Reconstruction of highly resolved atmospheric fields 1850-2007

Frederik Schenk & Eduardo Zorita

Why another reconstruction?

Extention back to 1850: *"Rebound from Little Ice Age"*

- **Changes of ocean climate 1850 – 1900?**

- **Long period prior to big human impact**

Avoid spatiotemporal interpolation for modeling

- **Daily resolution using long historical station data**

- **High spatial resolution of 0.25° x 0.25°**

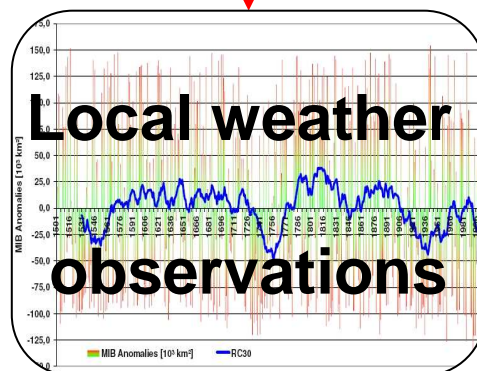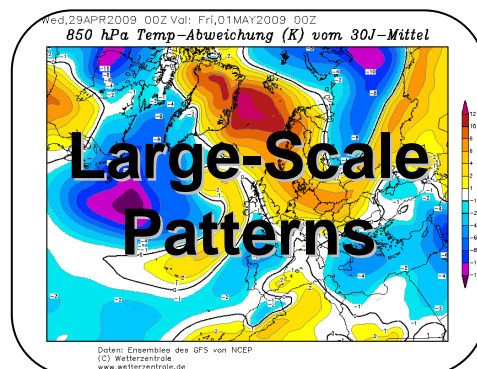- **Conservation of variability using analog-method**

Analog-Method

Stat. Downscaling

Sample of Analogs

Stat. Upscaling

GCM simulated large-scale patterns

Large-Scale Patterns

related to RCA simulated large-scale patterns

related to simultaneously observed lokal weather

Local weather observations

observed station data of lokal weather

Zorita, E. & H. von Storch (1999): The Analog Method as a simple statistical Downscaling Technique: Comparison with more complicated Methods. *Journal of Climate*, Vol. 12.

Analog-Method

Settings:

Cross-wise cal/val for 25 years

    a) Predictor = SLP (7 grids refer to 7 stations)

    b) Predictor = T2M (6 stations refer to 6 stations)

Daily resolution with overlapping months

- e.g. FEB is reconstructed from days of JAN to MAR
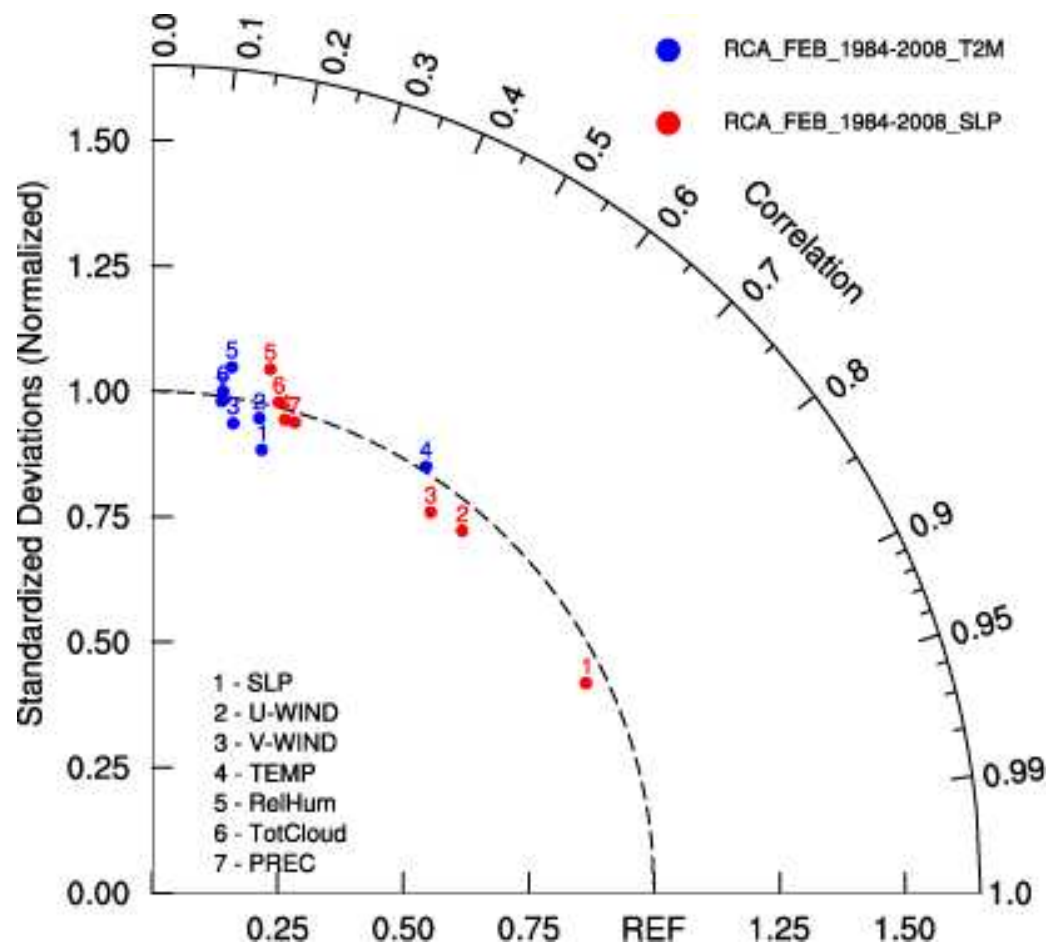
- More samples as they are not restricted only to FEB

