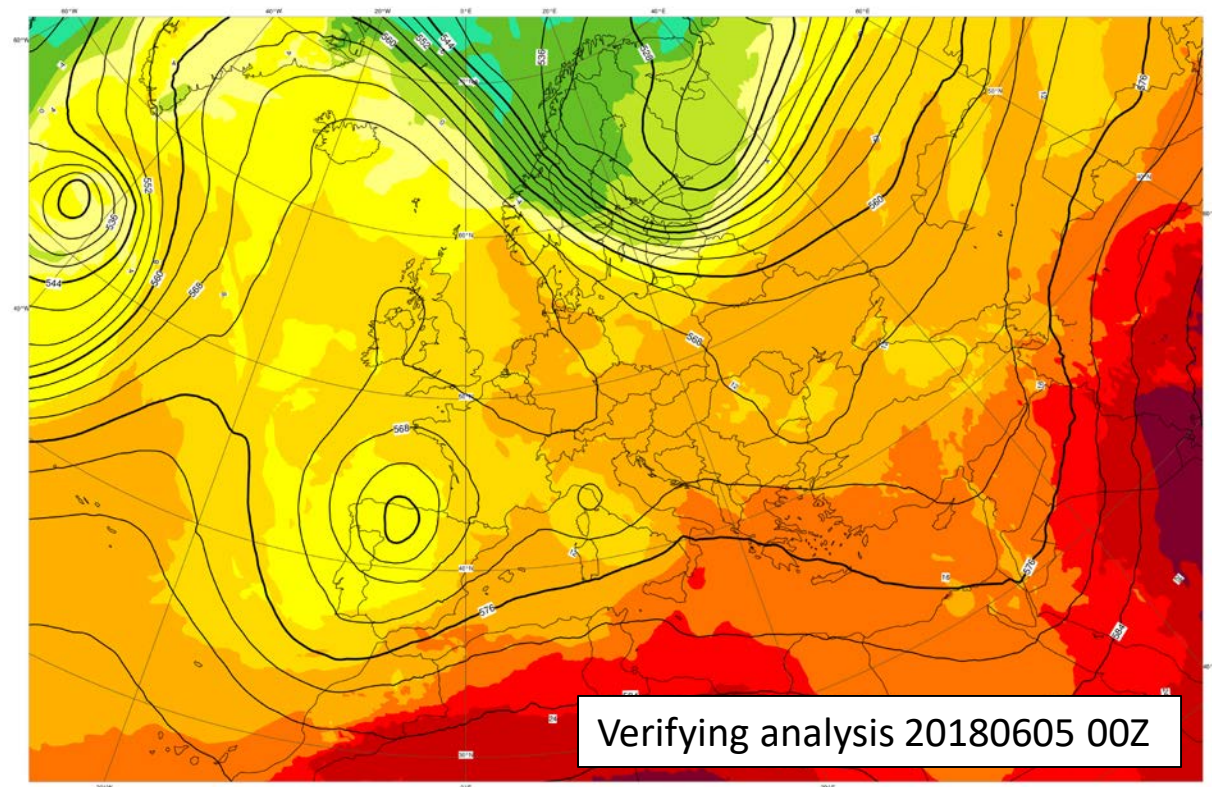# Verification news from ECMWF

Thomas Haiden, Martin Janousek, Zied Ben Bouallegue

Forecast 20180531 00Z, STEP=120

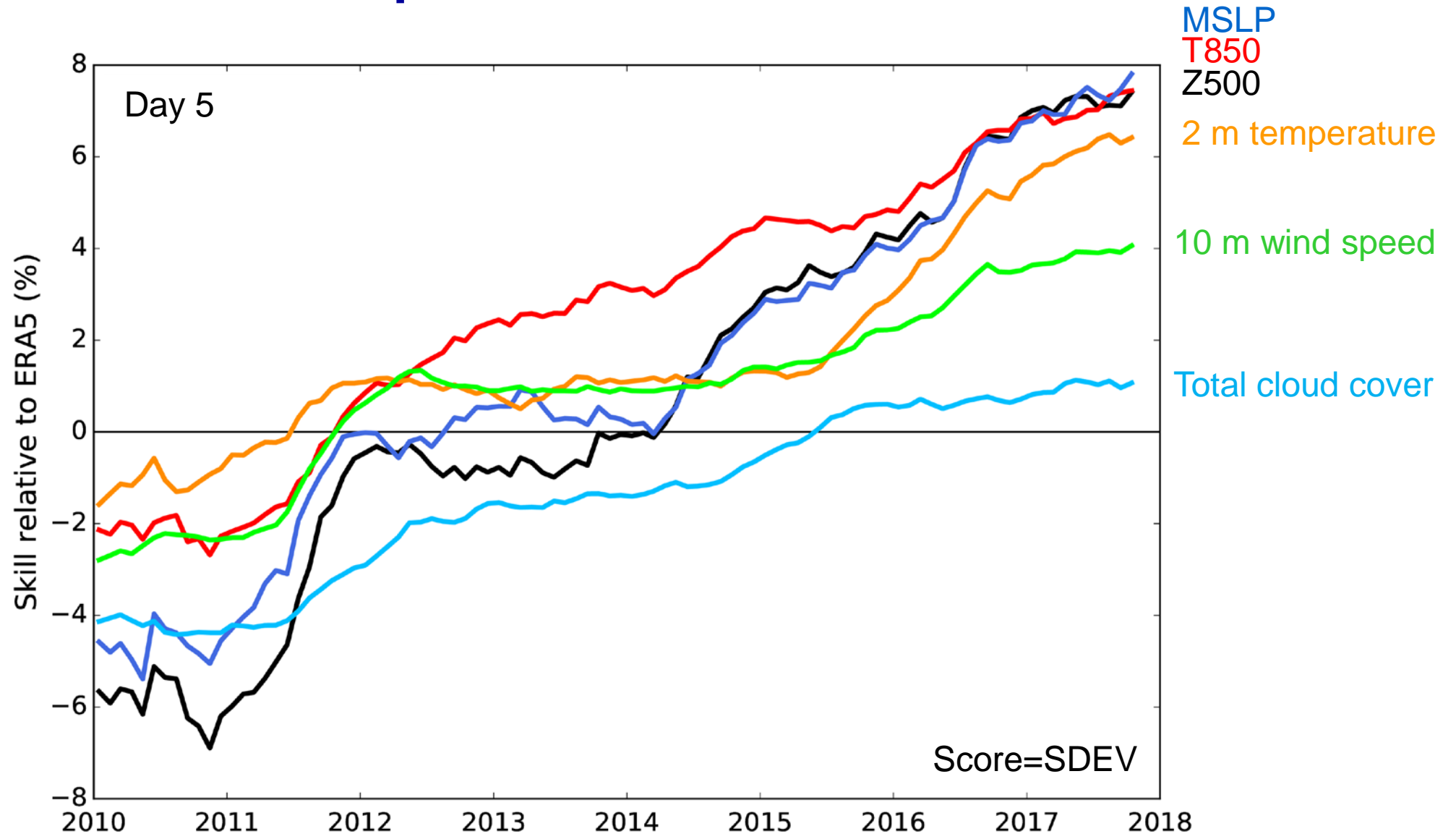Verifying analysis 20180605 00Z
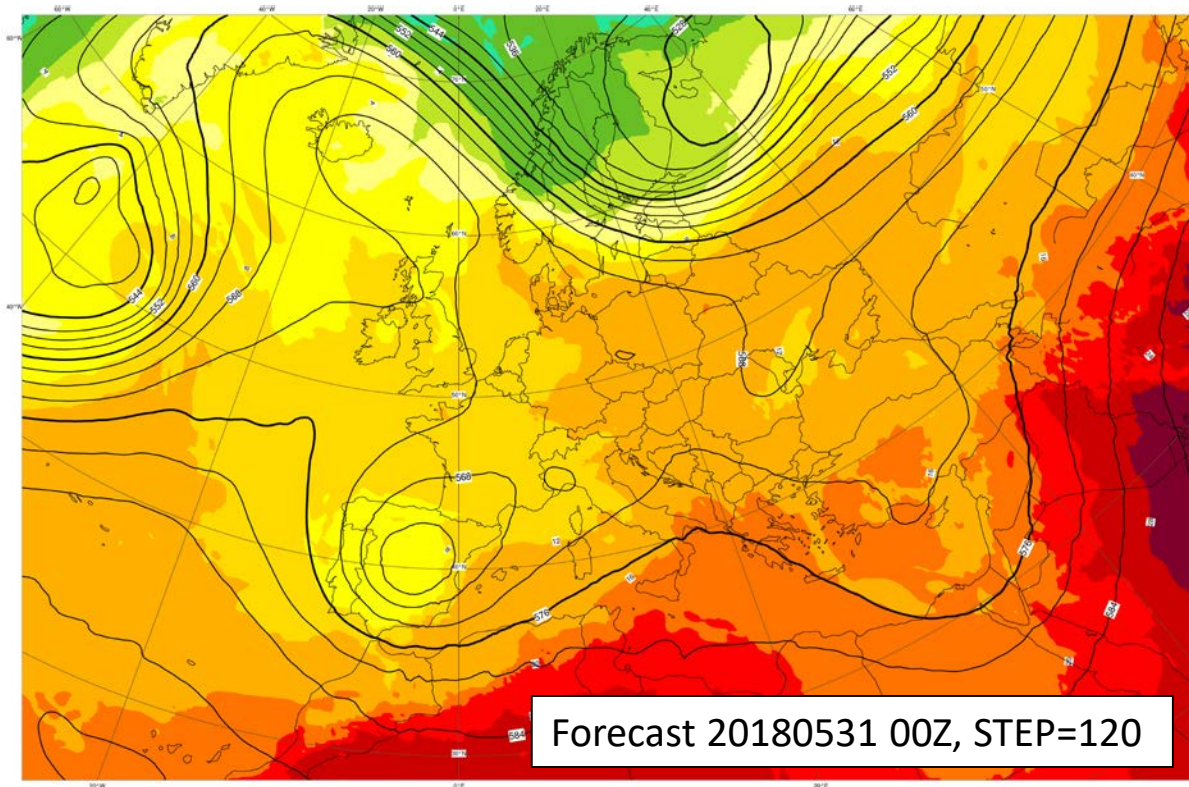
Outline

- Updates on evolution of forecast skill

- Two new headline scores

- Temperature, cloudiness and radiation

- Precipitation

- Use of high-density observations

- Taking into account observation uncertainty

ECMWF

Upper-air forecast skill

500hPa geopotential
Anomaly correlation
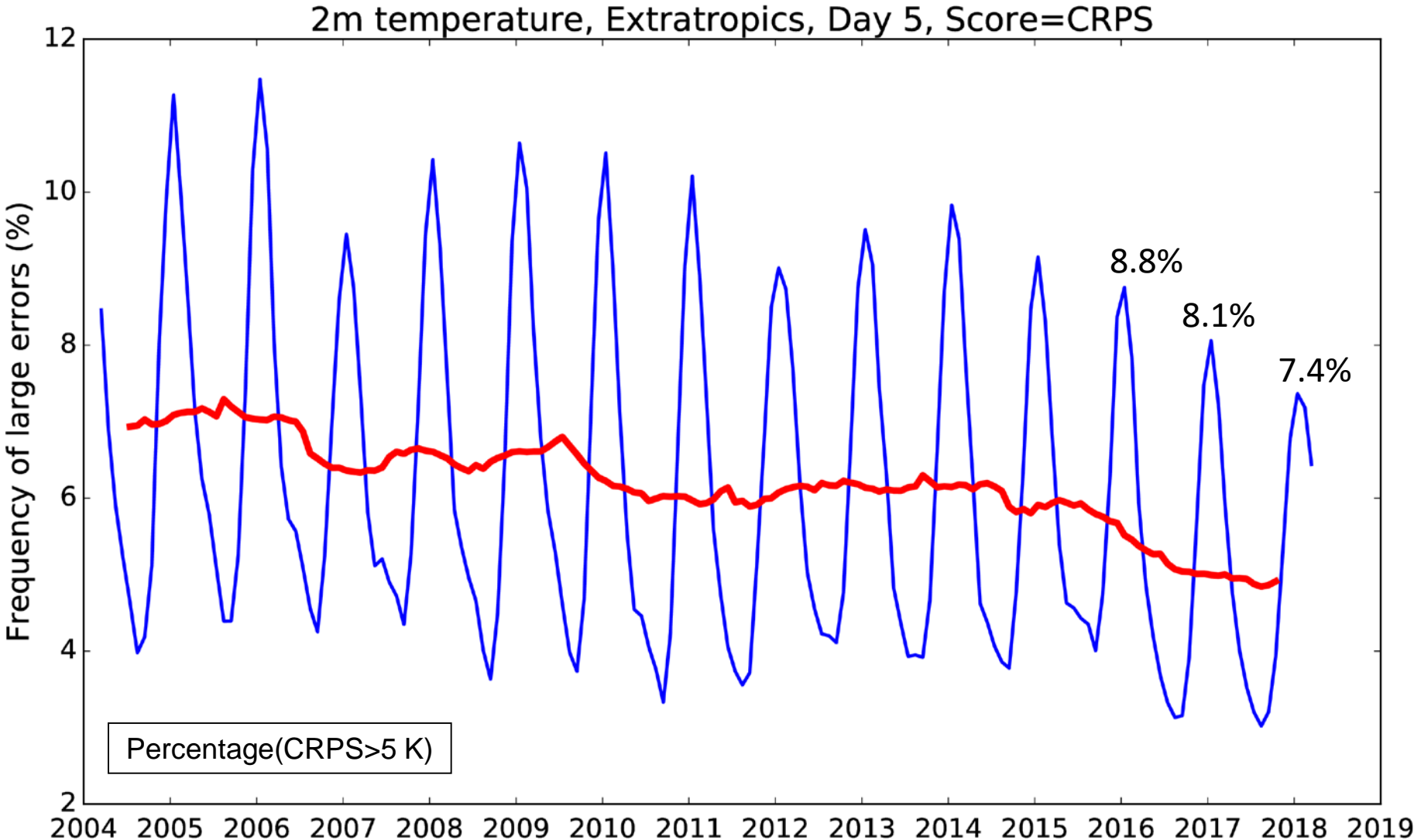NHem Extratropics (lat 20.0 to 90.0, lon -180.0 to 180.0)

