, %]

var	season	field	$P_{DWD}$	$(EP)$	$\Delta_{sn,NCEP}$	$\Delta_{nn,NCEP}$
SLP	DJF	unfiltered	99.4		-0.7*	-2.2*
		low pass	99.6		-1.0*	-3.4*
		medium pass	91.3		<b>1.4*</b>	-1.1*
SLP	JJA	unfiltered	98.0		-2.0*	-8.0*
		low pass	98.5		-2.6*	-11.6*
		medium pass	84.2		<b>4.1*</b>	-0.6
T	DJF	unfiltered	96.0		<b>1.0*</b>	<b>0.5*</b>
		low pass	95.8		<b>0.8*</b>	-0.8*
		medium pass	76.9		<b>3.6*</b>	<b>1.5*</b>
T	JJA	unfiltered	95.8		<b>1.4*</b>	<b>0.5*</b>
		low pass	96.3		<b>0.8*</b>	-1.0*
		medium pass	65.4		<b>10.4*</b>	<b>6.1*</b>

Positive values (in bold) show added value of RCM

95% significant deviations are marked with an \*

PCC  
DWD und NCEP

PCC  
changes due to RCM with SN

PCC  
changes due to RCM without SN

## 2. Example

Winterfeldt, J., 2008: Comparison of measured and simulated wind speed data in the North Atlantic, PhD thesis, GKSS Forschungszentrum Report (also submitted to peer reviewed journal)

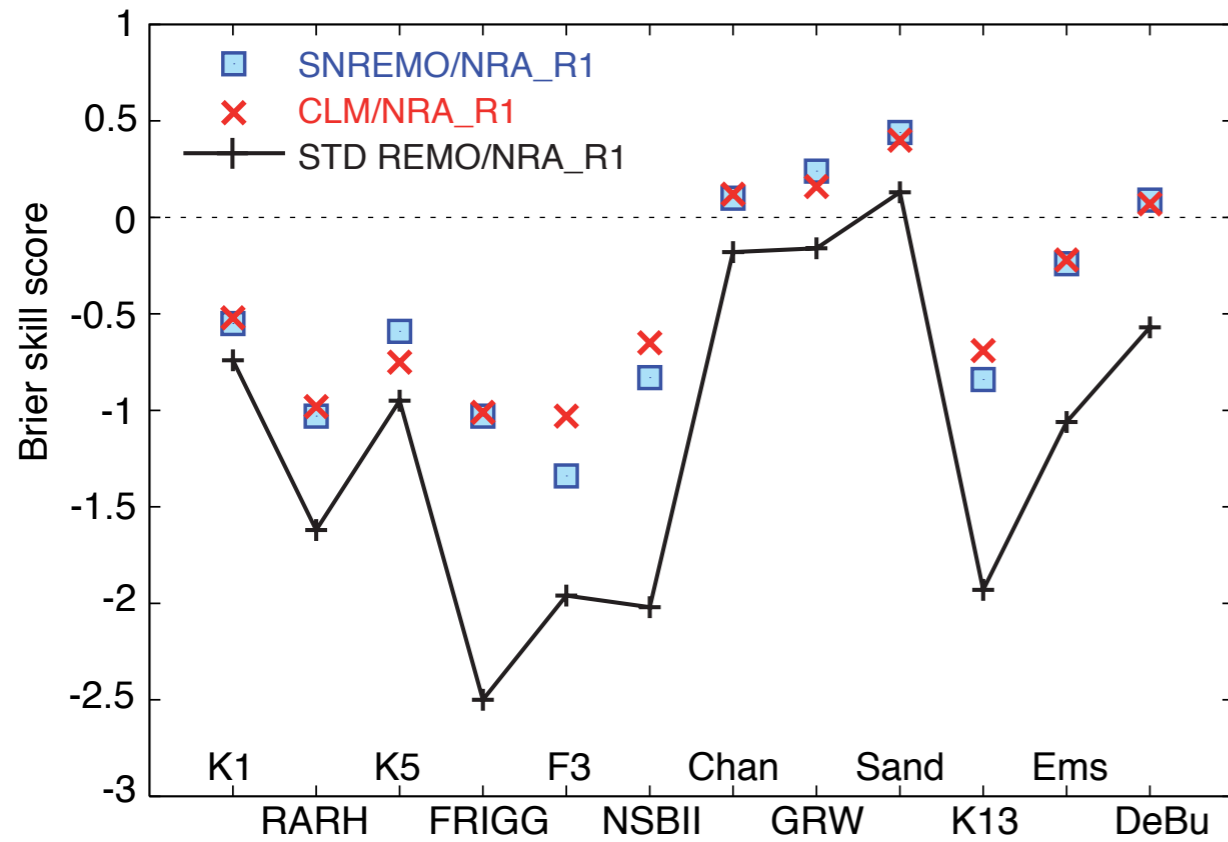
Added value in near surface wind speed ?