Testing Results for statistical Upscaling

RCA used as surrogate climate

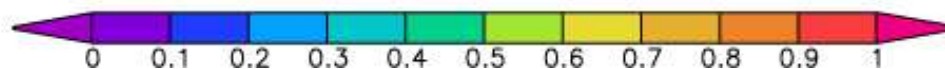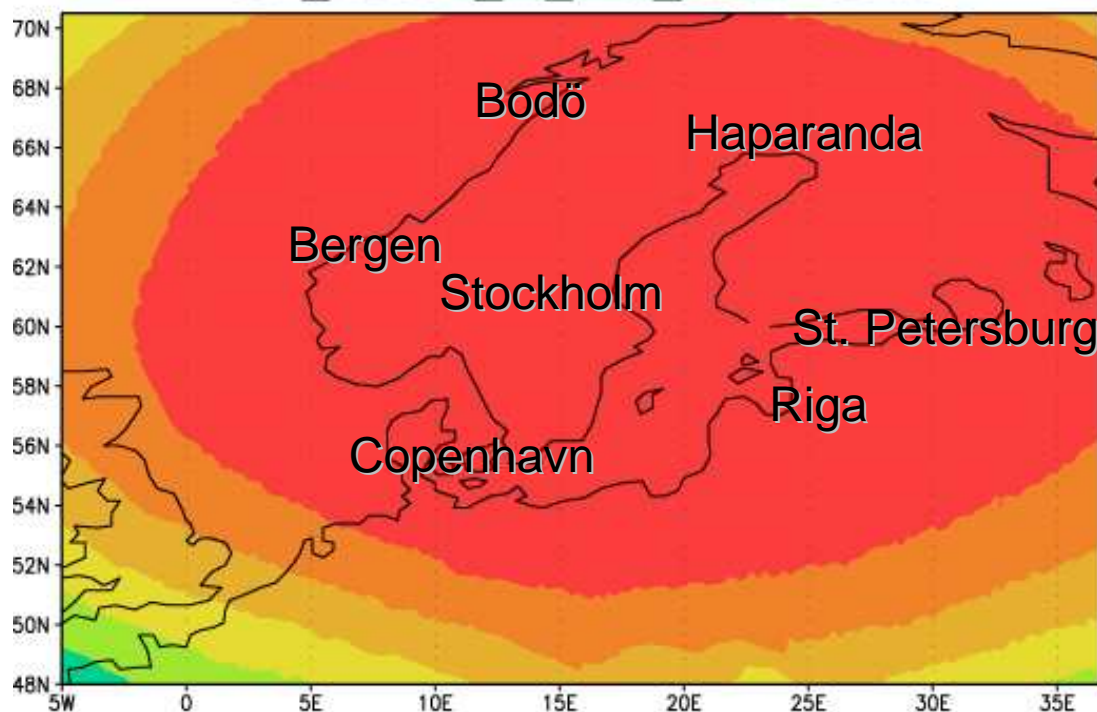**SLP or T2M grids used as predictors for RCA fields**

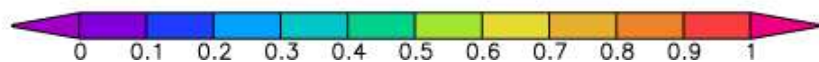**Calibration-Validation for 1960-1983 vs. 1984-2008**
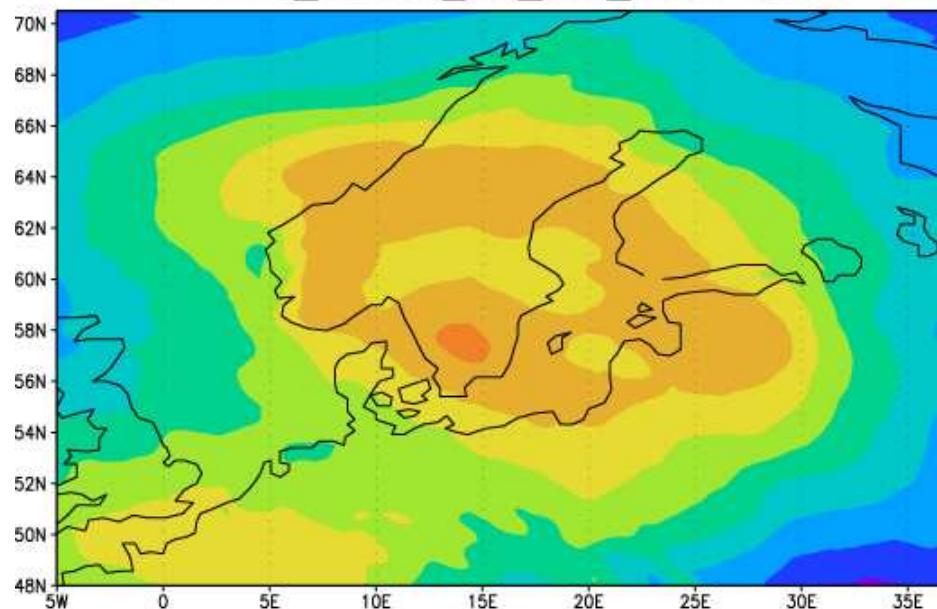
Reconstruction Skill