Legend: CMC, JMA, UKMO, ECMWF, ERA5, ERA-Interim, NCEP, DWD
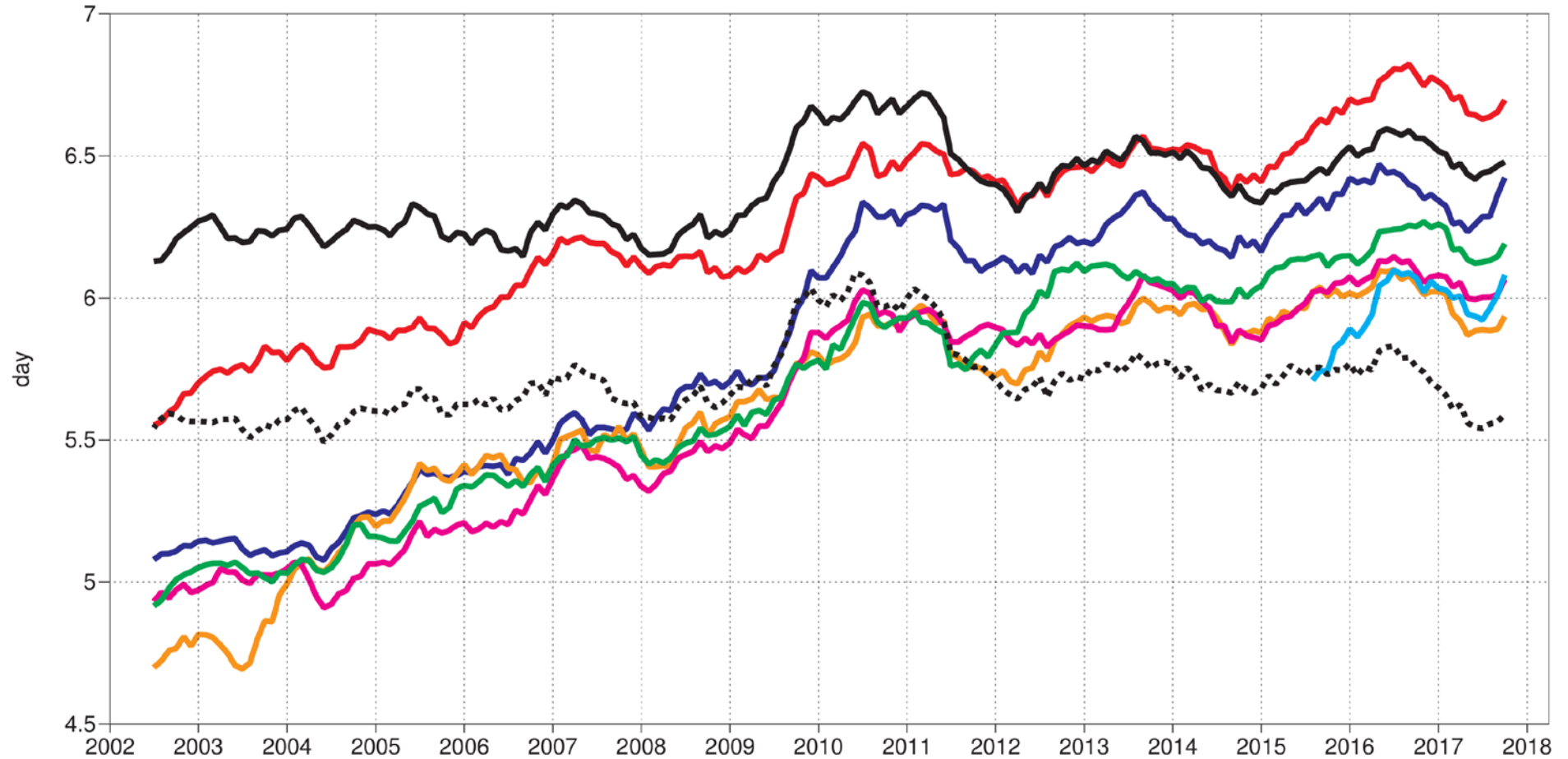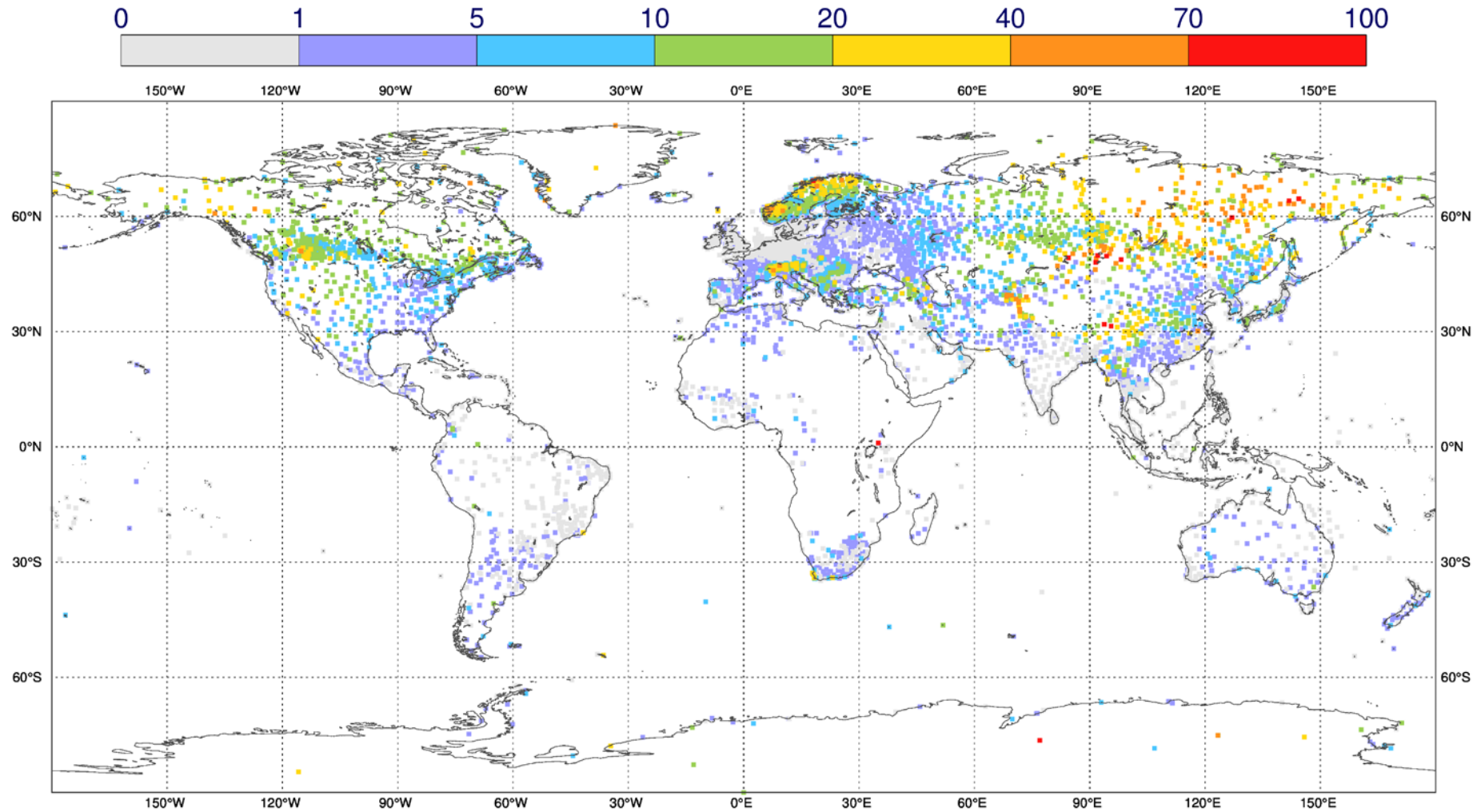
Improvement for other parameters

Additional ENS headline score: fraction of large T2M errors

2m temperature, Extratropics, Day 5, Score=CRPS

Frequency of large errors (%)

8.8%
8.1%
7.4%

Percentage(CRPS>5 K)

2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019
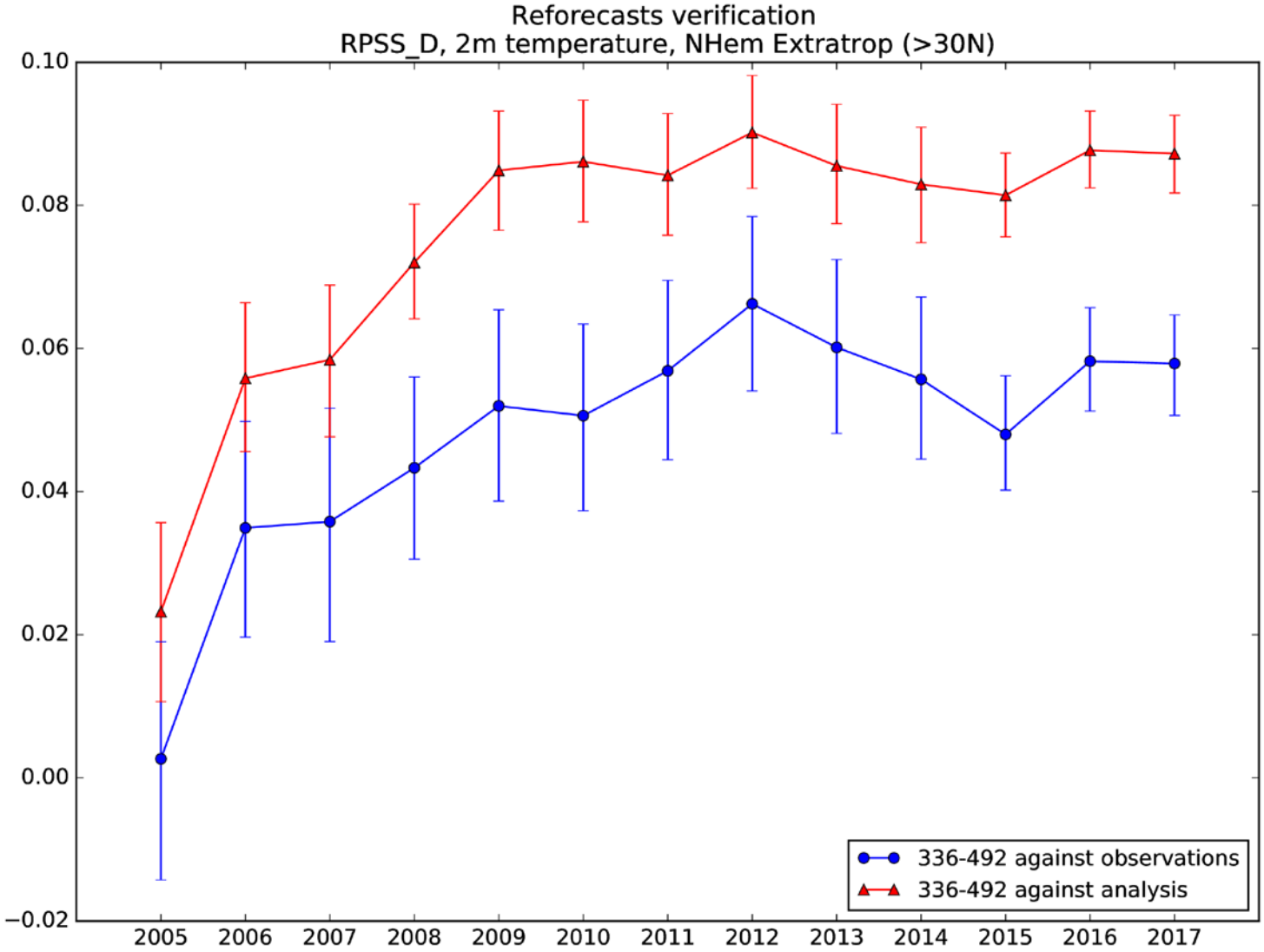
ECMWF

