Norwegian Meteorological Institute

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Verification of Operational Weather Prediction Models September to November 2019

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More information...

Verification results are also available on internal web pages

- http://metcoop.smhi.se/ - MetCoOp Web Tools - including verification and observation monitoring
- http://verif/vmap/ - timeseries and windroses - on Google map

Models

The following Numerical Weather Prediction (NWP) models are verified in this report.

ECMWF	Global model (IFS) at the European Centre for Medium-Range Weather Forecasts. From 26 January 2010 horizontal resolution approximately 16×16 km^2. From 8 March 2016 cycle 41r2 with horizontal resolution about $9km$. ECMWF is available about 5 hours later than models run at MET.
AROME-MetCoOp (AM25)	HARMONIE with AROME physics, horizontal resolution defined by a 2.5×2.5 km^2 grid on same domain as AROME-Norway. Run in cooperation with Swedish Meteorological and Hydrological Institute (SMHI). Experimental with cycle 38h1.1 from 9 December 2013, operational from 12 March 2014 to 8 November 2016, cycle 38h1.2 from 8 December 2014.
AROME-Arctic (AA25)	HARMONIE with AROME physics, horizontal resolution defined by a 2.5×2.5 km^2 grid, same domain size as AROME-MetCoOp. Experimental with cycle 38h1.2 from 15 October 2015, on Yr from 14 December 2016, cycle 40h1.1 since 19 June 2017.
MetCoOp ensemble system (MEPSctrl)	MEPS has 10 ensemble members, only member 0, the control, is verified in this report. MEPS is based on HARMONIE cycle 40h1.1 with AROME physics and non-hydrostatic dynamics, horizontal resolution defined by a 2.5×2.5 km^2 grid. Experimental since 25 May 2016. Operational status since 8 November 2016.

Analysis and lead times of forecasts are denoted by e.g. 00+30 UTC which indicates forecast generated at 00 UTC and valid 30 hours later.

A change log for HARMONIE AROME is available on internal webpages
https://metcoop.smhi.se/dokuwiki/nwp/metcoop/changelog/start.

Post processed forecasts

Most of the raw NWP model data are post processed before being published on Yr.

The met nordic temperature forecasts, YrPP in the plots, are post-processed forecasts based on the latest MEPS control run. The MEPS temperature forecasts are first downscaled to 1 km resolution using the model lapse rate in a neighbourhood. The forecasts are then bias corrected using a fine scale 1 km temperature analysis as reference. The temperature analysis is based on mulitple data sources using both conventional and citizen observations.

10 m wind speed is statistically post processed to represent maximum wind speed 10m last hour, and called YrPP.

The HARMONIE system

HARMONIE is the acronym for HIRLAM's meso-scale forecast system (Hirlam Aladin Regional/Meso-scale Operational NWP In Europe). For documentation see
- *The HARMONIE-AROME Model Configuration in the ALADIN-HIRLAM NWP System* by Bengtsson et al. 2017, available at https://doi.org/10.1175/MWR-D-16-0417.1
- *AROME-MetCoOp: A Nordic Convective-Scale Operational Weather Prediction Model* by Müller et al. 2017, available at https://doi.org/10.1175/WAF-D-16-0099.1

More documentation is also available on http://www.cnrm.meteo.fr/gmapdoc/ and http://hirlam.org/.

This section presents some of the main components and setups that are used at MET.

AROME physics

AROME (Applications of Research to Operations at MEsoscale) is targeted for horizontal resolution 2.5 km or finer. It uses physical parameterizations based on the French academia model Meso-NH and the external surface model SURFEX. AROME has been operational at Météo-France since 18 December 2008 with a horizontal resolution of 2.5 km and 65 vertical layers, and from April 2015 1.3 km and 90 vertical layers.

SURFEX as surface model

SURFEX (Surface externalisée) is developed at Météo-France and academia for offline experiments and introduced in NWP models to ensure consistent treatment of processes related to surface. Météo-France uses SURFEX in all their configurations. Surface modelling and assimilation benefit from the possibility of running offline experiments. SURFEX is also used for offline applications in e.g. hydrology, vegetation monitoring and snow avalanche forecasts.

SURFEX includes routines to simulate the exchange of energy and water between the atmosphere and 4 surface types (tiles); land, sea (ocean), lake (inland water) and town. The land or nature tile can be divided further into 12 vegetation types (patches). ISBA (Interaction between Soil Biosphere and Atmosphere) is used for modelling the land surface processes. There are 3 ISBA options; 2- and 3-layer force restore and a diffusive approach, where the first one is used in HIRLAM. Towns may be treated by a separate TEB (Town Energy Balance) module. Seas and lakes are also treated separately. The lake model, FLAKE (Freshwater LAKE), has recently been introduced in SURFEX. A global ECOCLIMAP database which combines land cover maps and satellite information gives information about surface properties. The orography is taken from gtopo30.

SURFEX Scientific Documentation and *User's Guide* are available on http://www.cnrm.meteo.fr/surfex/

Data assimilation

NWP models are updated regularly using observations received in real-time from the global observing system. MEPS is updated each third hour; at 00, 03, 06, 09, 12, 15, 18 and 21 UTC.

Surface analysis

Surface analysis is performed by CANARI (Code d'Analyse Nécessaire à ARPEGE pour ses Rejets et son Initialisation) (Taillefer, 2002). The analysis method is Optimal Interpolation and only conventional synoptic observations are used. 2 meter temperature and relative humidity observations are used to update the surface and soil temperature and moisture.

The snow analysis is also performed with CANARI in analogy with the HIRLAM snow analysis. Snow depth observations are used to update Snow Water Equivalent. The snow fields are analysed only at 06 UTC as there are very few snow depth observations at 00, 03, 09, 12, 15, 18 and 21.

The Sea Surface Temperature (SST) and Sea Ice Concentration (SIC) is not analysed, but taken from the boundaries. ECMWF uses the OSTIA (Operational Sea Surface Temperature and Sea Ice Analysis) product, including SST from UK Met Office and SIC from MET. SST and SIC for the Baltic Sea have since 26 November 2015 been taken from ocean models run at SMHI; first HIROMB and since 26 April 2017 NEMO.

The surface temperature over sea ice was taken from the boundary model and remained unchanged through the forecast. A simple thermodynamical sea ice scheme (SICE) giving prognostic sea ice temperatures in 4 fixed layers was introduced 26 November 2015.

Upper air analysis

MEPS runs three dimensional variational (3D VAR) data assimilation using conventional observations from synop stations, ships, radiosondes and aircrafts and AMSU-A and AMSU-B/MHS data from polar orbiting NOAA and METOP satellites. GNSS were introduced 17 February 2015, radar reflectivities 16 June 2015, IASI 26 November 2015 and ASCAT 17 March 2016.

Boundary fields

MEPS gets its boundary values (1-hourly) from the ECMWF model at approximately 16 km resolution, and has currently 65 vertical levels. None of the HARMONIE configurations at MET have applied digital filter initialization (DFI).

Verification measures

All model forecasts in this report are verified against observations by interpolating (linear) the grid based forecasts to the observational sites. As a consequence, it should be noted that it is the models' abilities to forecast the observations that is being quantifed and assessed. Thus, there is no attempt in this report to verify area averaged precipitation for example.

Verification is carried out both for raw and categorized forecasts. In the following, let $f_1, ..., f_n$ denote the forecasts and $o_1, ..., o_n$ the corresponding observations.

Forecasts of continuous variables

The verification statistics applied to continuous variables are defined in the table below

Statistic	Acronym	Formula	Range	Optimal score
Mean Error	ME	$\frac{1}{n}\ \sum_{i=1}^{n}(f_i - o_i)$	$-\infty$ to ∞	0
Mean Absolute Error	MAE	$\frac{1}{n}\ \sum_{i=1}^{n} \mid f_i - o_i \mid$	0 to ∞	0
Standard Deviation of Error	SDE	$\Big(\frac{1}{n}\sum_{i=1}^{n}(f_i - o_i - \mathsf{ME})^2\Big)^{1/2}$	0 to ∞	0
Root Mean Square Error	RMSE	$\Big(\frac{1}{n}\sum_{i=1}^{n}(f_i - o_i)^2\Big)^{1/2}$	0 to ∞	0
Correlation	COR	$\frac{\frac{1}{n}\sum_{i=1}^{n}(f_i - \bar{f})(o_i - \bar{o})}{\mathsf{SD}(f)\mathsf{SD}(o)}$	-1 to 1	1

In the formula for COR the following definitions are used

$$\bar{f}\ =\ \frac{1}{n}\sum_{i=1}^{n} f_i, \qquad \bar{o}\ =\ \frac{1}{n}\sum_{i=1}^{n} o_i$$

$$\mathsf{SD}(f)\ =\ \big(\frac{1}{n}\sum_{i=1}^{n}(f_i - \bar{f})^2\big)^{1/2}, \qquad \mathsf{SD}(o)\ =\ \big(\frac{1}{n}\sum_{i=1}^{n}(o_i - \bar{o})^2\big)^{1/2}$$

for the means and standard deviations of the forecasts and observations.

Forecasts of categorical variables

All variables in this report are continuous in raw form, but it is possible to categorize them and verify these. For example, wind speed above a given threshold could be of interest which would result in two possible outcomes (yes and no). The verification is then completely summarized by a contingency table as the one shown below

		event observed	
		yes	no
event forecasted	yes	a	b
	no	c	d

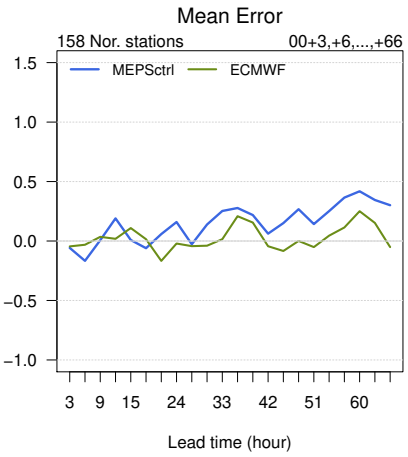
Verification statistics for such forecasts are listed in the following table

Statistic	Acronym	Formula	Range	Optimal score
Hit rate	HR	$\frac{a}{a+c}$	0 to 1	1
False alarm rate	F	$\frac{b}{b+d}$	0 to 1	0
False alarm ratio	FAR	$\frac{b}{a+b}$	0 to 1	0
Equitable threat score	ETS	$\frac{a-ar}{a+b+c-ar}$	$-1/3$ to 1	1 (0 = no skill)
Hanssen-Kuipers skill score	KSS	HR - F	-1 to 1	1 (0 = no skill)
Heidke skill score	HSS	$\frac{(a+d)/n-ssf}{1-ssf}$	$-\infty$ to 1	1 (0 = no skill)

In the formula for ETS $ar = (a+b)(a+c)/n$.
In the formula for HSS the score for the standard forecast $ssf = [(a+b)(a+c)+(b+d)(c+d)]/n^2$.

Observations

All observations come from Klimadatavarehuset at MET. Only synop stations are used. The model wind speed is verified against mean wind observations, FF. The post processed wind speed is intended to represent maximum wind speed 10m last hour, and is verified against FX.


Mean Error
158 Nor. stations
00+3,+6,...,+66
MEPSctrl
ECMWF
1.5
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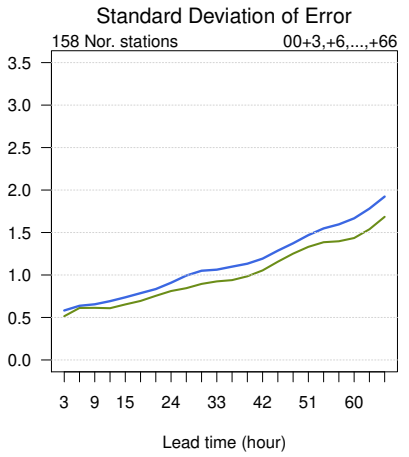
0.5
0.0
−0.5
−1.0
3 9 15 24 33 42 51 60
Lead time (hour)


Standard Deviation of Error
158 Nor. stations
00+3,+6,...,+66
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0.0
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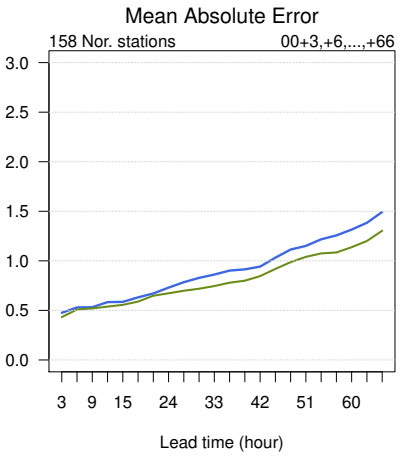
Lead time (hour)


Mean Absolute Error
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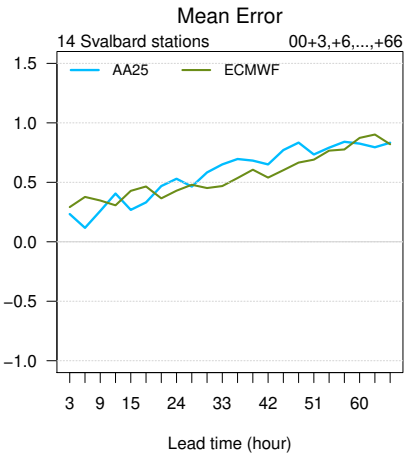
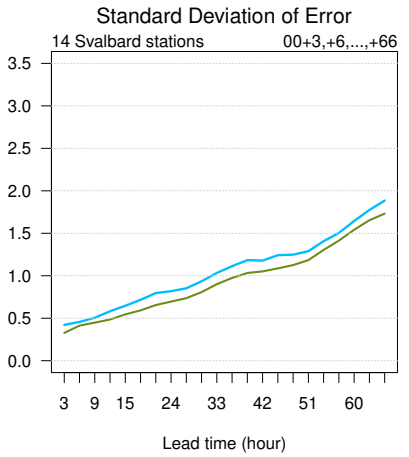
0.5
0.0
3 9 15 24 33 42 51 60
Lead time (hour)


Mean Error
14 Svalbard stations
00+3,+6,...,+66
AA25
ECMWF
1.5
1.0
0.5
0.0
−0.5
−1.0
3 9 15 24 33 42 51 60
Lead time (hour)


Standard Deviation of Error
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00+3,+6,...,+66
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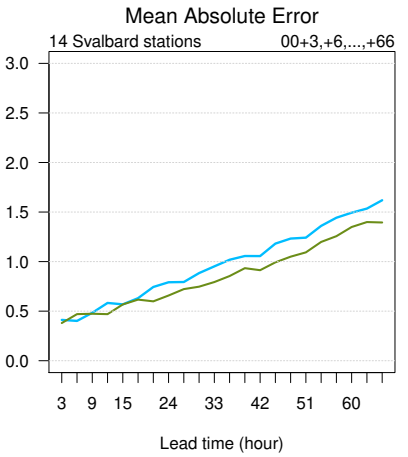
2.5
2.0
1.5
1.0
0.5
0.0
3 9 15 24 33 42 51 60
Lead time (hour)


Mean Absolute Error
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2.5
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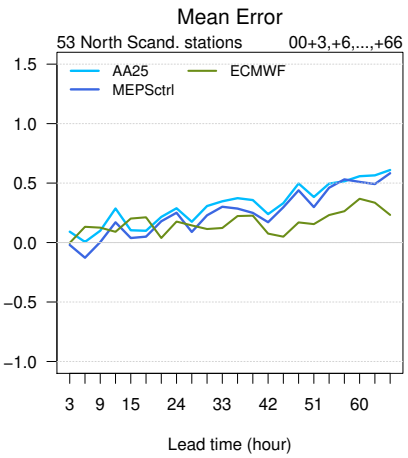
0.5
0.0
3 9 15 24 33 42 51 60
Lead time (hour)


Mean Error
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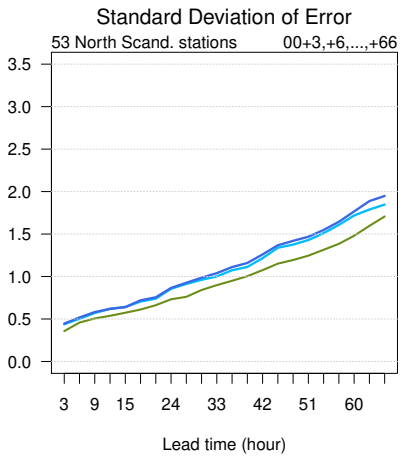
AA25
ECMWF
MEPSctrl
1.5
1.0
0.5
0.0
−0.5
−1.0
3 9 15 24 33 42 51 60
Lead time (hour)


Standard Deviation of Error
53 North Scand. stations
00+3,+6,...,+66
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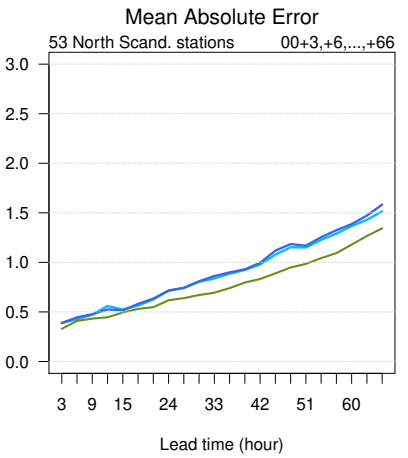
3.0
2.5
2.0
1.5
1.0
0.5
0.0
3 9 15 24 33 42 51 60
Lead time (hour)


Mean Absolute Error
53 North Scand. stations
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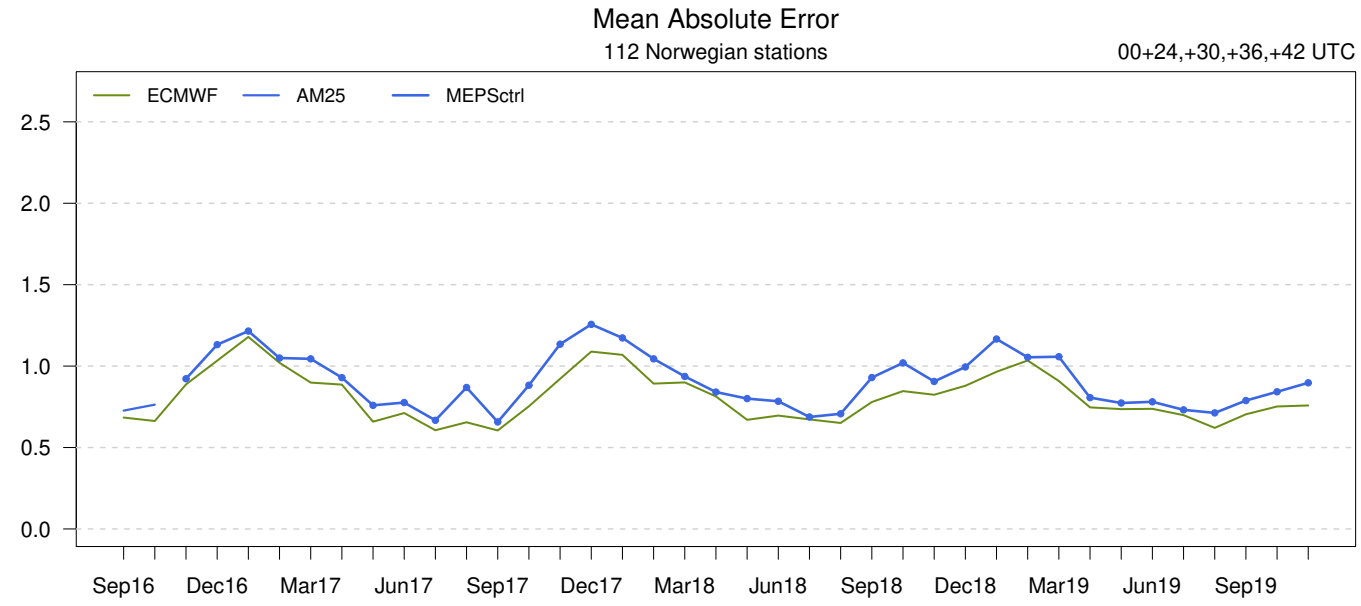
2.5
2.0
1.5
1.0
0.5
0.0
3 9 15 24 33 42 51 60
Lead time (hour)


Mean Absolute Error
112 Norwegian stations
00+24,+30,+36,+42 UTC
ECMWF
AM25
MEPSctrl
2.5
2.0
1.5
1.0
0.5
0.0
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Dec16
Mar17
Jun17
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Mar18
Jun18
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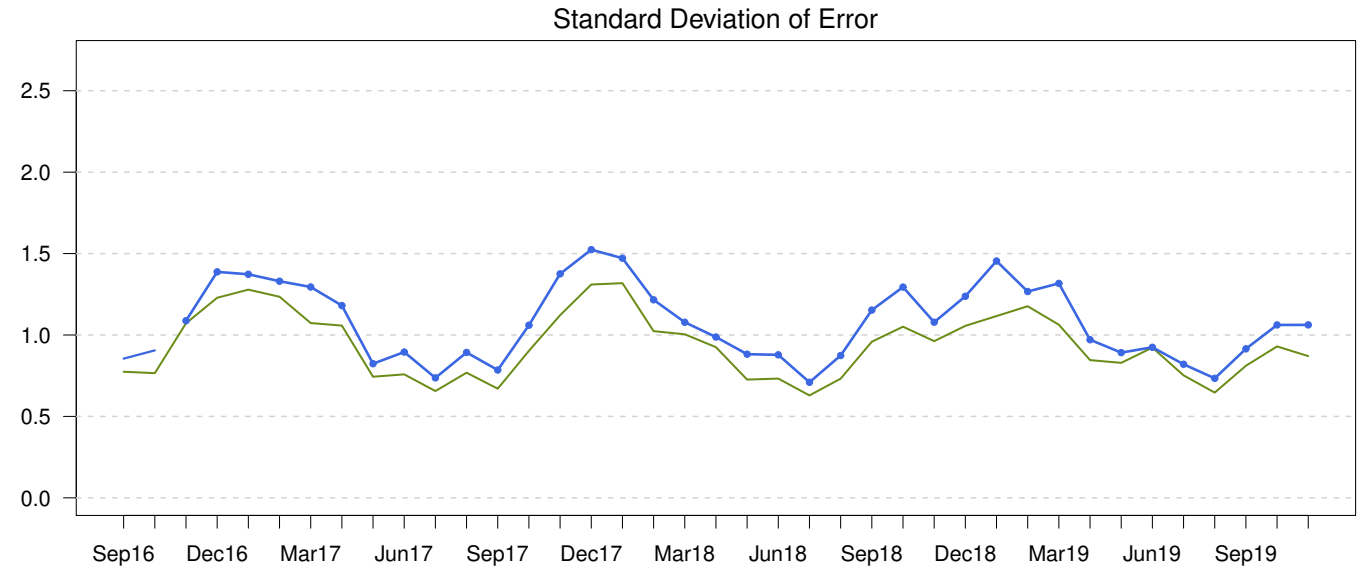
Dec18
Mar19
Jun19
Sep19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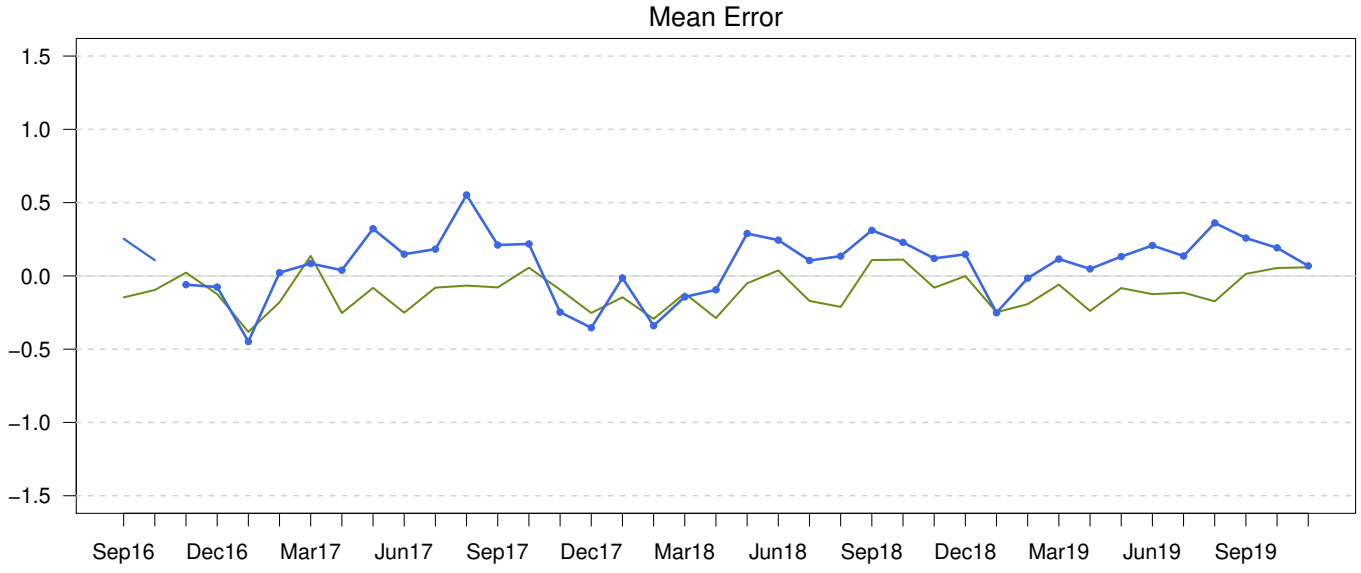
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Jun19
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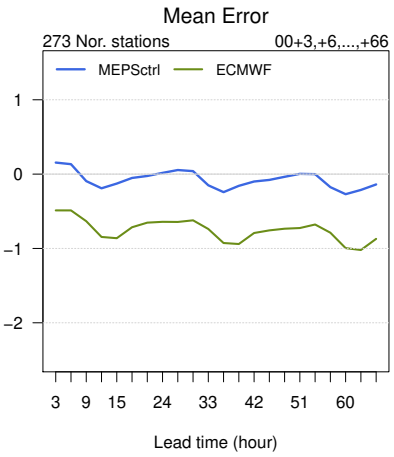
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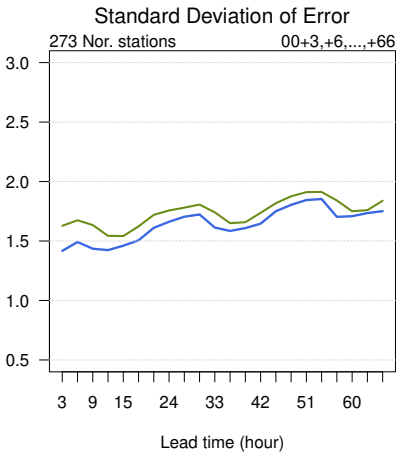
MEPSctrl
ECMWF
1
0
−1
−2
3 9 15 24 33 42 51 60
Lead time (hour)


Standard Deviation of Error
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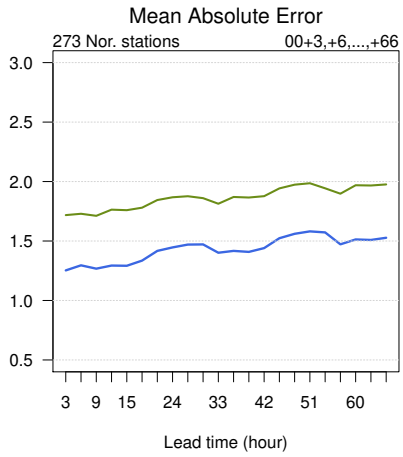
Lead time (hour)


Mean Absolute Error
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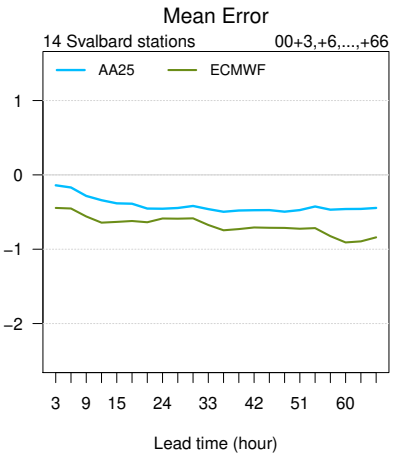
1.0
0.5
3 9 15 24 33 42 51 60
Lead time (hour)


Mean Error
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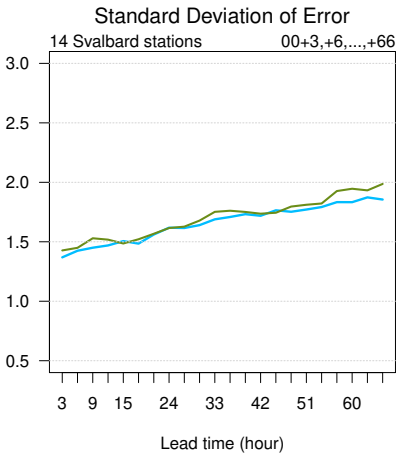
AA25
ECMWF
1
0
−1
−2
3 9 15 24 33 42 51 60
Lead time (hour)


Standard Deviation of Error
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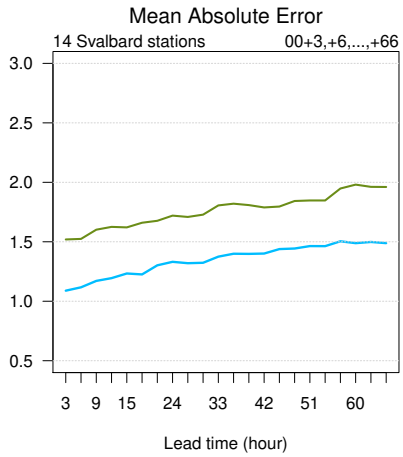
1.0
0.5
3 9 15 24 33 42 51 60
Lead time (hour)


Mean Absolute Error
14 Svalbard stations
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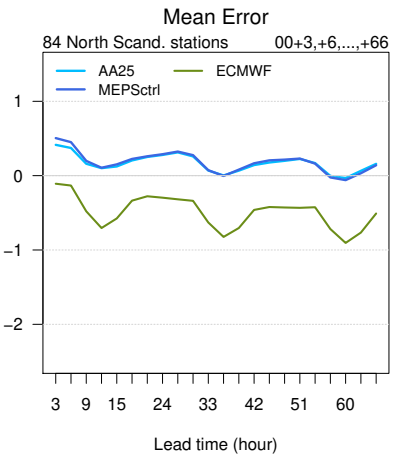
1.5
1.0
0.5
3 9 15 24 33 42 51 60
Lead time (hour)