SLP-field

SLP_RECON_of_FEB_1984-2008

U-Wind
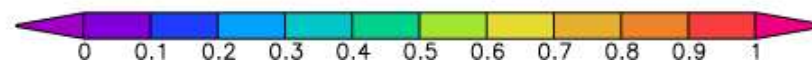
T2M → T2M-fields ← SLP
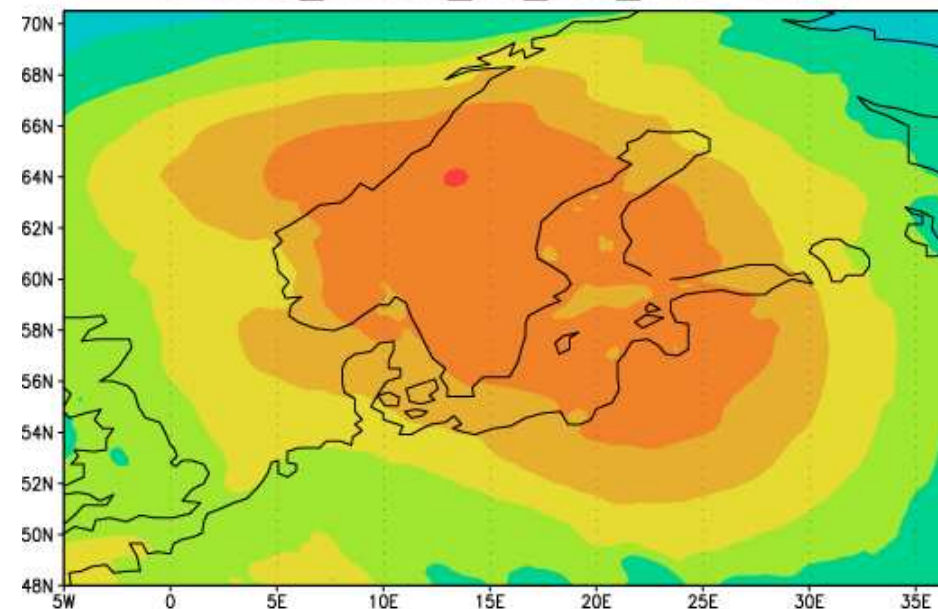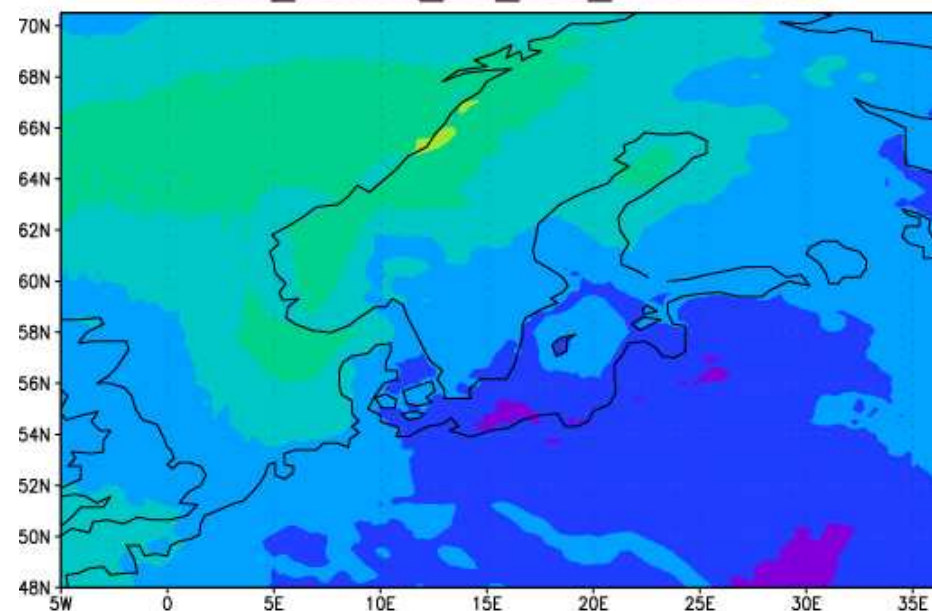

TEMPERATURE_RECONS_for_1984-2008_by_t2m
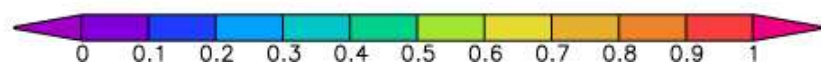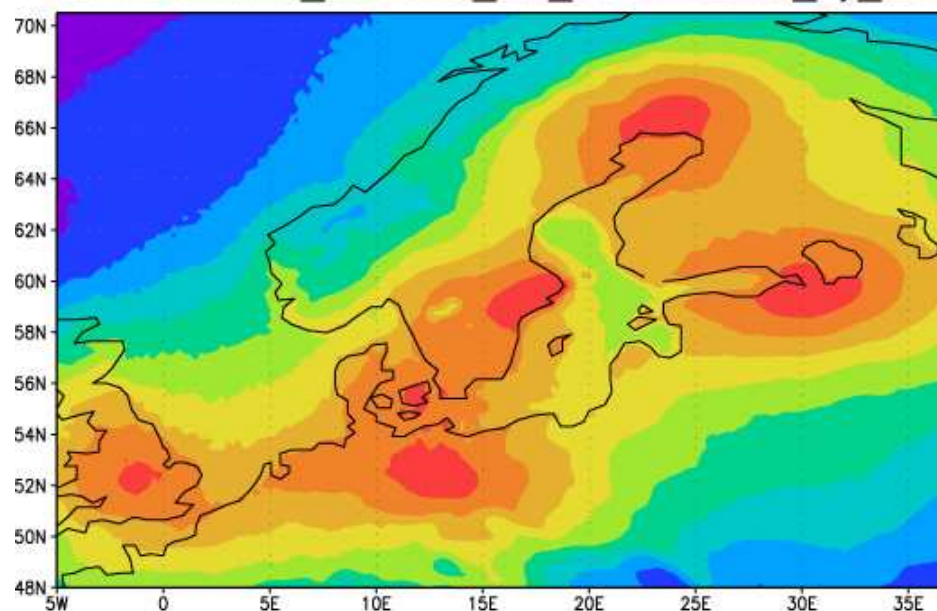
TEMP_RECON_for_FEB_1984-2008
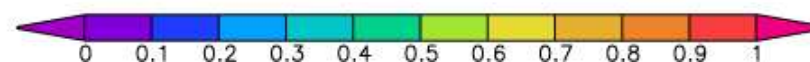
Clouds and rel. Humidity

Tot_CLOUD_Cov_for_FEB_1984−2008
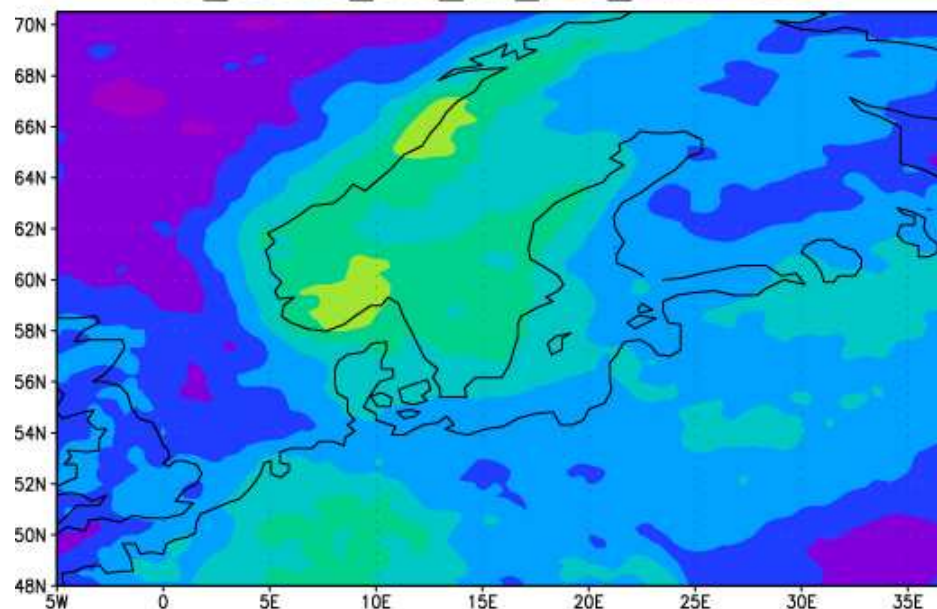
Rel_HUMID_RECON_for_FEB_1984−2008