Additional ENS headline score: fraction of large T2M errors

T2M, RUN=02, STEP=120, CRPS>5K (%), expv=1

DJF 2017-18

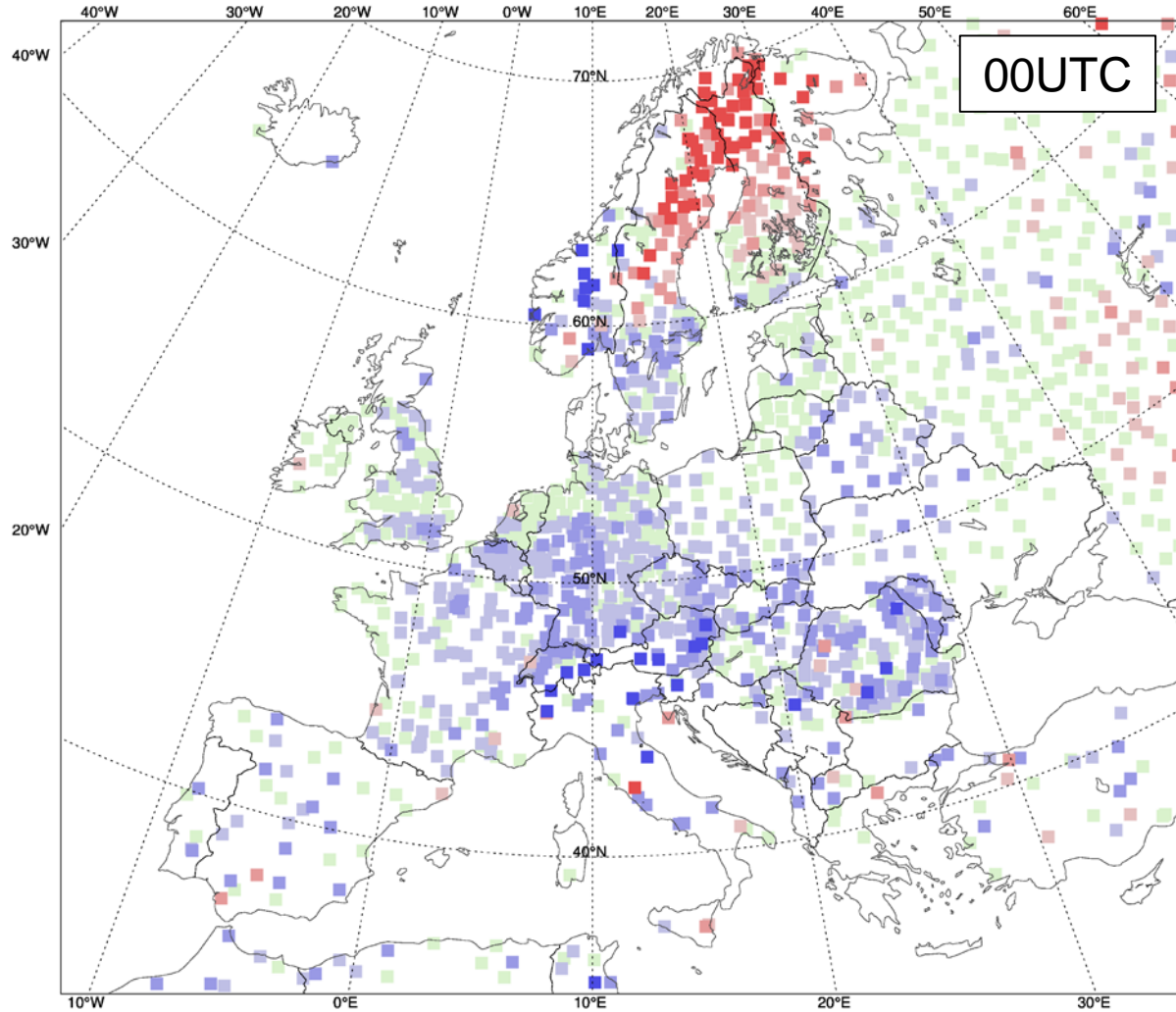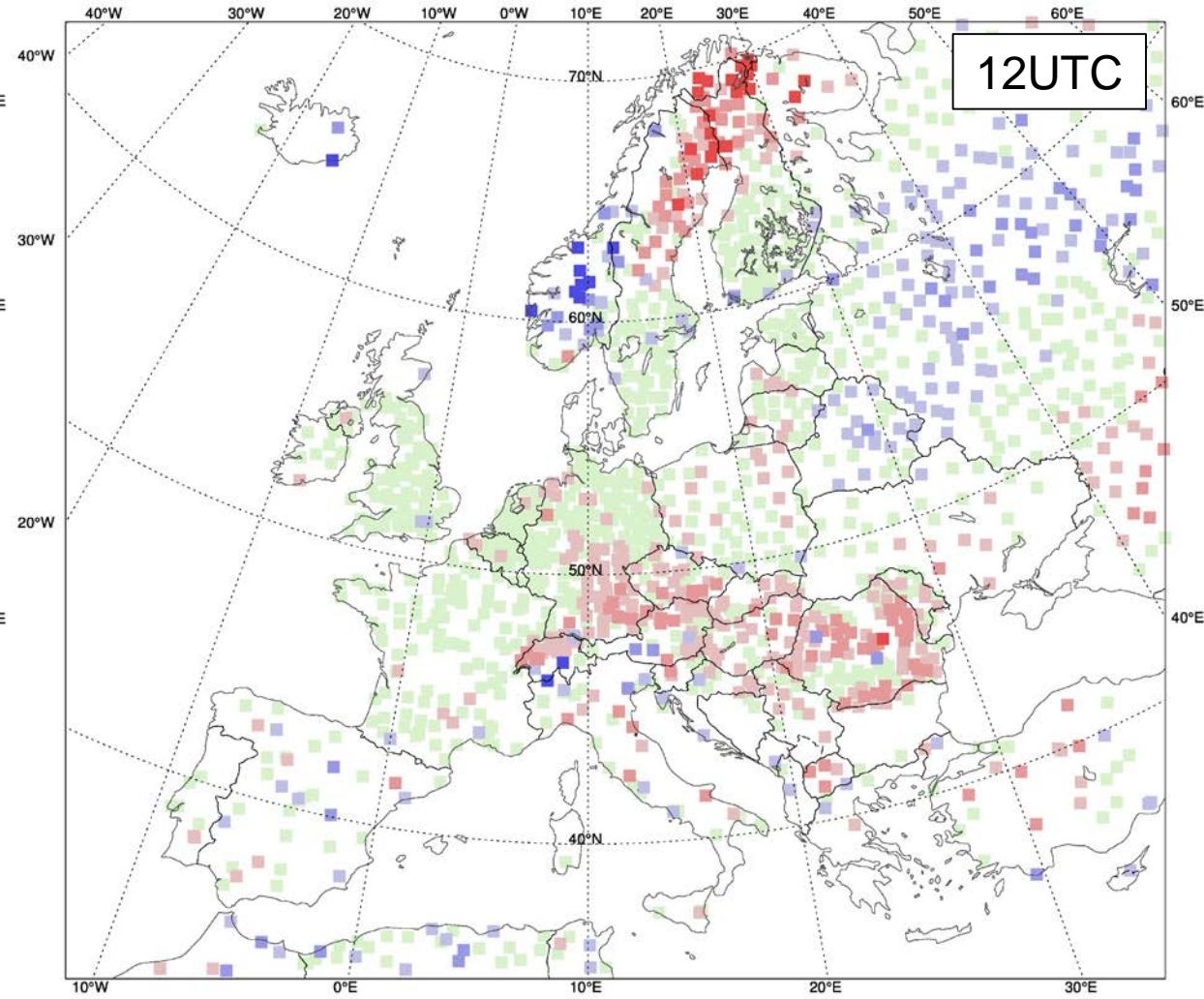# Additional ENS headline score: T2m anomalies in week 3

Reforecasts verification
RPSS_D, 2m temperature, NHem Extratrop (>30N)

Legend:
- 336-492 against observations
- 336-492 against analysis

2m temperature bias, DJF 2017-18

T2M, RUN=12, STEP=060, ME (K), expv=1

-5.4417   -2   -1   -0.5   0.5   1   2   6.2206

00UTC
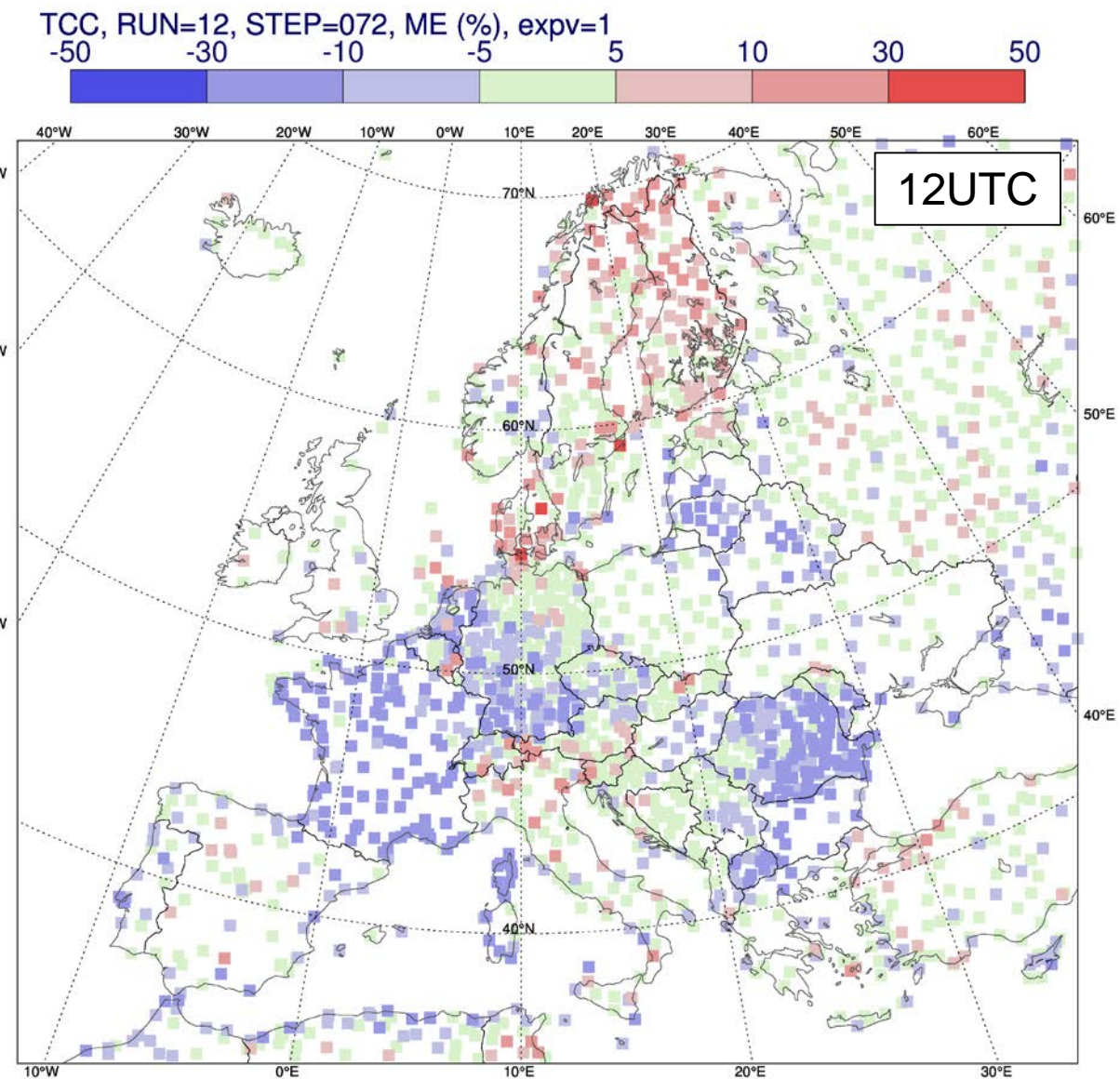
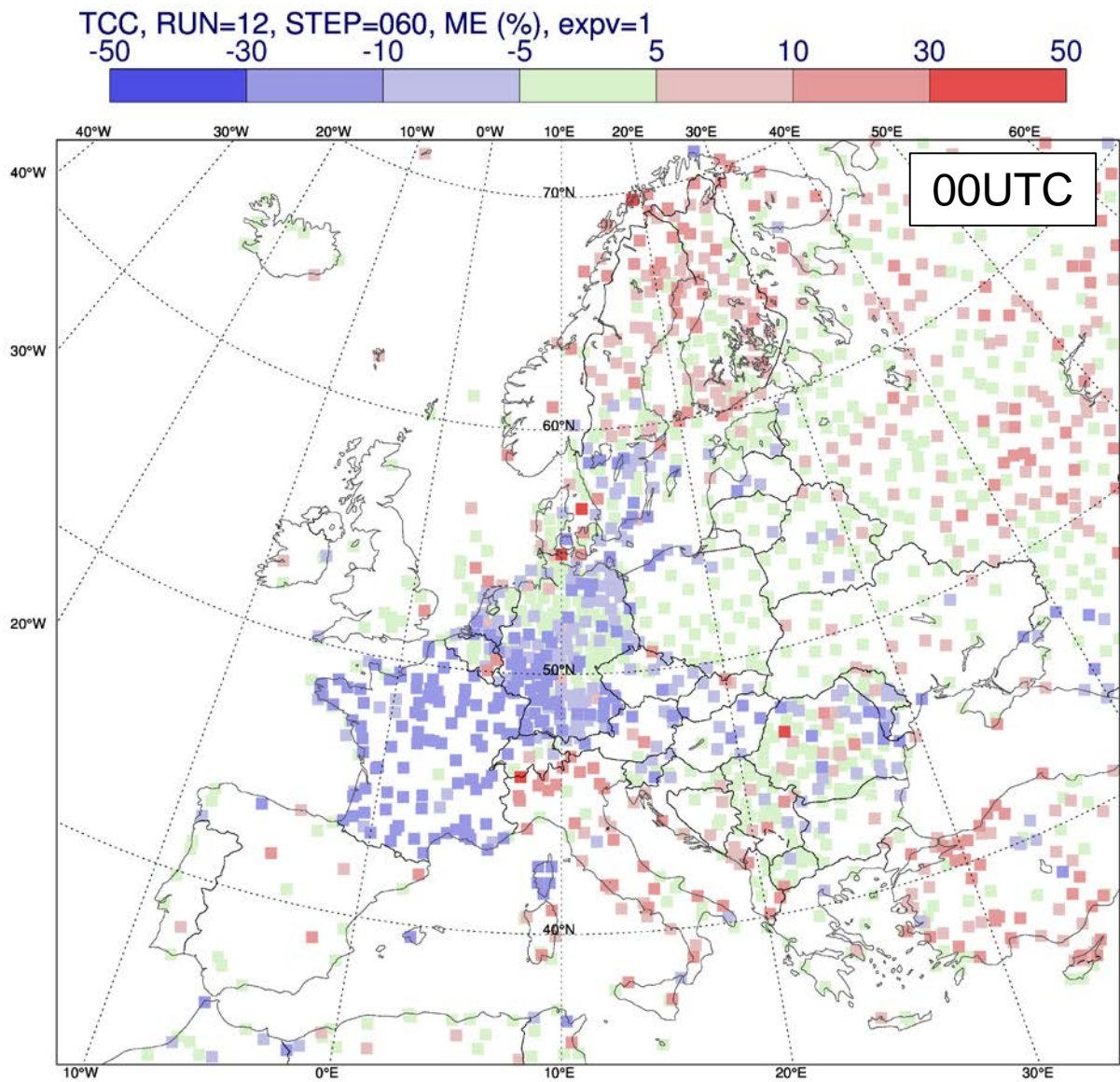T2M, RUN=12, STEP=072, ME (K), expv=1
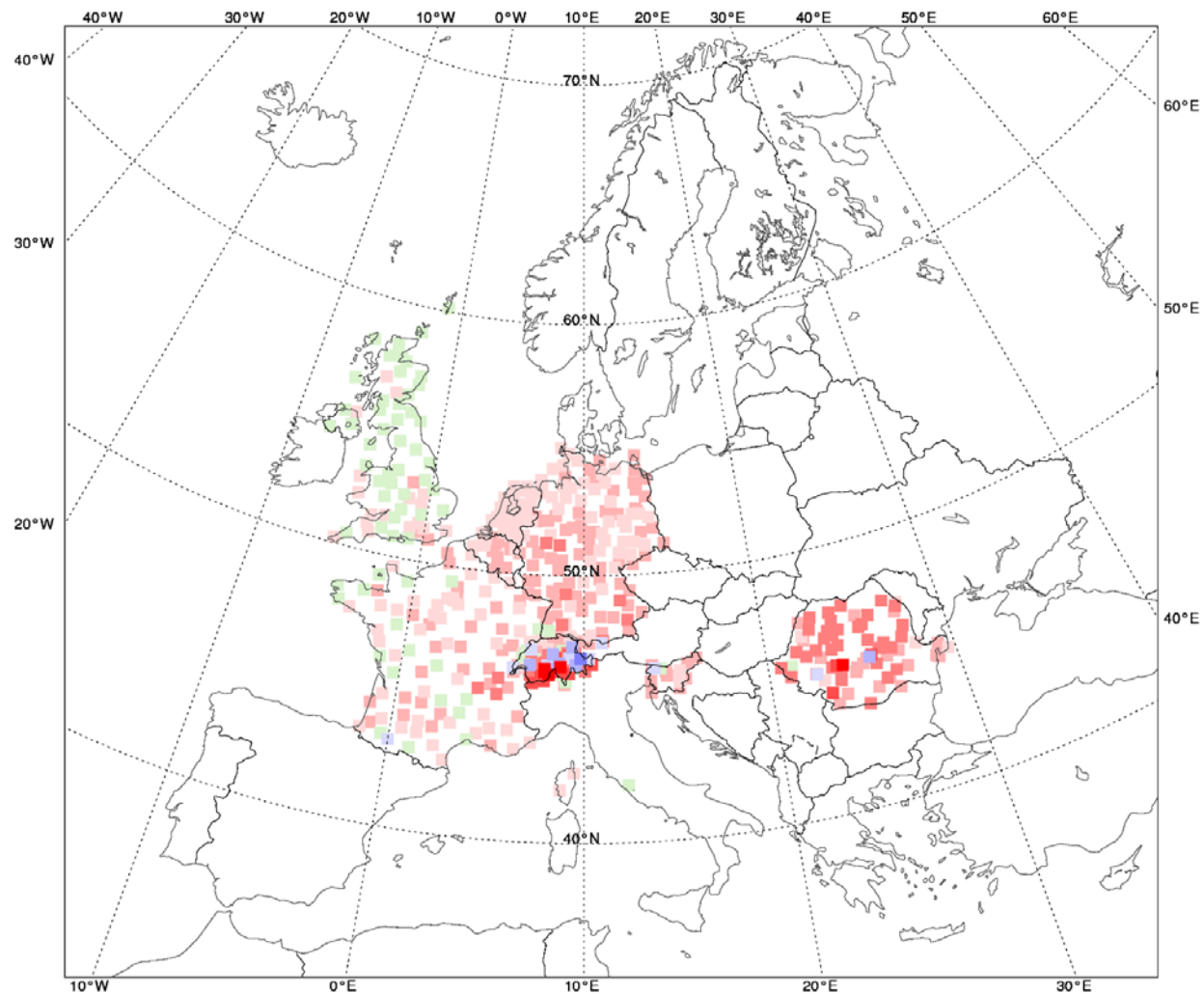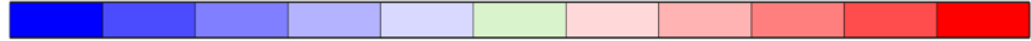
-9.2142   -2   -1   -0.5   0.5   1   2   5.4172