Mean Error
84 North Scand. stations
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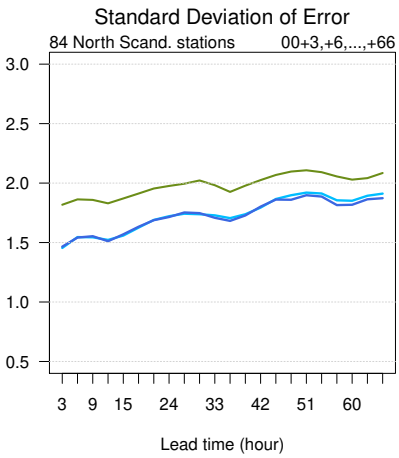
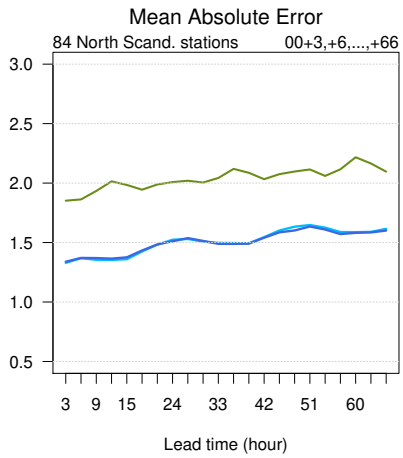
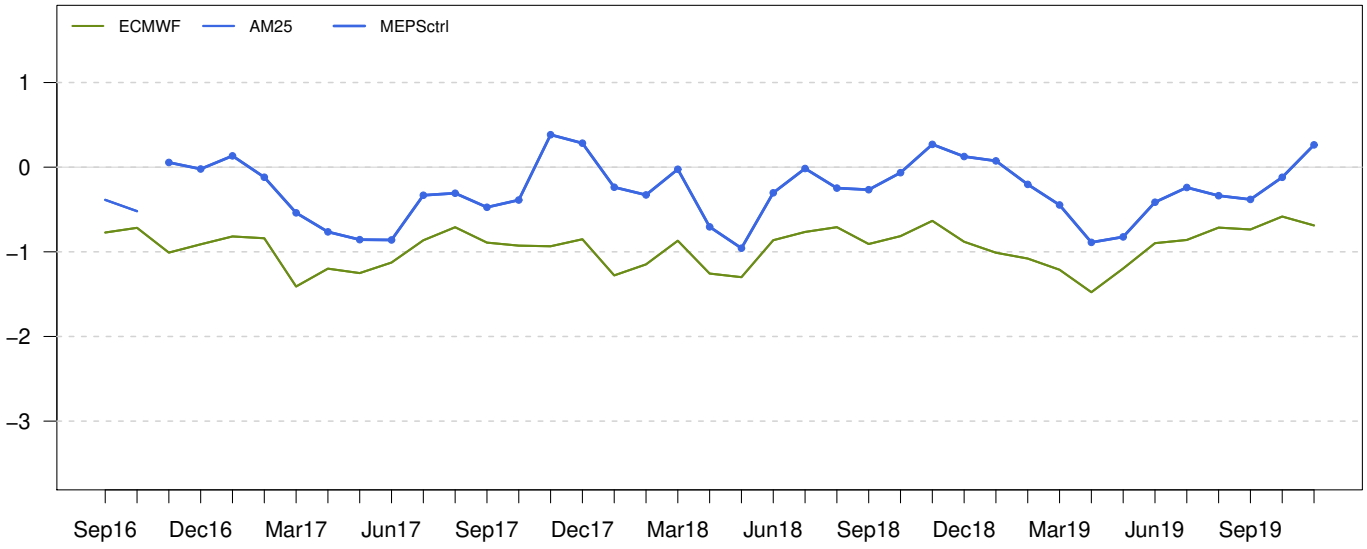
AA25
ECMWF
MEPSctrl
1
0
−1
−2
3 9 15 24 33 42 51 60
Lead time (hour)


Standard Deviation of Error
84 North Scand. stations
00+3,+6,...,+66
3.0
2.5
2.0
1.5
1.0
0.5
3 9 15 24 33 42 51 60
Lead time (hour)

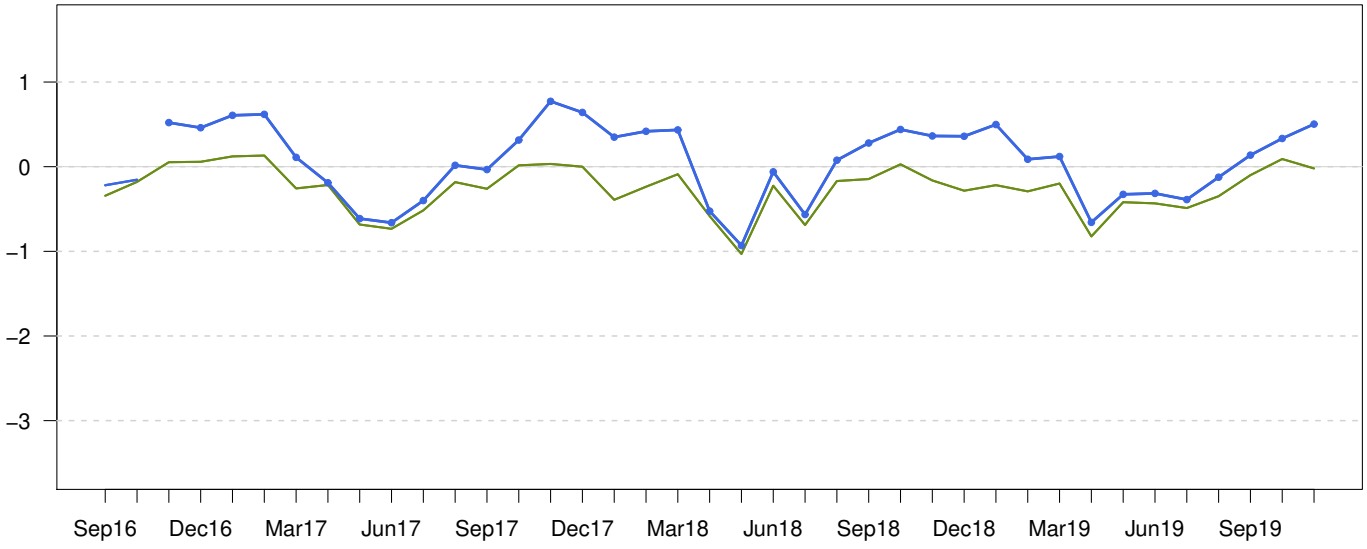

Mean Absolute Error
84 North Scand. stations
00+3,+6,...,+66
3.0
2.5
2.0
1.5
1.0
0.5
3 9 15 24 33 42 51 60
Lead time (hour)

Mean Error

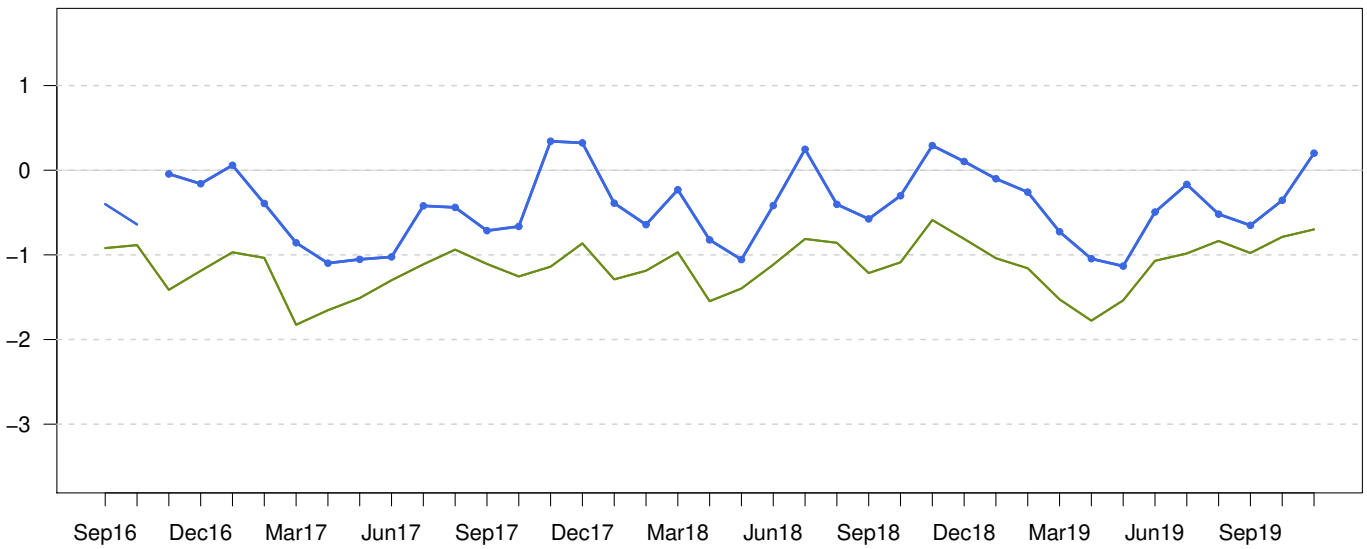
157 Norwegian stations 00+24,+30,+36,+42 UTC



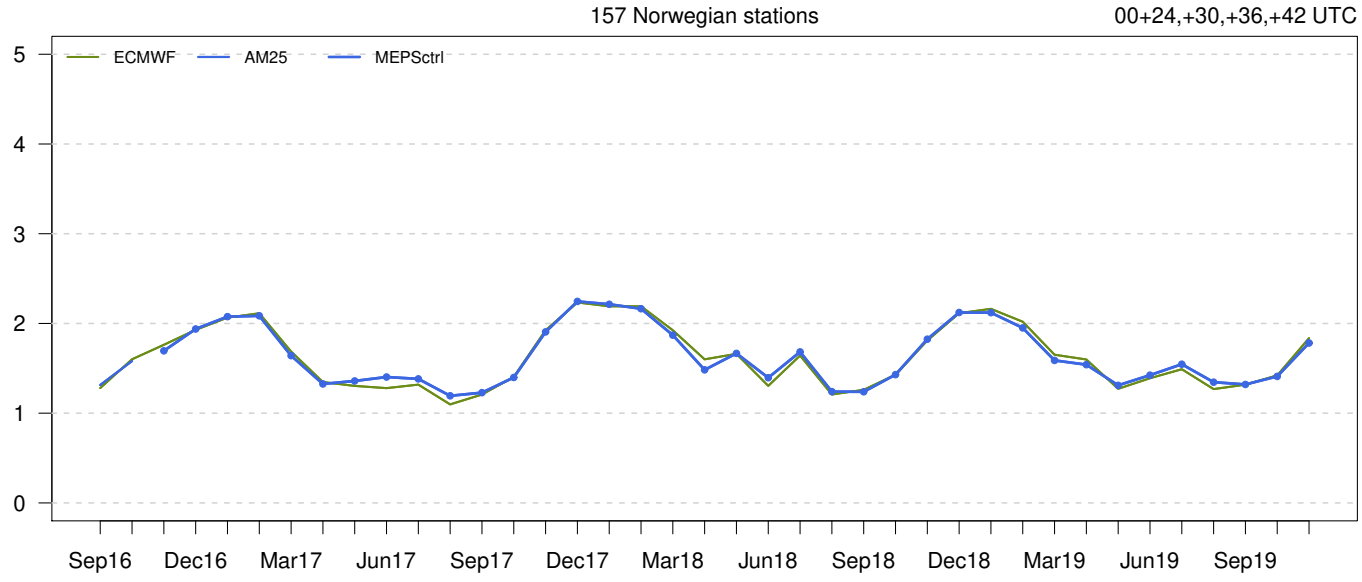
40 Norwegian coastal stations

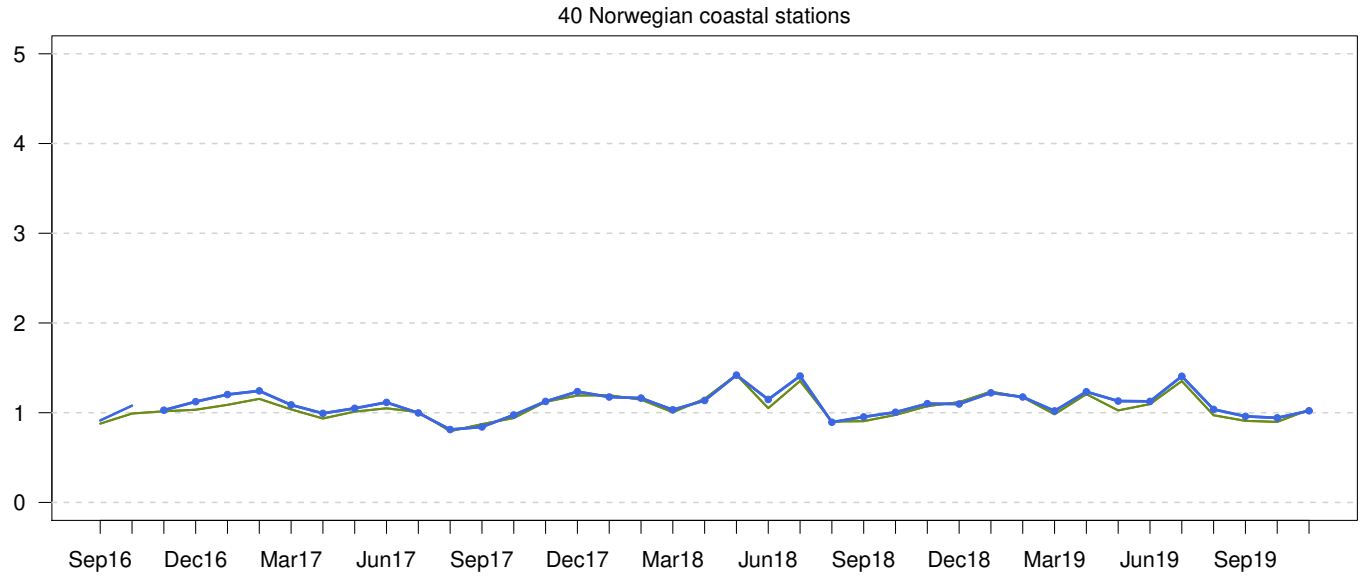


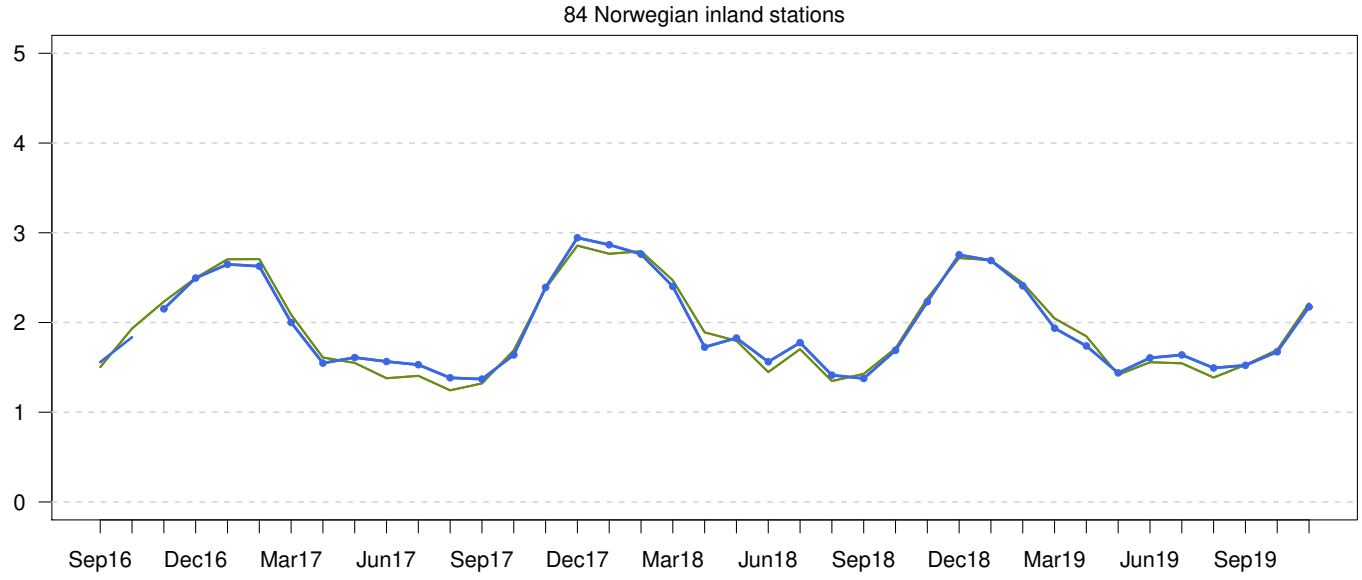
84 Norwegian inland stations



Standard Deviation of Error

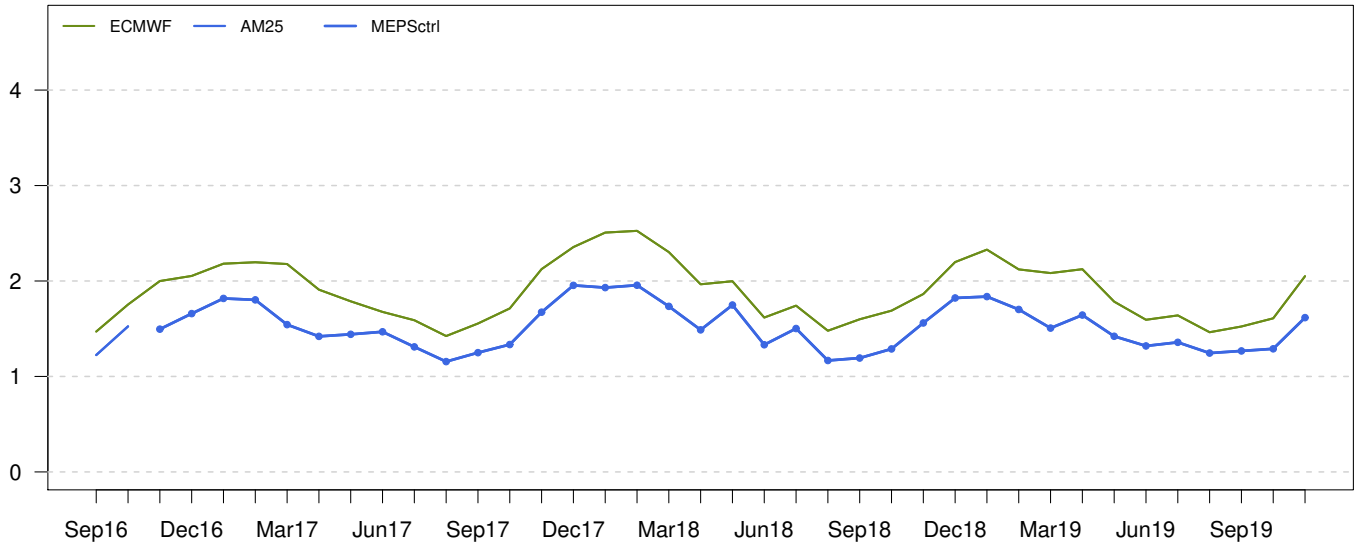




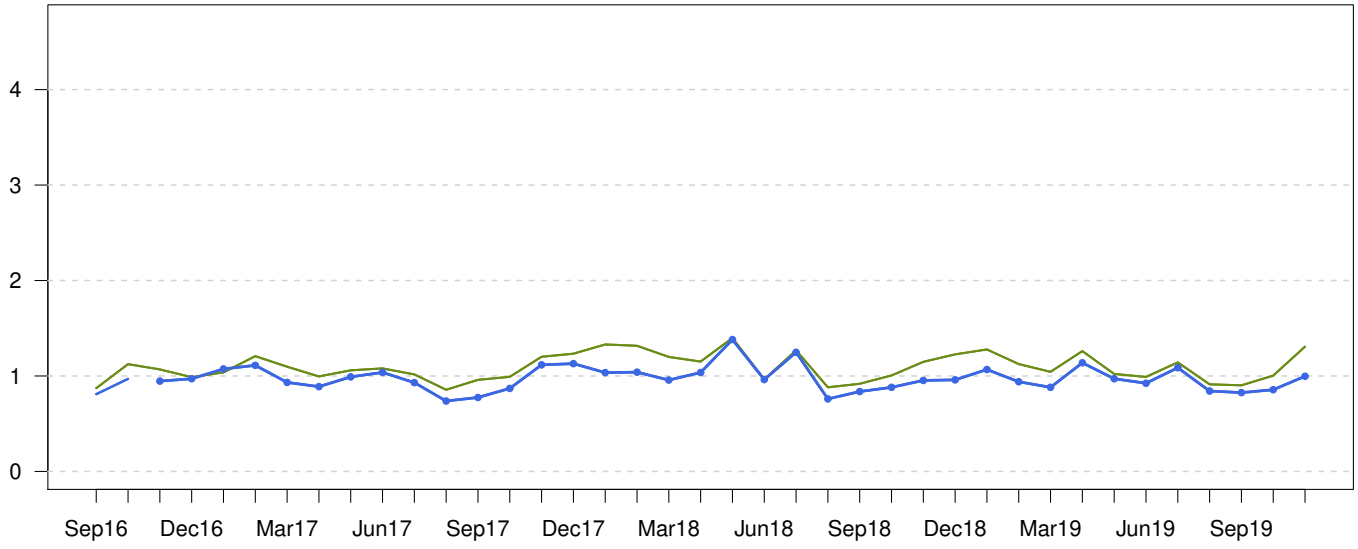


Mean Absolute Error

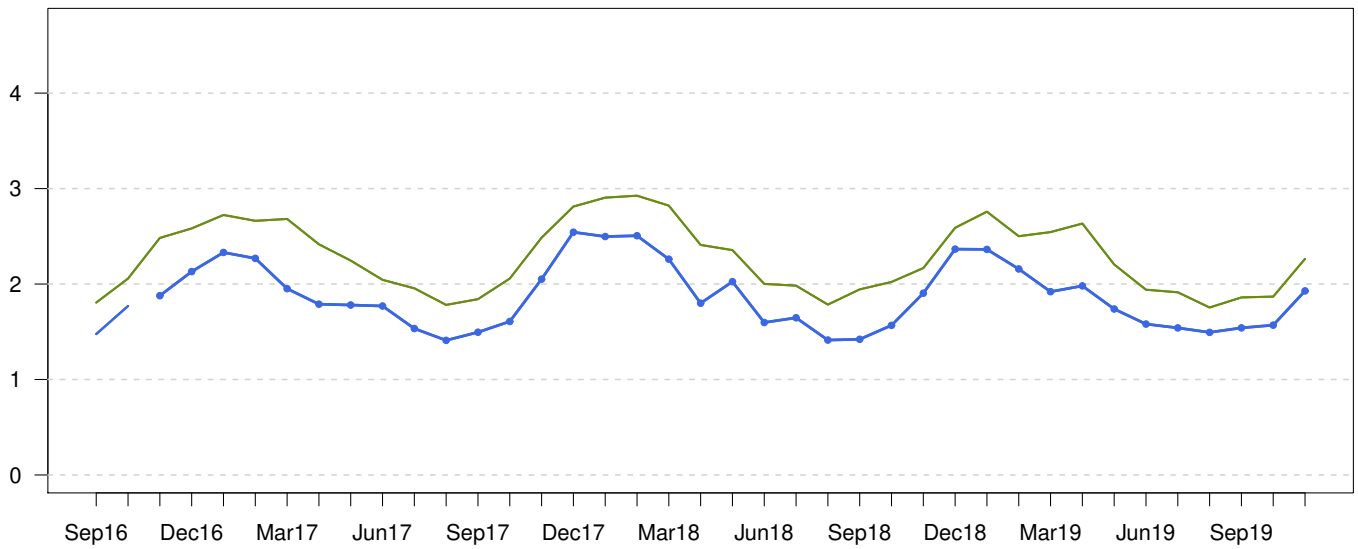
157 Norwegian stations 00+24,+30,+36,+42 UTC



40 Norwegian coastal stations

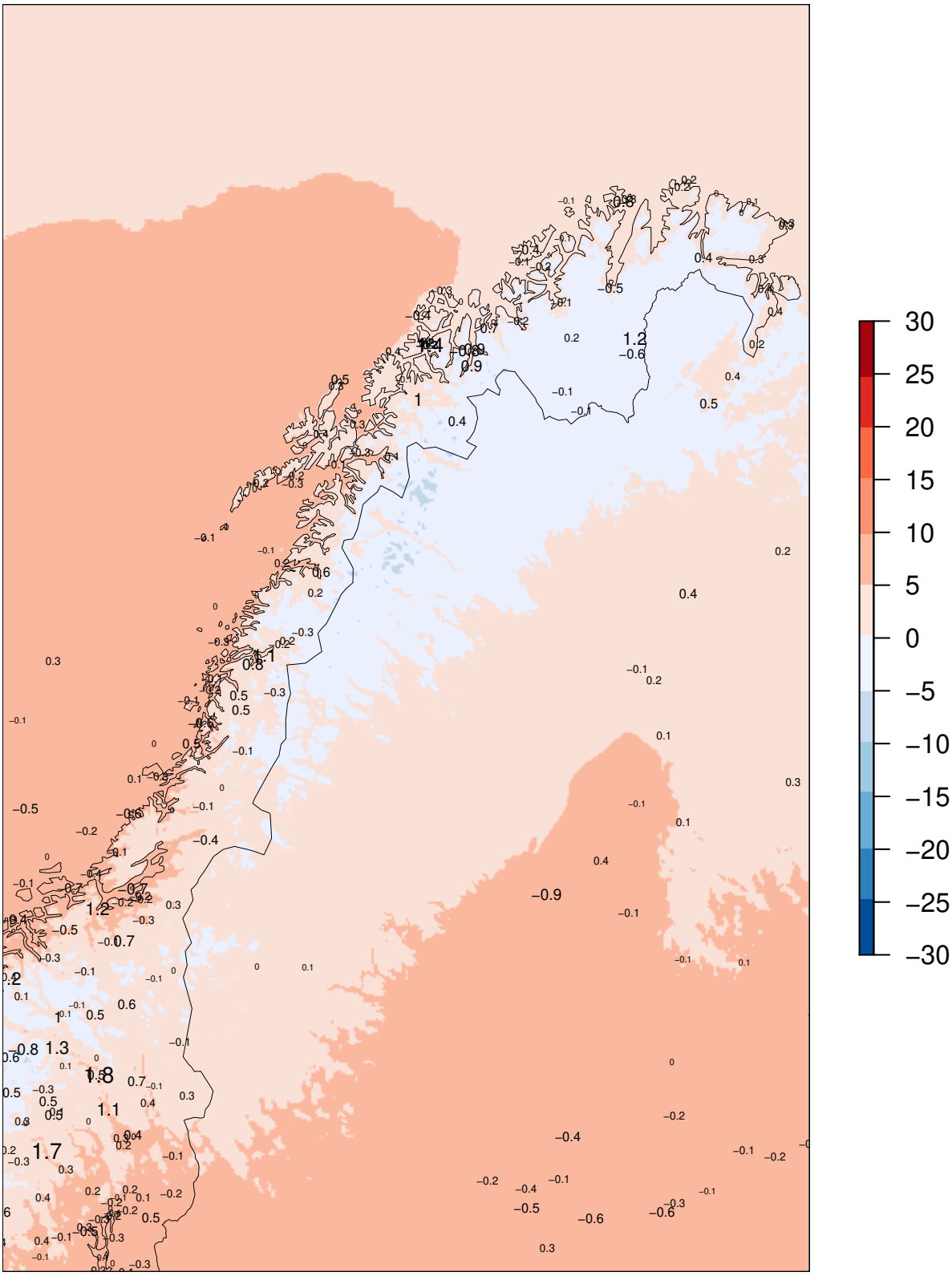


84 Norwegian inland stations



MEPSctrl 00+12

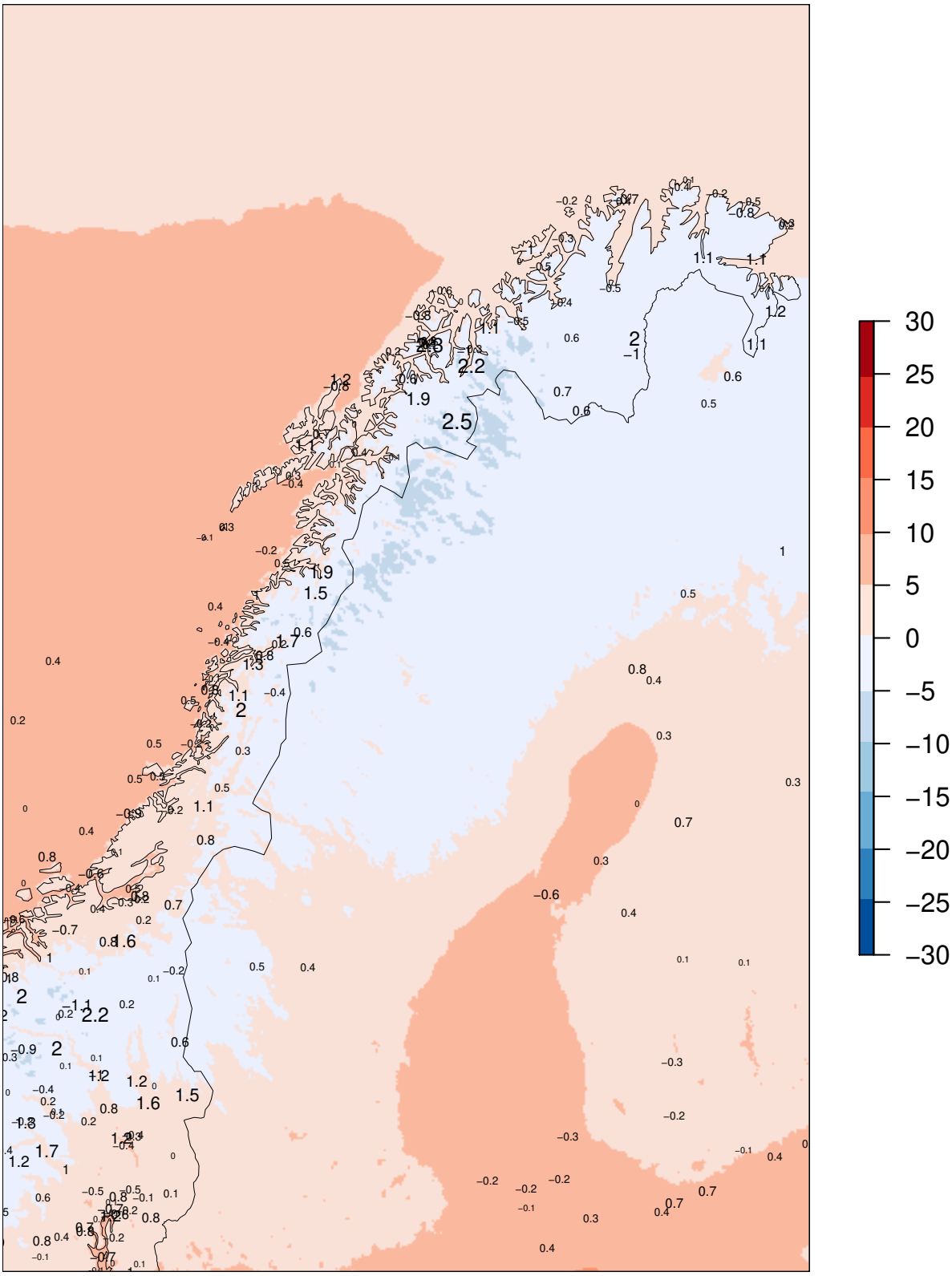
ME at observing sites
(numbers in black)



Model "climatology" 01.09.2019 – 30.11.2019

MEPSctrl 00+24

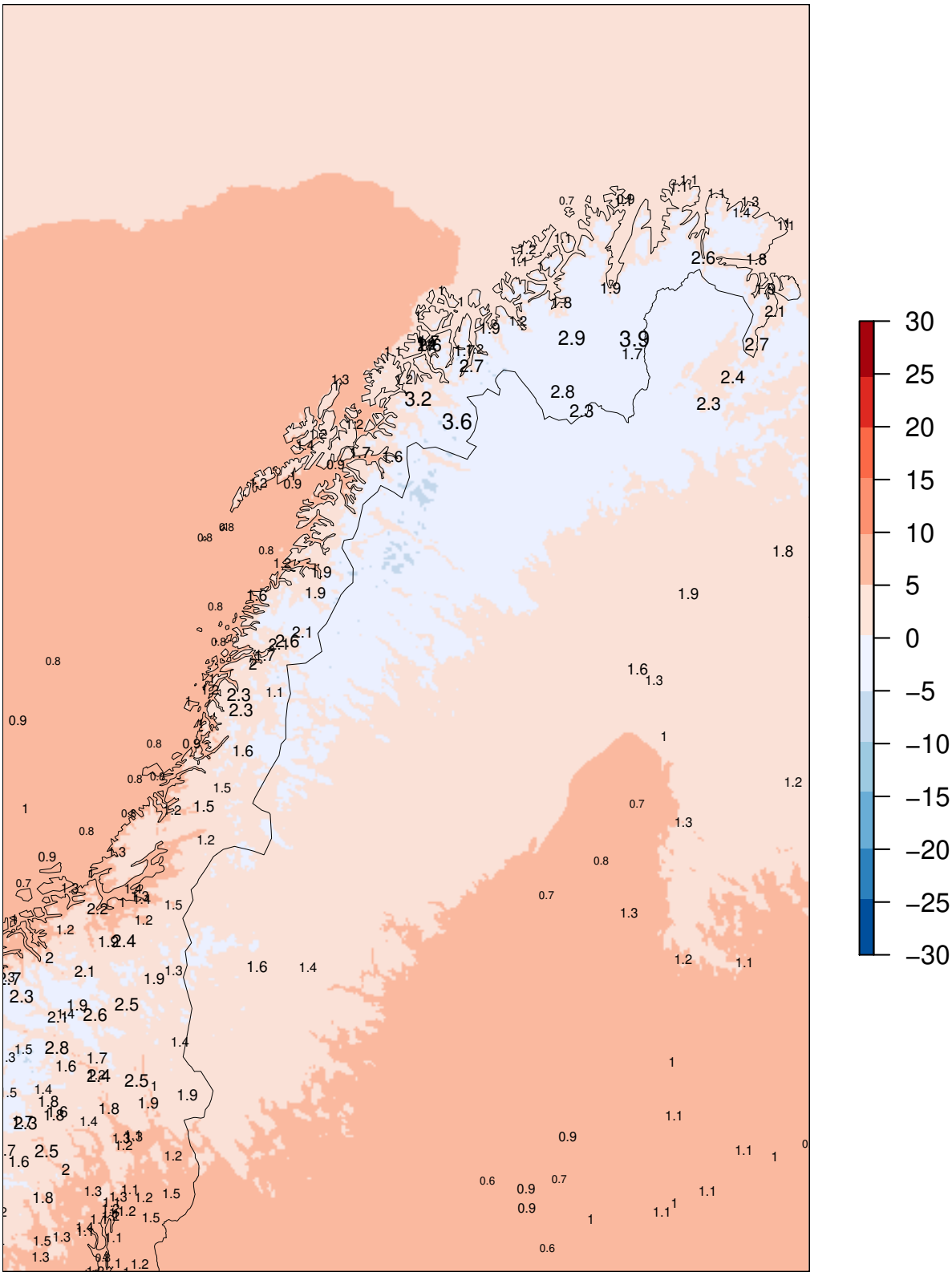
ME at observing sites
(numbers in black)