NCEP-RA vs. RCMs (REMO, with and without spectral nudging, CLM)

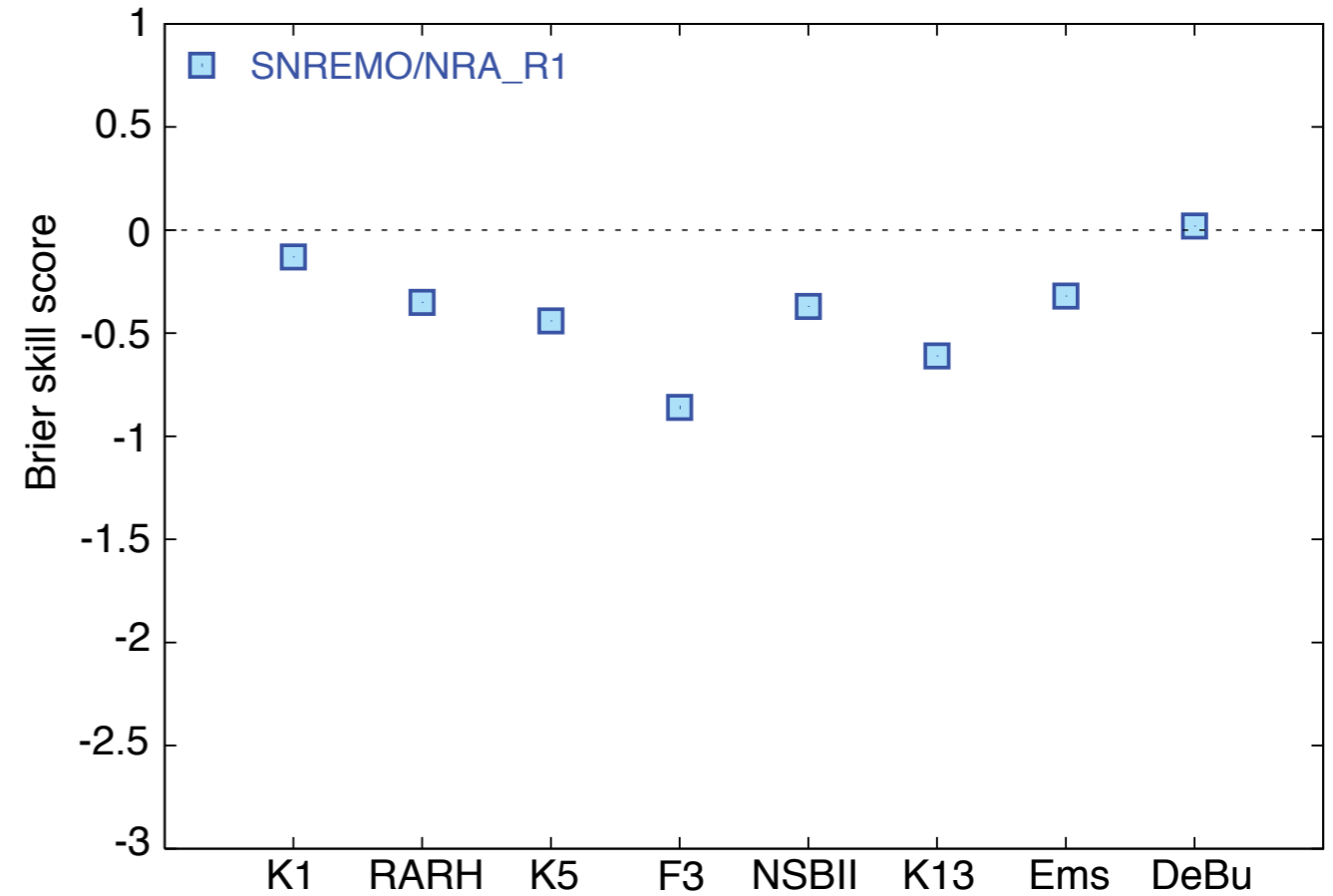