12UTC

Total cloud cover bias, DJF 2017-18

TCC, RUN=12, STEP=060, ME (%), expv=1

-50   -30   -10   -5   5   10   30   50

00UTC

TCC, RUN=12, STEP=072, ME (%), expv=1

-50   -30   -10   -5   5   10   30   50

12UTC

Bias in downward solar radiation at the surface, NDJ 2017-18

SSRD, RUN=00, STEP=036, ME (W/m2), expv=1

SYNOP
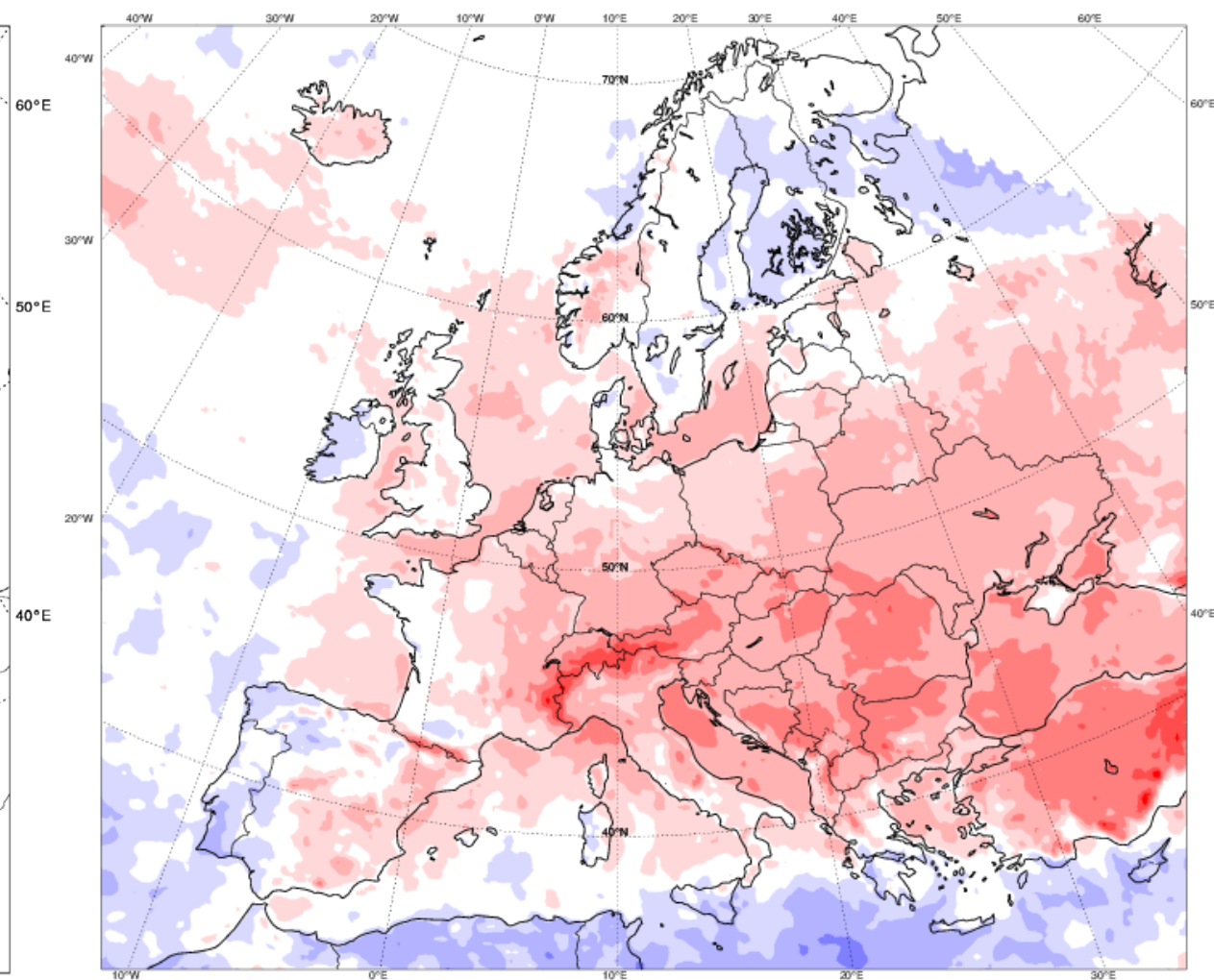
CM SAF

Baseline Surface Radiation Network
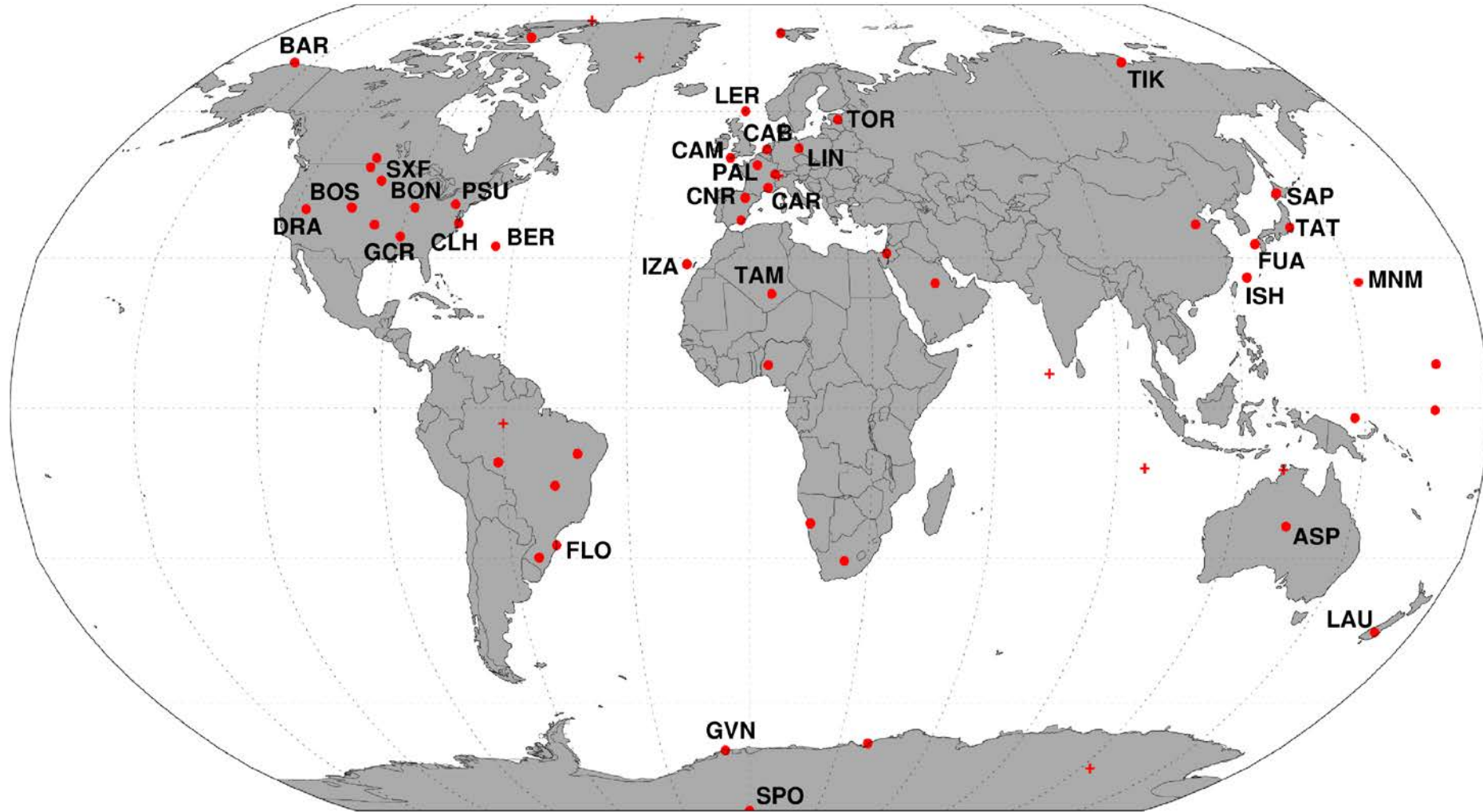
BSRN station Lindenberg (Germany)