Deutscher Wetterdienst
MET9 IR108-STC 27.11.2007 06:00 UTC
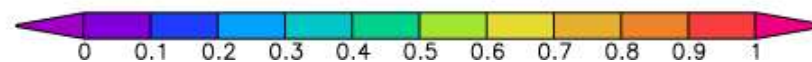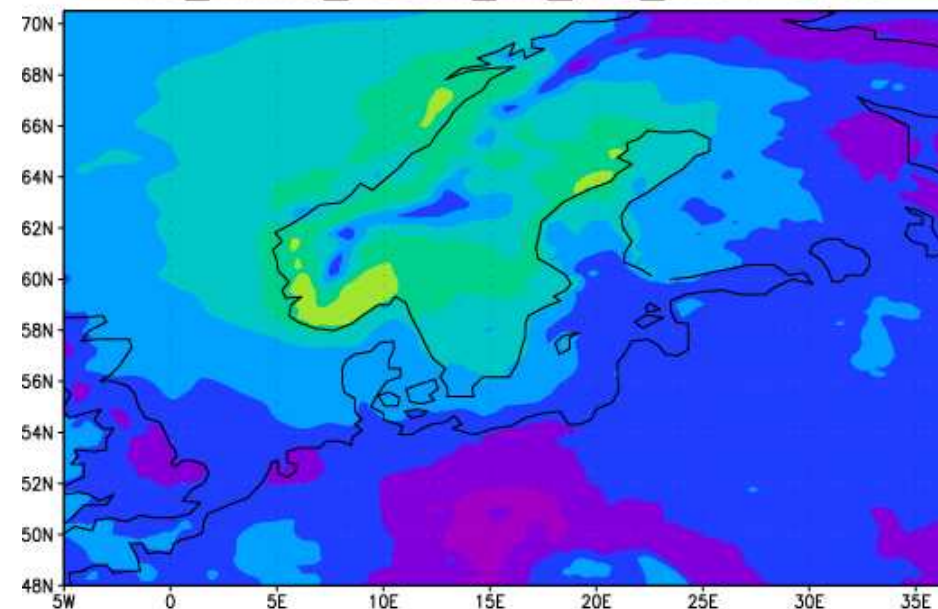