# 2. Example (1)

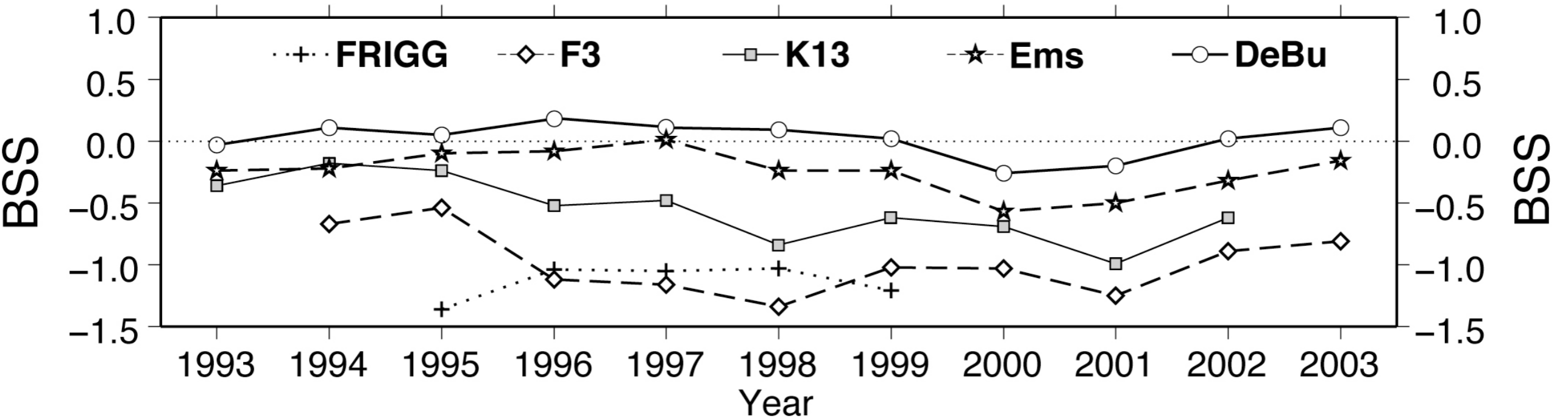
1998