Surface downward solar flux, LIN [LAT: 52.2,LON: 14.1], +072 h

SDEV = 29.8
BIAS = 4.4

Shortwave

SDEV

BIAS

Surface downward longwave flux, LIN [LAT: 52.2,LON: 14.1], +072 h

SDEV = 13.8
BIAS = −5.7

Longwave

SDEV
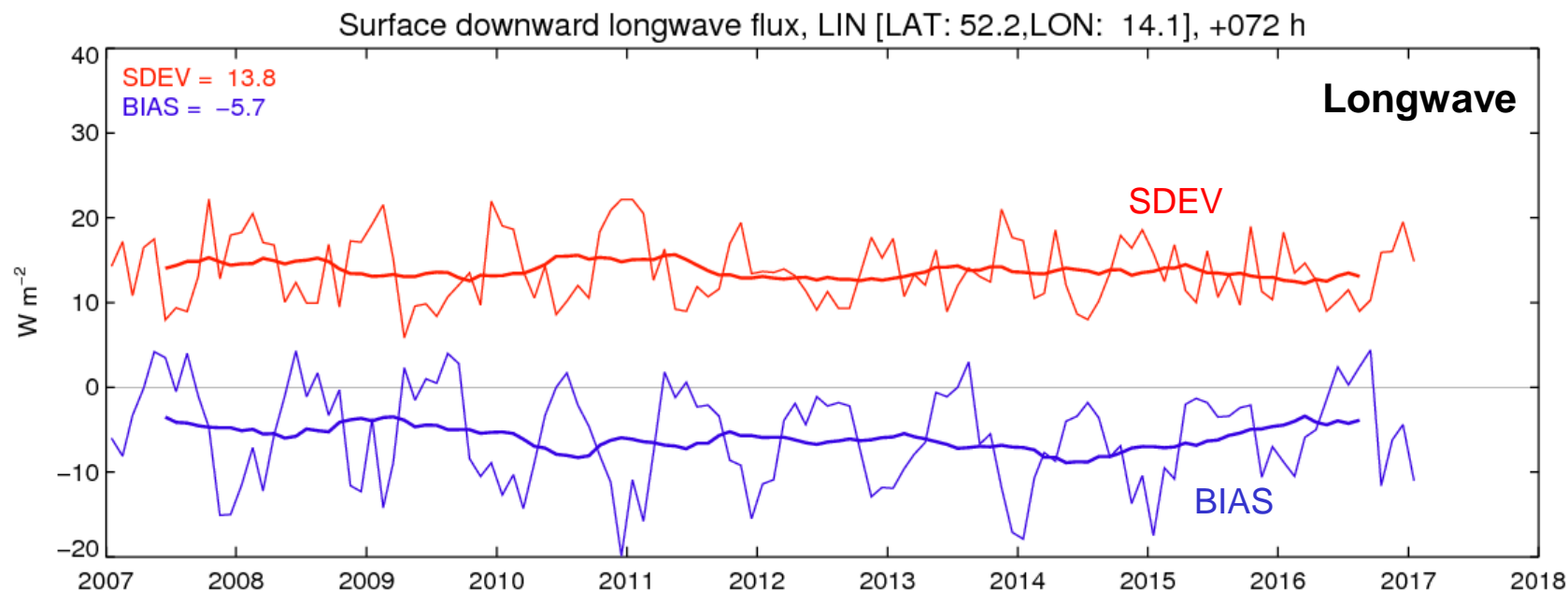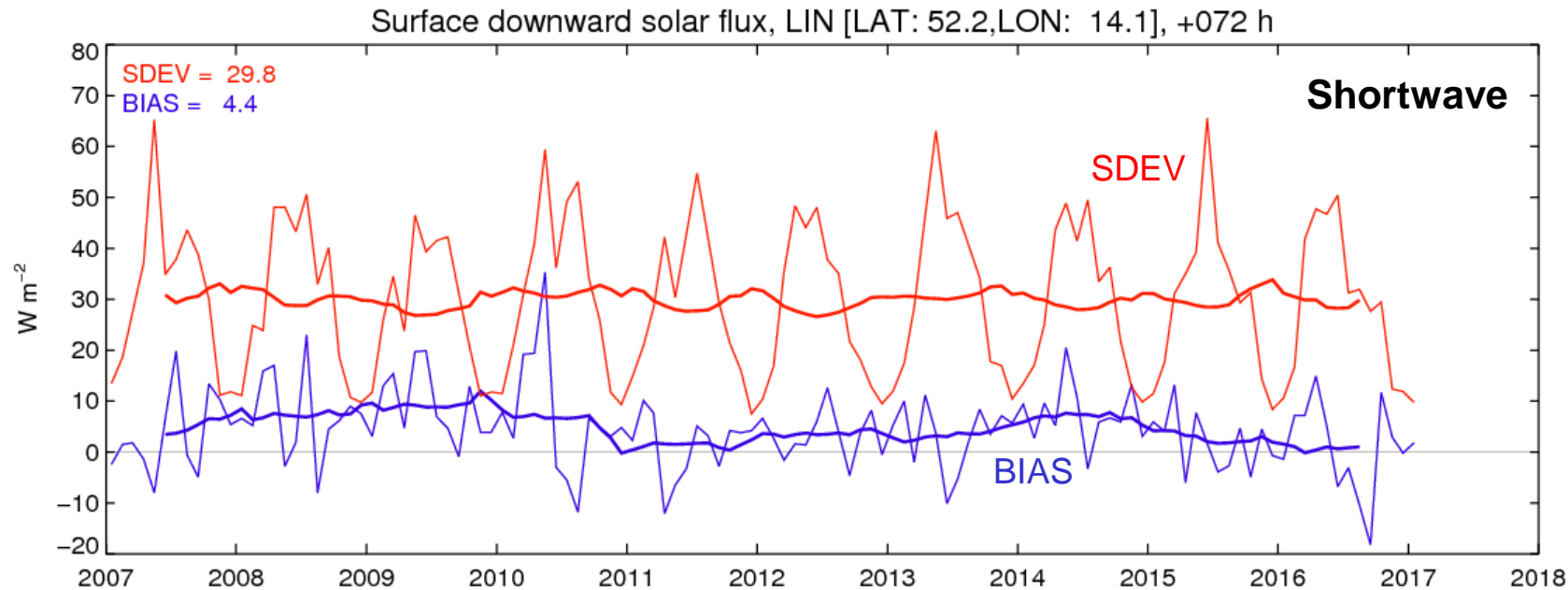
BIAS

SW bias ~0 Wm^{-2}
LW bias -5 Wm^{-2}
e.g.
Cabauw (Netherlands)
Lindenberg (Germany)
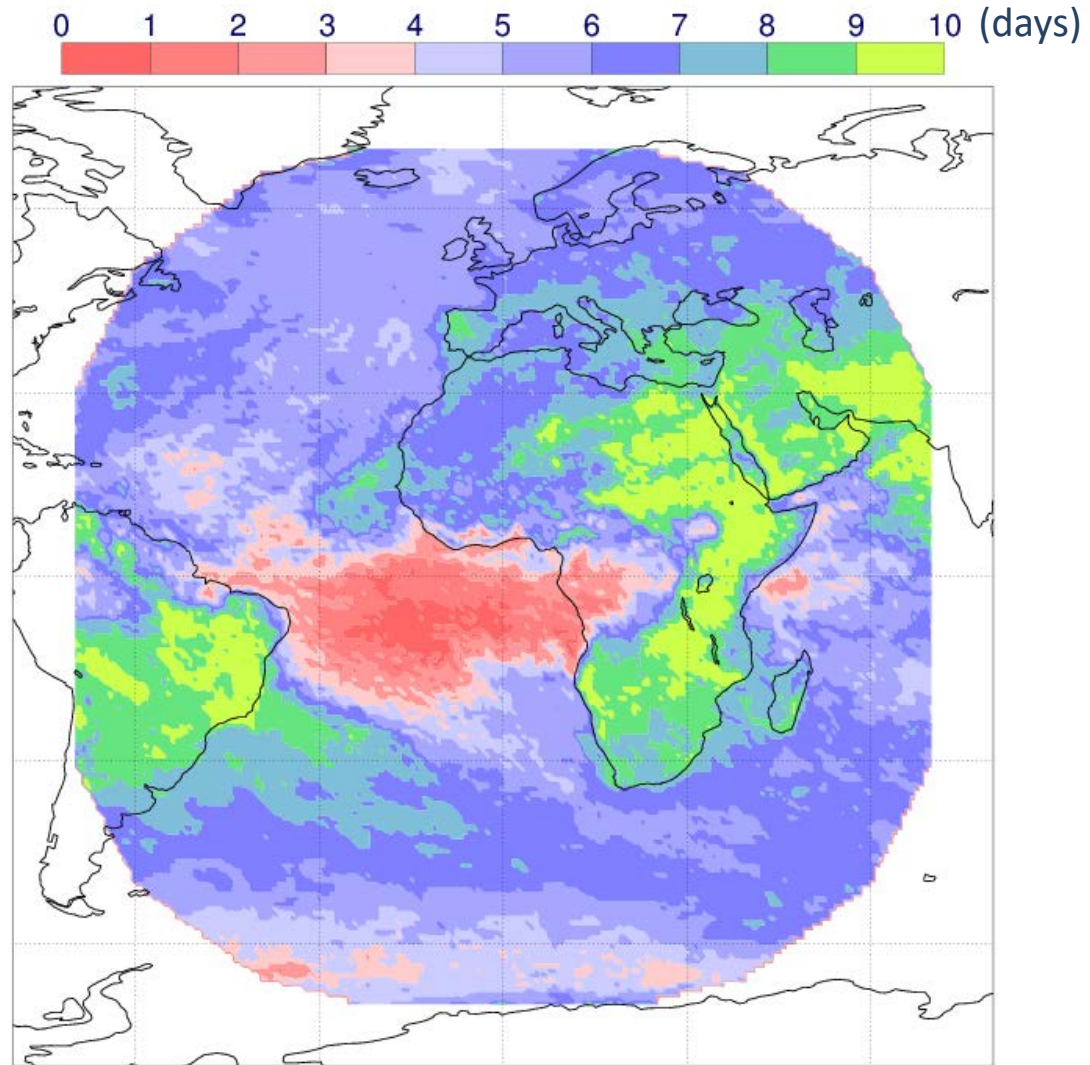Palaiseau (France)
Toravere (Estonia)
Tateno (Japan)
Florianopolis (Brazil)

5-15 Wm^{-2} underestimation of LW flux except Minami-Torishima (Pacific)

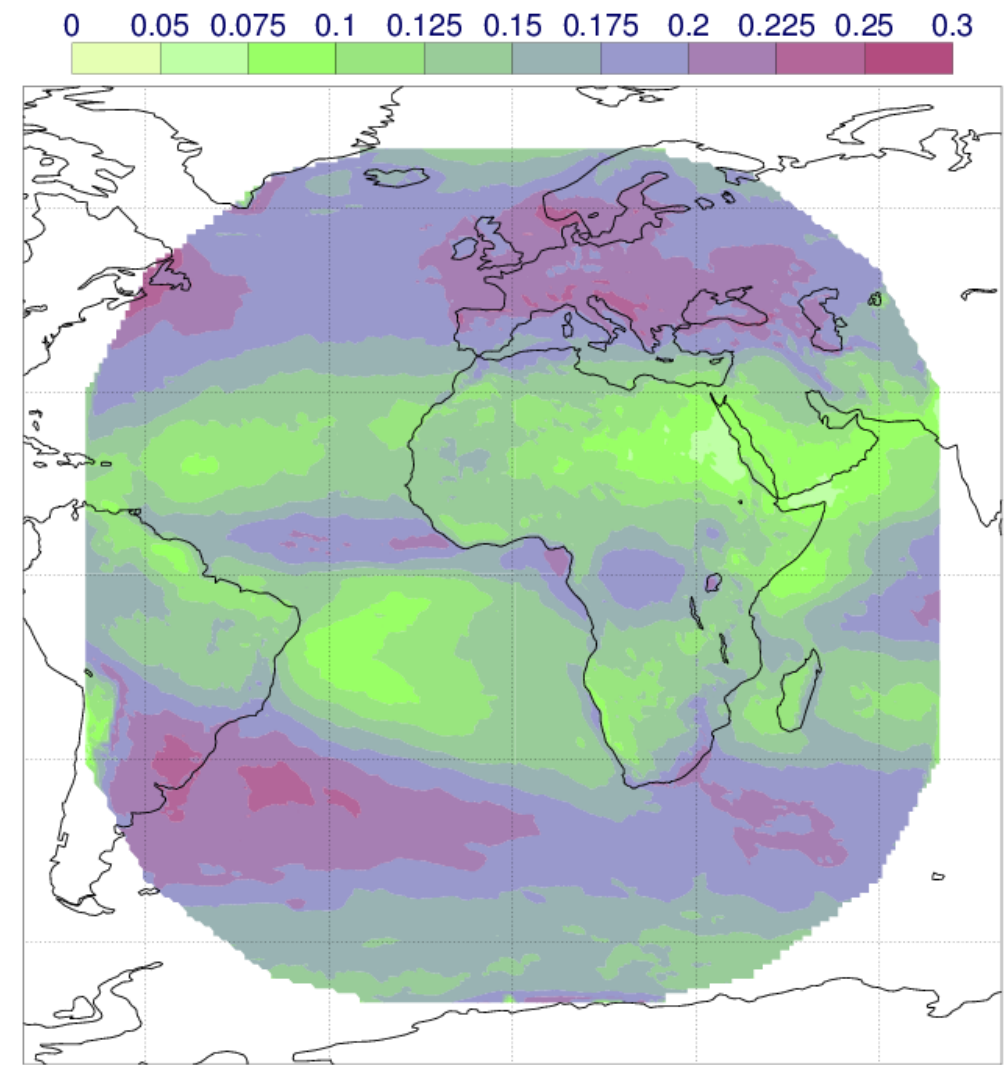0-15 Wm^{-2} overestimation of SW flux

Forecast skill of downward solar radiation
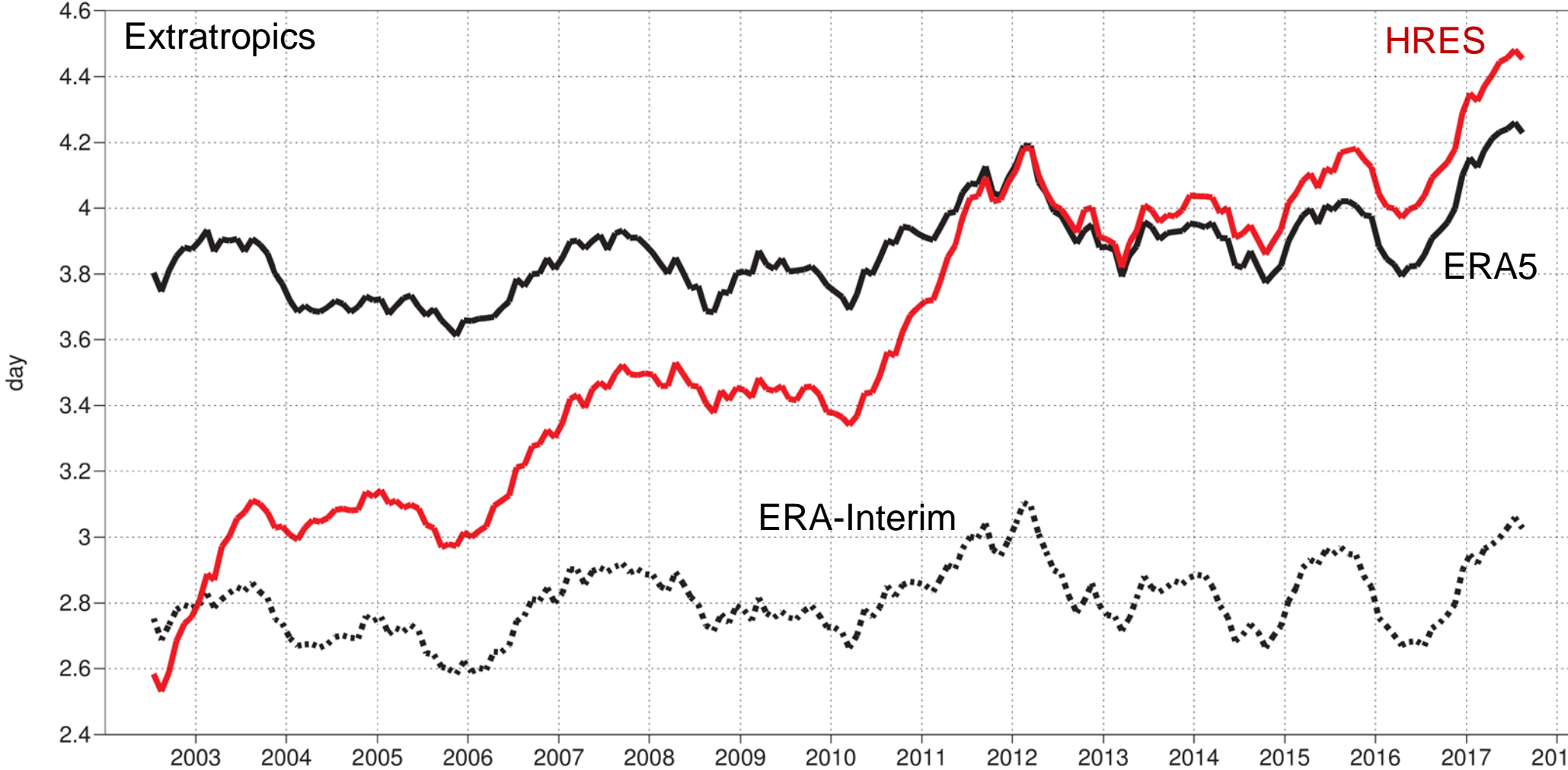