Model "climatology" 01.09.2019 – 30.11.2019

MEPSctrl 00+12

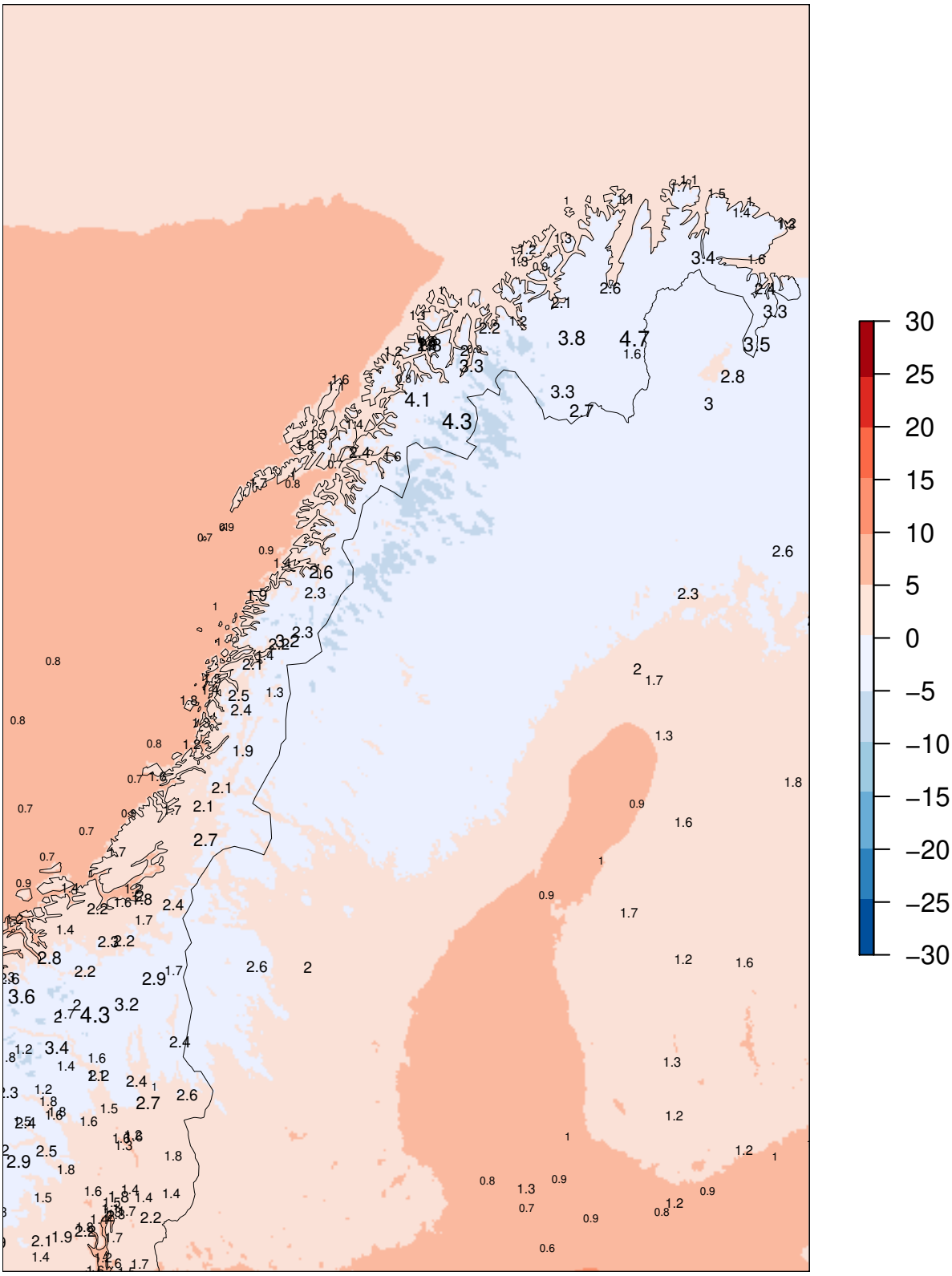
SDE at observing sites
(numbers in black)



Model "climatology" 01.09.2019 – 30.11.2019

MEPSctrl 00+24

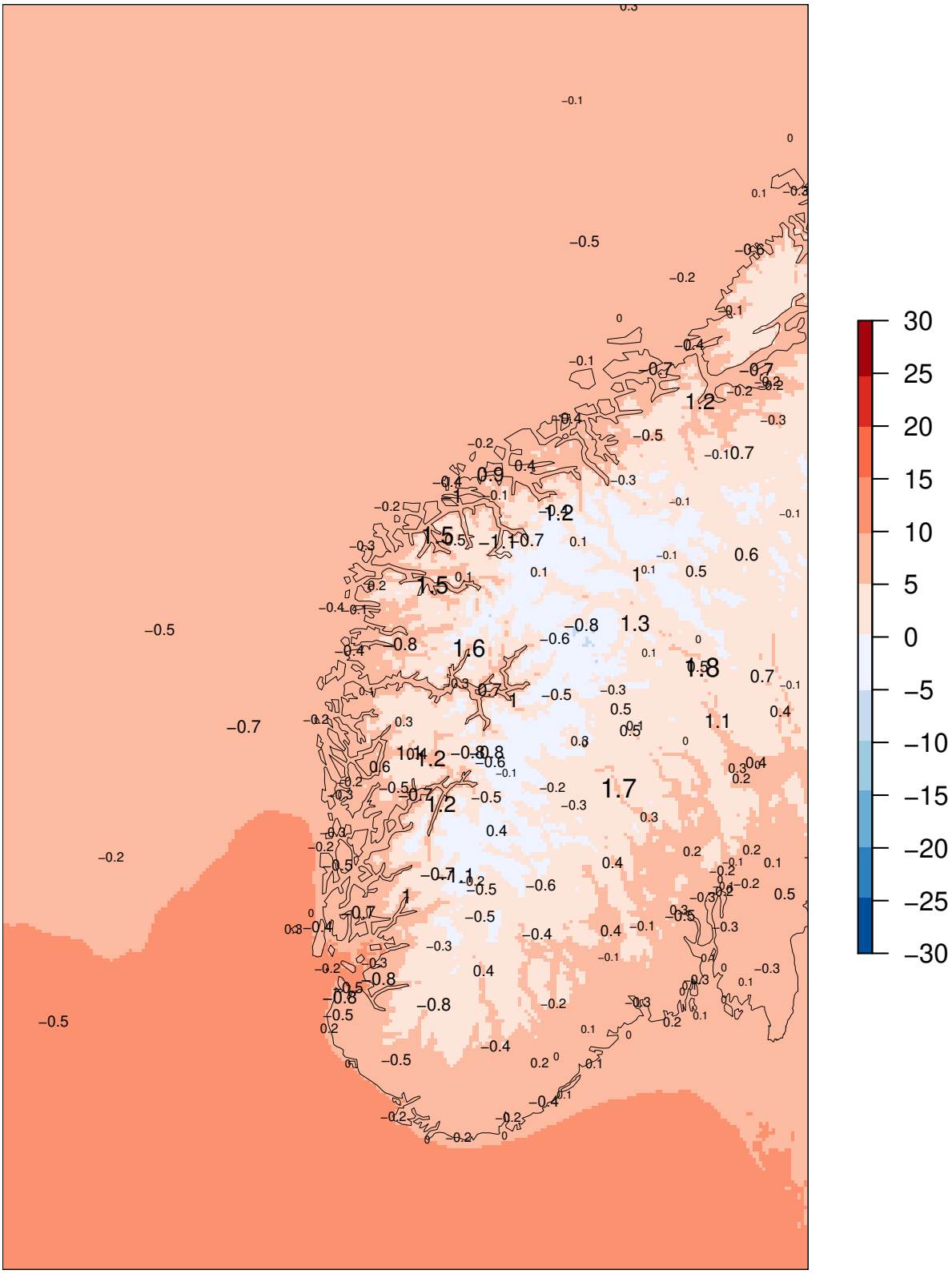
SDE at observing sites
(numbers in black)



Model "climatology" 01.09.2019 – 30.11.2019

MEPSctrl 00+12

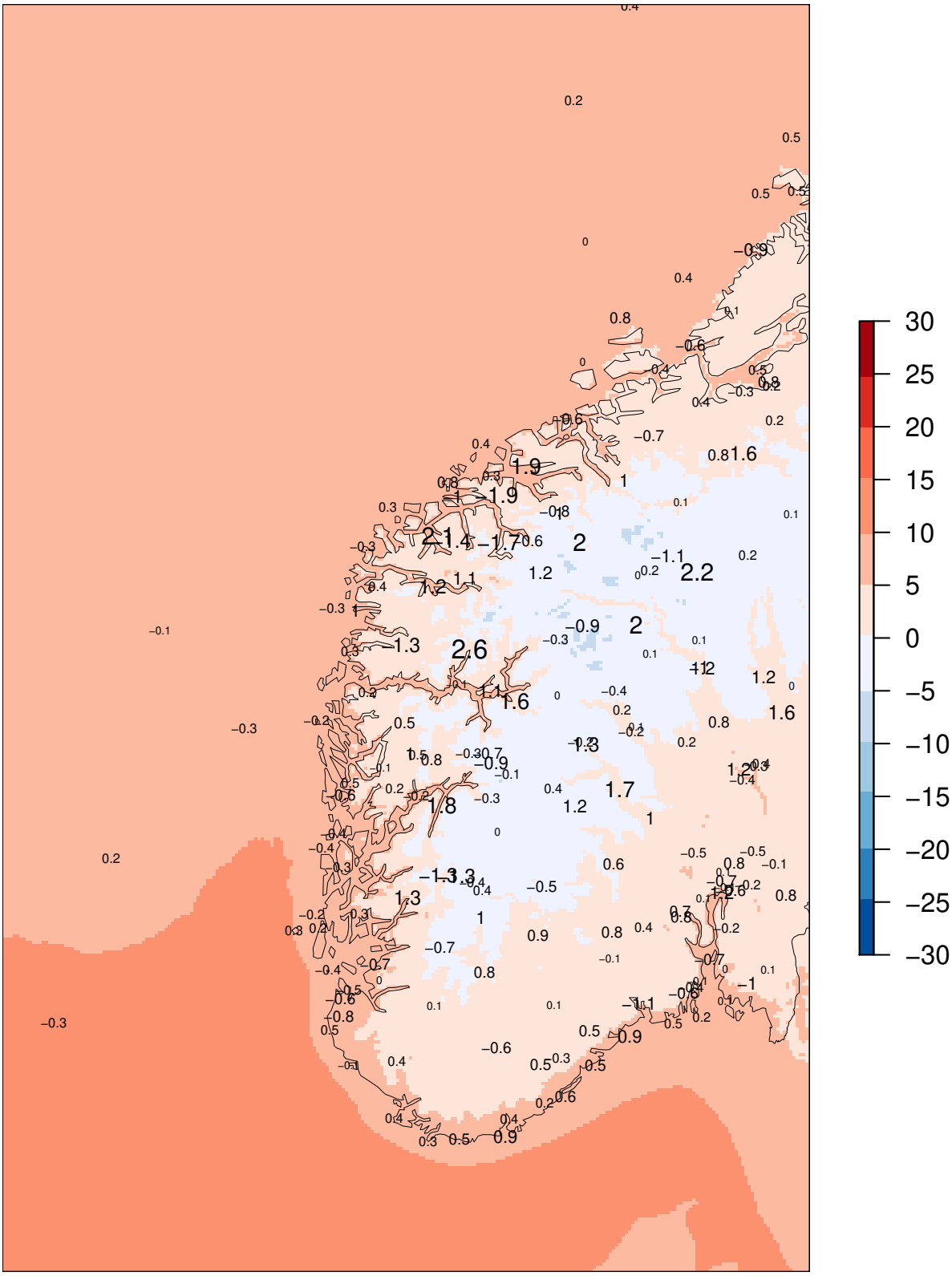
ME at observing sites
(numbers in black)



Model "climatology" 01.09.2019 – 30.11.2019

MEPSctrl 00+24

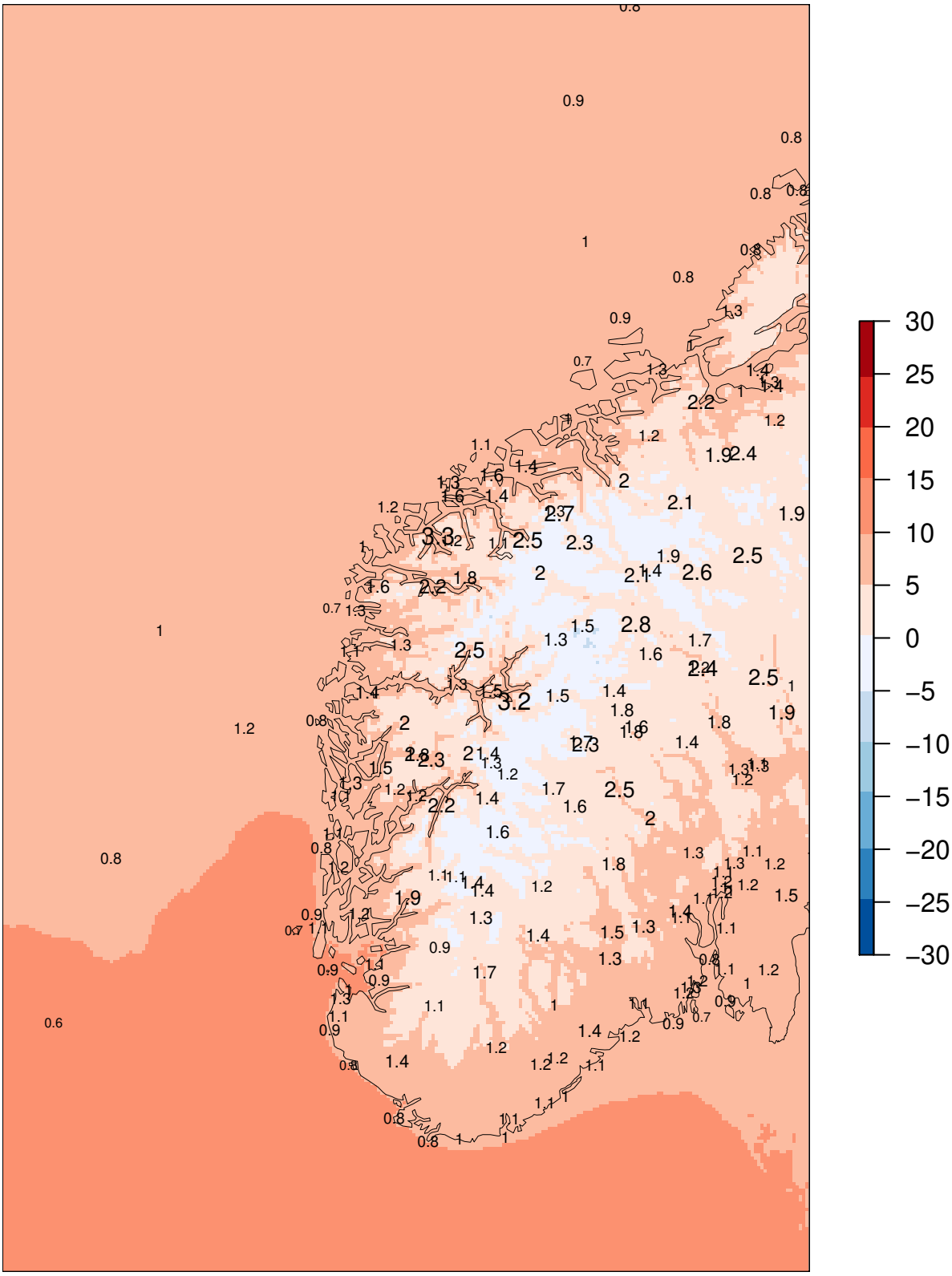
ME at observing sites
(numbers in black)



Model "climatology" 01.09.2019 – 30.11.2019

MEPSctrl 00+12

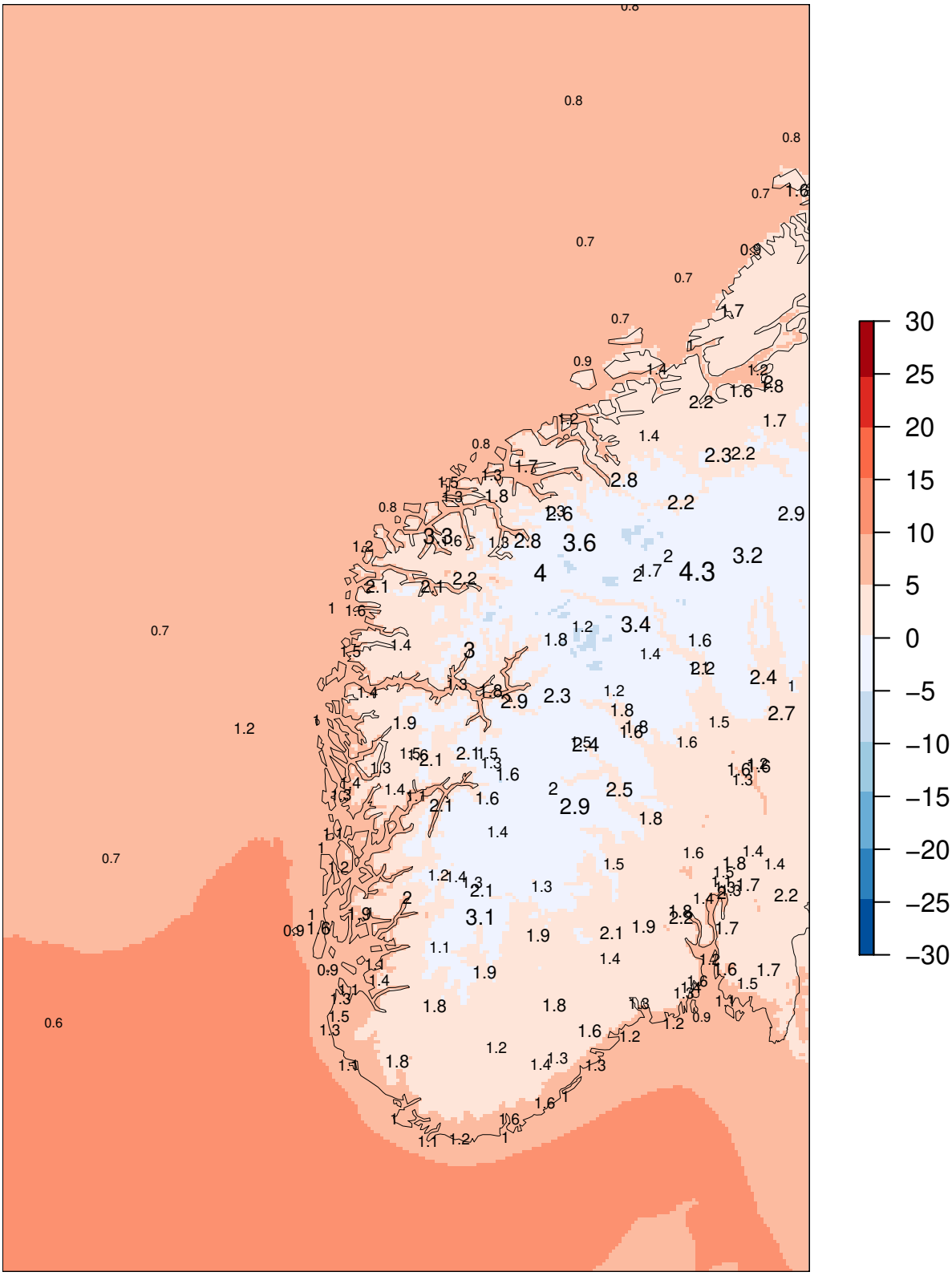
SDE at observing sites
(numbers in black)



Model "climatology" 01.09.2019 – 30.11.2019

MEPSctrl 00+24

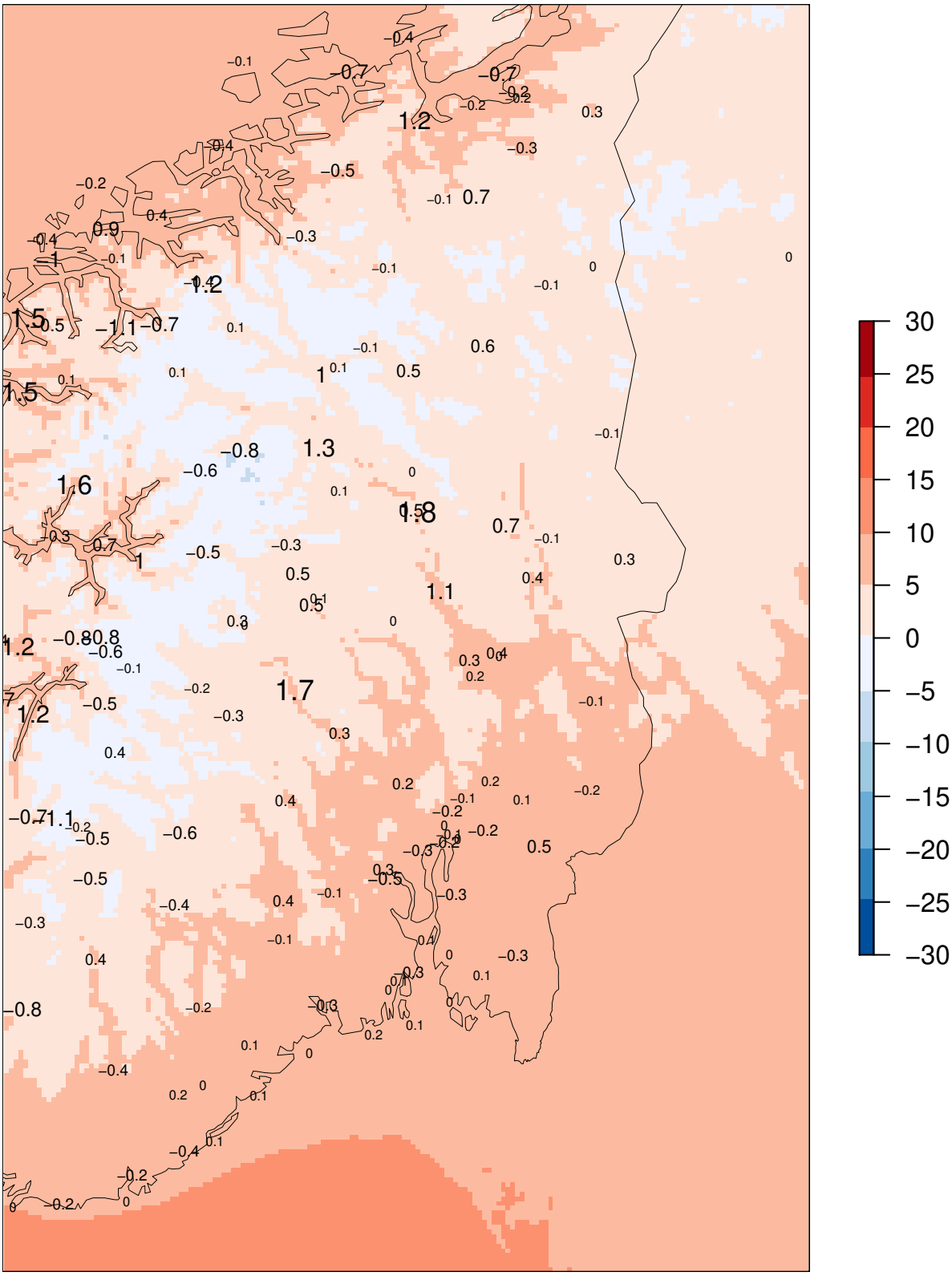
SDE at observing sites
(numbers in black)



Model "climatology" 01.09.2019 – 30.11.2019

MEPSctrl 00+12

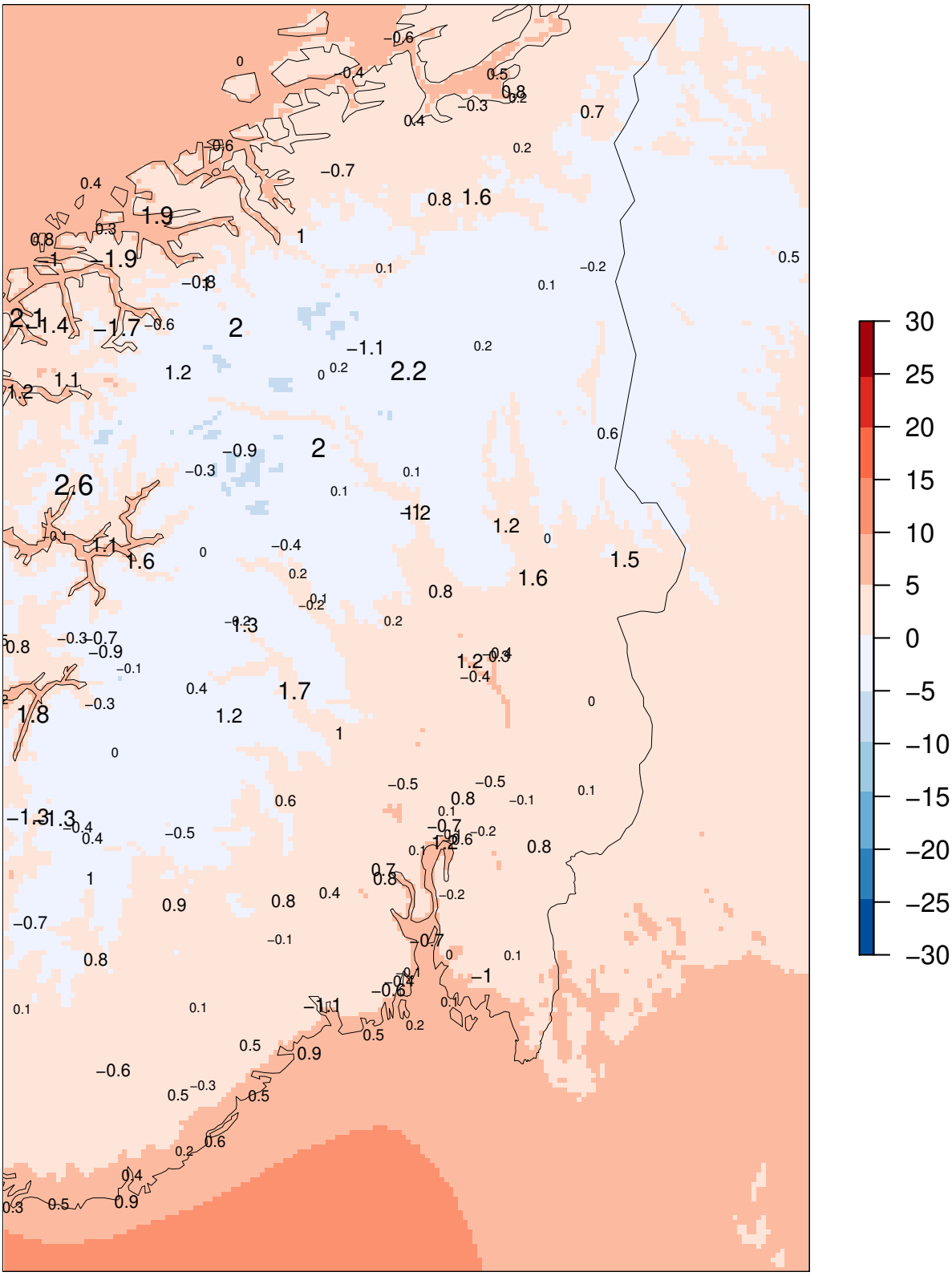
ME at observing sites
(numbers in black)



Model "climatology" 01.09.2019 – 30.11.2019

MEPSctrl 00+24

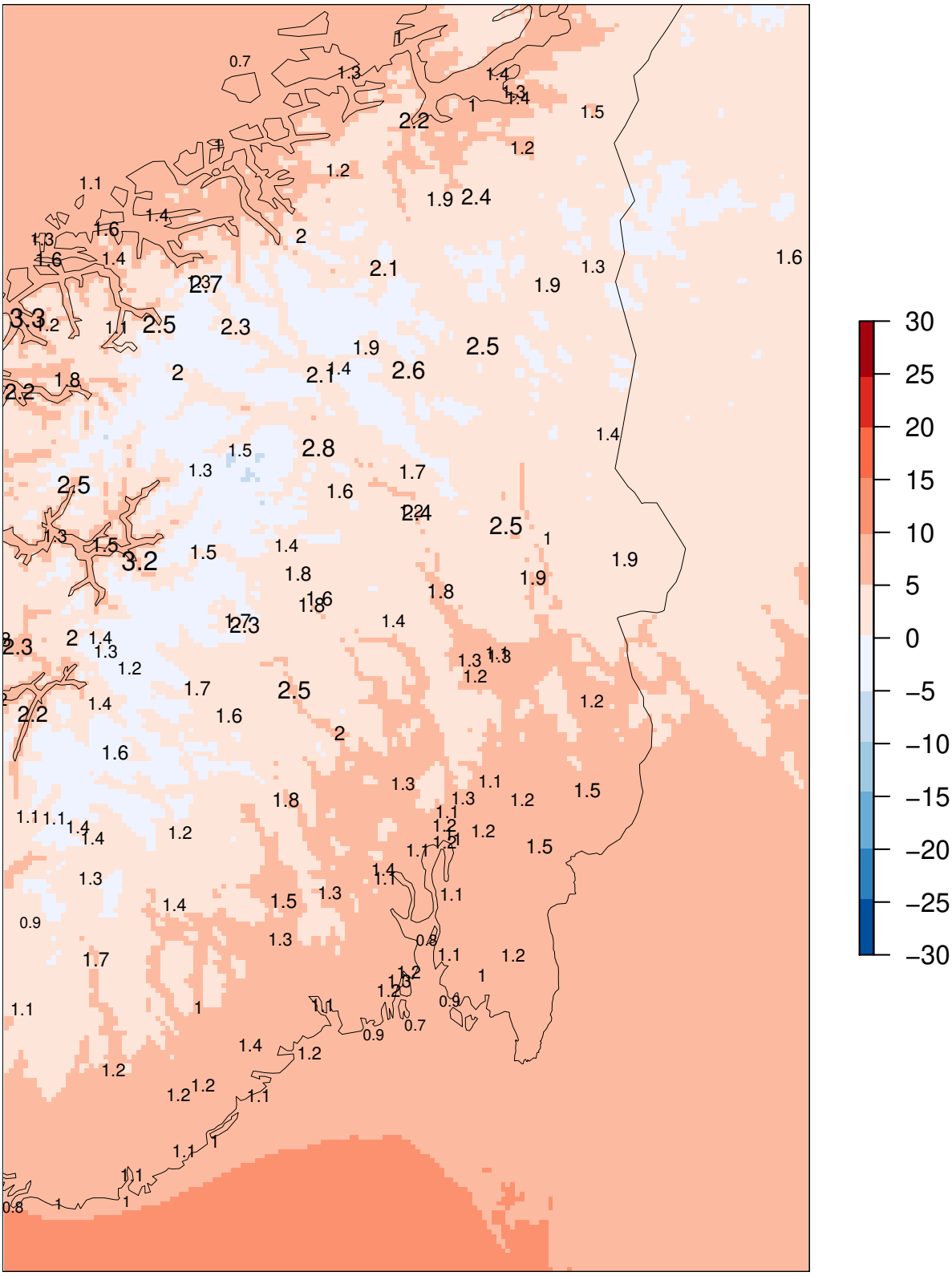
ME at observing sites
(numbers in black)