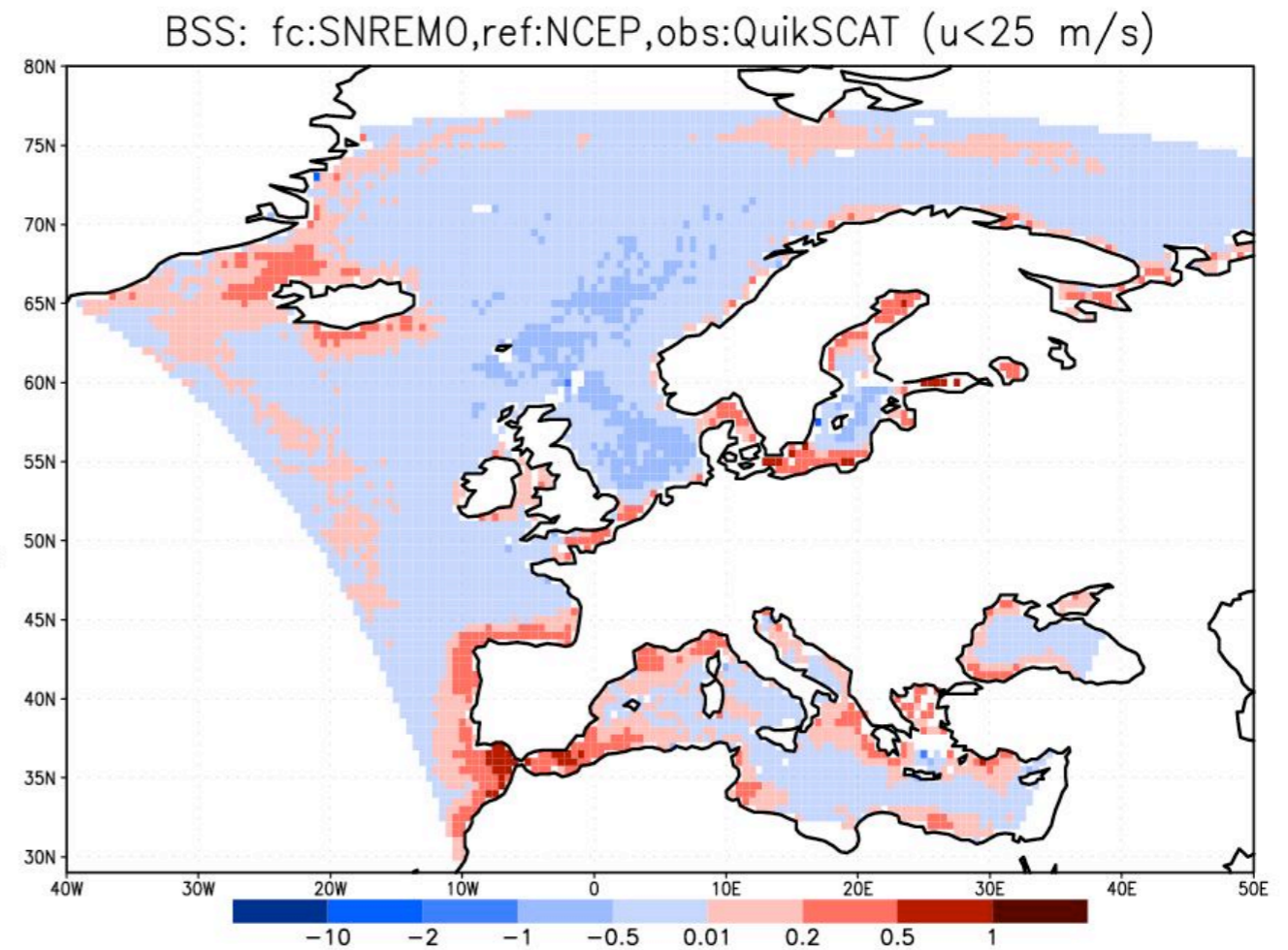
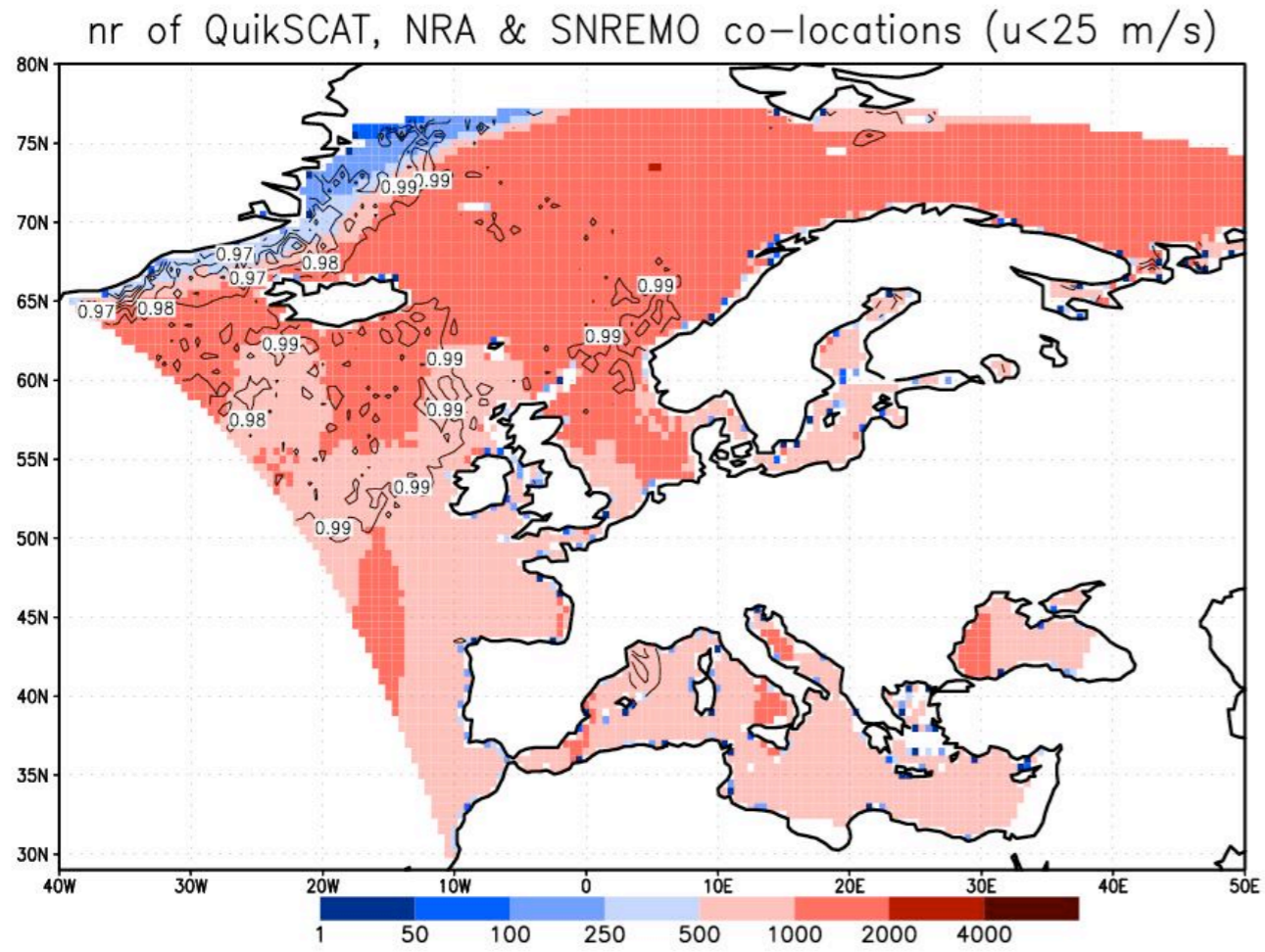
1999