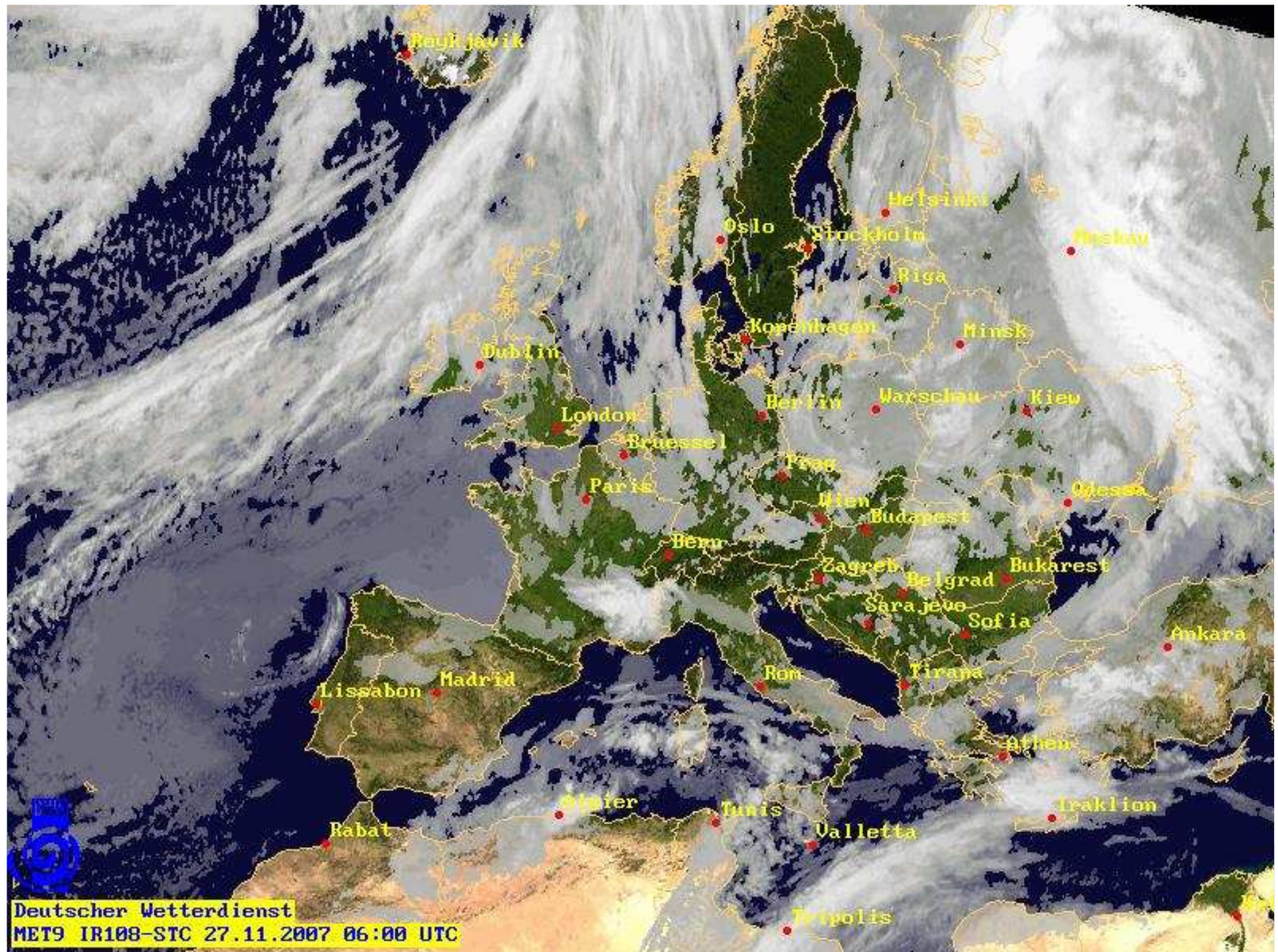
Daily Total Cloud Cover with R ~ 0.25
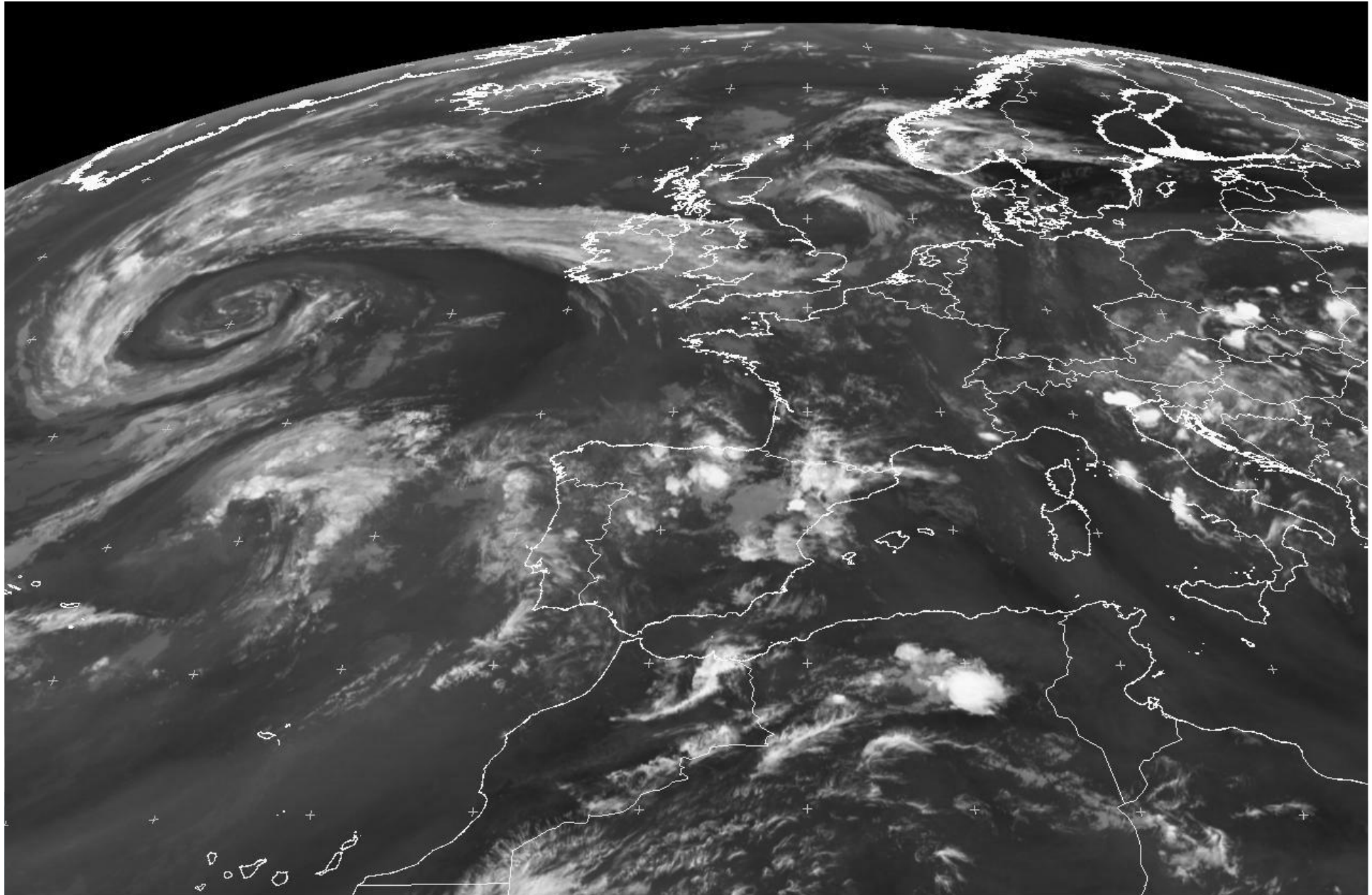
MET9 RGB-airmass 2009-06-28 19:00 UTC