Skill horizon (ACC<0.3)

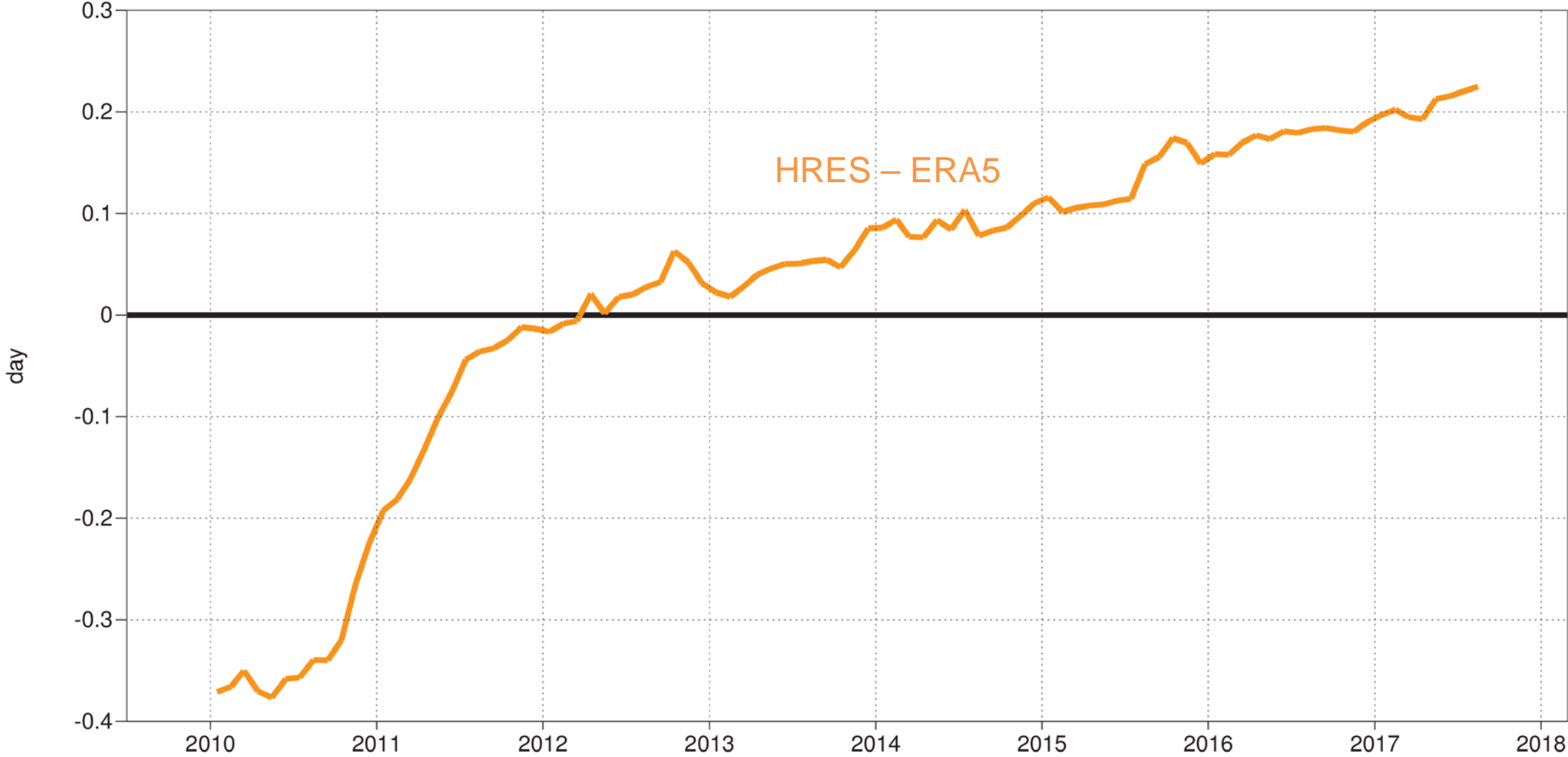Observed variability (annual cycle removed)

HRES precipitation headline score - SEEPS

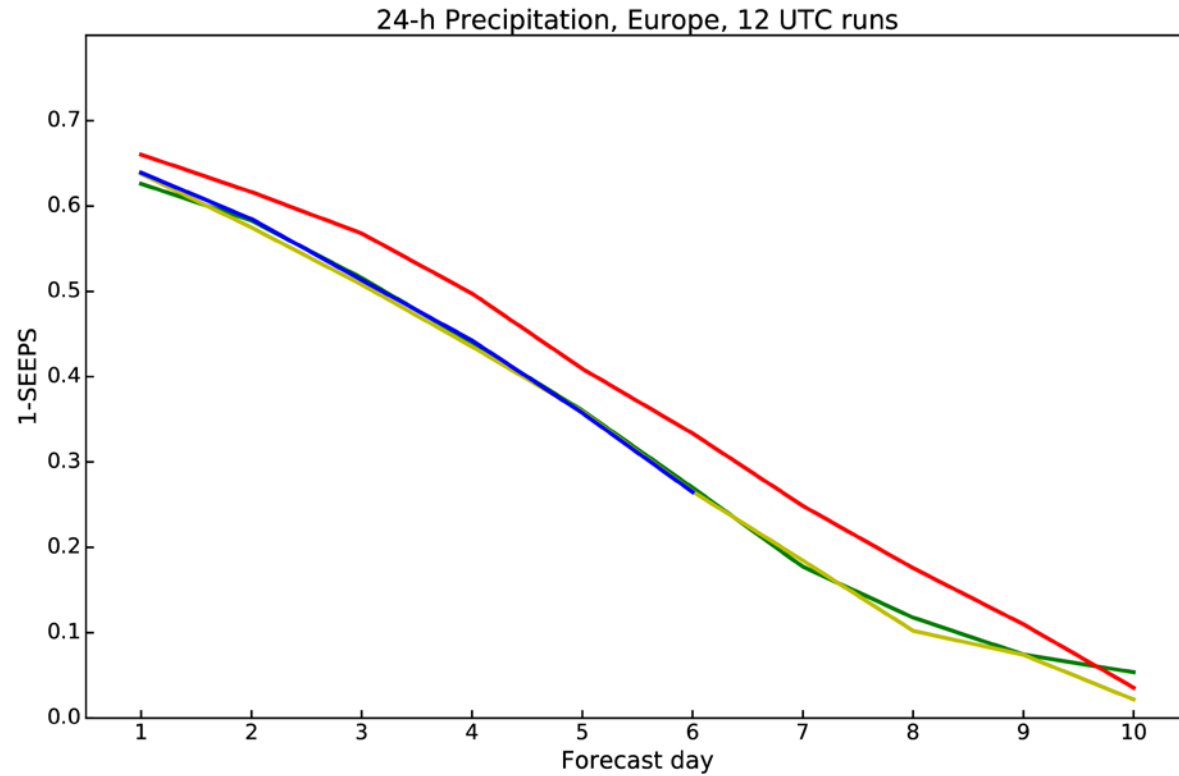# HRES precipitation headline score - SEEPS

HRES precipitation headline score - SEEPS

Tropics: too frequent light precipitation in the IFS

Period: DJF 2017-18

Europe
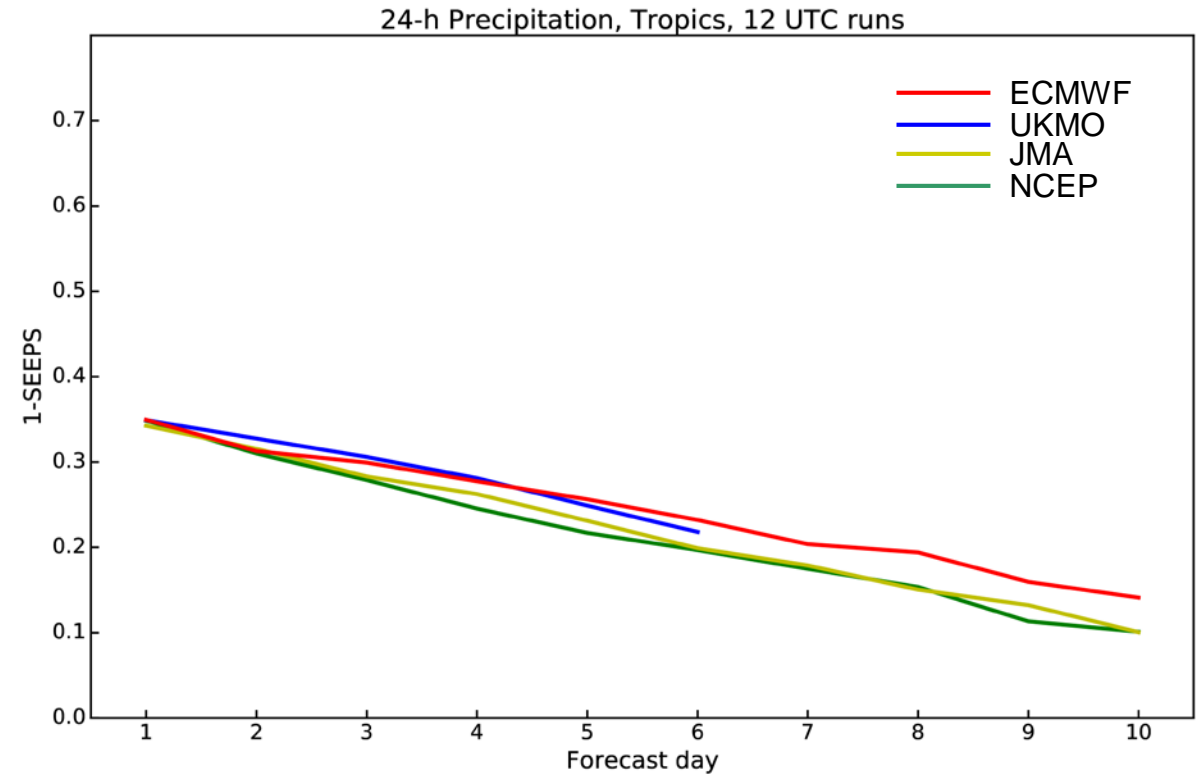
Tropics

High-density surface observations (HDOBS)