Model "climatology" 01.09.2019 – 30.11.2019

MEPSctrl 00+12

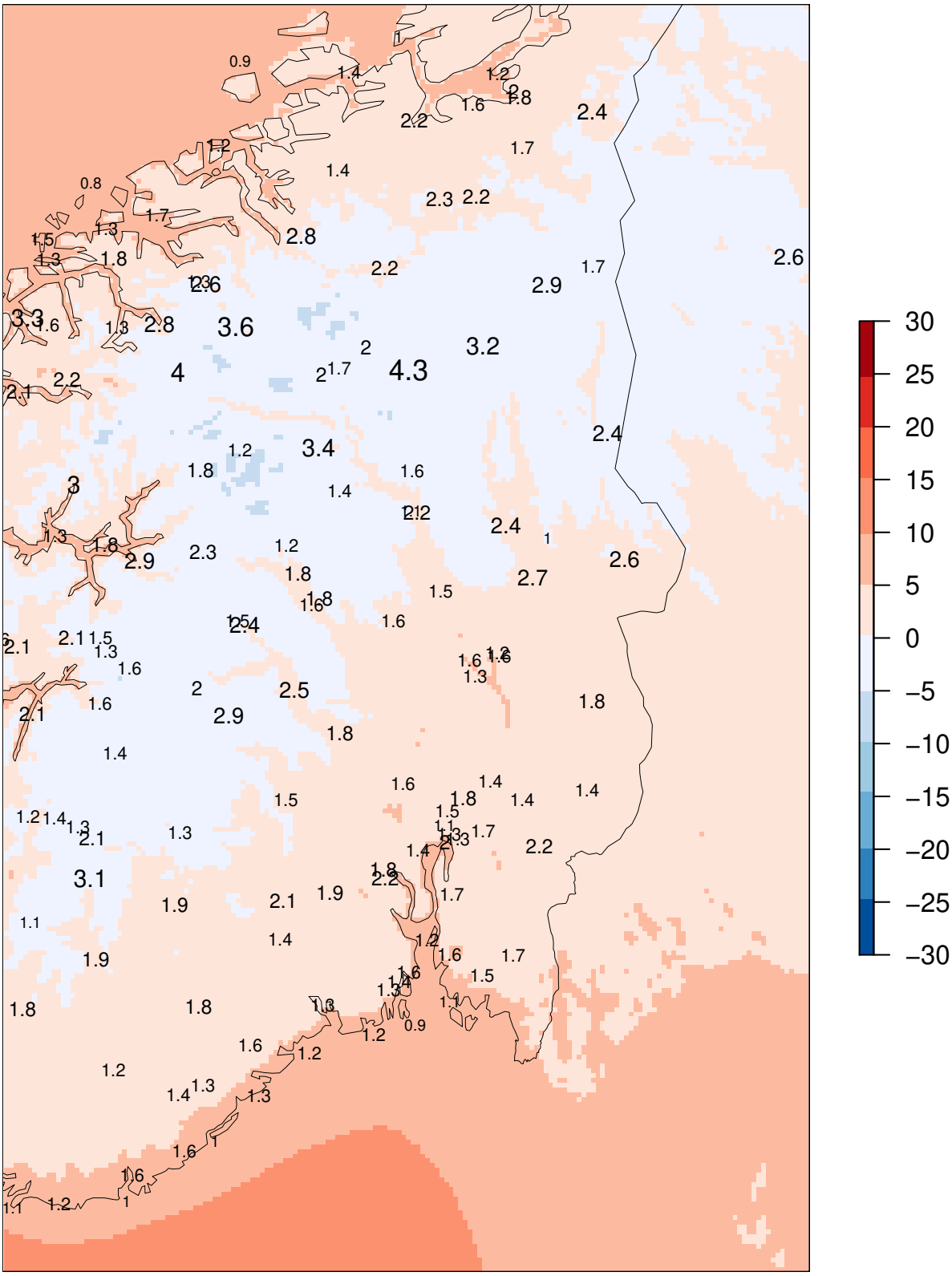
SDE at observing sites
(numbers in black)



Model "climatology" 01.09.2019 – 30.11.2019

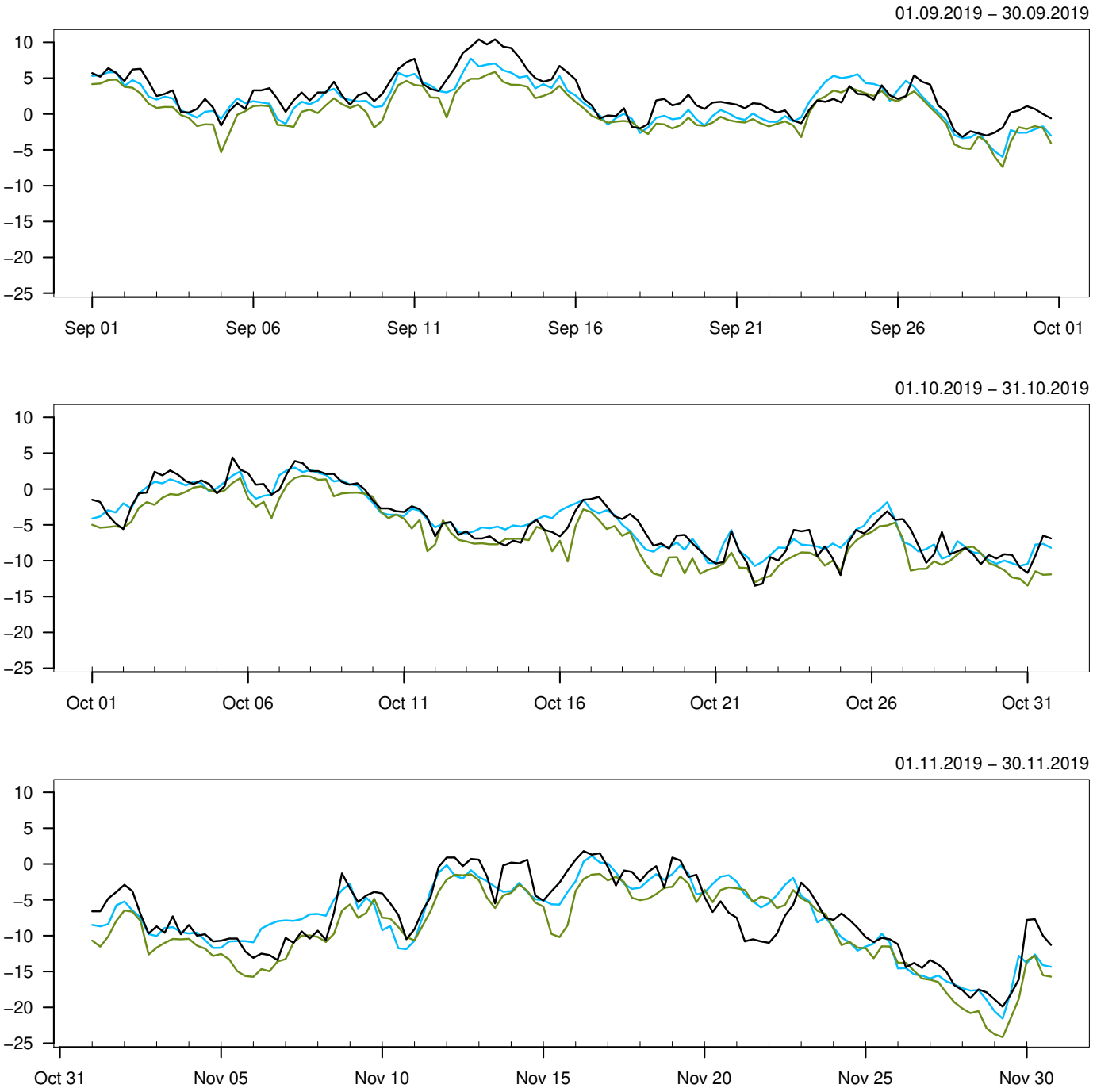
MEPSctrl 00+24

SDE at observing sites
(numbers in black)



Model "climatology" 01.09.2019 – 30.11.2019

SVALBARD LUFTHAVN

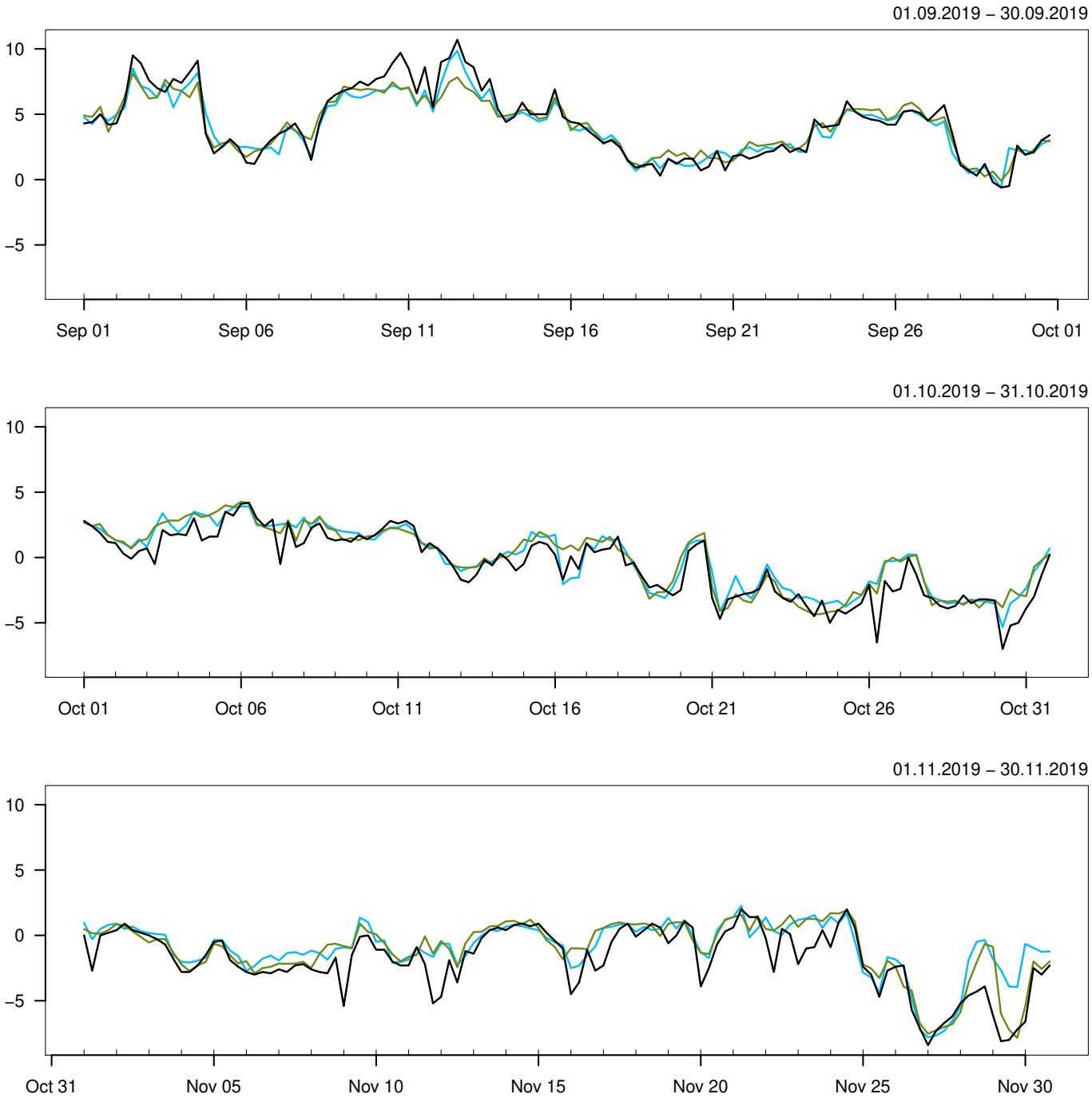


01.09.2019 – 30.11.2019

	Min	Mean	Max	Std	N
synop: 00,06,12,18	−19.9	−3.1	10.4	6	364
AA25: 12+18,+24,+30,+36	−21.6	−3.5	7.7	5.6	364
ECMWF: 12+18,+24,+30,+36	−24.2	−5	5.9	5.9	364

	ME	SDE	RMSE	MAE	Max.abs.err.	N
AA25 – synop	−0.4	2	2	1.6	6.6	364
ECMWF – synop	−1.9	1.9	2.7	2.3	7.7	364

BJØRNØYA

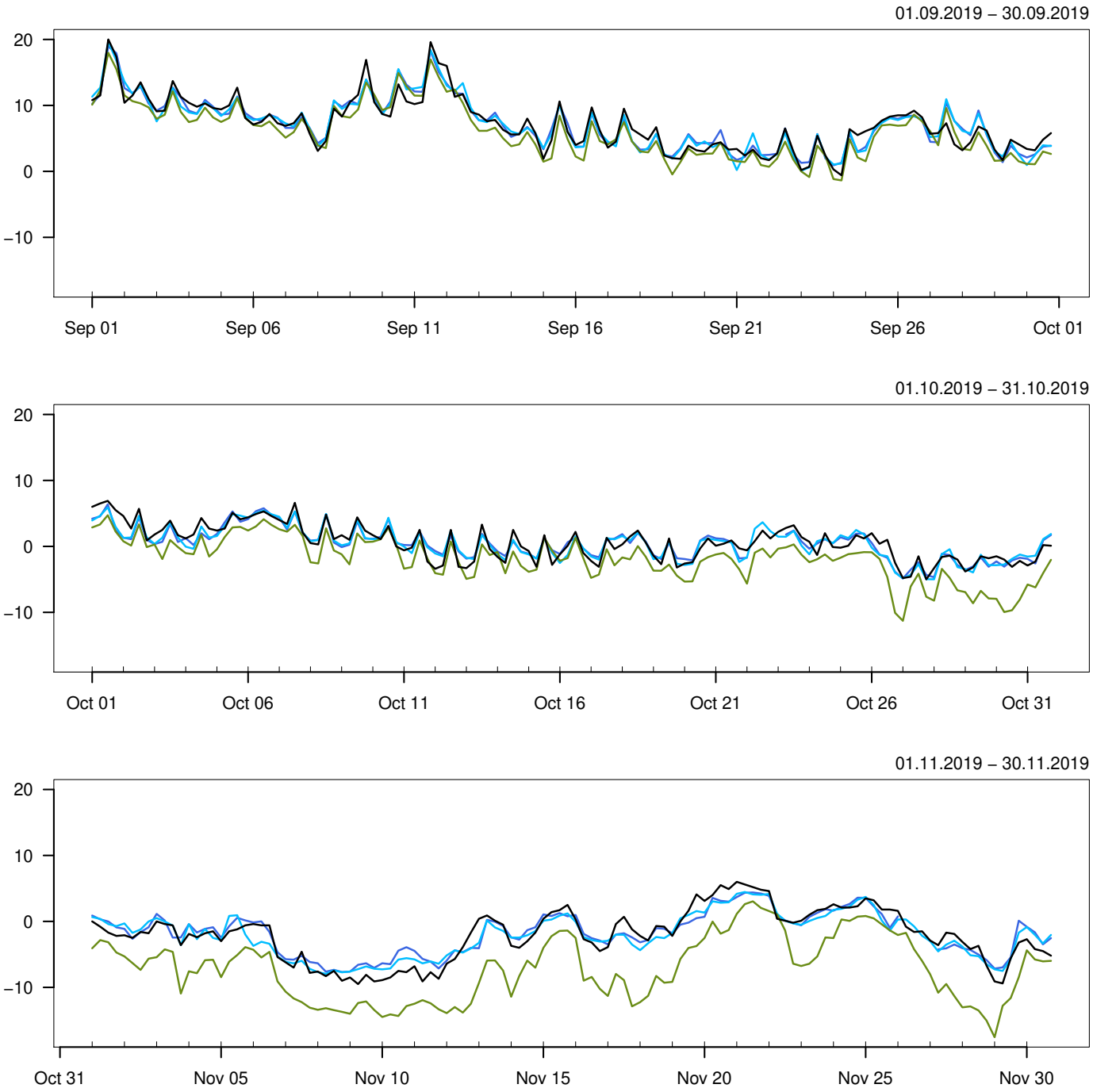


01.09.2019 – 30.11.2019

	Min	Mean	Max	Std	N
synop: 00,06,12,18	−8.4	0.6	10.7	3.6	364
AA25: 12+18,+24,+30,+36	−7.8	1	9.8	3.1	364
ECMWF: 12+18,+24,+30,+36	−7.8	1	8.1	3.2	364

	ME	SDE	RMSE	MAE	Max.abs.err.	N
AA25 – synop	0.4	1.1	1.2	0.8	5.9	364
ECMWF – synop	0.4	1.1	1.2	0.8	5.2	364

TROMSØ

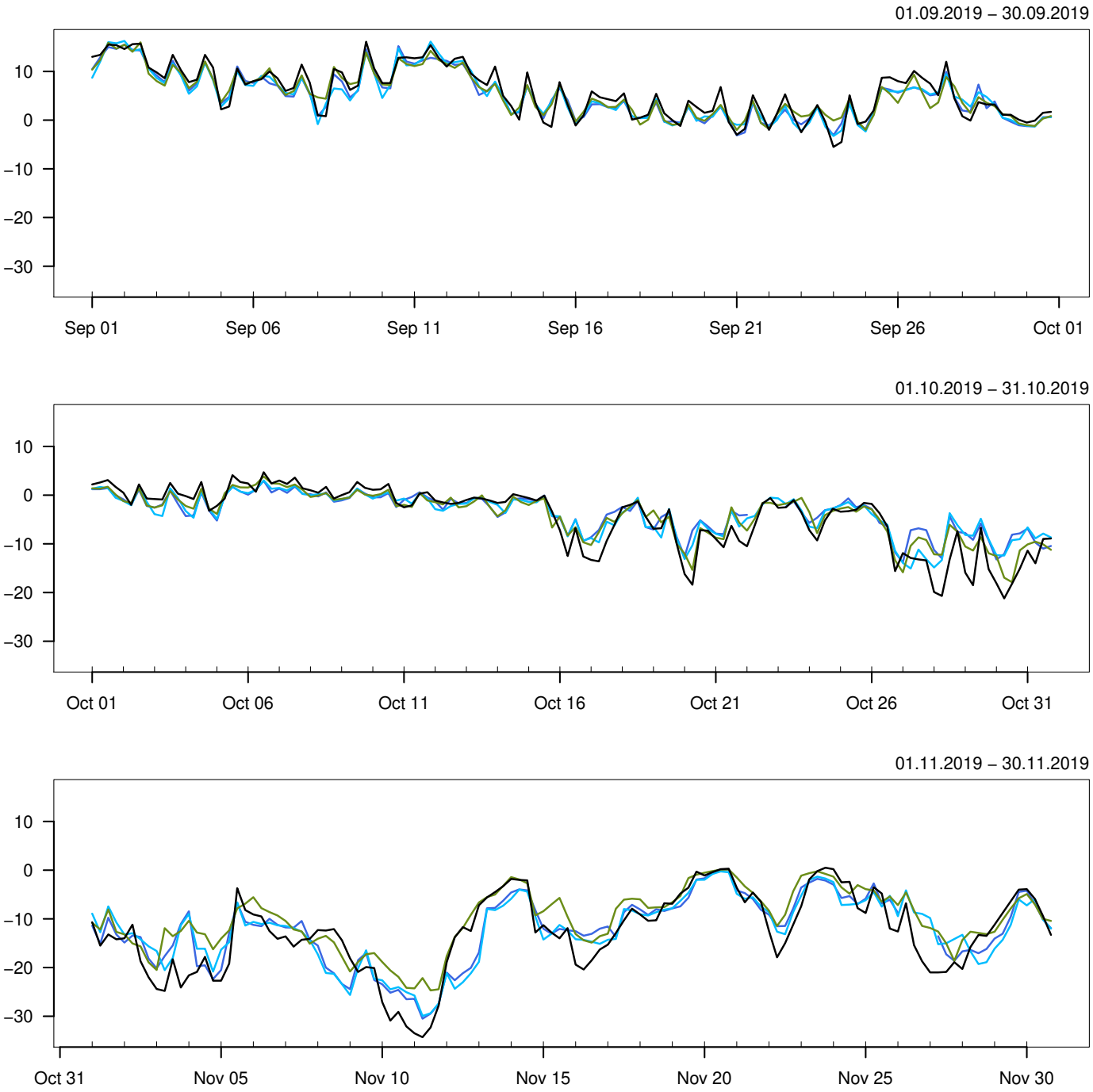


01.09.2019 – 30.11.2019

	Min	Mean	Max	Std	N
synop: 00,06,12,18	−9.5	1.9	20	5.3	364
MEPSctrl: 12+18,+24,+30,+36	−7.7	2	18.9	5	356
AA25: 12+18,+24,+30,+36	−7.9	1.8	19.6	5.1	364
ECMWF: 12+18,+24,+30,+36	−17.6	−1	18	6.8	364

	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl – synop	0.1	1.3	1.3	1	4.5	356
AA25 – synop	−0.1	1.3	1.3	1	3.7	364
ECMWF – synop	−2.9	2.5	3.8	3.1	11.7	364

KAUTOKEINO



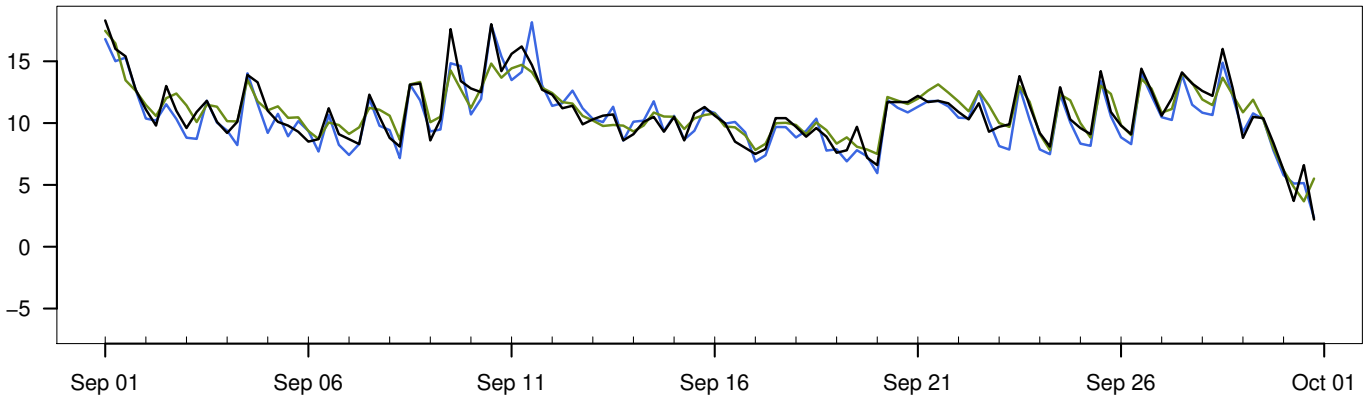
01.09.2019 – 30.11.2019

	Min	Mean	Max	Std	N
synop: 00,06,12,18	−34.3	−3.8	16.1	10.1	364
MEPSctrl: 12+18,+24,+30,+36	−30.5	−3.5	15.5	8.9	356
AA25: 12+18,+24,+30,+36	−30	−3.7	16.3	8.9	364
ECMWF: 12+18,+24,+30,+36	−24.7	−2.9	16	8.1	364

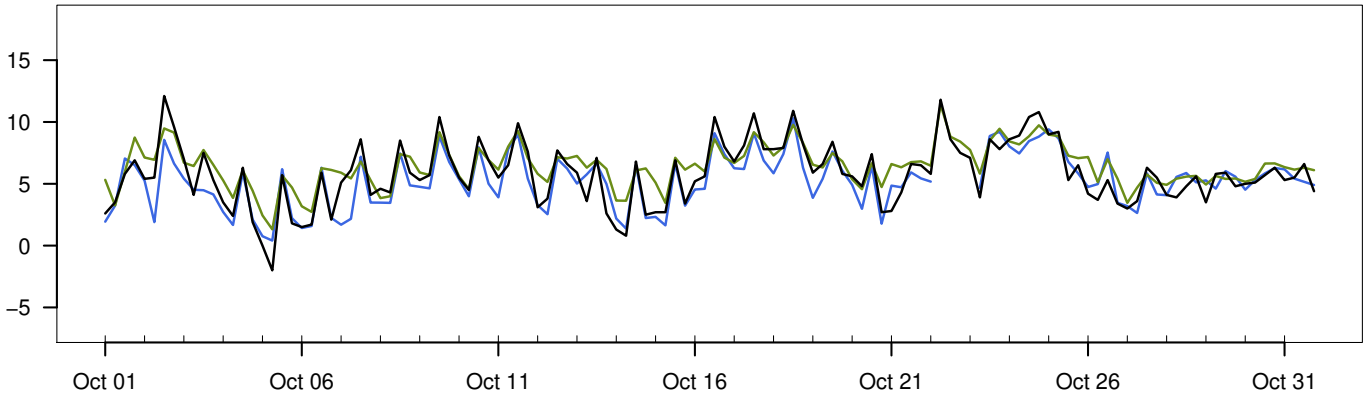
	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl – synop	0.2	3.2	3.2	2.3	13.1	356
AA25 – synop	0.2	3.4	3.4	2.4	12.8	364
ECMWF – synop	0.9	3.1	3.2	2.2	12.9	364

ØRLAND III

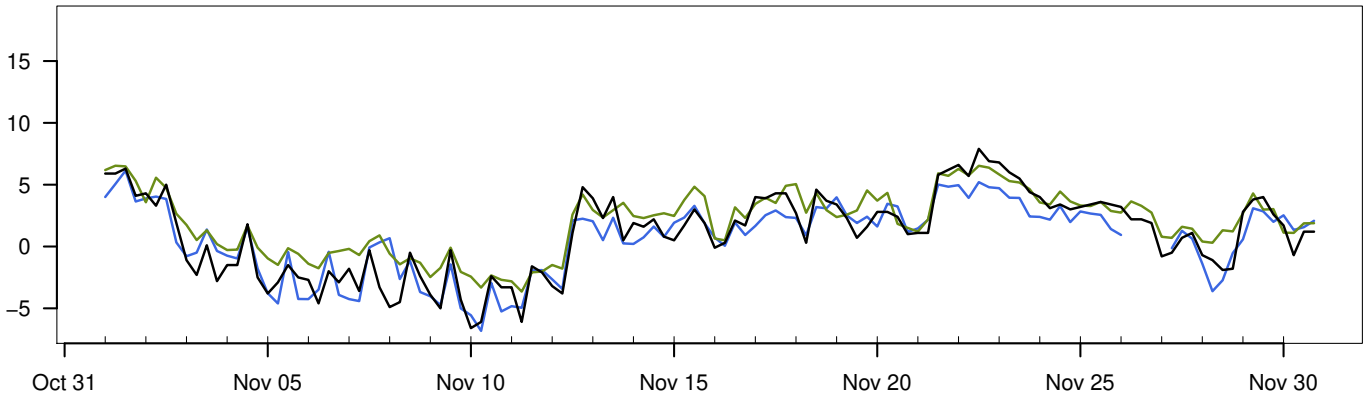
01.09.2019 – 30.09.2019



01.10.2019 – 31.10.2019



01.11.2019 – 30.11.2019



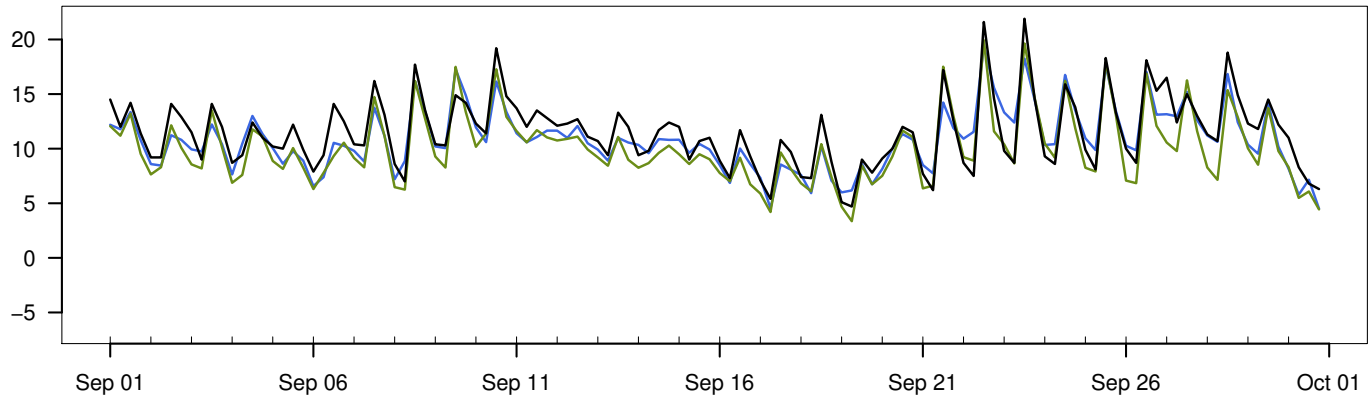
01.09.2019 – 30.11.2019

	Min	Mean	Max	Std	N
synop: 00,06,12,18	−6.6	5.9	18.3	4.9	364
MEPSctrl: 12+18,+24,+30,+36	−6.8	5.5	18.2	4.7	356
ECMWF: 12+18,+24,+30,+36	−3.6	6.4	17.5	4.2	364

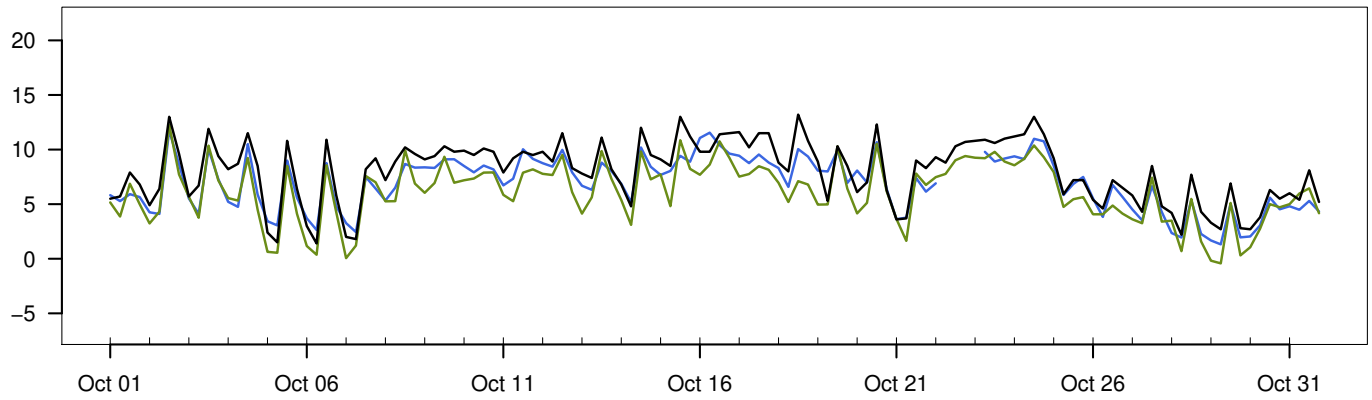
	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl – synop	−0.4	1.2	1.3	1	5.6	356
ECMWF – synop	0.6	1.3	1.4	1	4.3	364