EUMETSAT

Short Wave radiation in ECHO-G

Correlation_SLP-grid_SLP-field_FEB_1000-1990   Correlation_SLP-grid_hv-field_FEB_1000-1990
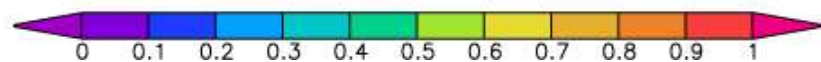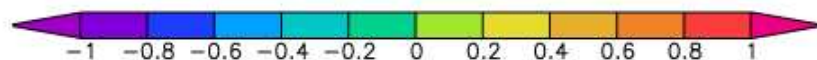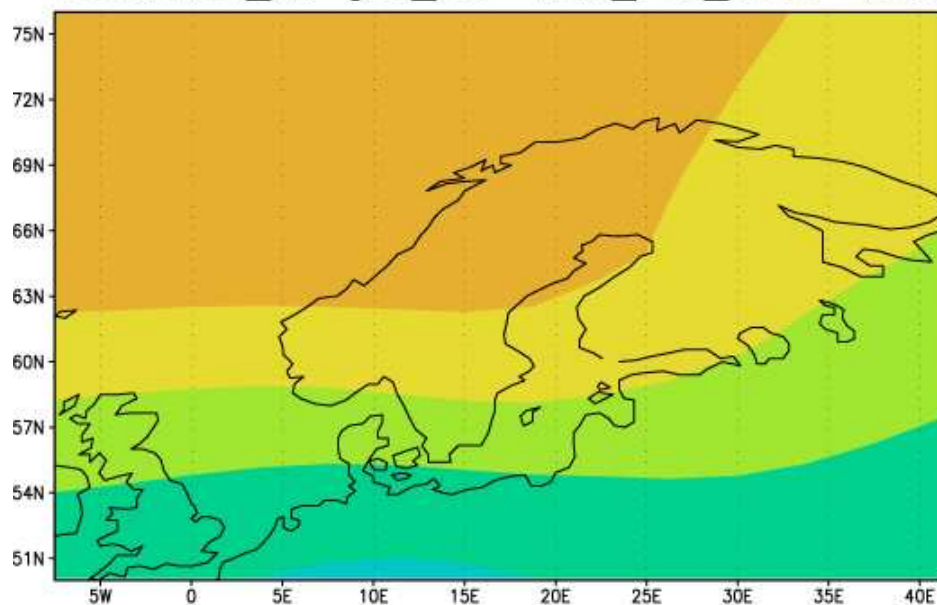
Short Wave radiation in ECHO-G
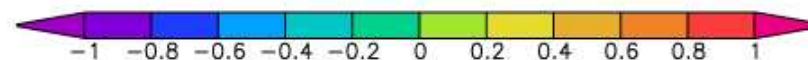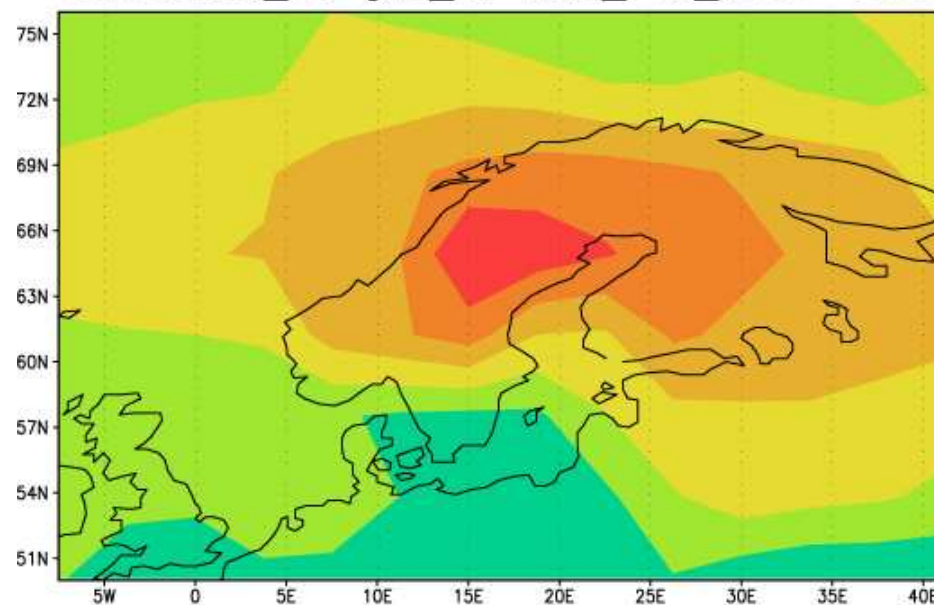
monthly → PREC-fields ← daily

PREC_RECON_for_FEB_1984−2008
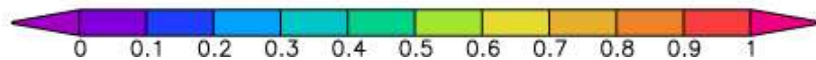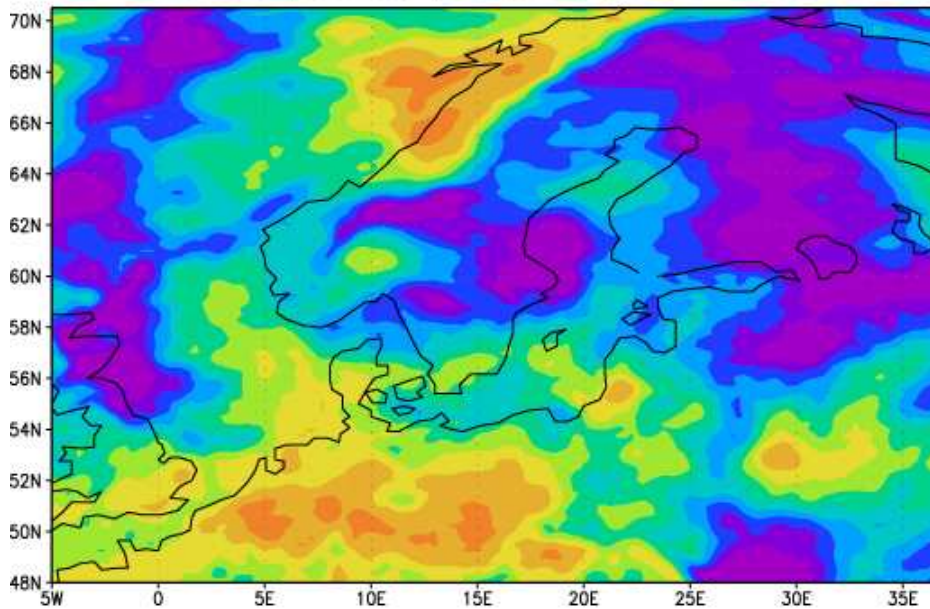
PREC_RECON_of_FEB_1984−2008
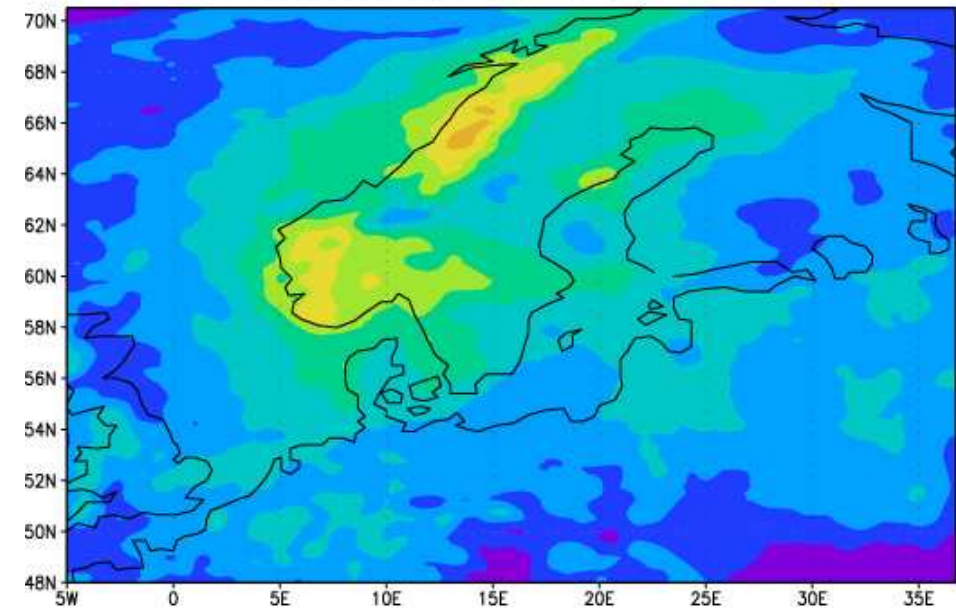
Daily SLP Station Data