Observation availability July 2017

SYNOP
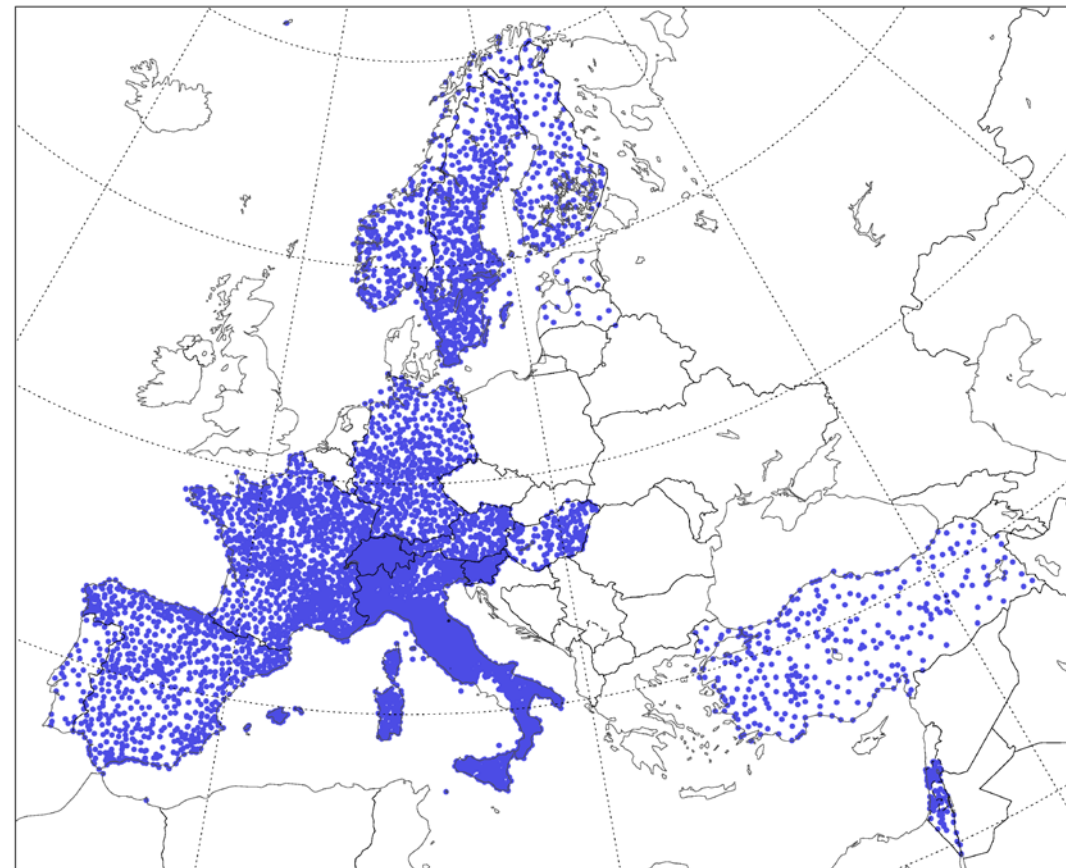
HDOBS

Use of up-scaled HDOBS in verification

Average distance between stations

	SYNOP	HDOBS
France	64 km	24 km
Italy	58 km	11 km
Spain	90 km	25 km

Up-scaling requires several stations
per grid box
→ tests with 0.5° x 0.5° grid
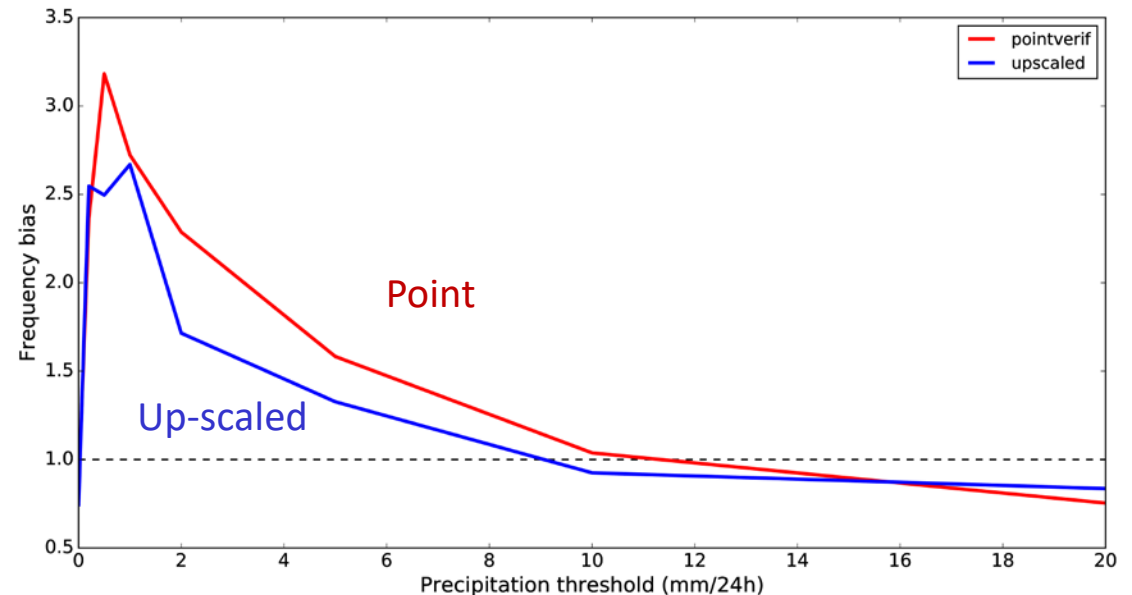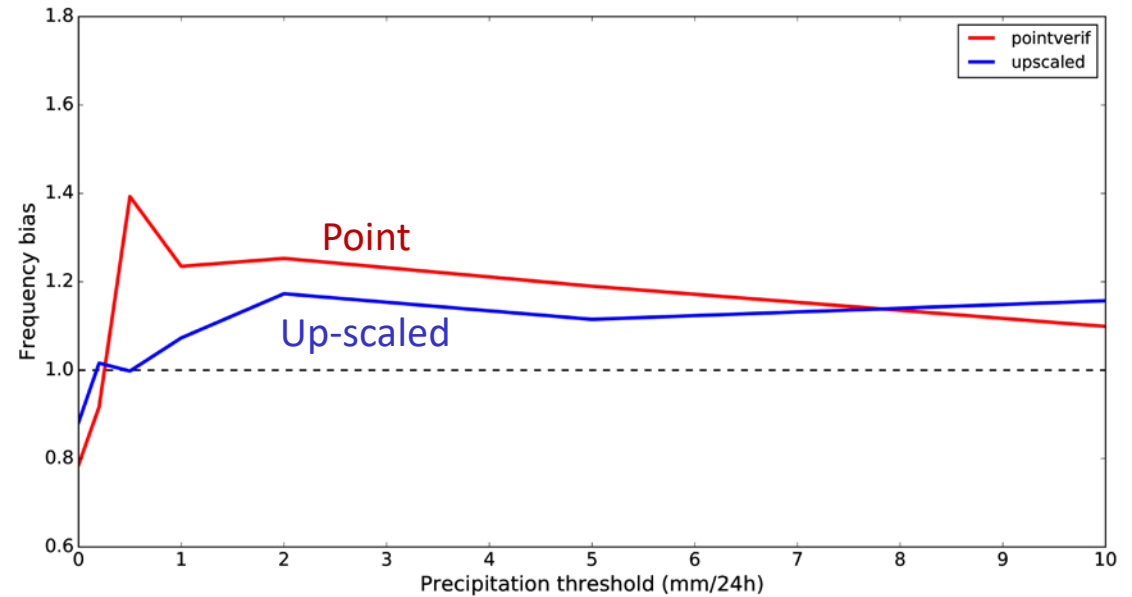
Winter

Summer

High-impact weather

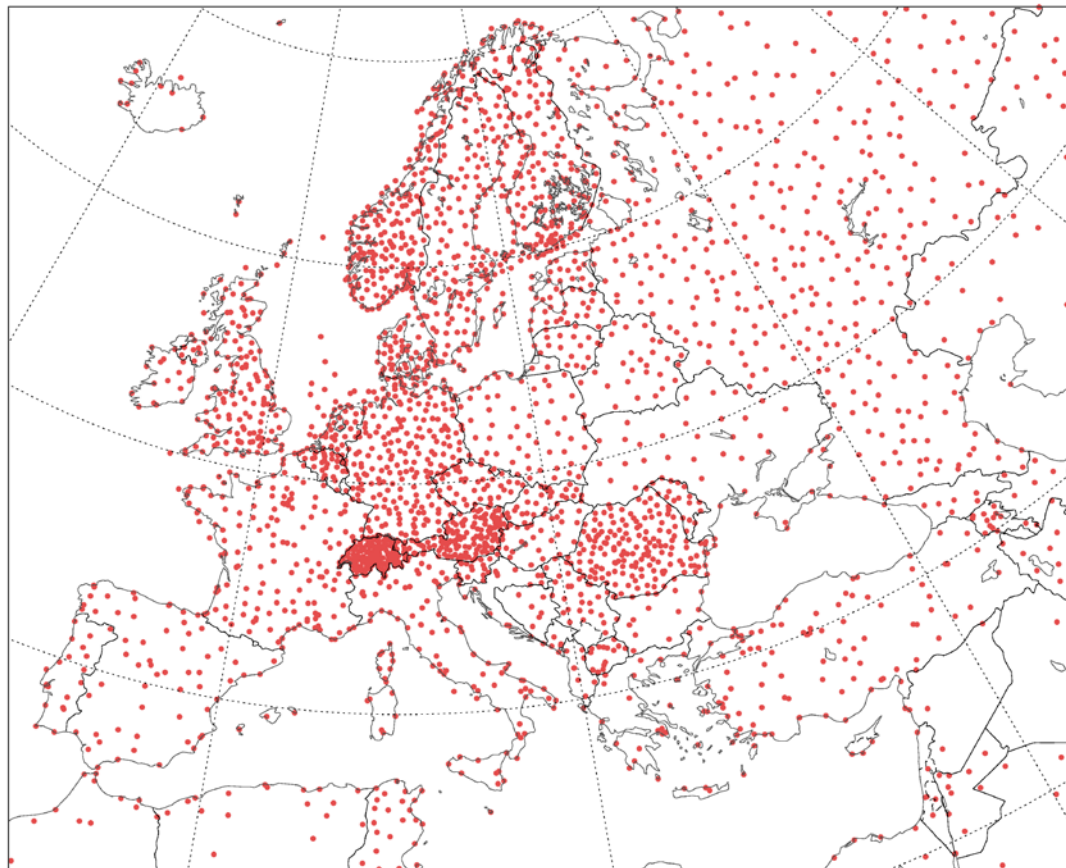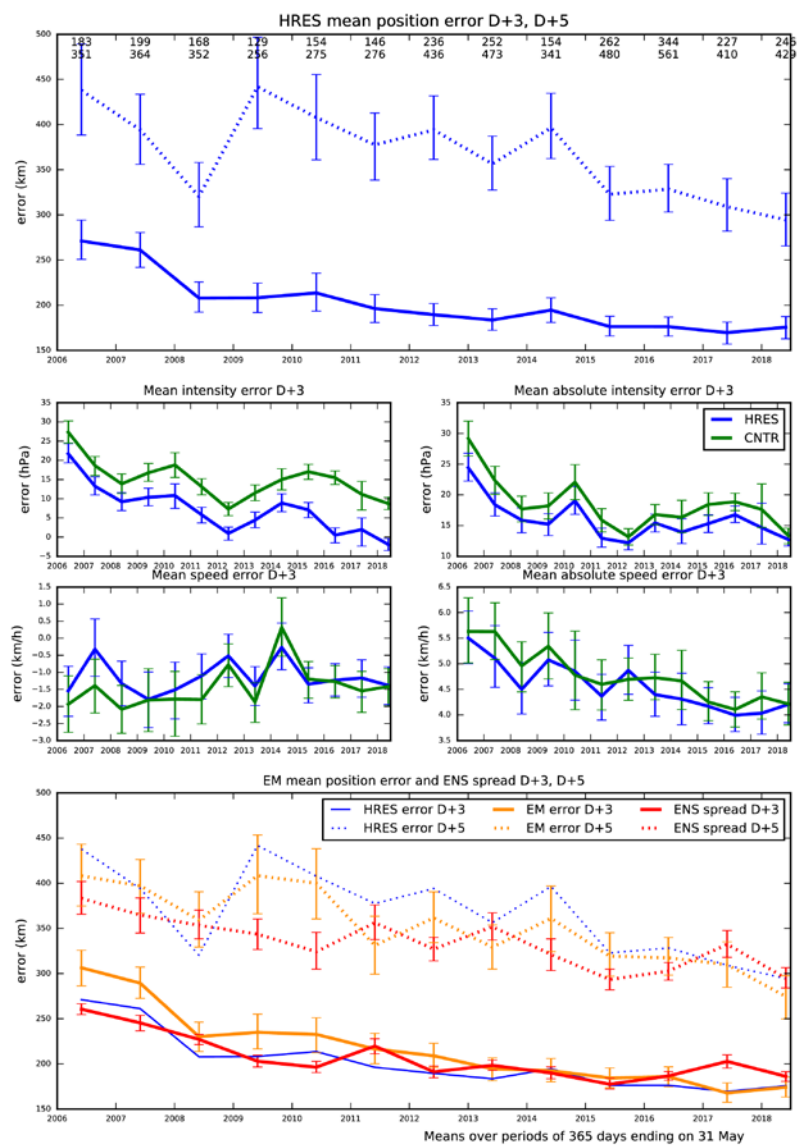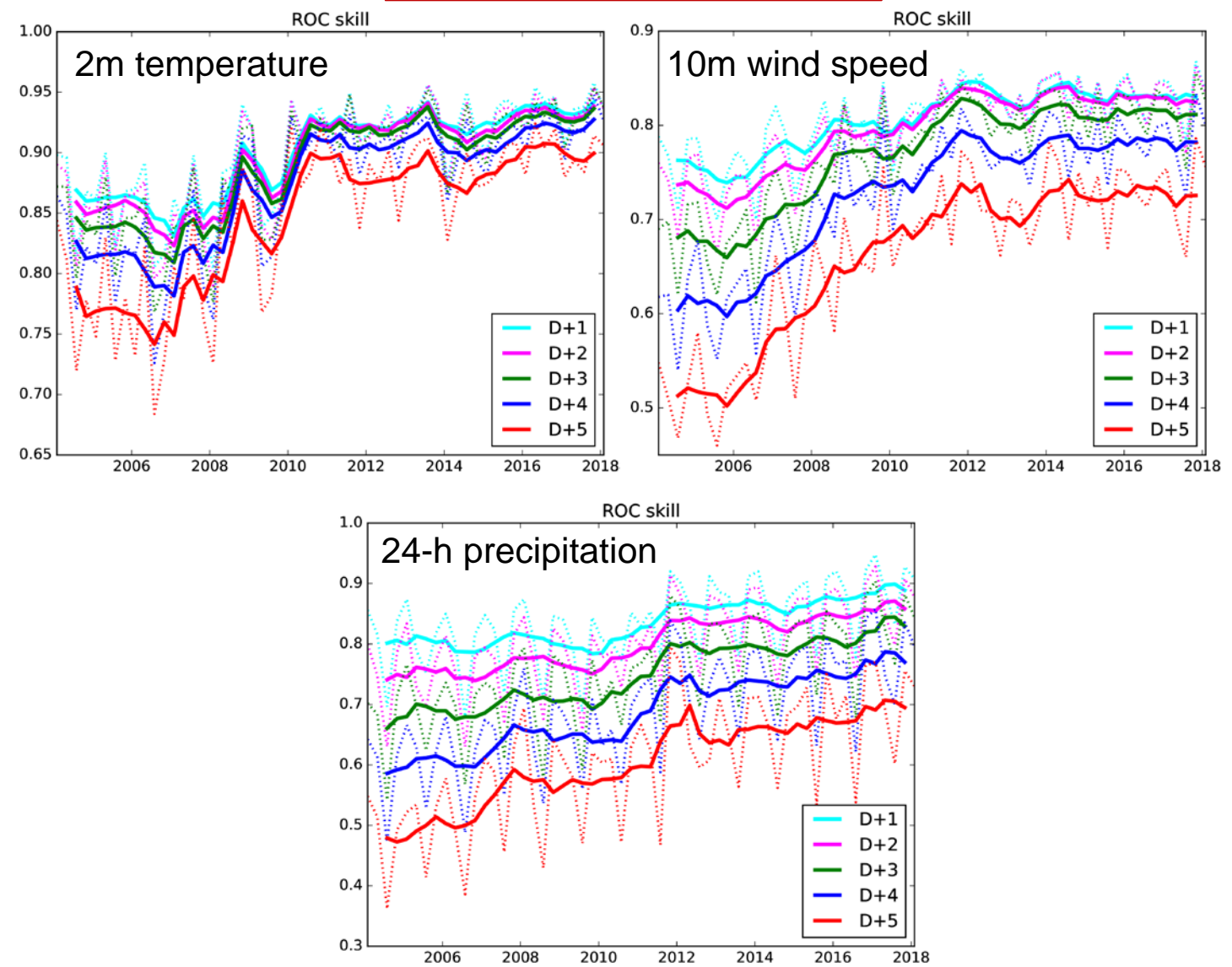# Taking into account observation uncertainty
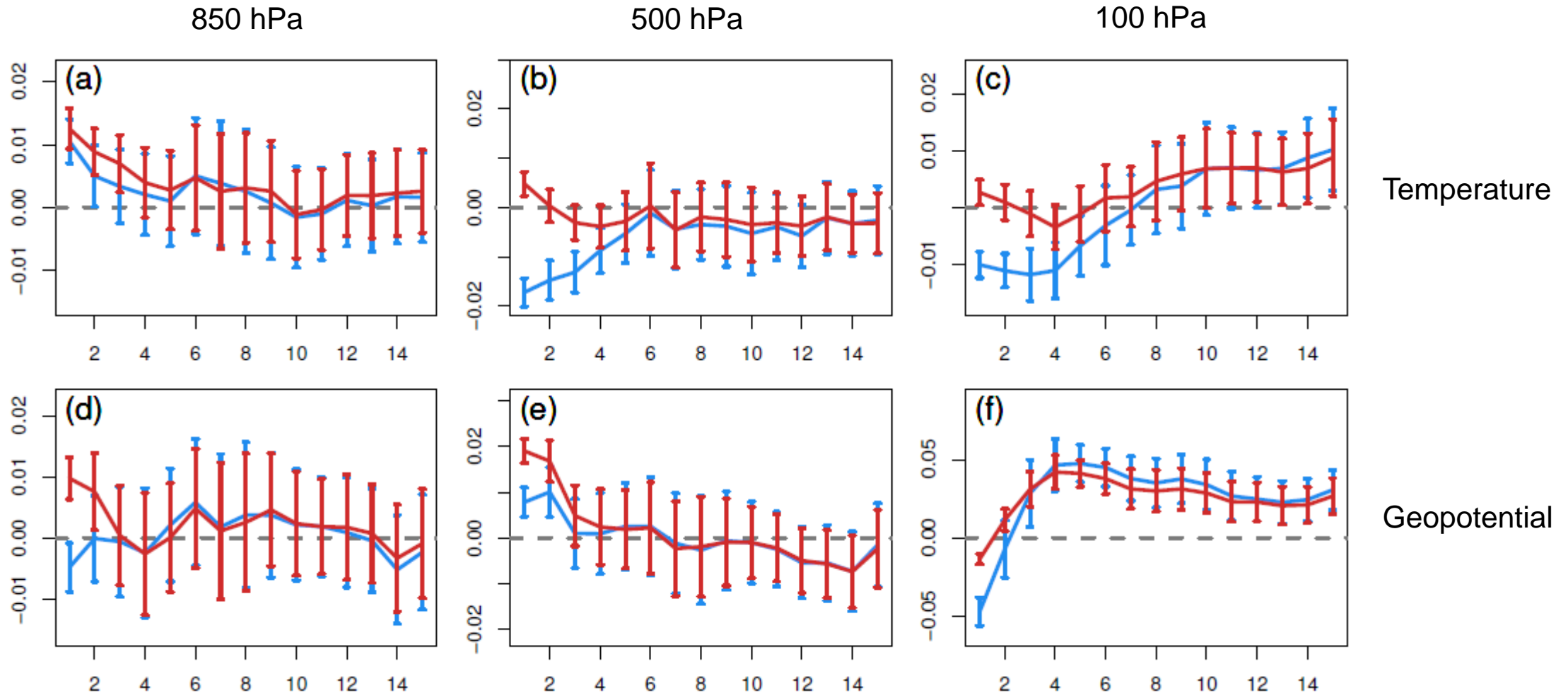
ENS performance of new model cycle (45r1) compared to previous (43r3)
Metric: normalized CRPS difference