BERGEN – FLORIDA

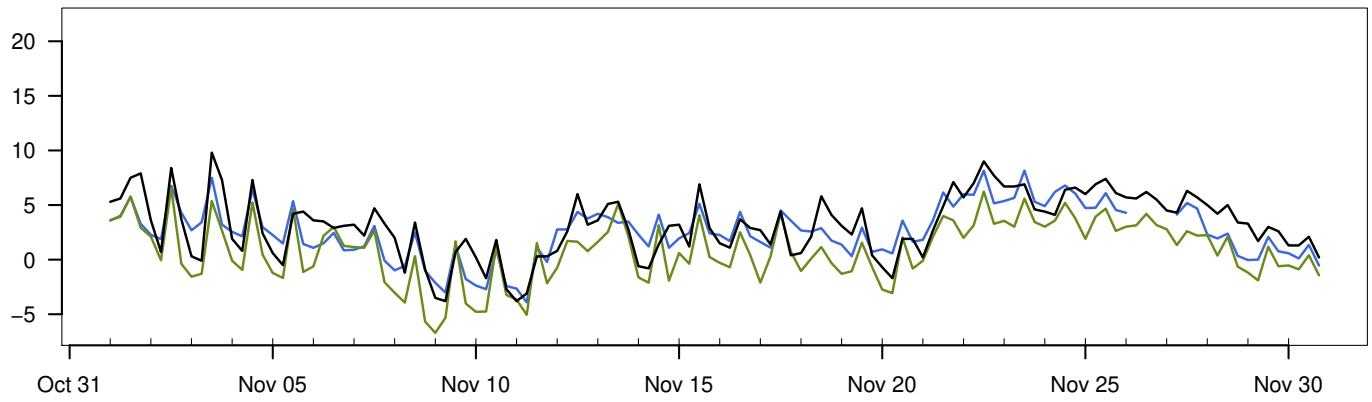
01.09.2019 – 30.09.2019



01.10.2019 – 31.10.2019



01.11.2019 – 30.11.2019



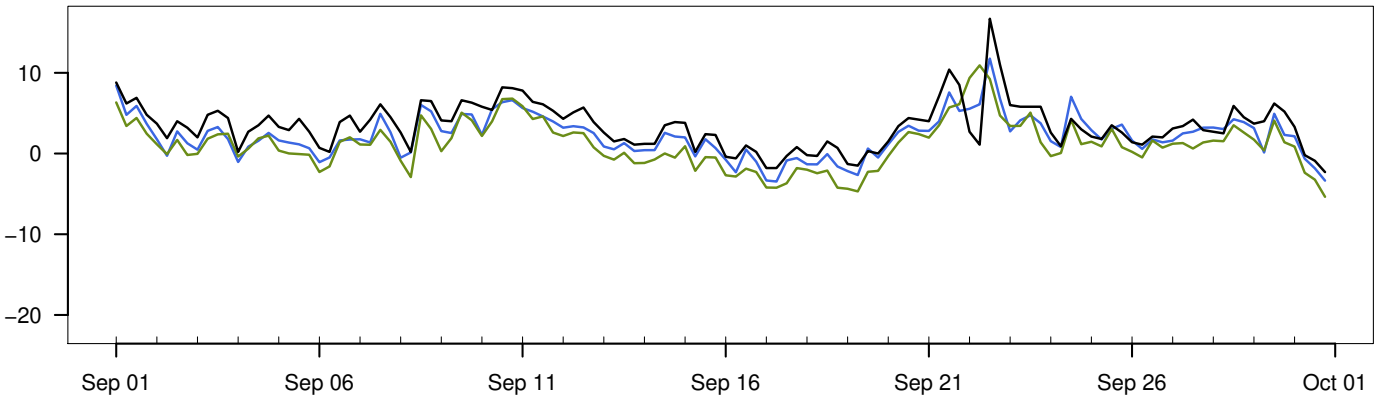
01.09.2019 – 30.11.2019

	Min	Mean	Max	Std	N
synop: 00,06,12,18	−3.8	7.6	21.9	4.5	364
MEPSctrl: 12+18,+24,+30,+36	−3.9	6.8	19.4	4.3	356
ECMWF: 12+18,+24,+30,+36	−6.7	5.7	19.9	4.8	364

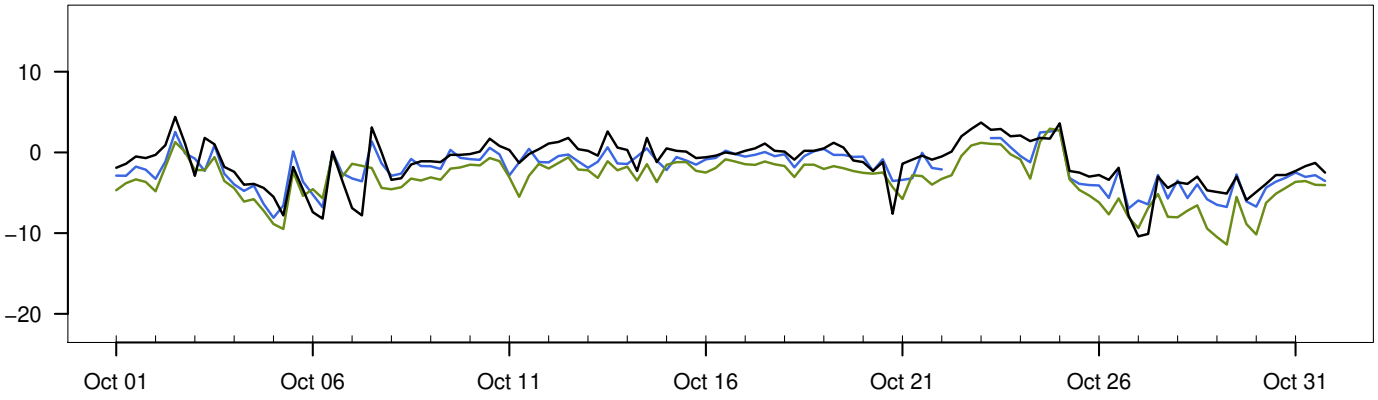
	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl – synop	−0.8	1.5	1.6	1.4	4.6	356
ECMWF – synop	−1.9	1.3	2.3	2	6.1	364

FINSEVATN

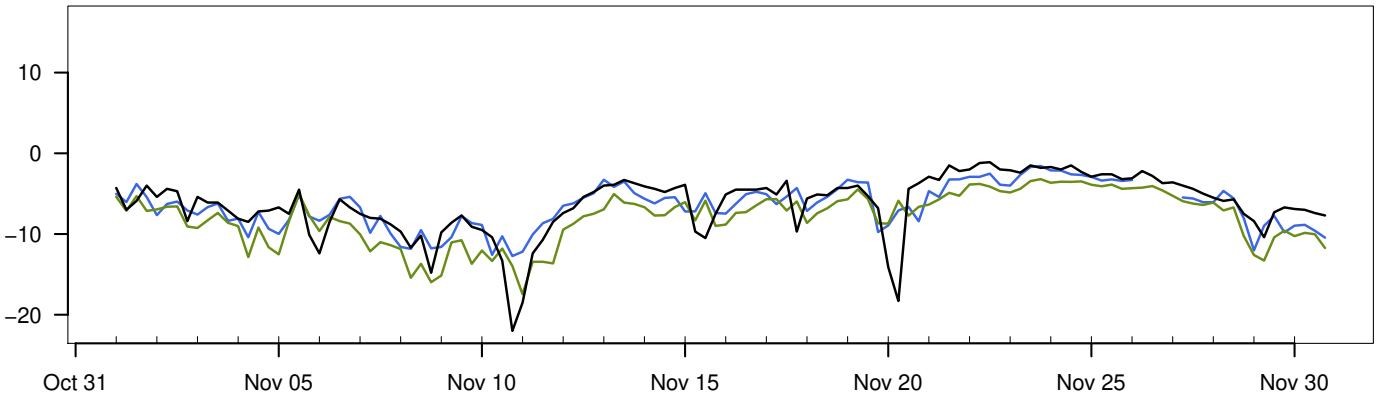
01.09.2019 – 30.09.2019



01.10.2019 – 31.10.2019



01.11.2019 – 30.11.2019



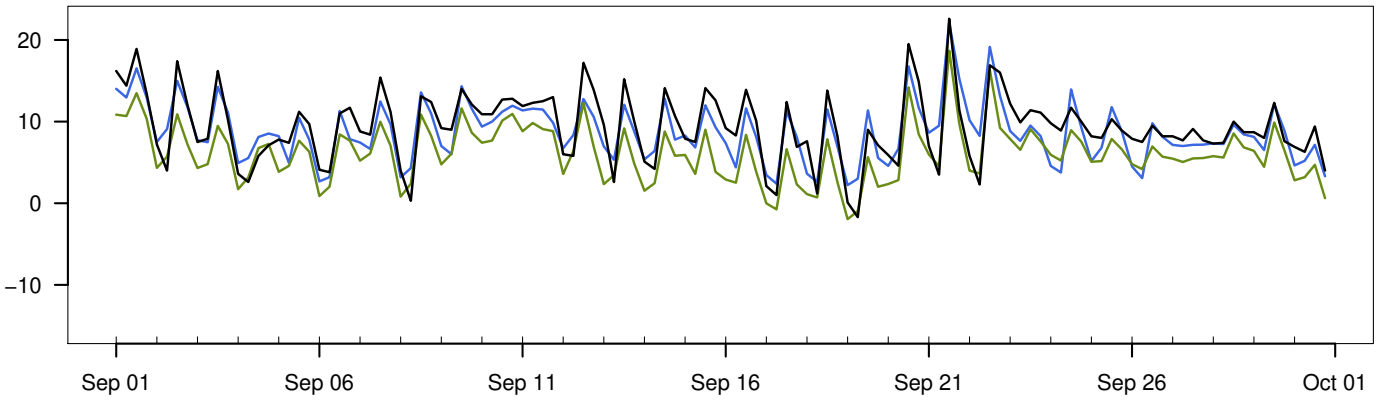
01.09.2019 – 30.11.2019

	Min	Mean	Max	Std	N
synop: 00,06,12,18	−22	−1.4	16.7	5	364
MEPSctrl: 12+18,+24,+30,+36	−12.7	−2.1	11.8	4.4	356
ECMWF: 12+18,+24,+30,+36	−17.5	−3.4	10.9	4.8	364

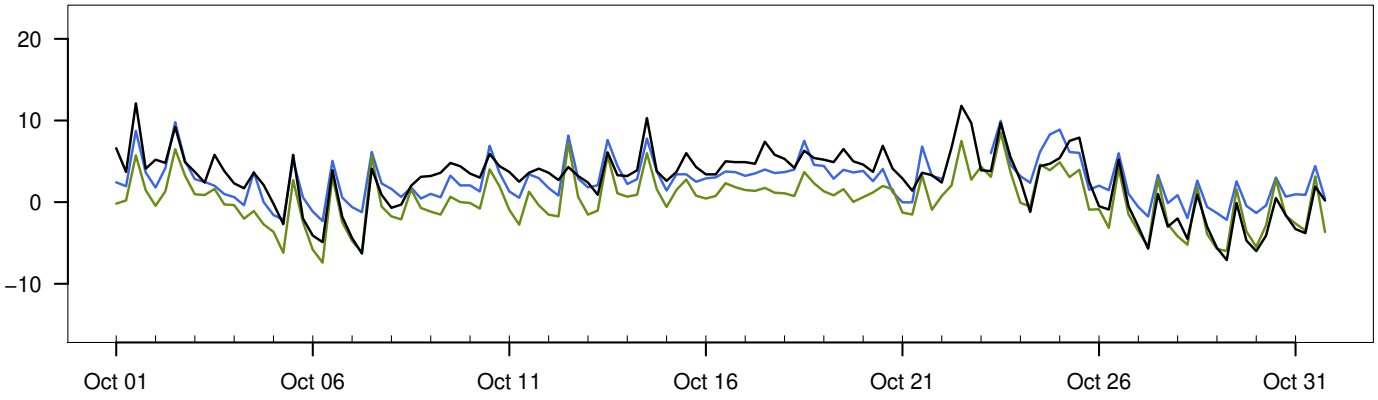
	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl – synop	−0.7	1.8	1.9	1.4	11.2	356
ECMWF – synop	−2	2	2.8	2.5	12.4	364

NESBYEN – TODOKK

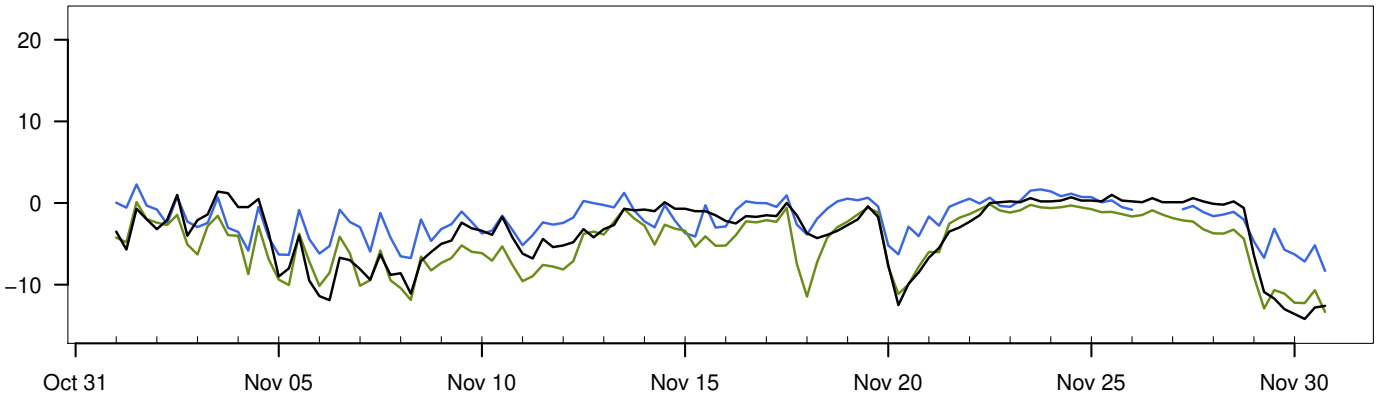
01.09.2019 – 30.09.2019



01.10.2019 – 31.10.2019



01.11.2019 – 30.11.2019

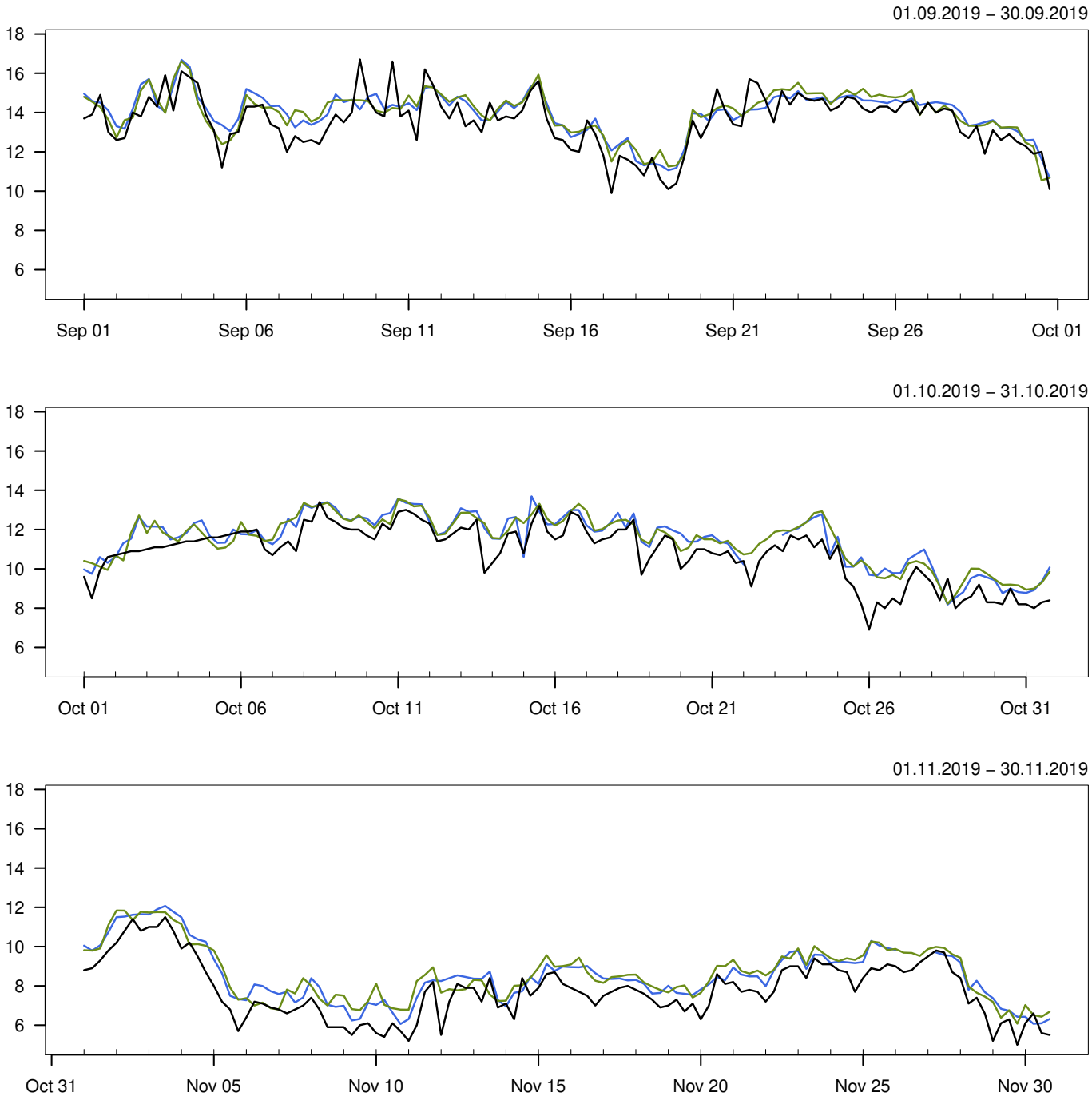


01.09.2019 – 30.11.2019

	Min	Mean	Max	Std	N
synop: 00,06,12,18	−14.2	2.8	22.6	6.6	364
MEPSctrl: 12+18,+24,+30,+36	−8.3	3.2	22.1	5.3	356
ECMWF: 12+18,+24,+30,+36	−13.3	0.5	18.7	5.6	364

	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl – synop	0.4	2.6	2.6	2.1	8.5	356
ECMWF – synop	−2.3	2.2	3.2	2.6	8.8	364

EKOFISK

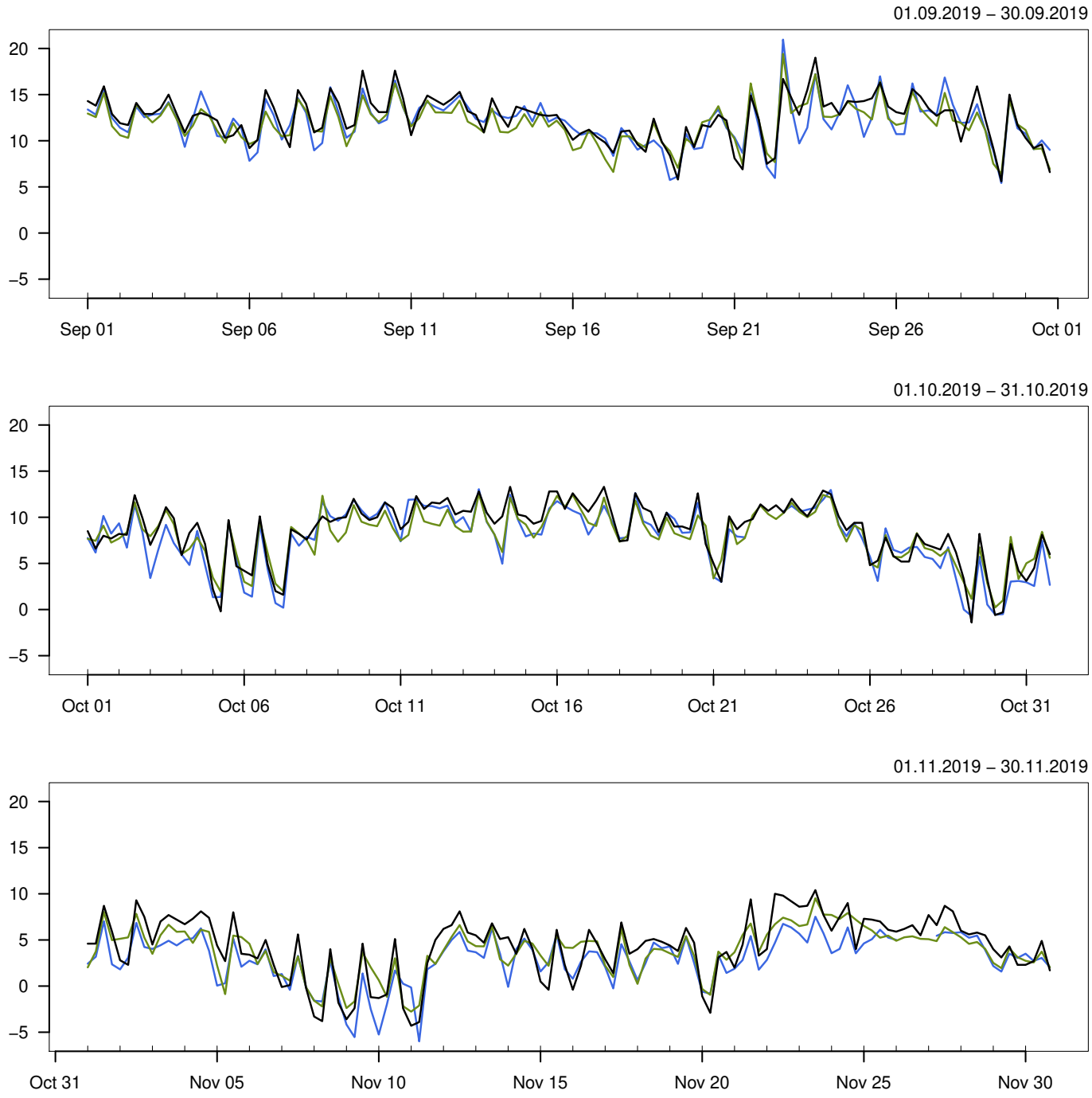


01.09.2019 – 30.11.2019

	Min	Mean	Max	Std	N
synop: 00,06,12,18	5	10.7	16.7	2.7	364
MEPSctrl: 12+18,+24,+30,+36	6.1	11.4	16.7	2.6	356
ECMWF: 12+18,+24,+30,+36	6.1	11.4	16.6	2.5	364

	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl – synop	0.6	0.6	0.9	0.7	2.8	356
ECMWF – synop	0.7	0.7	0.9	0.8	3.2	364

SOLA

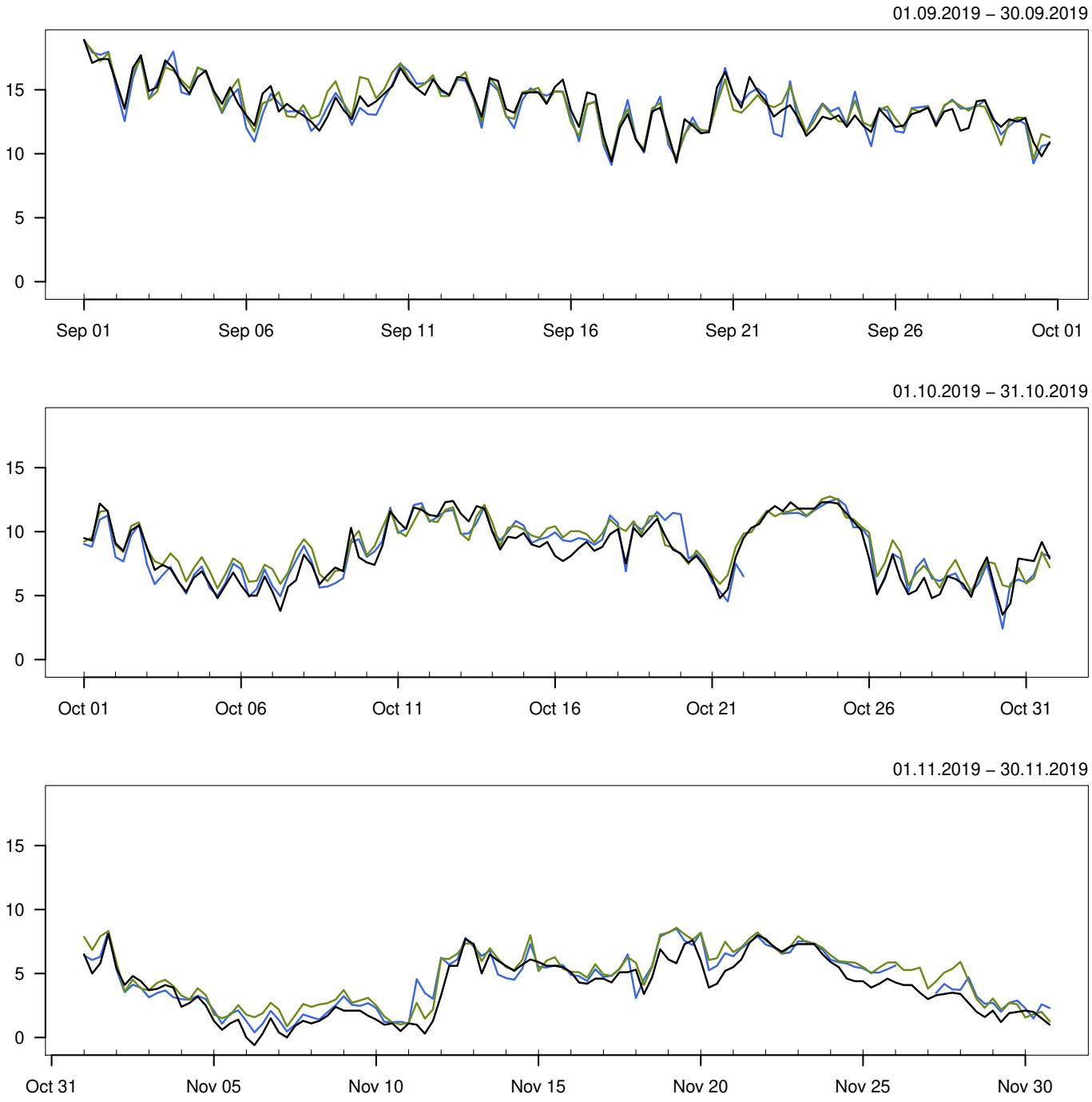


01.09.2019 – 30.11.2019

	Min	Mean	Max	Std	N
synop: 00,06,12,18	−4.3	8.4	19	4.5	364
MEPSctrl: 12+18,+24,+30,+36	−6	7.6	21	4.7	356
ECMWF: 12+18,+24,+30,+36	−2.8	7.9	19.4	4.1	364

	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl – synop	−0.8	1.5	1.7	1.3	5.4	356
ECMWF – synop	−0.5	1.3	1.4	1.1	4.5	364

FÆRDER FYR

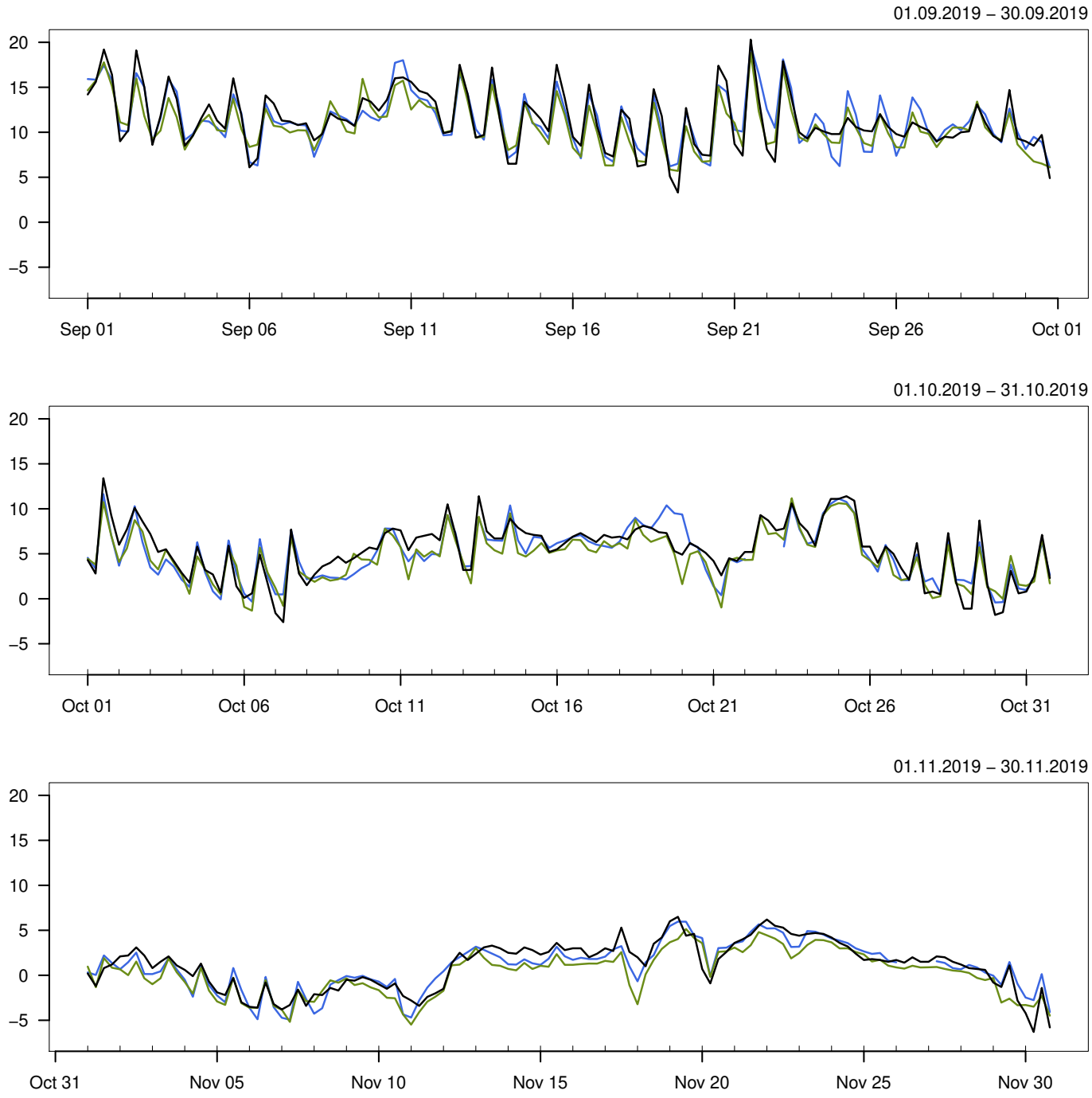


01.09.2019 – 30.11.2019

	Min	Mean	Max	Std	N
synop: 00,06,12,18	−0.6	8.7	18.9	4.5	364
MEPSctrl: 12+18,+24,+30,+36	0.4	8.9	18.9	4.3	356
ECMWF: 12+18,+24,+30,+36	0.9	9.2	18.8	4.2	364

	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl – synop	0.2	0.9	0.9	0.7	3.6	356
ECMWF – synop	0.5	0.9	1	0.8	2.9	364