No Data

(No) Problems!
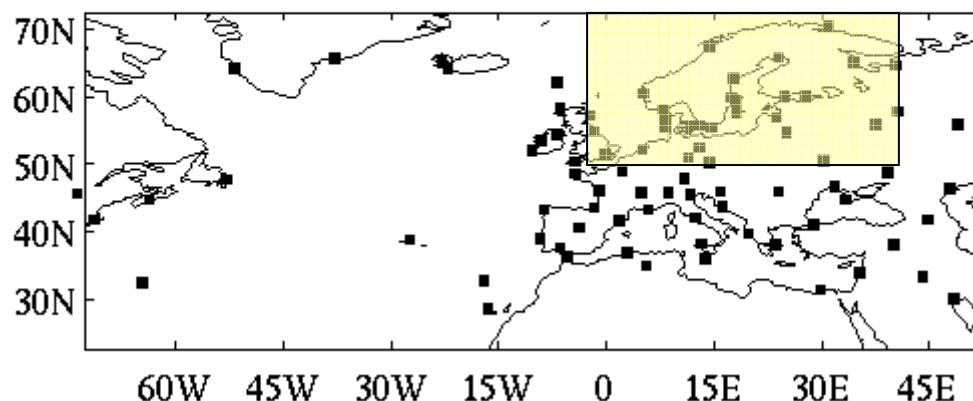
EMULATE Mean Sea Level Pressure data set (EMSLP)

→ provides 86 stations (~ 30 for RCA-domain)

→ partly covers 1850 - 2002

Ansell, T. J. et al. (2006) Daily mean sea level pressure reconstructions for the European - North Atlantic region for the period 1850-2003', Journal of Climate, vol 19, No. 12, pp 2717-2742.

Data is needed

	°N	°E	start	end	updates	end	source	country
Riga	56°81'	23°89'	1850	1990	yes	29.09.09	ECA	Latvia
StPetersburg	59°93'	27°96'	1850	2000	yes	29.09.09	ECA	Russia
deBilt	52°07'	5°11'	1850	2001	yes	30.09.09	ECA	Netherlands
Helsinki	60°10'	24°50'	1850	2001	yes	29.09.09	ECA	Finland
Paris	48°81'	2°33'	1851	1880	yes	29.09.09	ECA	France
Goteborg	57°43'	11°58'	1860	2002	yes	29.09.09	ECA	Sweden
Visby	57°63'	18°28'	1860	2002	yes	29.09.09	ECA	Sweden
Happaranda	65°82'	24°13'	1860	2002	yes	29.09.09	ECA	Sweden
Lund	55°70'	13°20'	1864	2001	yes	29.09.09	ECA	Sweden
Bodo	67°17'	14°29'	1868	1994	yes	30.09.09	ECA	Norway
Oksoyfyr	58°07'	8°05'	1870	2002	yes	30.09.09	ECA	Norway
Nordby	55°43'	8°40'	1874	2002	yes	31.12.08	ECA	Denmark
Vestervig	56°77'	8°32'	1874	1995	yes	29.09.09	ECA	Denmark
Hammerodde	55°8'	14°55'	1874	1995	yes	29.09.09	ECA	Denmark
Torshavn	62°01'	-6°46'	1874	2002	yes	29.09.09	ECA	Denmark
Potsdam	52°38'	13°06'	1893	1993	yes	30.09.09	ECA	Germany
Bergen	60°23'	5°19'	1968	2002	yes	30.09.09	ECA	Norway
Harnosand	62°38'	17°56'	1860	1995	partly	31.12.04	ECA	Sweden

Data is not available

	N	E	start	end	updates	end	source	country
Harnosand	62°38'	17°56'	1860	1995	partly	31.12.04	ECA	Sweden
Prag	50°08'	14°42'	1850	1880	no			Czech Republic
London	51°46'	0°0'	1850	1881	no			United Kingdom
Uppsala	59°86'	17°63'	1850	1998	no			Sweden
Kiev	50°40'	30°45'	1850	1990	no			Ukraine
Jena	50°56'	11°35'	1850	2000	no			Germany
Wilna	54°68'	25°30'	1850	1990	no			Lithuania
Durham	54°46'	-1°34'	1850	1881	no			United Kingdom
Stockholm	59°33'	18°05'	1850	1998	no			Sweden
Halifax	53°43'	-1°51'	1850	1880	no			United Kingdom
Plymouth			1861	1881	no			United Kingdom
Aberdeen	57°09'	-02°05'	1861	1995	no			United Kingdom
Rochefort			1862	1881	no			France
Kem	64°57'	34°36'	1866	1880	no			Russia
Sibiu			1874	1881	no			Romania