## 2. Example (2)



## 2. Example (3)



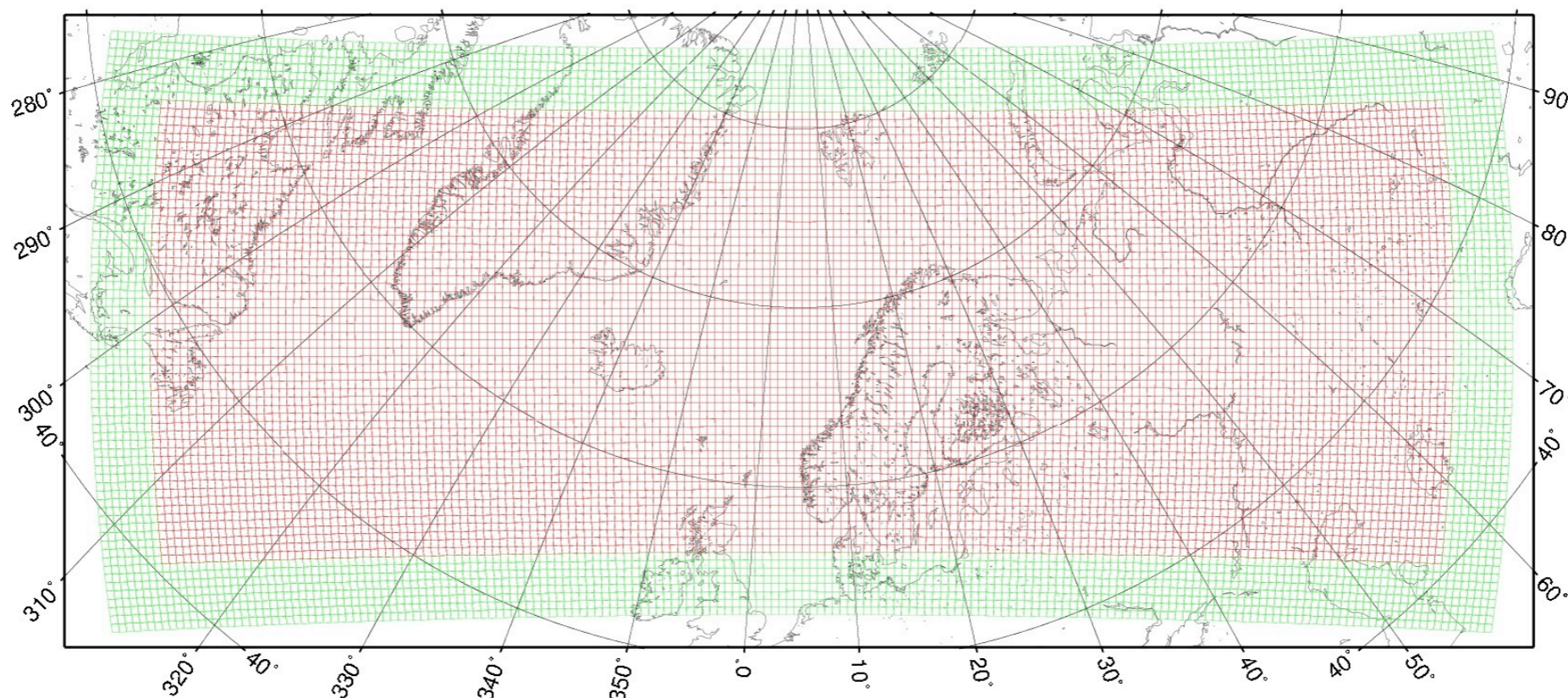
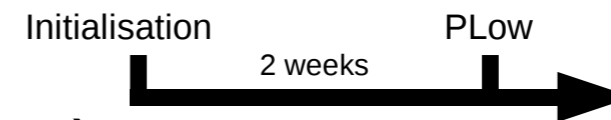
# 3. Example

Zahn, M., H. von Storch, and S. Bakan, 2008, Climate mode simulation of North Atlantic Polar Lows in a limited area model, *TellusA*, Vol. 60, pp 620-631



Ensemble simulations (2x4) with CLM ( ~50km ) in **climate mode** for polar low cases **Oct. 1993** (and Dec. 1993, Jan. 1998)

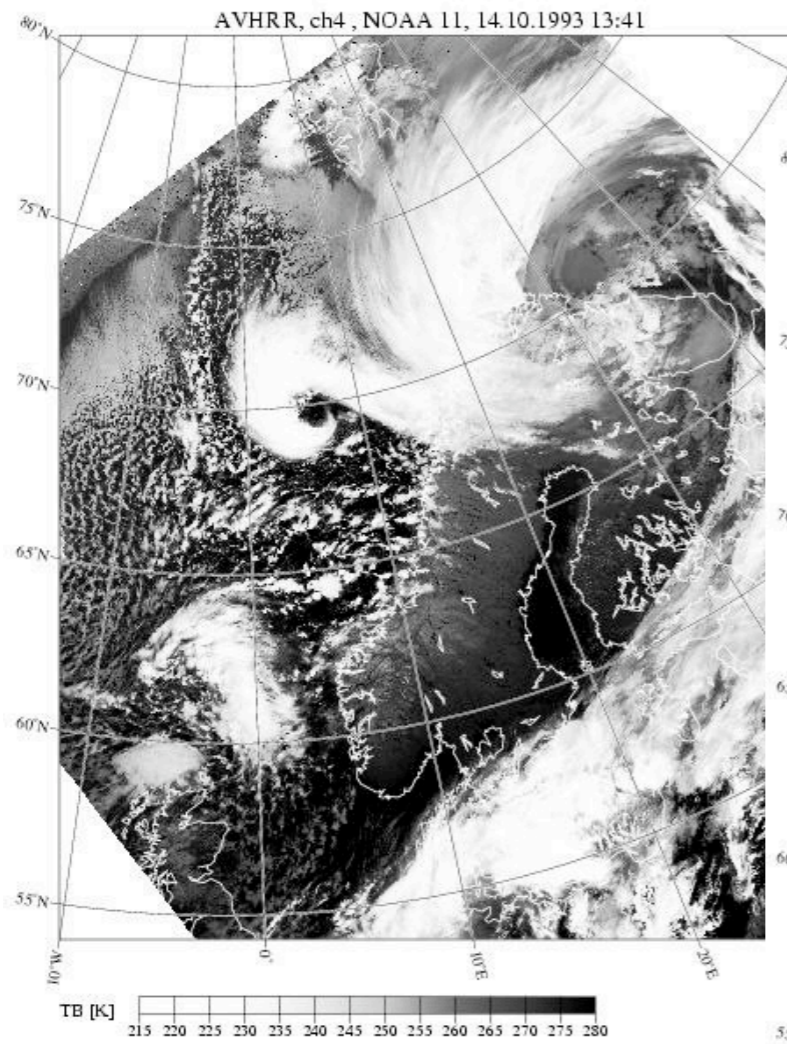
- Driven by the NCEP reanalysis
- Initial times
- Spectral Nudging (4x) and without (4x)
  - Different waves (above appr. 700 km)