Taking into account observation uncertainty
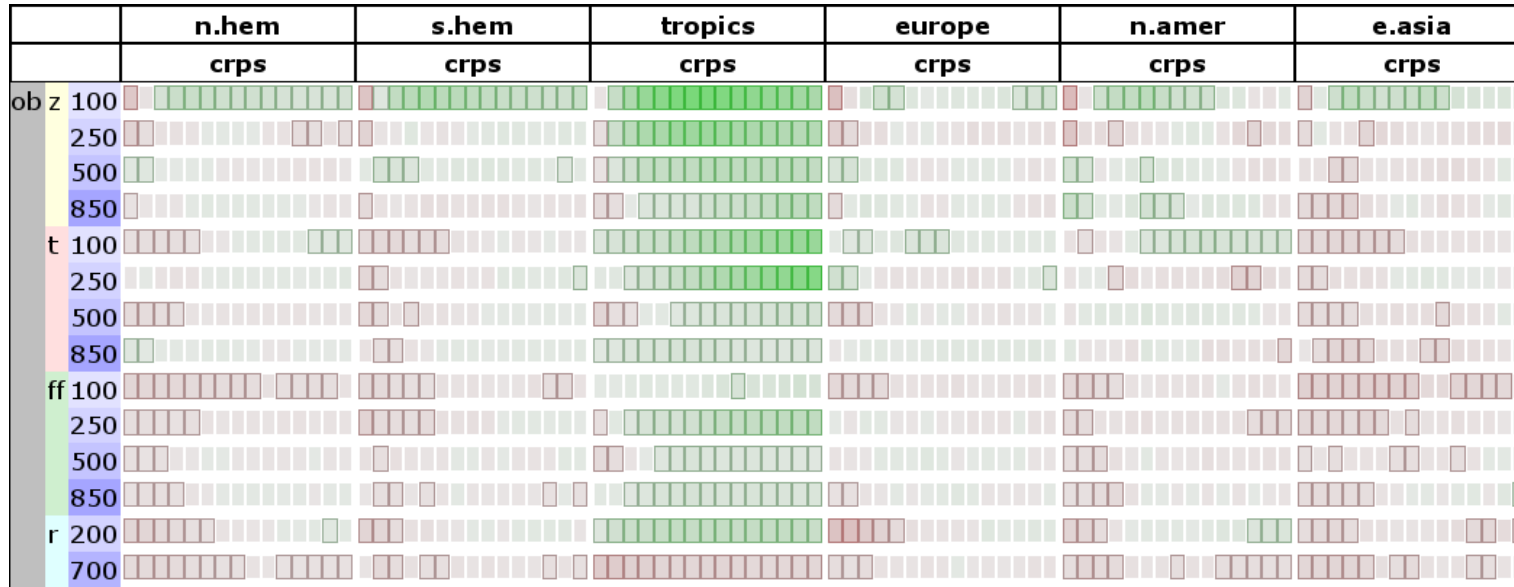
Standard scorecard
(no obs uncertainty)

Experimental scorecard
(with obs uncertainty)

More verification results: see ECMWF webpage & Tech Memos

Show All

Range

- [ ] Extended (30 days) (9/24)
- [ ] Medium (15 days) (28/214)

show 1 more

Type

- [x] Verification (37)

show 1 more

Parameters

- [ ] Geopotential height (9)
- [ ] Mean sea level pressure (7)
- [ ] Ocean waves (5)
- [ ] Precipitation (12)
- [ ] Temperature (14)
- [ ] Tropical cyclones (1)
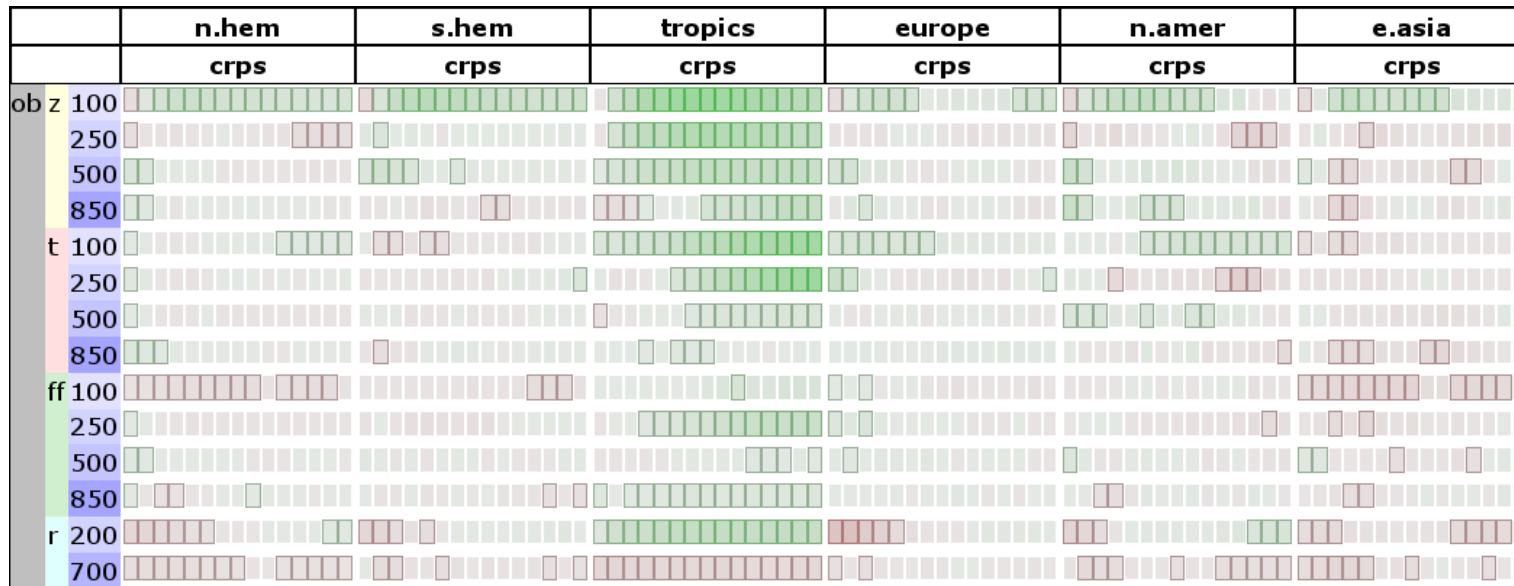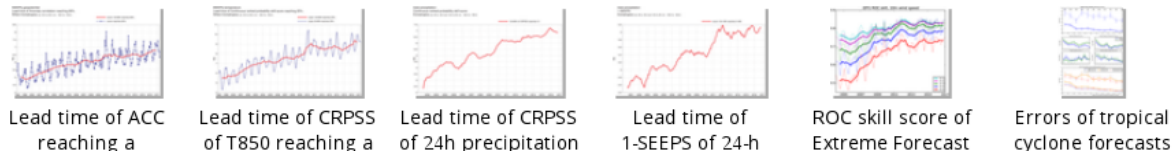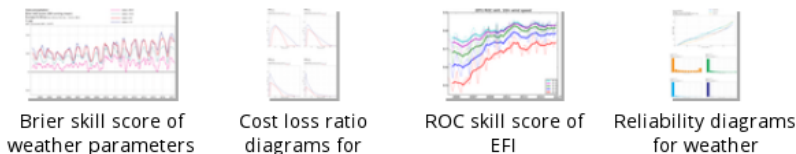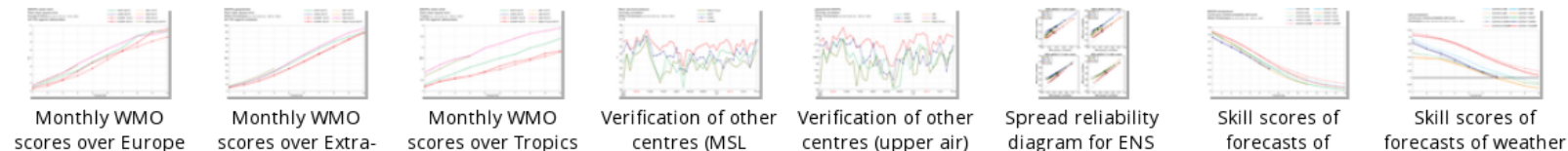- [ ] Wind (11)

show 3 more

Headline scores

Lead time of ACC reaching a

Lead time of CRPSS of T850 reaching a

Lead time of CRPSS of 24h precipitation

Lead time of 1-SEEPS of 24-h

ROC skill score of Extreme Forecast

Errors of tropical cyclone forecasts

Verification of high-resolution forecasts

Anomaly correlation of ECMWF 500hPa

Lead time of ACC reaching multiple

Verification of the high-resolution

Lead time of ACC reaching a

Lead time of 1-SEEPS of 24-h

Verification of ensemble forecasts

Brier skill score of weather parameters

Cost loss ratio diagrams for

ROC skill score of EFI

Reliability diagrams for weather

Comparison of verification scores to other centres

Monthly WMO scores over Europe

Monthly WMO scores over Extra-

Monthly WMO scores over Tropics

Verification of other centres (MSL

Verification of other centres (upper air)

Spread reliability diagram for ENS

Skill scores of forecasts of

Skill scores of forecasts of weather

Wave products comparison against in-situ data and analysis

Ocean waves and 10m wind

Annual scores for waves and wind

Comparison with other operational

Timeseries of statistics for wave

Skill scores of ENS forecasts of ocean

817
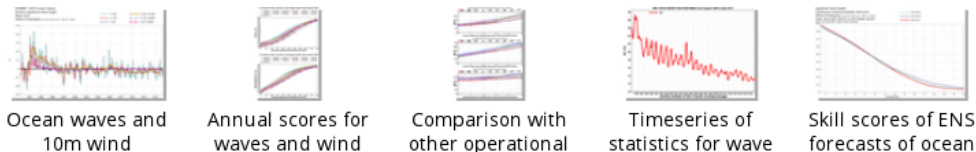
TECHNICAL MEMORANDUM

Evaluation of ECMWF forecasts, including 2016-2017 upgrades

T. Haiden, M. Janousek, J. Bidlot, L. Ferranti, F. Prates, F. Vitart, P. Bauer and D.S. Richardson

Forecast Department

December 2017

This paper has not been published and should be regarded as an Internal Report from ECMWF. Permission to quote from it should be obtained from the ECMWF.

European Centre for Medium-Range Weather Forecasts
Europäisches Zentrum für mittelfristige Wettervorhersage
Centre européen pour les prévisions météorologiques à moyen

Summary

- Medium-range NWP (slowly) **further improving**, ECMWF and other centres

- **Frequency of large errors** in ENS 2-m temperature decreasing

- Regional-scale **systematic errors in surface parameters** → Irina's talk

- Increased focus on verification of **radiation and cloudiness**

- High-density observations used for **up-scaling** (experimental)

- Taking **observation uncertainty** into account (experimental)

ECMWF