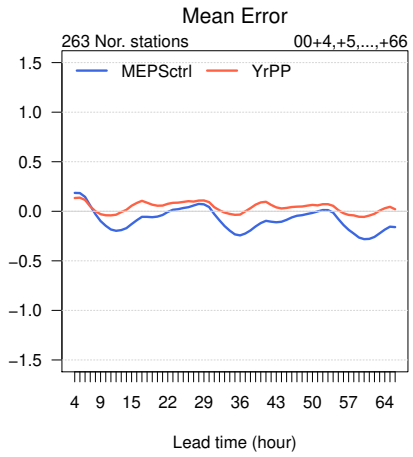
OSLO – BLINDERN

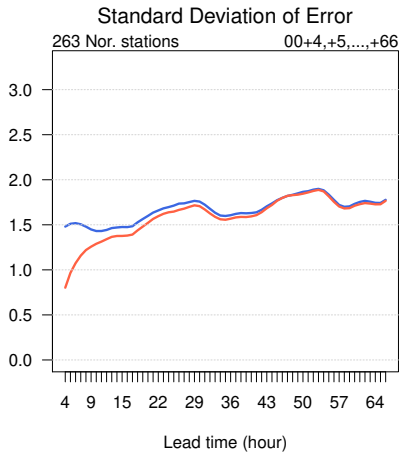


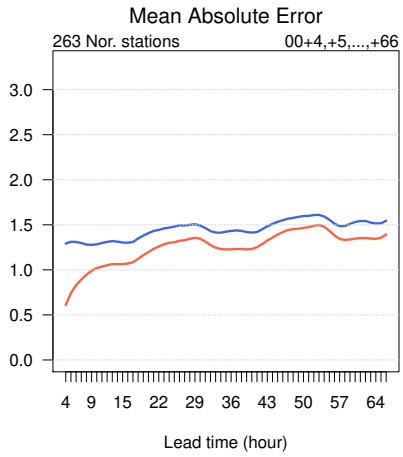
01.09.2019 – 30.11.2019

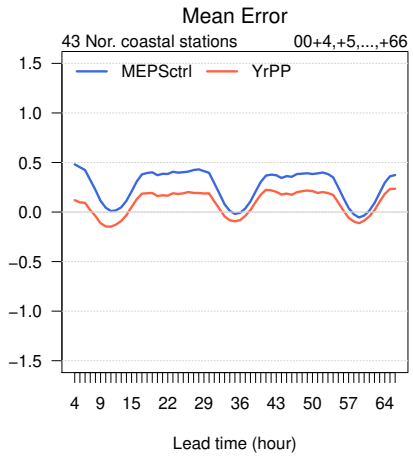
	Min	Mean	Max	Std	N
synop: 00,06,12,18	−6.3	5.9	20.3	5.2	364
MEPSctrl: 12+18,+24,+30,+36	−4.9	5.8	19.7	5.1	356
ECMWF: 12+18,+24,+30,+36	−5.5	5.2	18.8	5	364

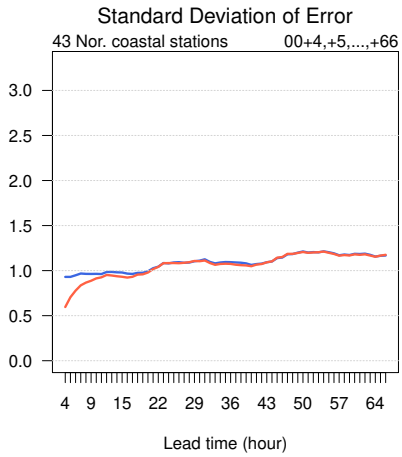
	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl – synop	−0.2	1.3	1.3	1	4.5	356
ECMWF – synop	−0.7	1.2	1.4	1.2	5.2	364

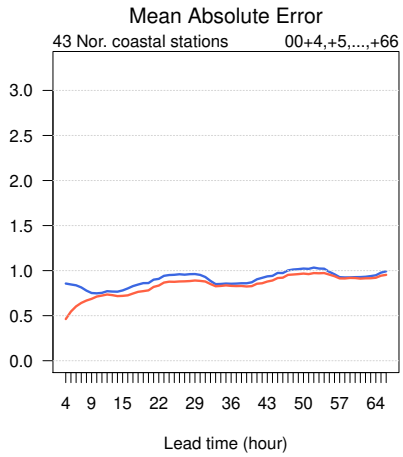

Mean Error
263 Nor. stations
00+4,+5,...,+66
MEPSctrl
YrPP
1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5
4 9 15 22 29 36 43 50 57 64
Lead time (hour)

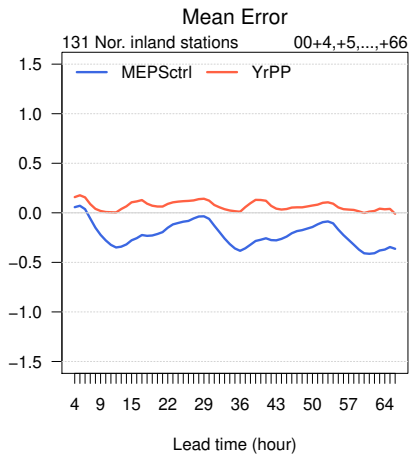

Standard Deviation of Error
263 Nor. stations
00+4,+5,...,+66
3.0
2.5
2.0
1.5
1.0
0.5
0.0
4 9 15 22 29 36 43 50 57 64
Lead time (hour)

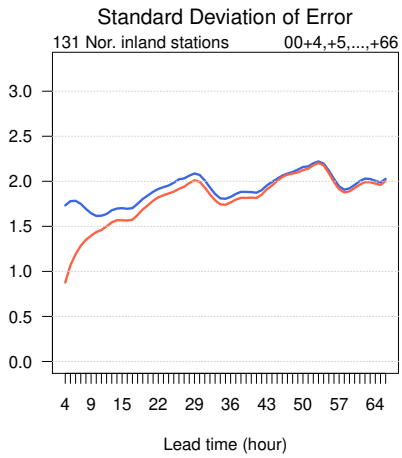

Mean Absolute Error
263 Nor. stations
00+4,+5,...,+66
3.0
2.5
2.0
1.5
1.0
0.5
0.0
4 9 15 22 29 36 43 50 57 64
Lead time (hour)

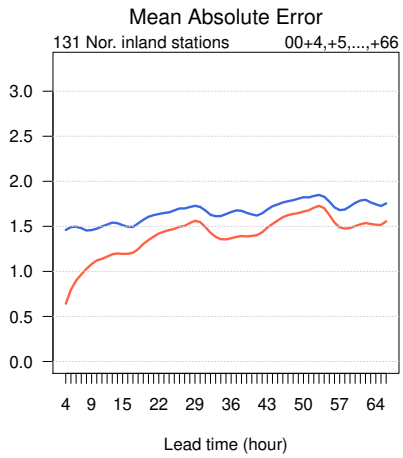

Mean Error
43 Nor. coastal stations
00+4,+5,...,+66
MEPSctrl
YrPP
1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5
4 9 15 22 29 36 43 50 57 64
Lead time (hour)


Standard Deviation of Error
43 Nor. coastal stations
00+4,+5,...,+66
3.0
2.5
2.0
1.5
1.0
0.5
0.0
4 9 15 22 29 36 43 50 57 64
Lead time (hour)

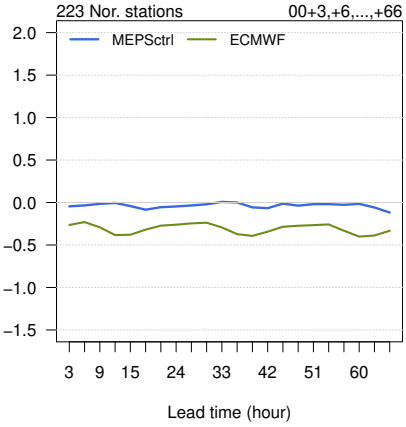

Mean Absolute Error
43 Nor. coastal stations
00+4,+5,...,+66
3.0
2.5
2.0
1.5
1.0
0.5
0.0
4 9 15 22 29 36 43 50 57 64
Lead time (hour)


Mean Error
131 Nor. inland stations
00+4,+5,...,+66
MEPSctrl
YrPP
1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5
4 9 15 22 29 36 43 50 57 64
Lead time (hour)

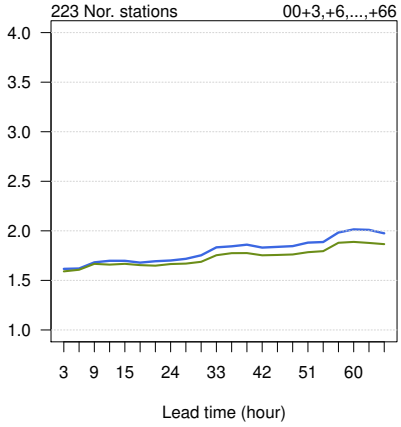

Standard Deviation of Error
131 Nor. inland stations
00+4,+5,...,+66
3.0
2.5
2.0
1.5
1.0
0.5
0.0
4 9 15 22 29 36 43 50 57 64
Lead time (hour)


Mean Absolute Error
131 Nor. inland stations
00+4,+5,...,+66
3.0
2.5
2.0
1.5
1.0
0.5
0.0
4 9 15 22 29 36 43 50 57 64
Lead time (hour)

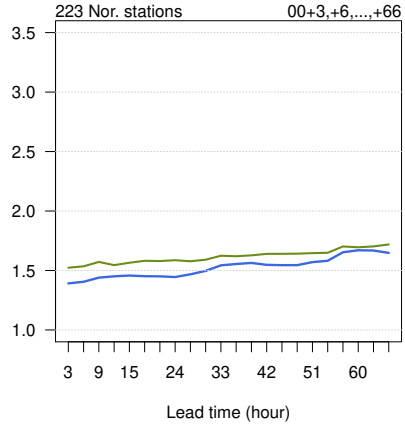
Mean Error



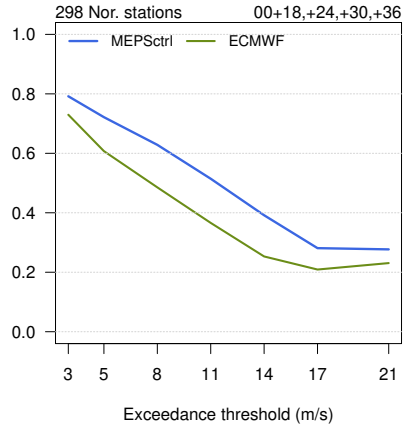
Standard Deviation of Error



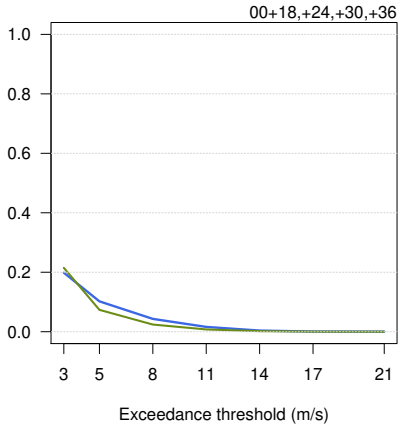
Mean Absolute Error



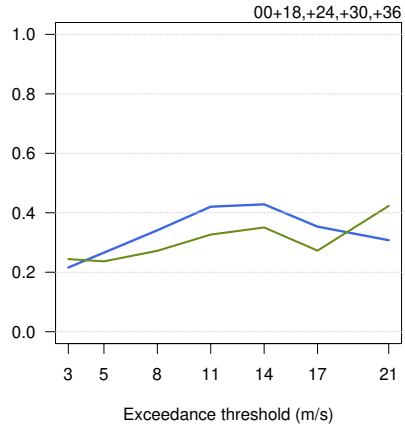
Hit Rate



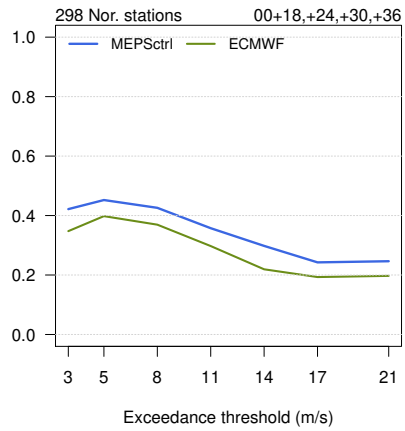
False Alarm Rate



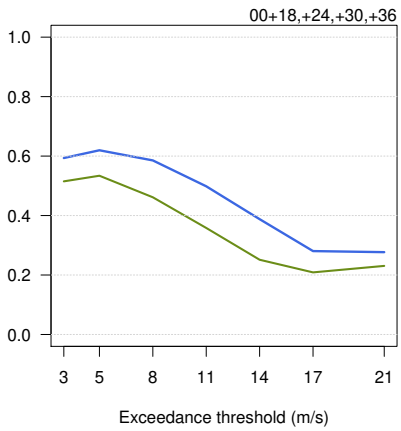
False Alarm Ratio



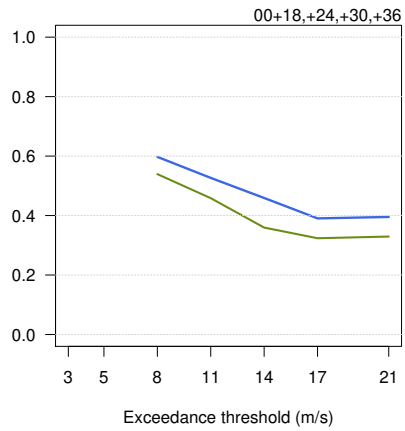
Equitable Threat Score

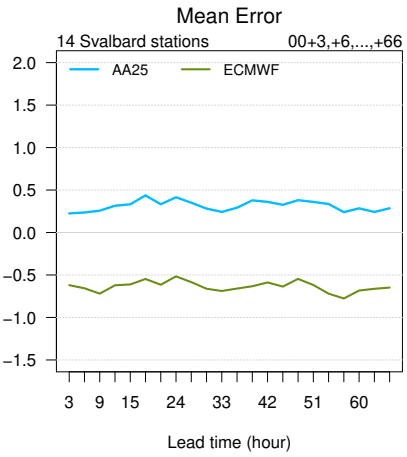


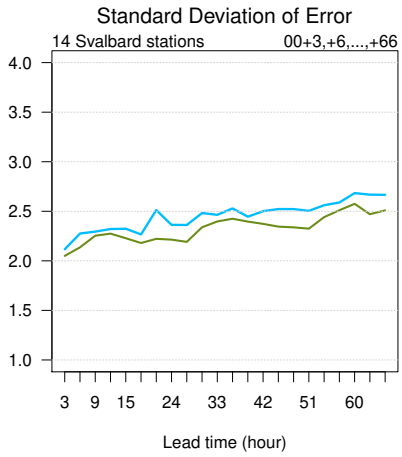
Hansen−Kuiper Skill Score

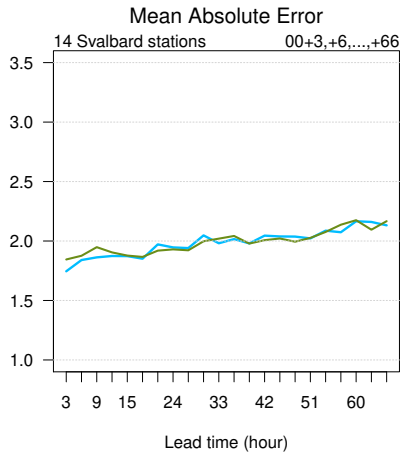


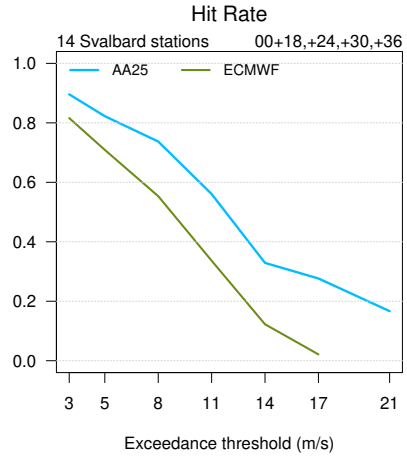
Heidke Skill Score

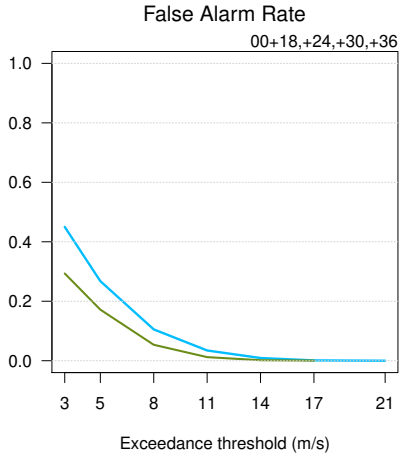


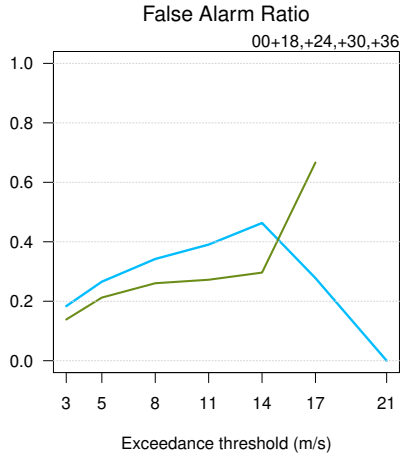

Mean Error
14 Svalbard stations
00+3,+6,...,+66
AA25
ECMWF
2.0
1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5
3 9 15 24 33 42 51 60
Lead time (hour)

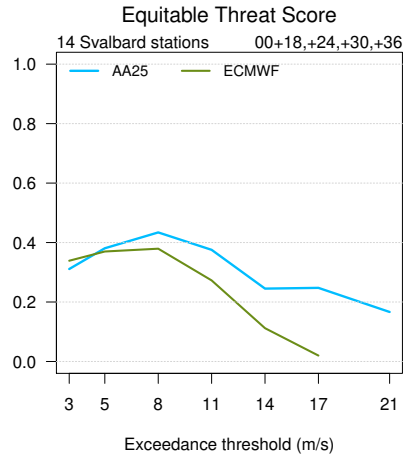

Standard Deviation of Error
14 Svalbard stations
00+3,+6,...,+66
4.0
3.5
3.0
2.5
2.0
1.5
1.0
3 9 15 24 33 42 51 60
Lead time (hour)

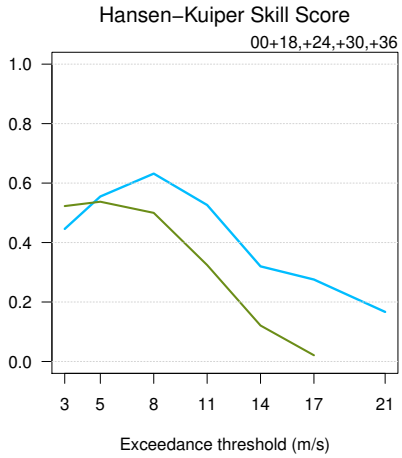

Mean Absolute Error
14 Svalbard stations
00+3,+6,...,+66
3.5
3.0
2.5
2.0
1.5
1.0
3 9 15 24 33 42 51 60
Lead time (hour)

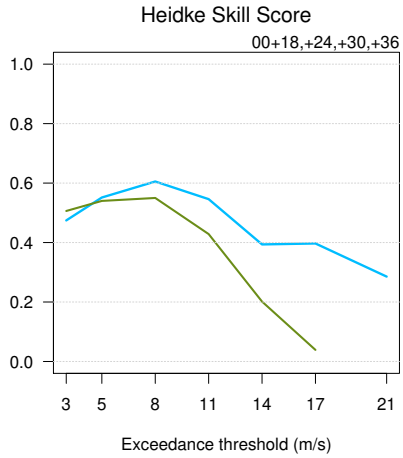

Hit Rate
14 Svalbard stations
00+18,+24,+30,+36
AA25
ECMWF
1.0
0.8
0.6
0.4
0.2
0.0
3 5 8 11 14 17 21
Exceedance threshold (m/s)


False Alarm Rate
00+18,+24,+30,+36
1.0
0.8
0.6
0.4
0.2
0.0
3 5 8 11 14 17 21
Exceedance threshold (m/s)

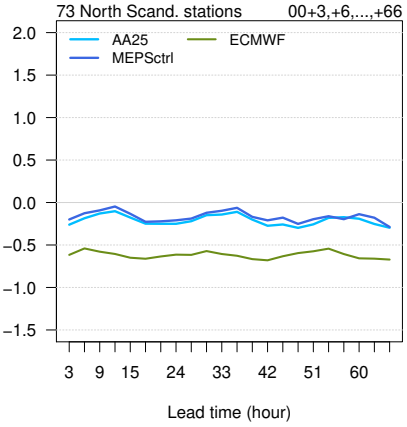

False Alarm Ratio
00+18,+24,+30,+36
1.0
0.8
0.6
0.4
0.2
0.0
3 5 8 11 14 17 21
Exceedance threshold (m/s)


Equitable Threat Score
14 Svalbard stations
00+18,+24,+30,+36
AA25
ECMWF
1.0
0.8
0.6
0.4
0.2
0.0
3 5 8 11 14 17 21
Exceedance threshold (m/s)

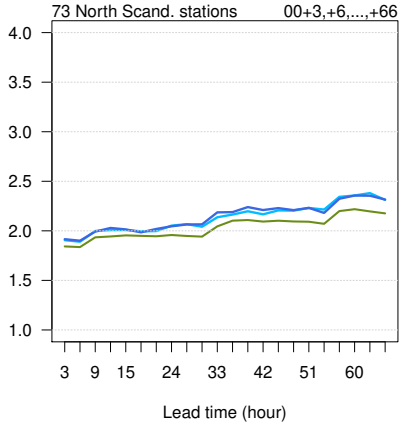

Hansen−Kuiper Skill Score
00+18,+24,+30,+36
1.0
0.8
0.6
0.4
0.2
0.0
3 5 8 11 14 17 21
Exceedance threshold (m/s)


Heidke Skill Score
00+18,+24,+30,+36
1.0
0.8
0.6
0.4
0.2
0.0
3 5 8 11 14 17 21
Exceedance threshold (m/s)

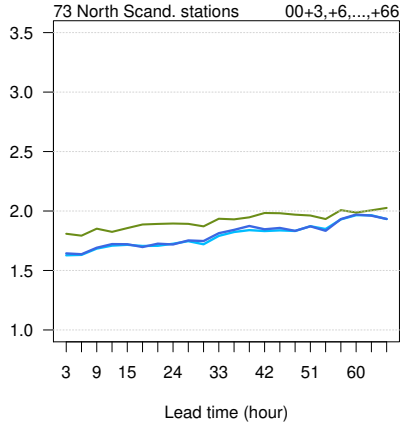
Mean Error
73 North Scand. stations 00+3,+6,...,+66
AA25 ECMWF MEPSctrl
Lead time (hour)



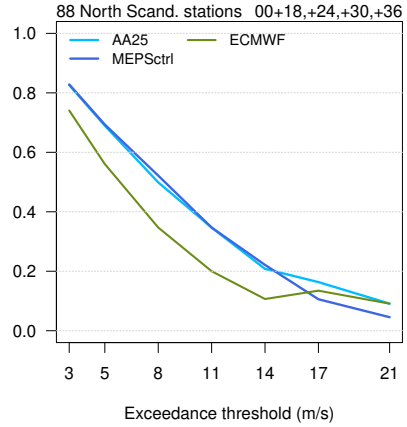
Standard Deviation of Error
73 North Scand. stations 00+3,+6,...,+66
Lead time (hour)



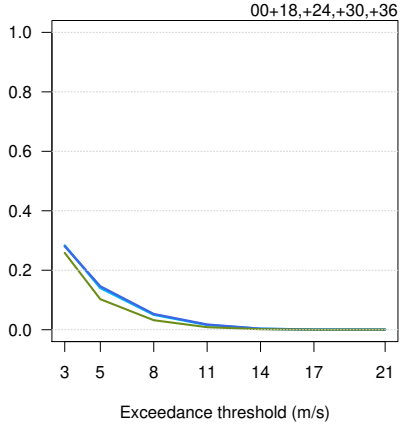
Mean Absolute Error
73 North Scand. stations 00+3,+6,...,+66
Lead time (hour)



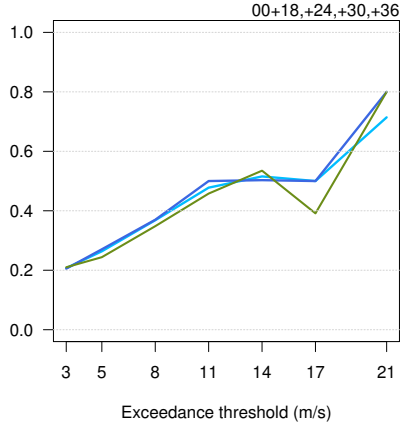
Hit Rate
88 North Scand. stations 00+18,+24,+30,+36
AA25 ECMWF MEPSctrl
Exceedance threshold (m/s)



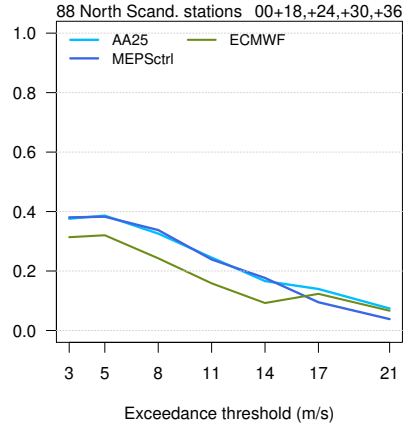
False Alarm Rate
00+18,+24,+30,+36
Exceedance threshold (m/s)



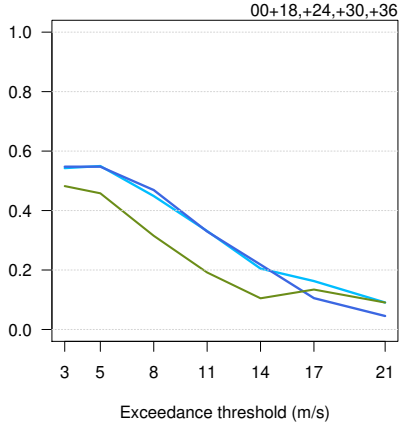
False Alarm Ratio
00+18,+24,+30,+36
Exceedance threshold (m/s)



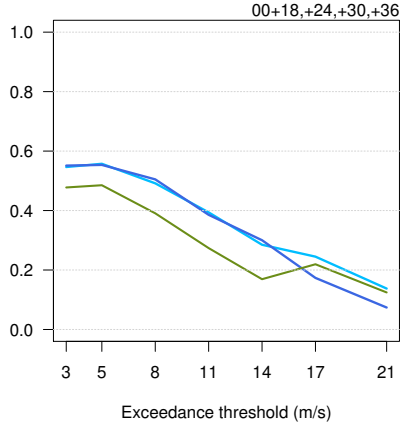
Equitable Threat Score
88 North Scand. stations 00+18,+24,+30,+36
AA25 ECMWF MEPSctrl
Exceedance threshold (m/s)



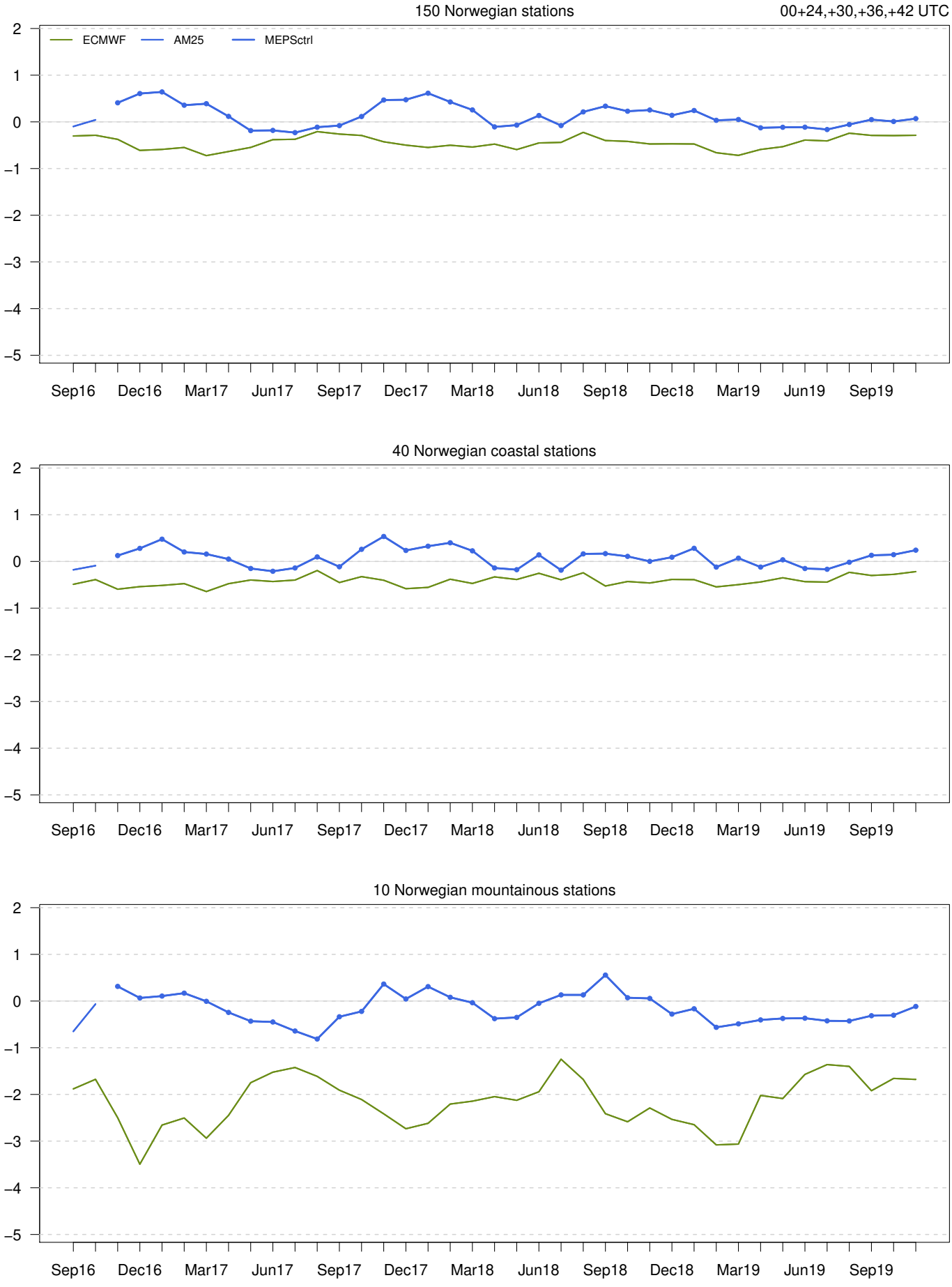
Hansen−Kuiper Skill Score
00+18,+24,+30,+36
Exceedance threshold (m/s)



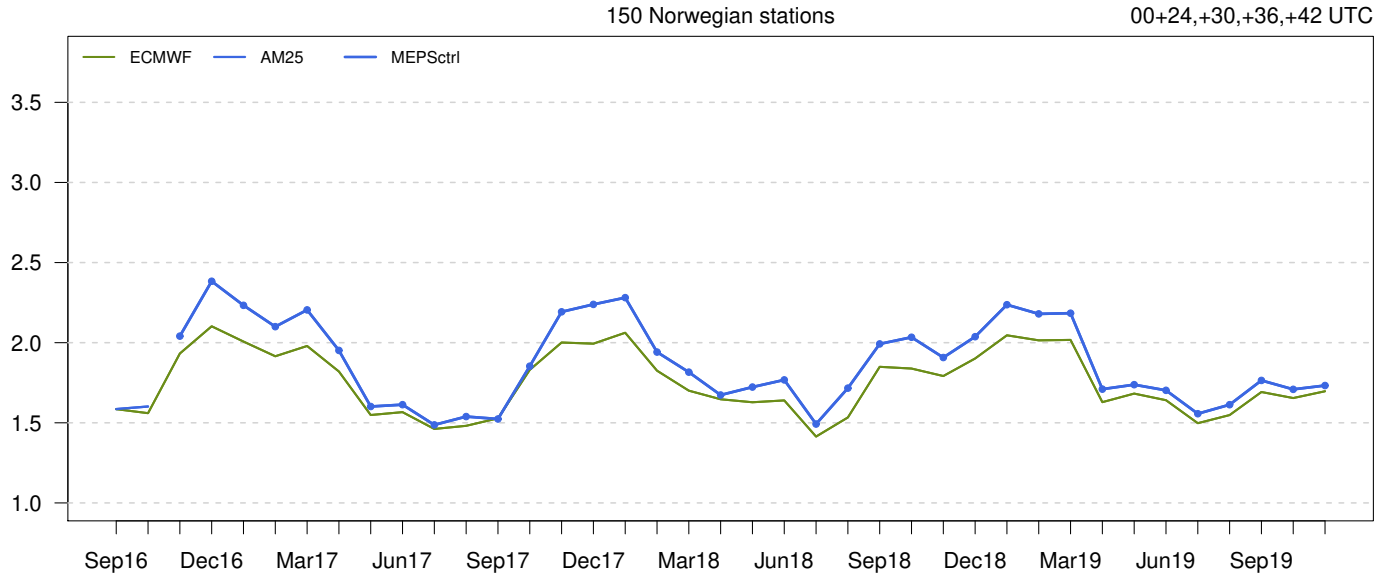
Heidke Skill Score
00+18,+24,+30,+36
Exceedance threshold (m/s)