Summary
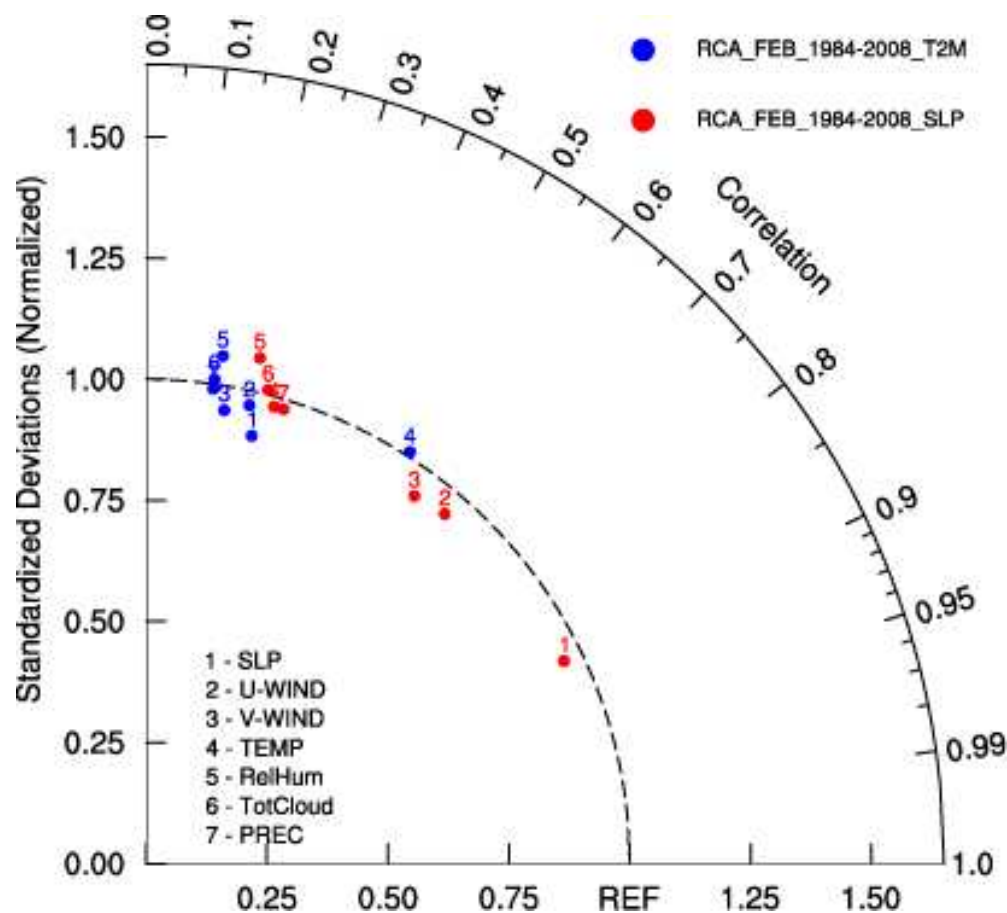
Reconstruction of fields by daily SLP (7 grids) for RCA

for FEB	1960-1983	1984-2008
SLP (001)	**0.90**	**0.90**
TEMP (011)	0.31	0.27
U-WIND (033)	**0.64**	**0.65**
V-WIND (034)	**0.59**	**0.59**
HUMID (052)	0.21	0.22
CLOUD (071)	0.24	0.25
PREC (167)	0.30	0.29

Reconstruction of fields by daily t2m (6 grids) for RCA

for FEB	1960-1983	1984-2008
SLP (001)	0.28	0.24
TEMP (011)	**0.61**	**0.54**
HUMID (052)	0.16	0.15
CLOUD (071)	0.14	0.14
PREC (167)	0.15	0.14
TEMP (011) for NOV	**0.61**	**0.62**

Questions?

- **Daily vs. monthly PREC**

- **Run-off by Daniel Hansson?**

- **Humidity and clouds?**

Data storage

Most easy (< 10 GB):

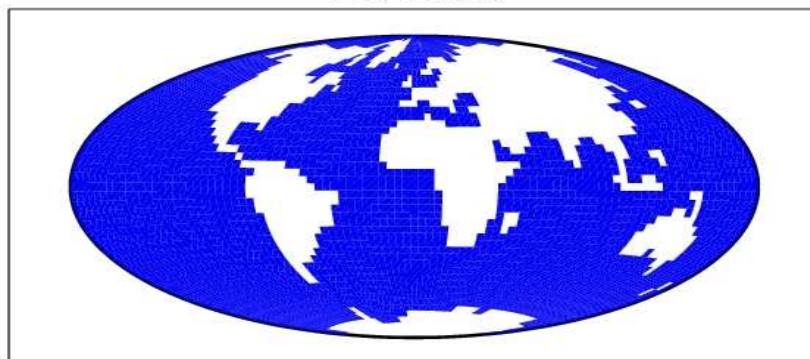ftp.gkss.de/outgoing/schenk

Which data format is needed?

ECHO-G

Atmosphere: ECHAM4

T30 (ECHAM4)

T30 (3.75° x 3.75°)
19 vertical layers

Ocean: HOPE-G

(HOPE-G)
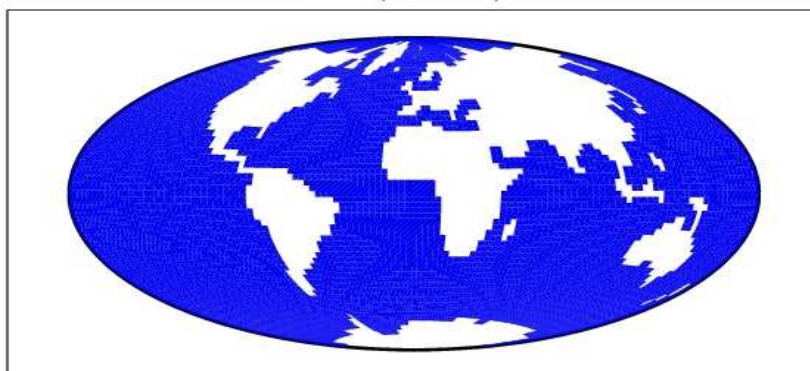
Horizontal Resolution 2,81° x 2,81°
20 vertical layers
increased tropical resolution