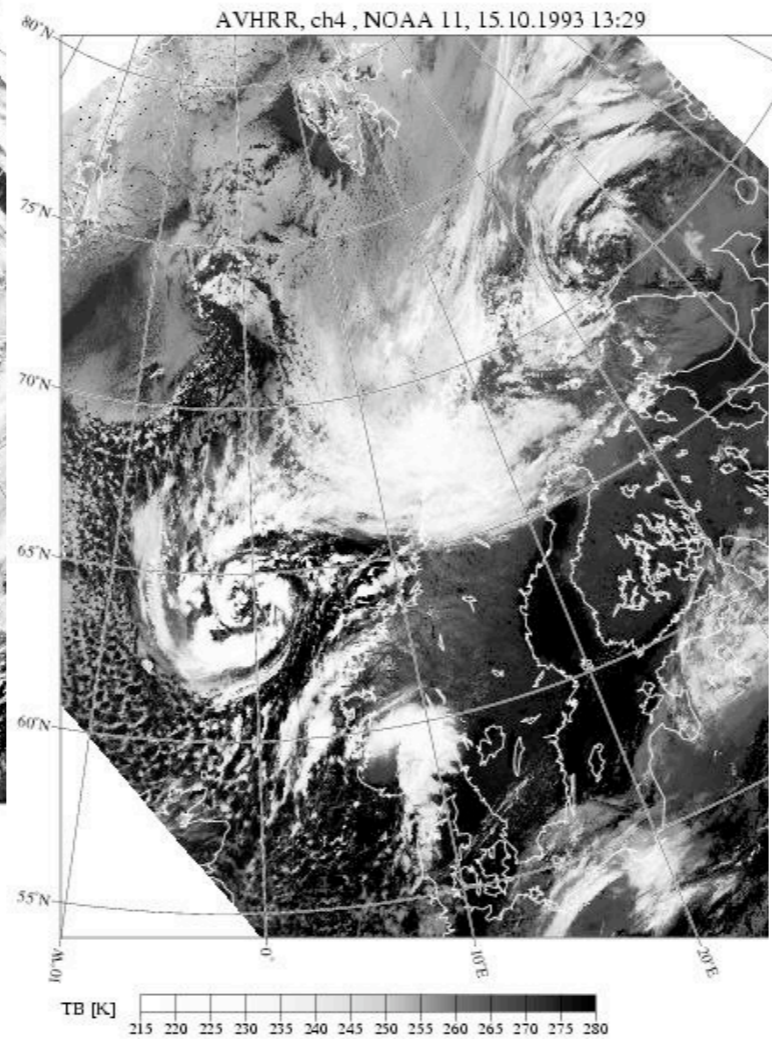
# Le Cygne Oct. 1993

14.10 13:41

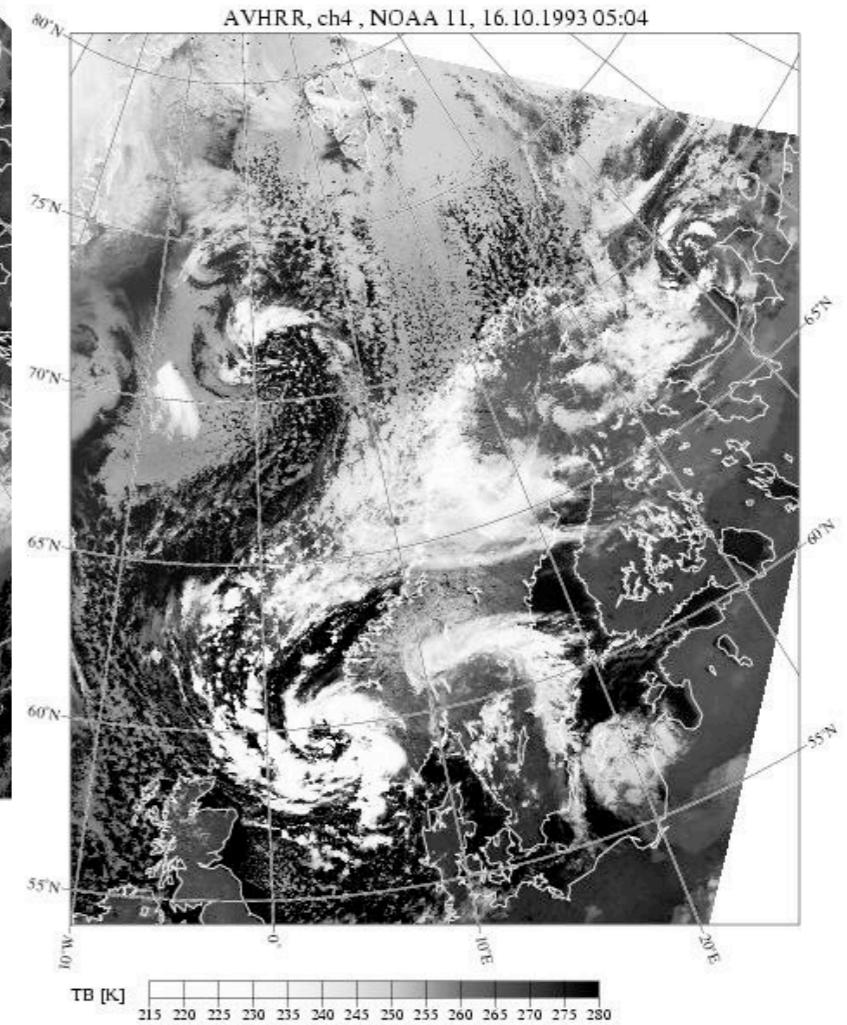


From Claud et.al

15.10 13:29



16.10 5:04

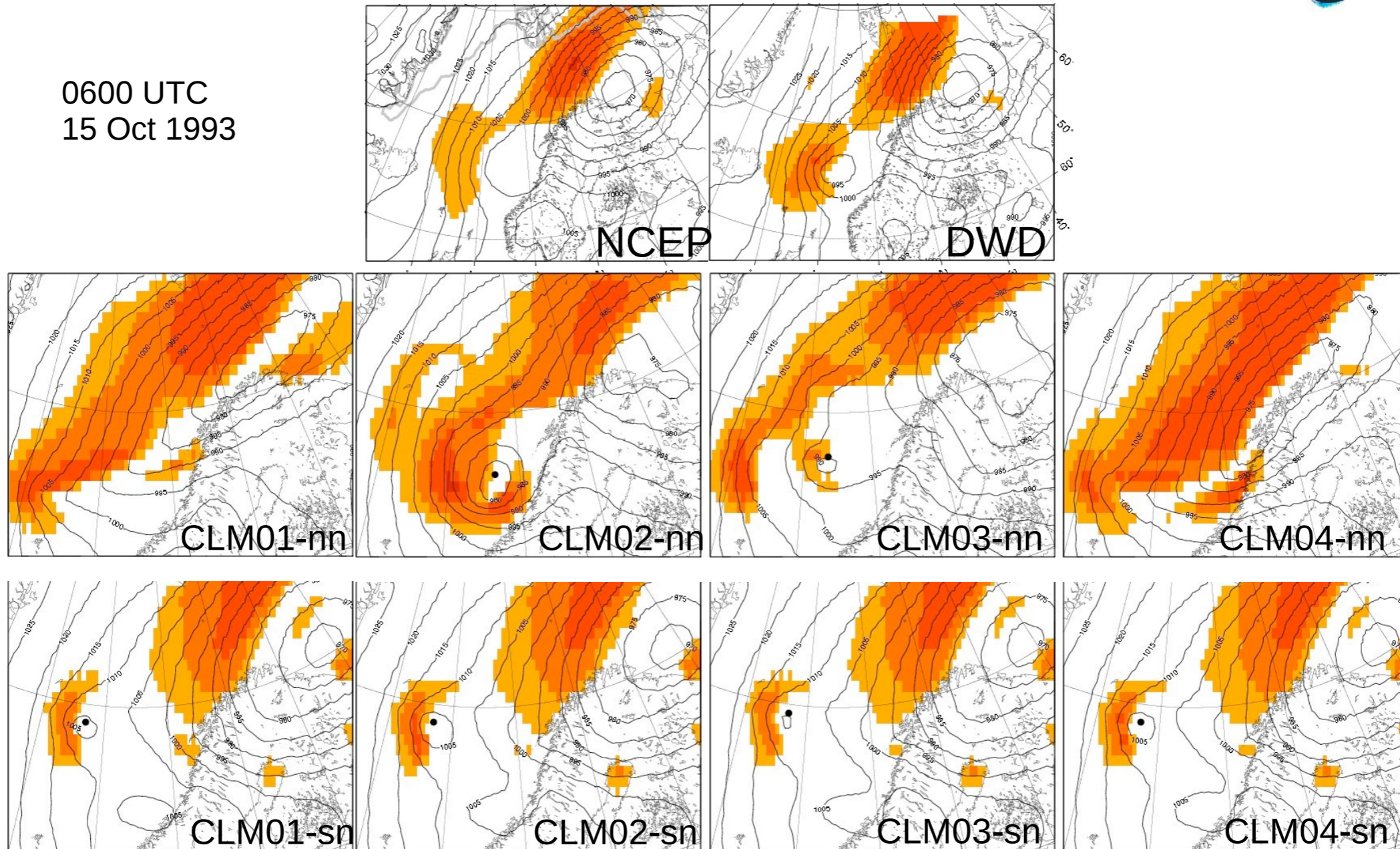




PLows in  
CLM-results



0600 UTC  
15 Oct 1993



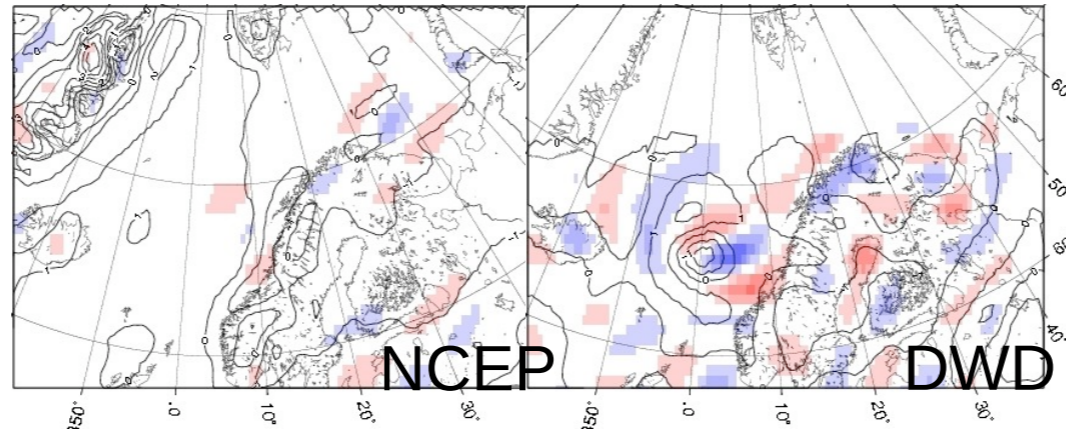
10m wind speed  $\geq 13.9\text{m/s}$  and air pressure (at mean sea level) on 15 October 1993:  