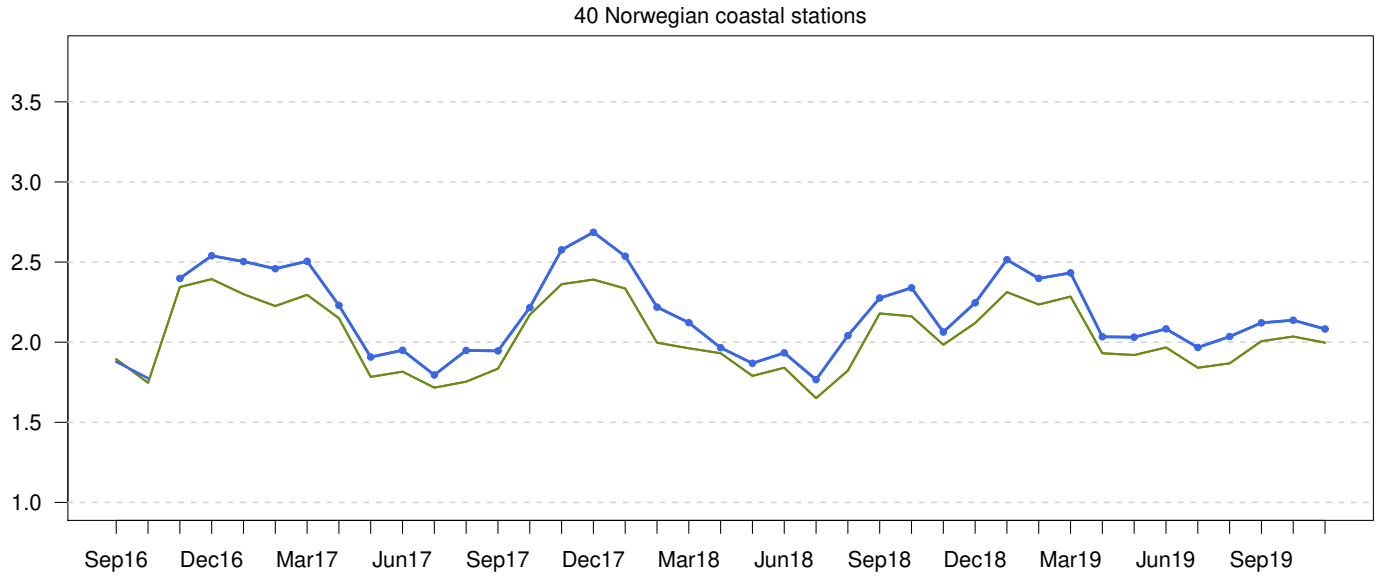


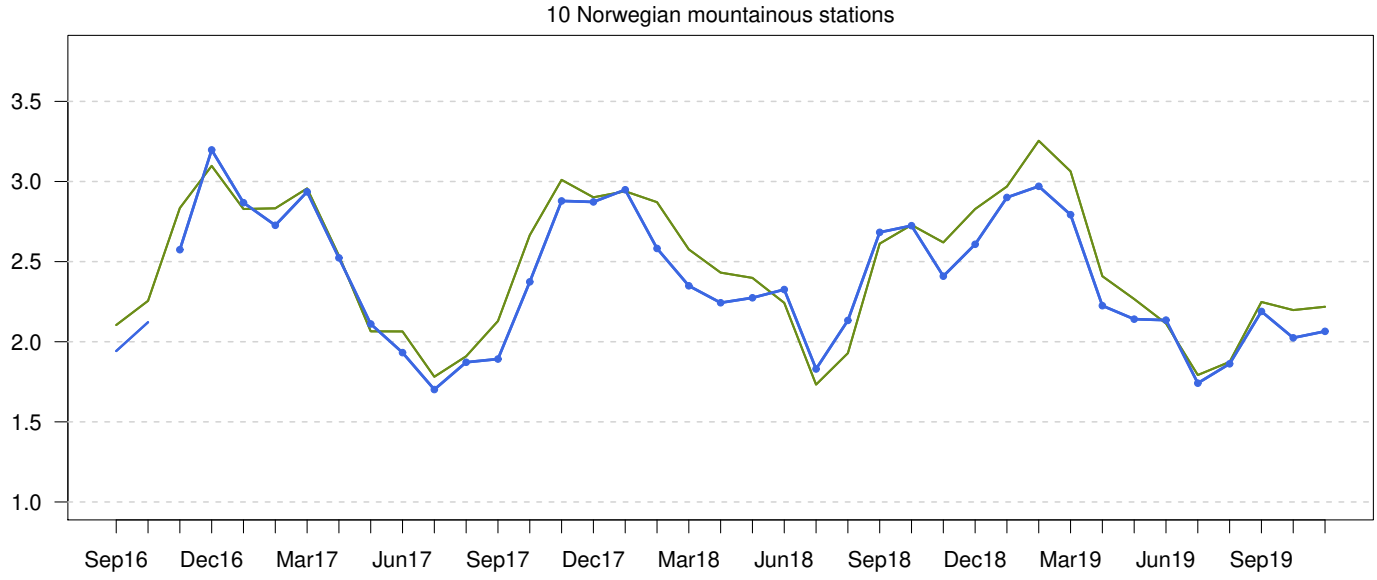
Mean Error


150 Norwegian stations
00+24,+30,+36,+42 UTC
ECMWF
AM25
MEPSctrl
40 Norwegian coastal stations
10 Norwegian mountainous stations
2
1
0
−1
−2
−3
−4
−5
Sep16
Dec16
Mar17
Jun17
Sep17
Dec17
Mar18
Jun18
Sep18
Dec18
Mar19
Jun19
Sep19

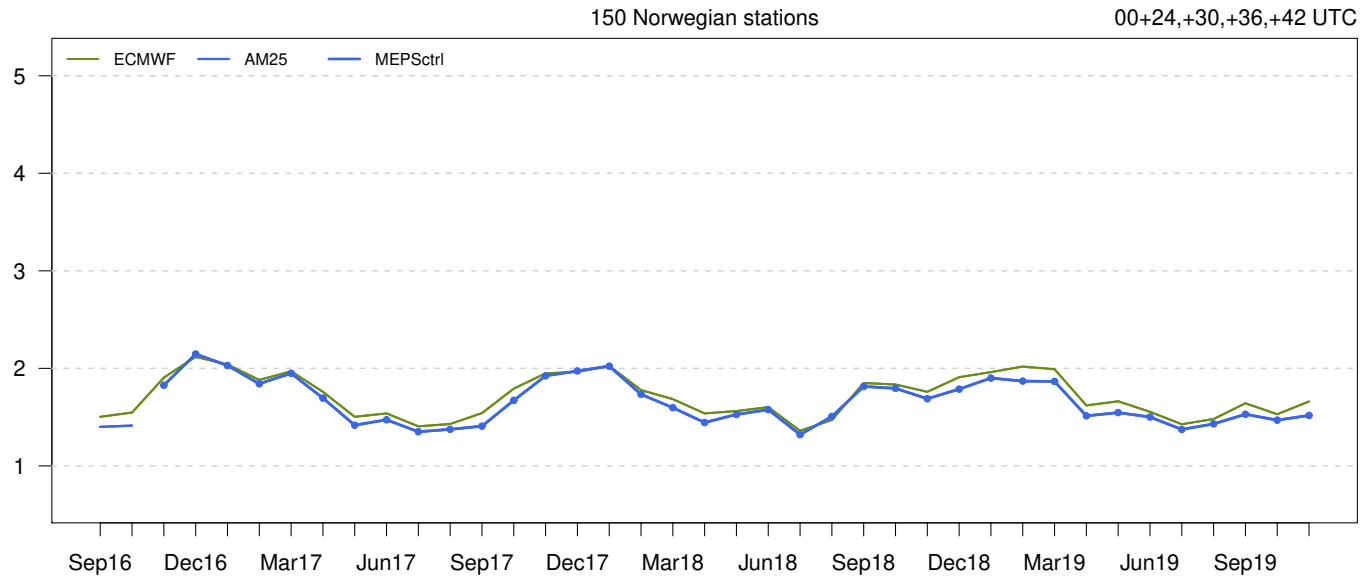
Standard Deviation of Error

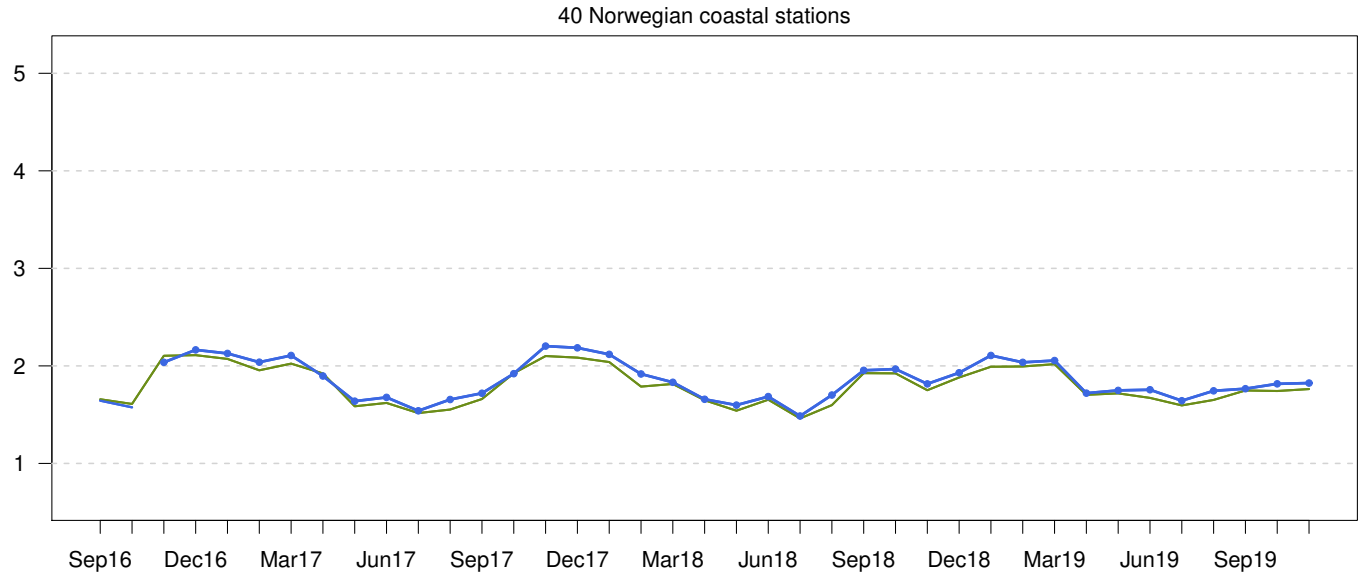


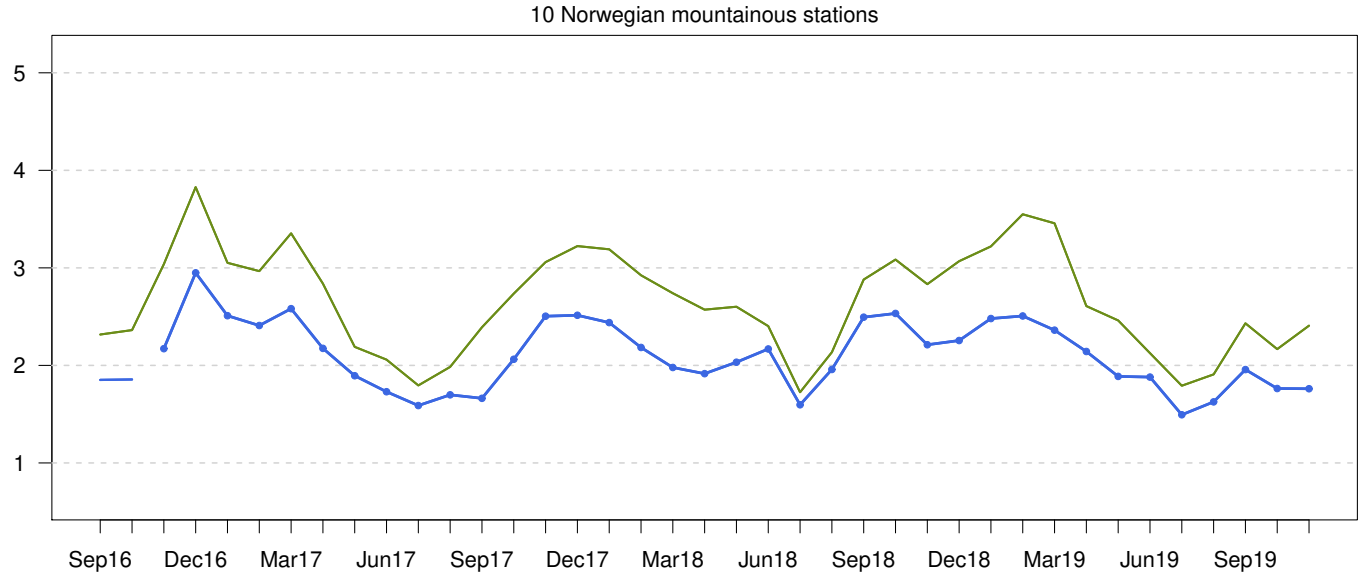




Mean Absolute Error

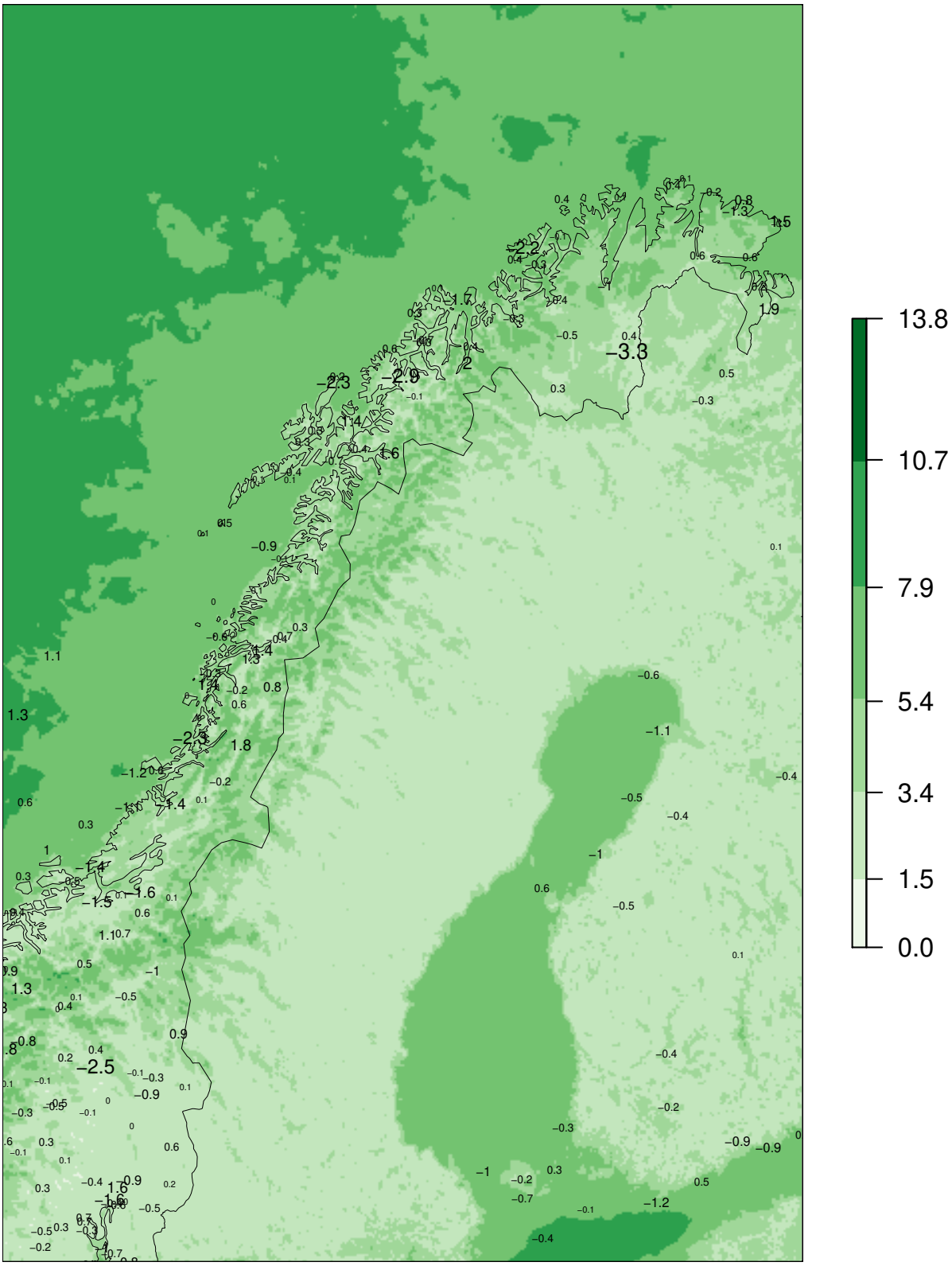






MEPSctrl 00+12

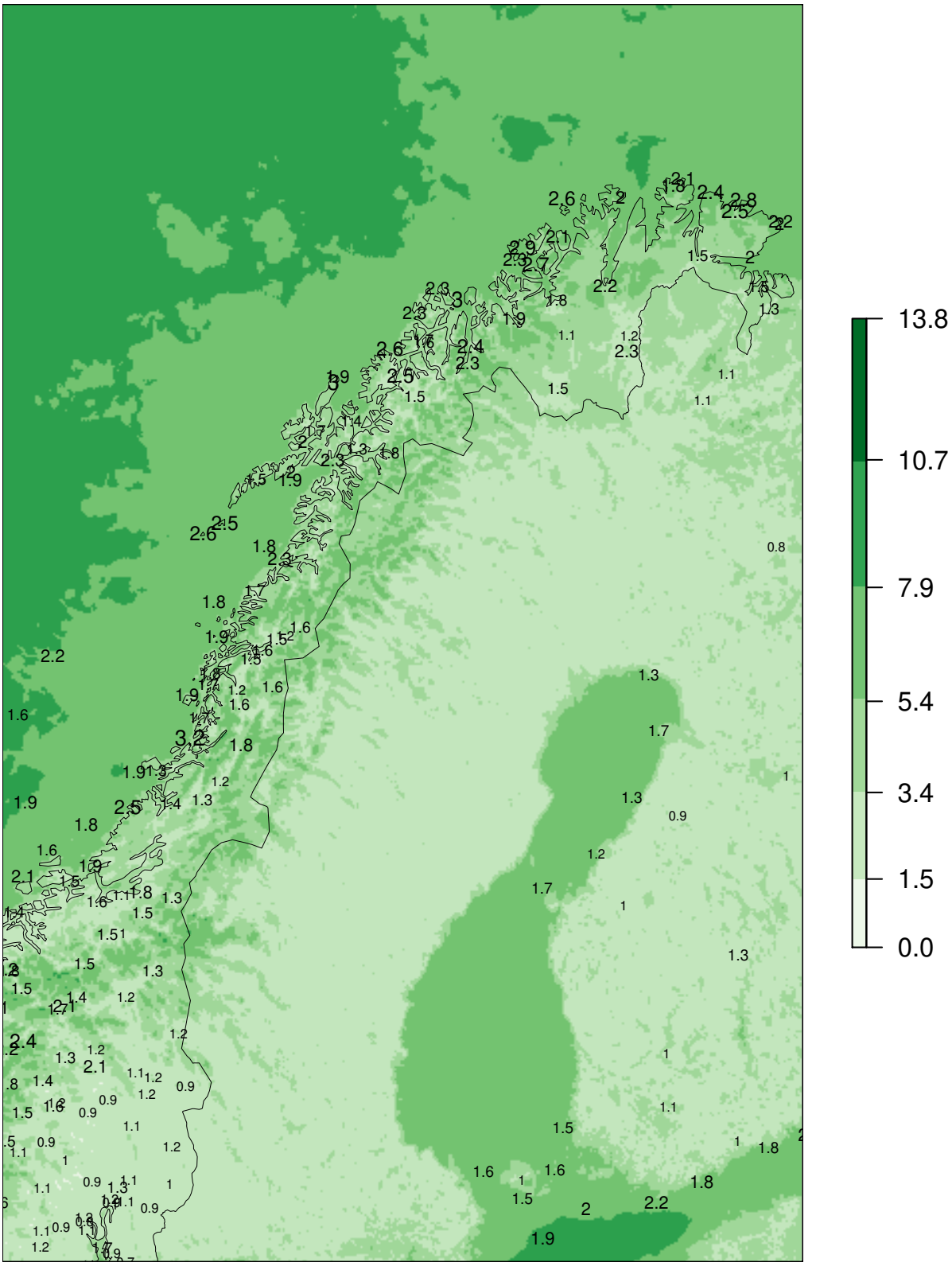
ME at observing sites
(numbers in black)



Model "climatology" 01.09.2019 – 30.11.2019

MEPSctrl 00+12

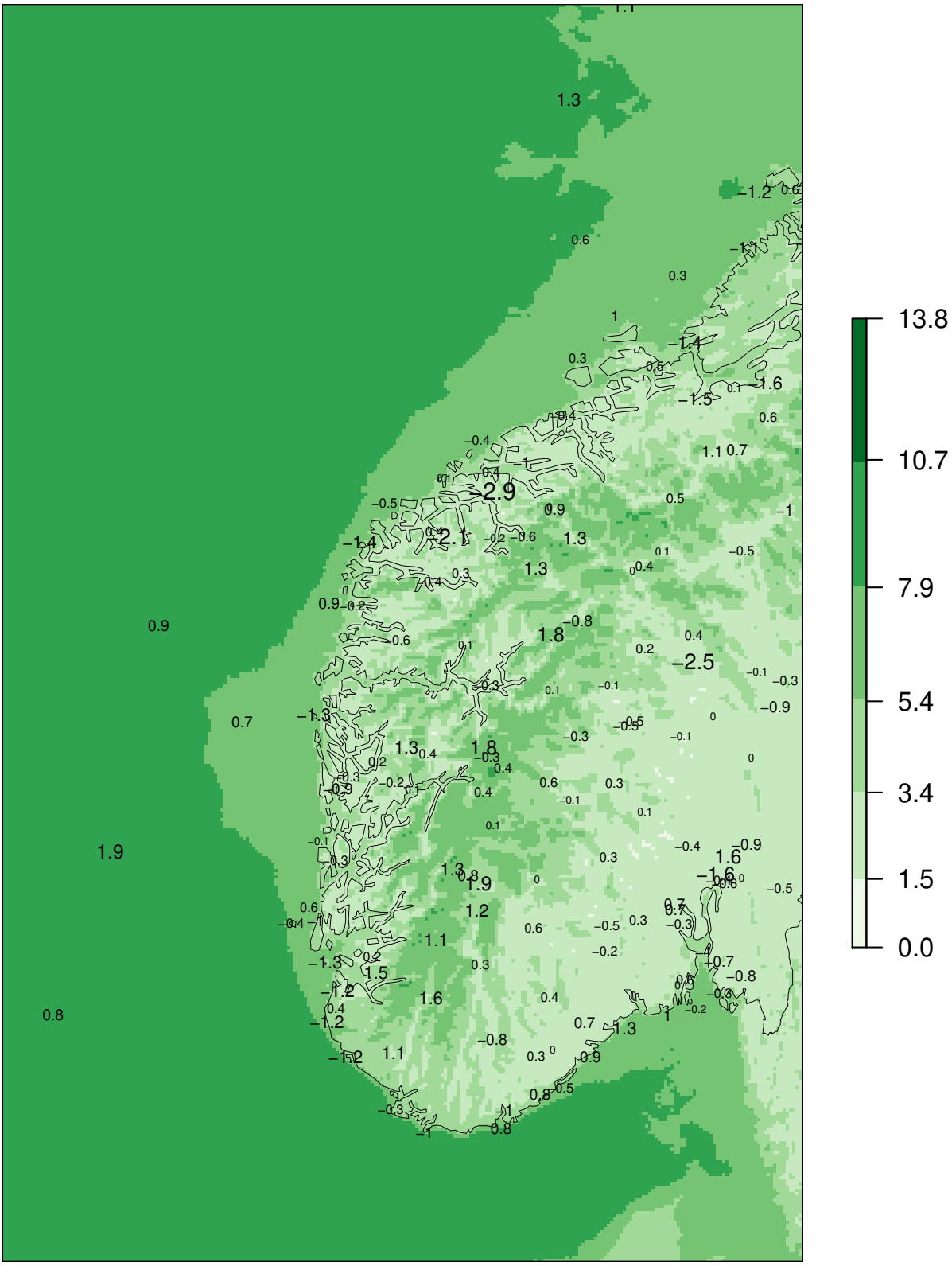
SDE at observing sites
(numbers in black)



Model "climatology" 01.09.2019 – 30.11.2019

MEPSctrl 00+12

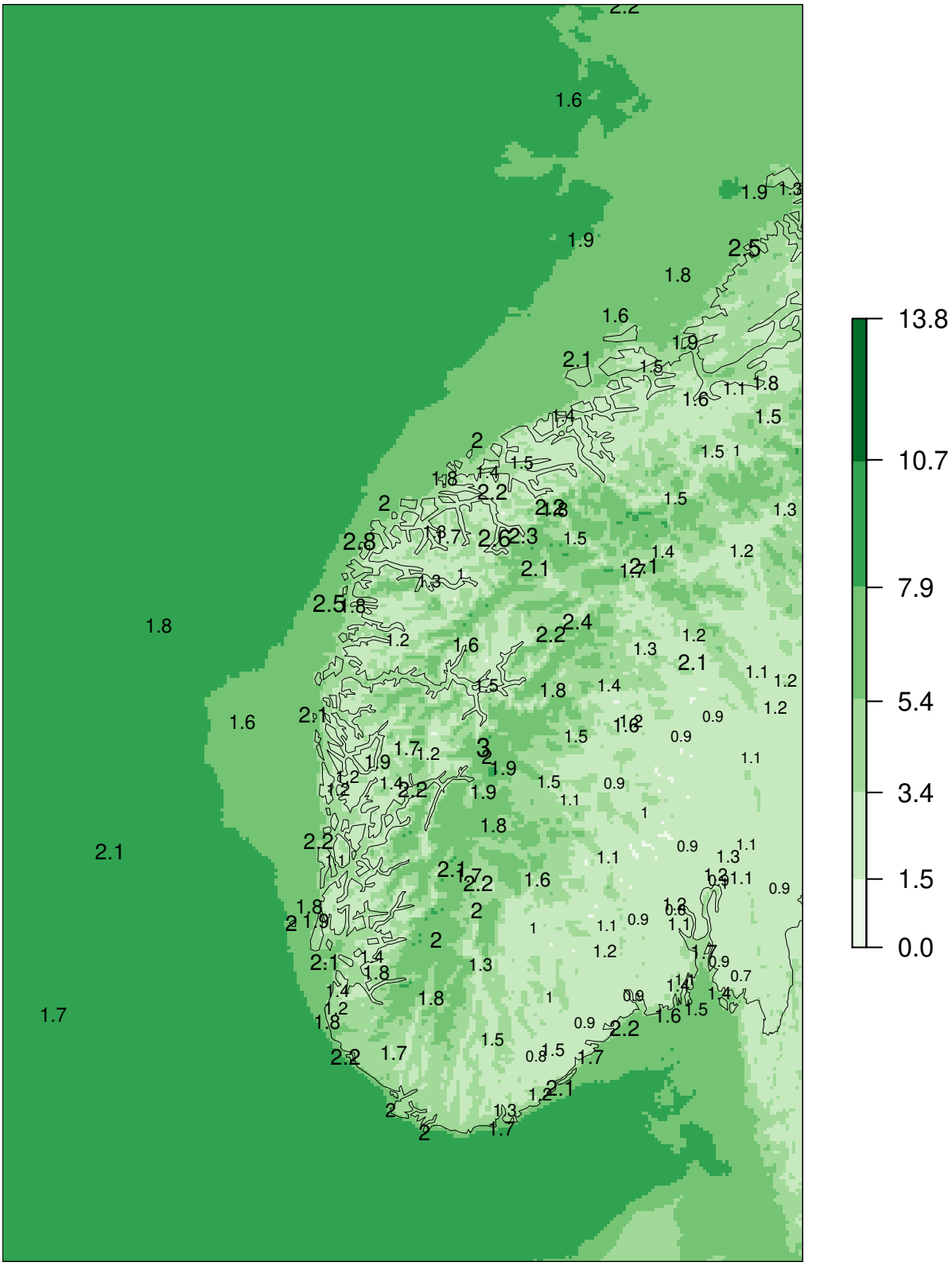
ME at observing sites
(numbers in black)



Model "climatology" 01.09.2019 – 30.11.2019

MEPSctrl 00+12

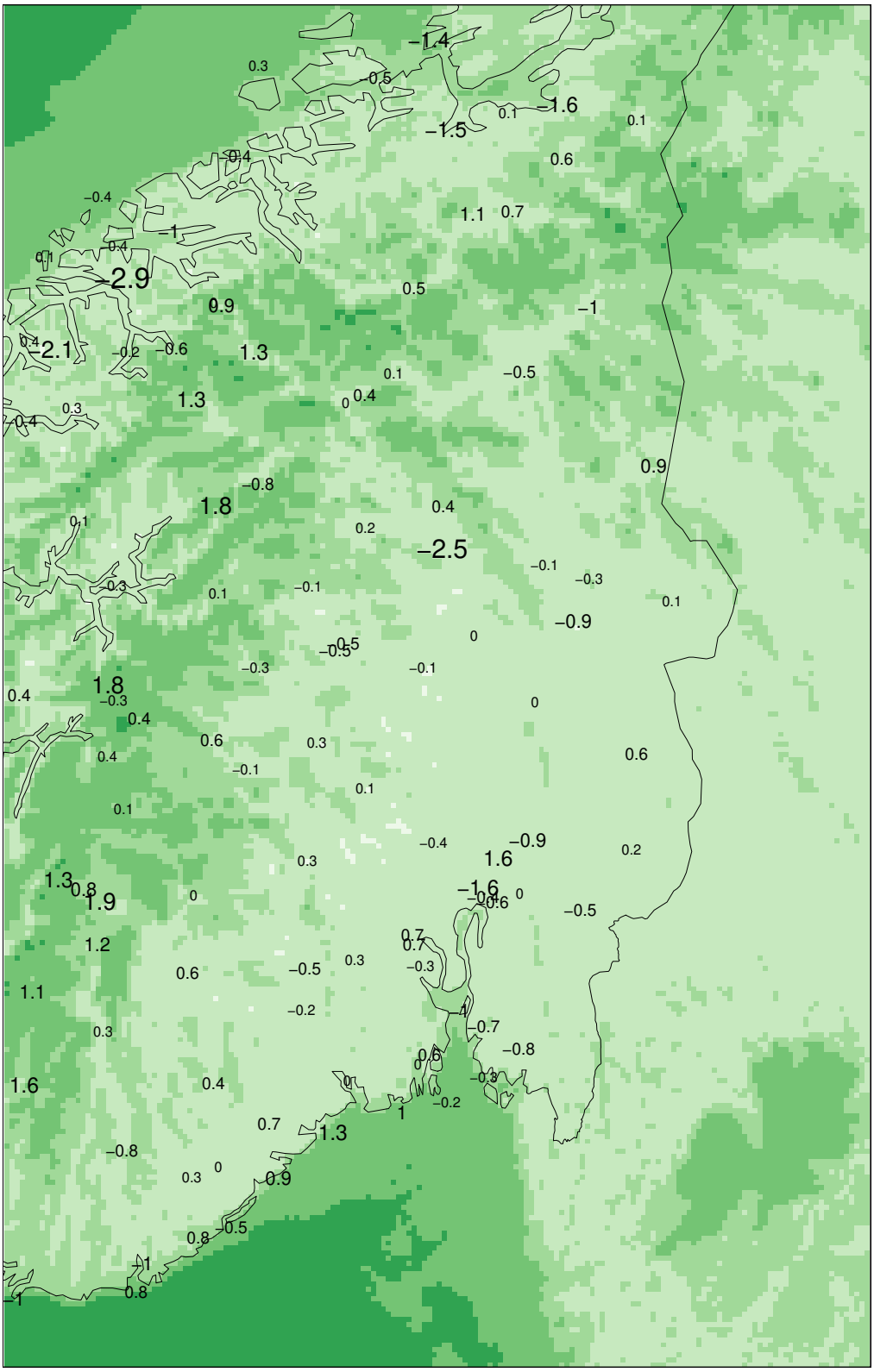
SDE at observing sites
(numbers in black)