NCEP/NCAR analysis after interpolation onto the CLM grid, 0600 UTC, DWD analysis data,  
0600 UTC, CLM ensemble run without (nn) and with (sn) spectral nudging, 0900 UTC



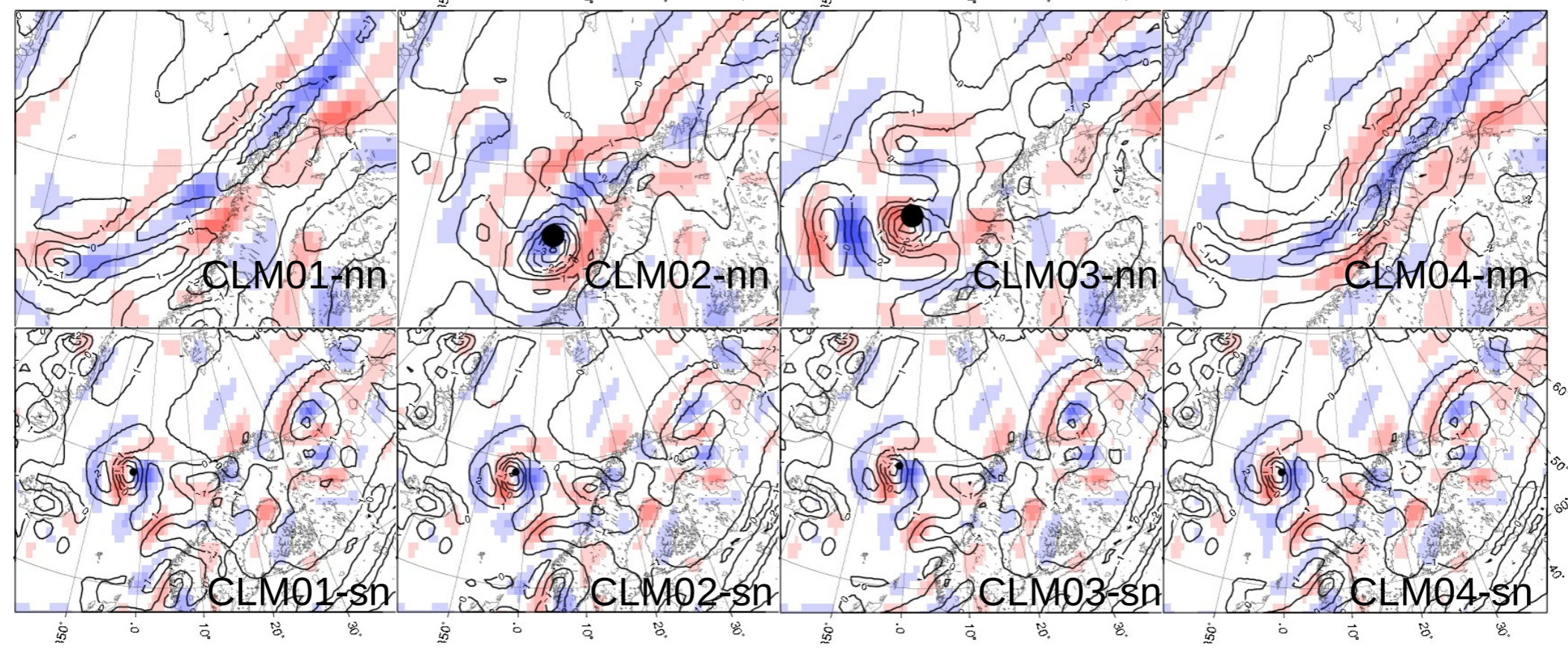
**PLows in  
CLM-results**



0600 UTC  
15 Oct 1993



(Response function:  
wave lengths between  
appr. 200 and 600 km  
are retained)



Band-pass filtered mslp (isolines; hPa) and 10m wind speed anomalies, NCEP/NCAR analysis after interpolation onto the CLM grid, 0600 UTC, DWD analysis data, 0600 UTC, CLM ensemble run without and with spectral nudging, 0900 UTC. Black dots indicate the positions of the polar low's pressure minimum in the respective untreated field of the ensemble run.