Model "climatology" 01.09.2019 – 30.11.2019

MEPSctrl 00+12

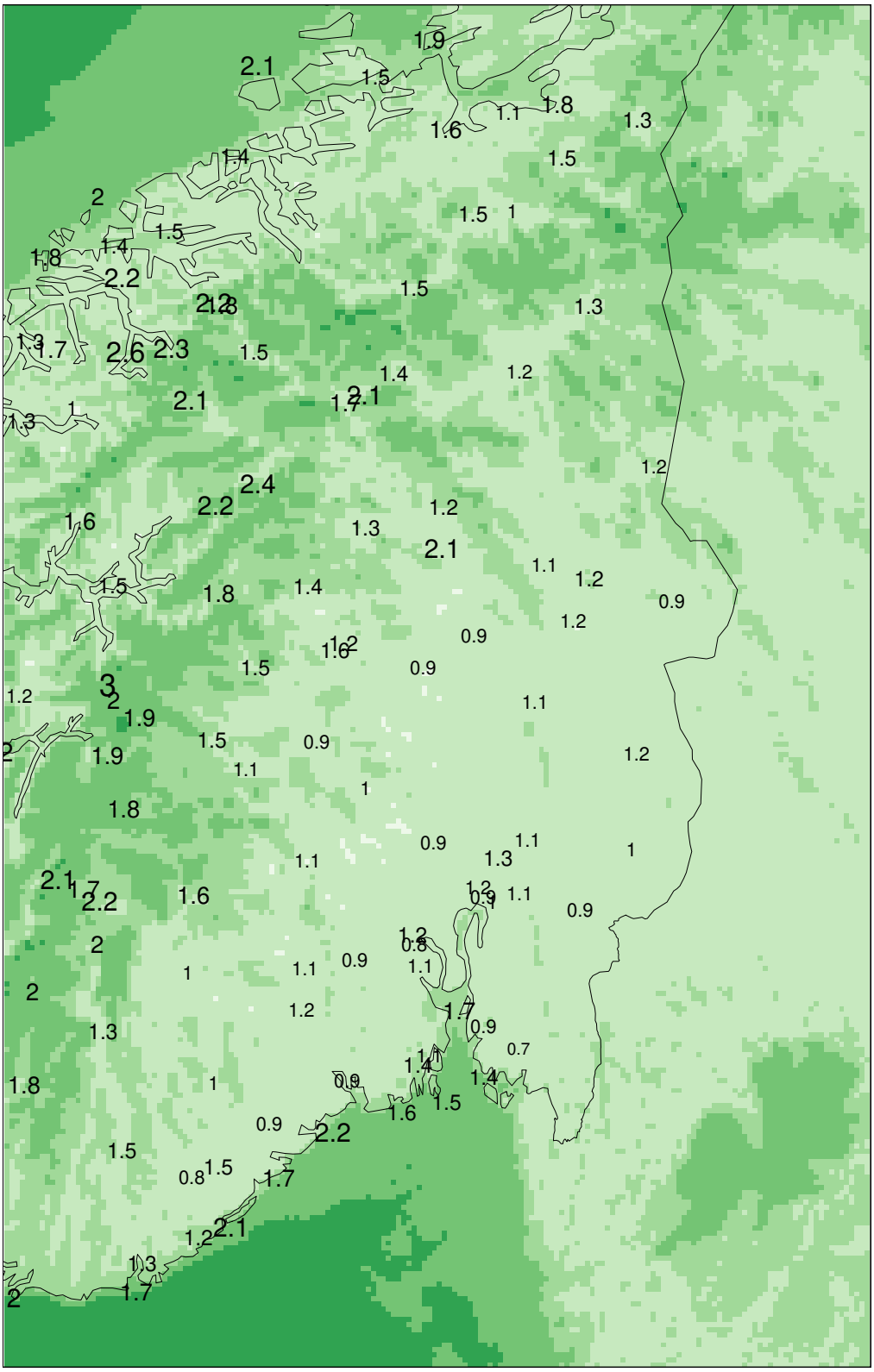
ME at observing sites
(numbers in black)



Model "climatology" 01.09.2019 – 30.11.2019

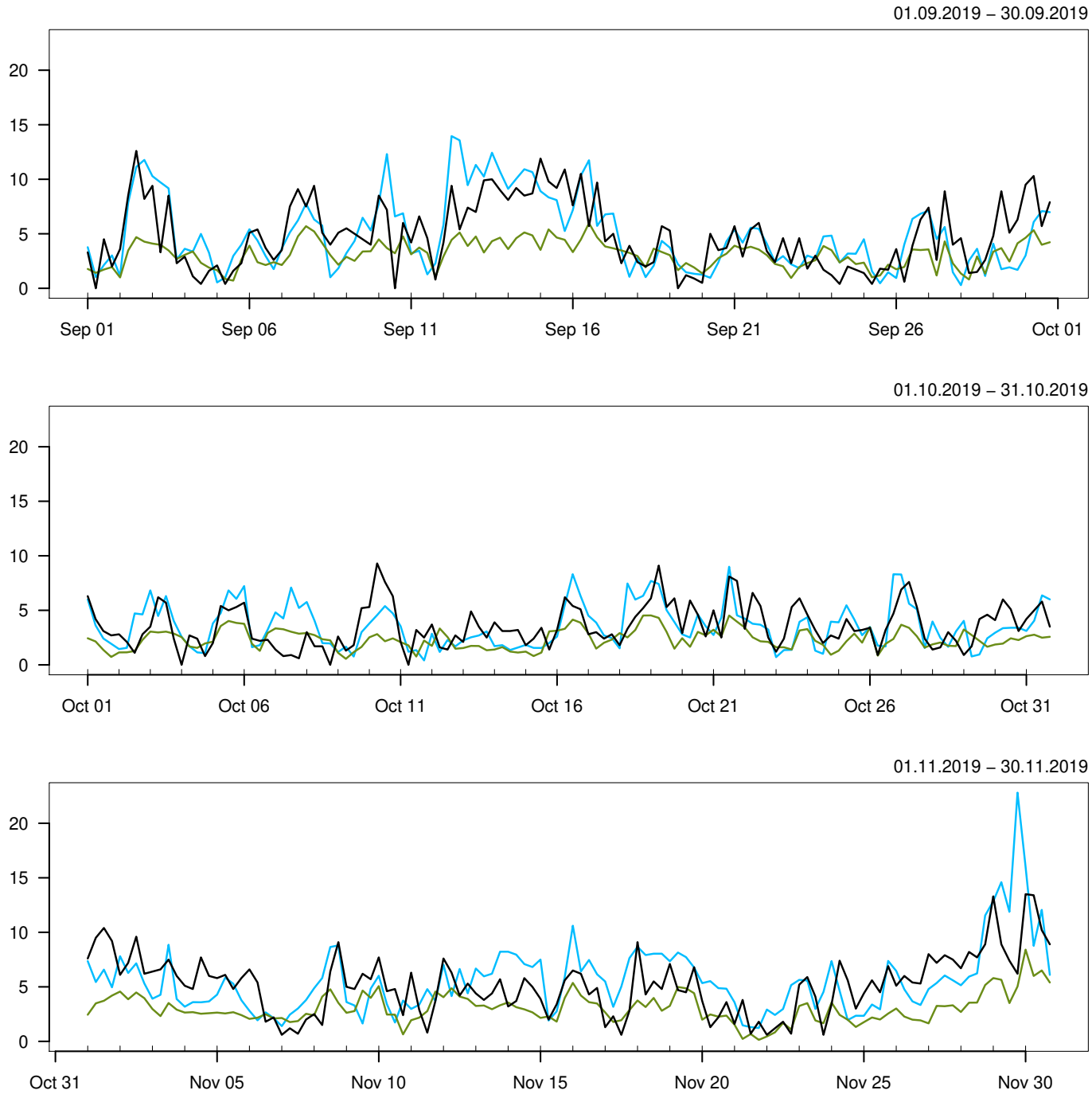
MEPSctrl 00+12

SDE at observing sites
(numbers in black)



Model "climatology" 01.09.2019 – 30.11.2019

SVALBARD LUFTHAVN



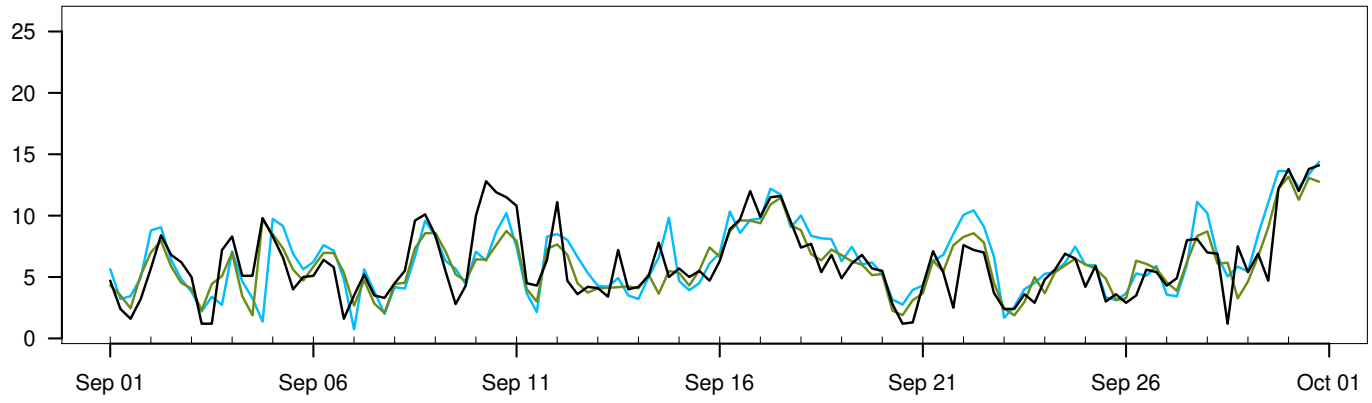
01.09.2019 – 30.11.2019

	Min	Mean	Max	Std	N
synop: 00,06,12,18	0	4.5	13.5	2.7	364
AA25: 12+18,+24,+30,+36	0.3	4.7	22.8	3	364
ECMWF: 12+18,+24,+30,+36	0.1	2.8	8.4	1.2	364

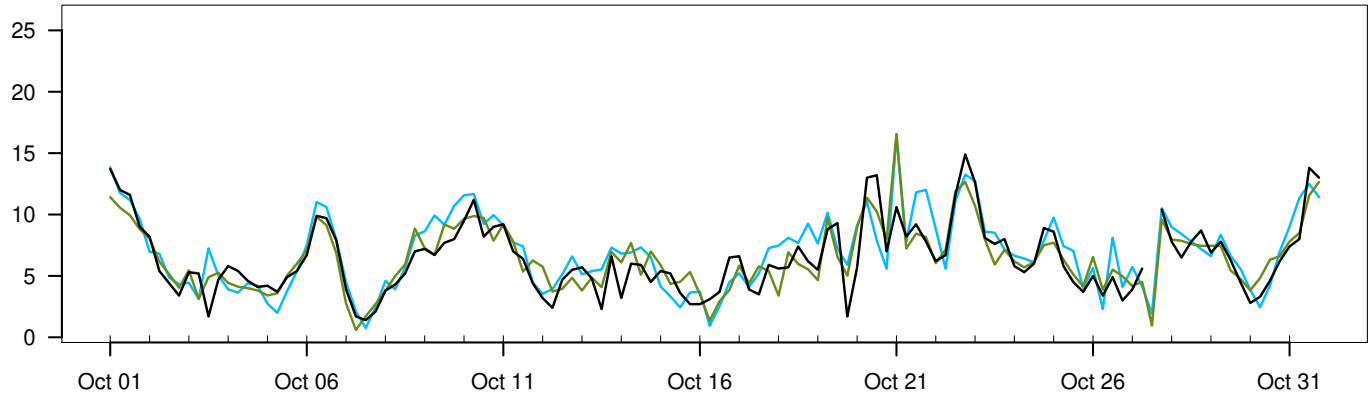
	ME	SDE	RMSE	MAE	Max.abs.err.	N
AA25 – synop	0.2	2.5	2.5	1.9	16.6	364
ECMWF – synop	−1.7	2.1	2.7	2.1	8.4	364

BJØRNØYA

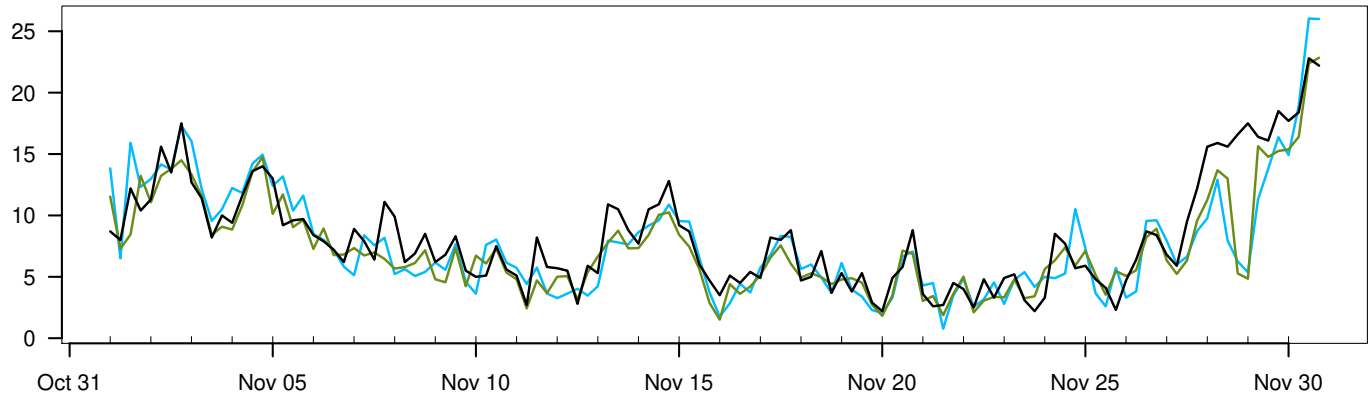
01.09.2019 – 30.09.2019



01.10.2019 – 31.10.2019



01.11.2019 – 30.11.2019



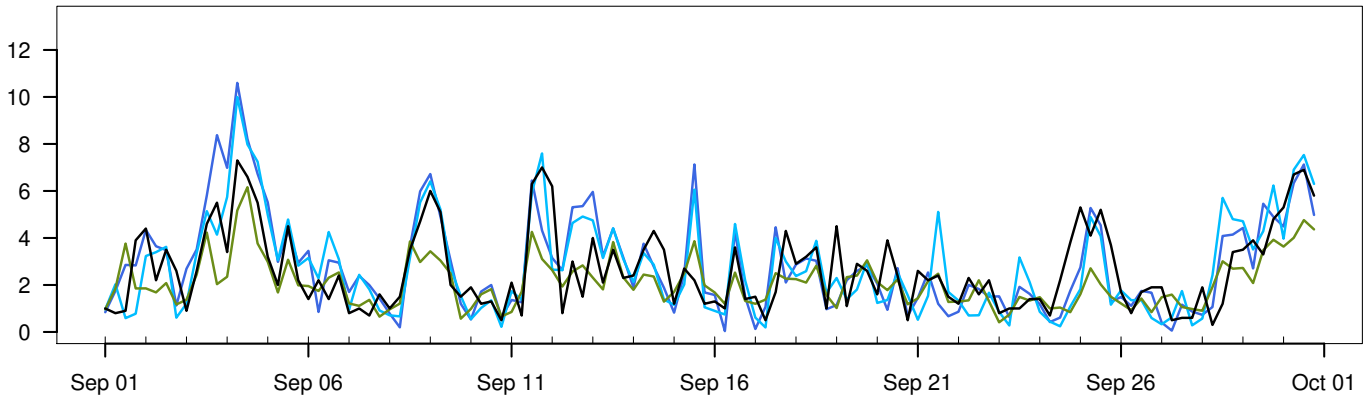
01.09.2019 – 30.11.2019

	Min	Mean	Max	Std	N
synop: 00,06,12,18	1.2	6.9	22.8	3.6	363
AA25: 12+18,+24,+30,+36	0.7	7	26	3.6	364
ECMWF: 12+18,+24,+30,+36	0.6	6.6	22.8	3.1	364

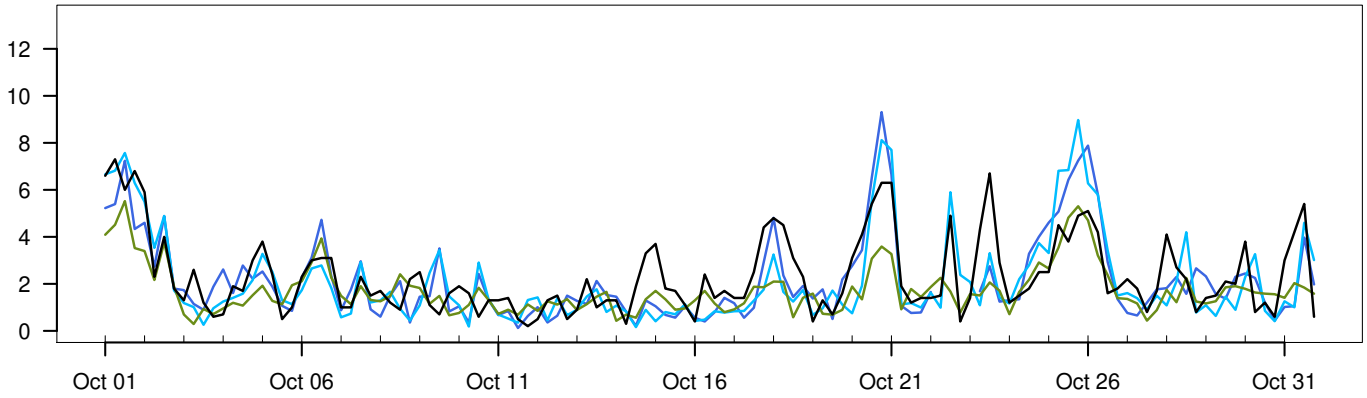
	ME	SDE	RMSE	MAE	Max.abs.err.	N
AA25 – synop	0.1	2.2	2.2	1.6	12.1	363
ECMWF – synop	−0.3	1.8	1.8	1.3	12.7	363

TROMSØ

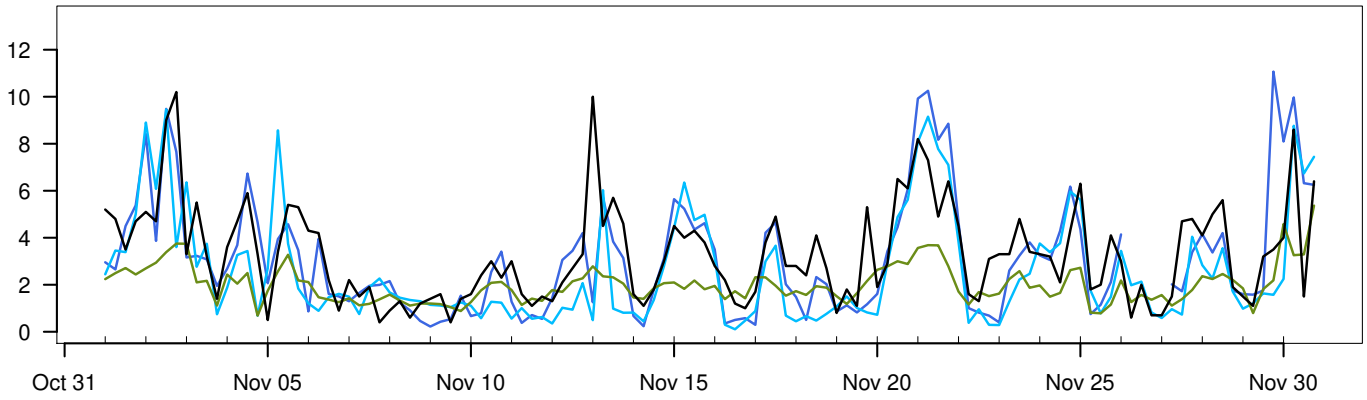
01.09.2019 – 30.09.2019



01.10.2019 – 31.10.2019



01.11.2019 – 30.11.2019

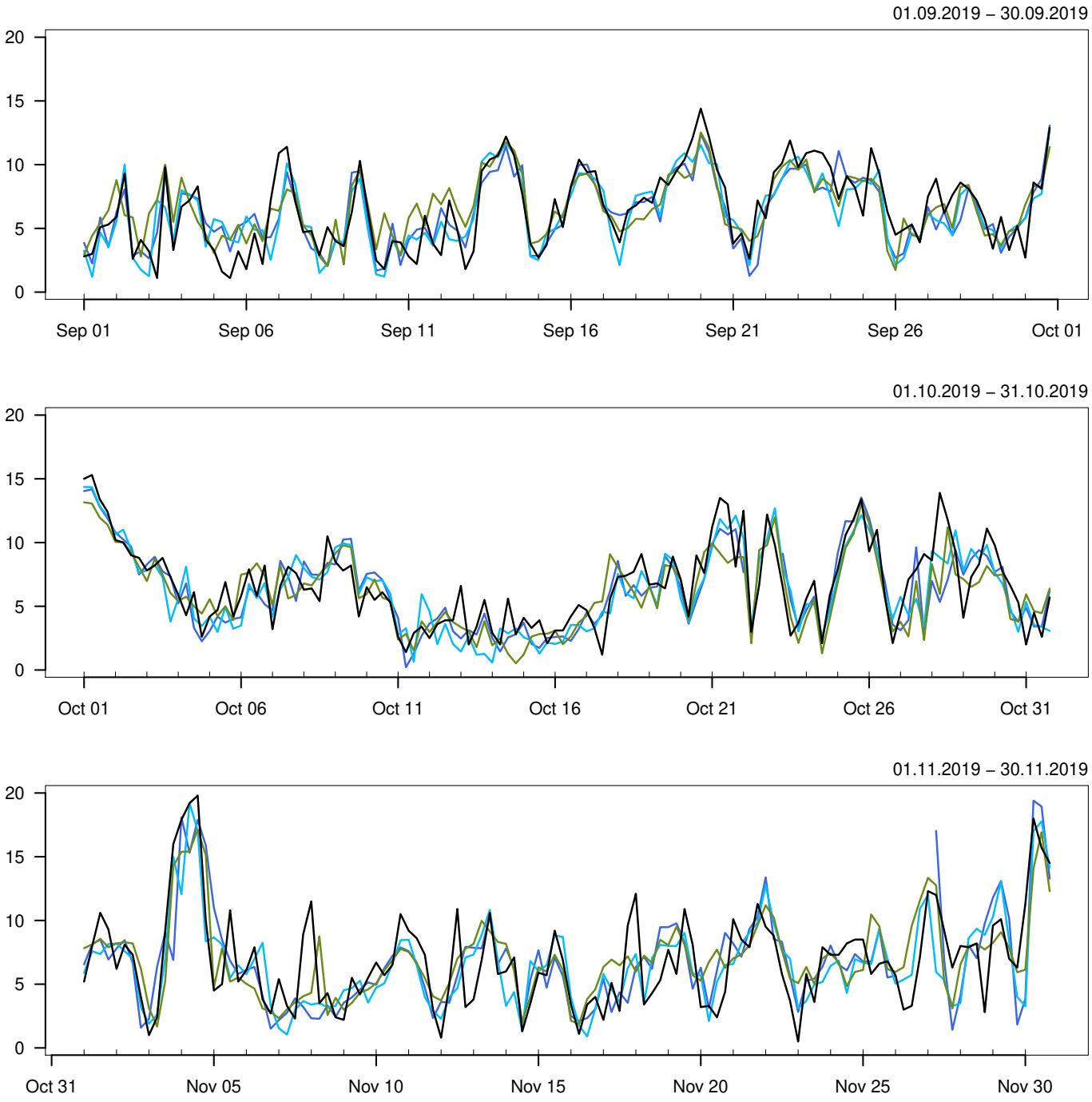


01.09.2019 – 30.11.2019

	Min	Mean	Max	Std	N
synop: 00,06,12,18	0.2	2.8	10.2	1.9	364
MEPSctrl: 12+18,+24,+30,+36	0	2.7	11.1	2.2	356
AA25: 12+18,+24,+30,+36	0.1	2.5	10	2.1	364
ECMWF: 12+18,+24,+30,+36	0.3	1.9	6.2	1	364

	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl – synop	–0.1	1.5	1.5	1.1	8.7	356
AA25 – synop	–0.3	1.6	1.7	1.2	9.5	364
ECMWF – synop	–0.8	1.4	1.6	1.2	7.2	364

SLETTNES FYR



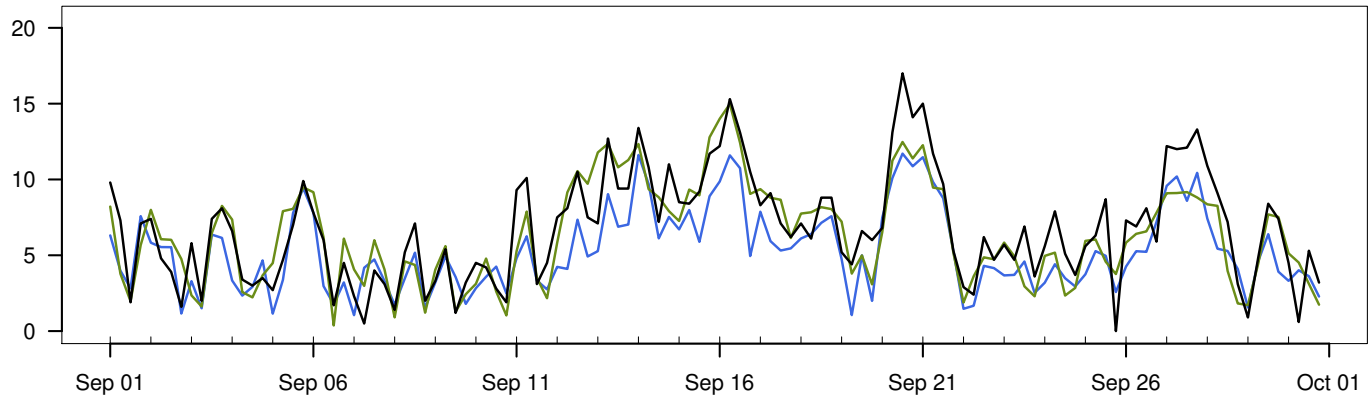
01.09.2019 – 30.11.2019

	Min	Mean	Max	Std	N
synop: 00,06,12,18	0.5	6.7	19.8	3.4	364
MEPSctrl: 12+18,+24,+30,+36	0.2	6.5	19.4	3.2	356
AA25: 12+18,+24,+30,+36	0.6	6.4	19.2	3.2	364
ECMWF: 12+18,+24,+30,+36	0.5	6.6	17.1	2.8	364

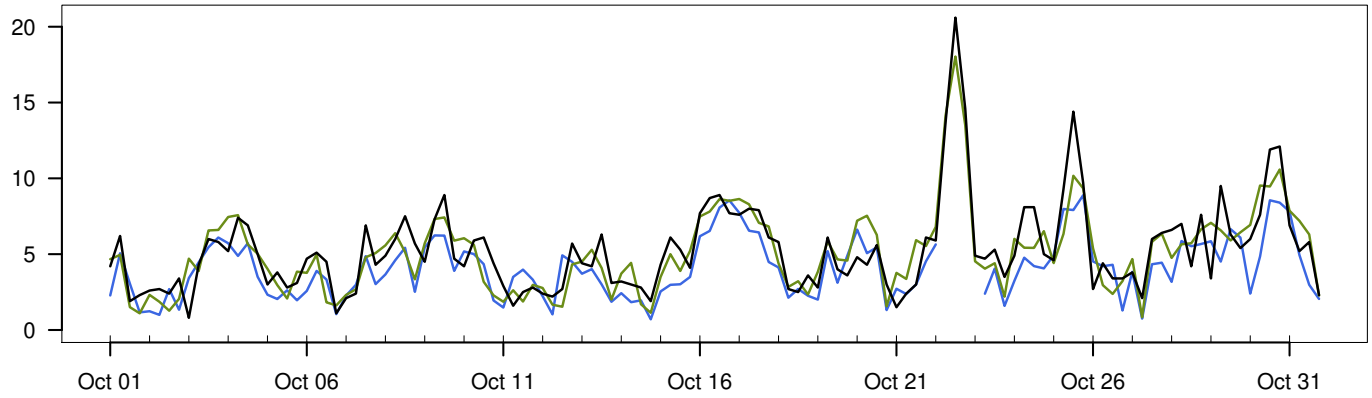
	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl – synop	–0.3	2.3	2.3	1.7	9.2	356
AA25 – synop	–0.3	2.1	2.2	1.7	8.1	364
ECMWF – synop	–0.1	2.2	2.2	1.7	7.9	364

ØRLAND III

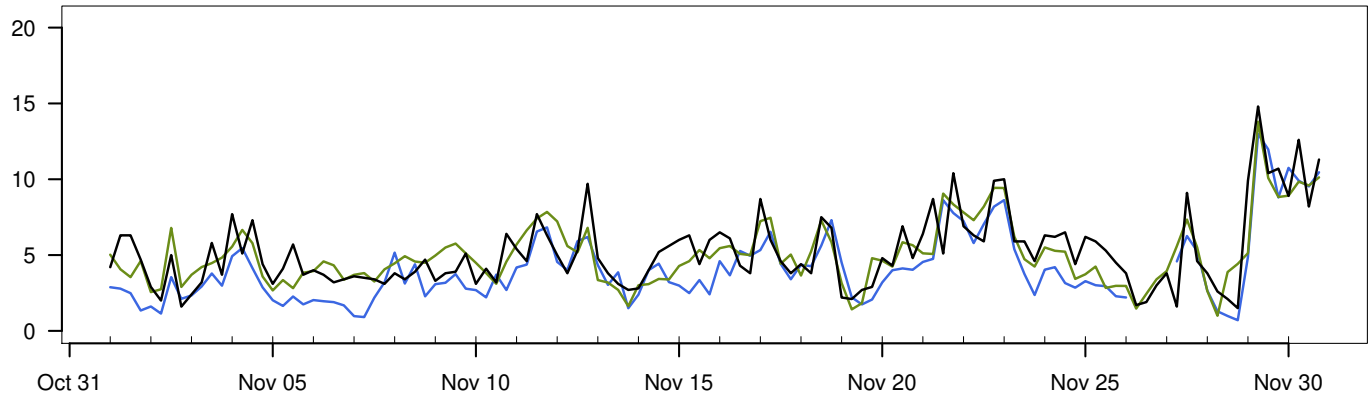
01.09.2019 – 30.09.2019



01.10.2019 – 31.10.2019



01.11.2019 – 30.11.2019



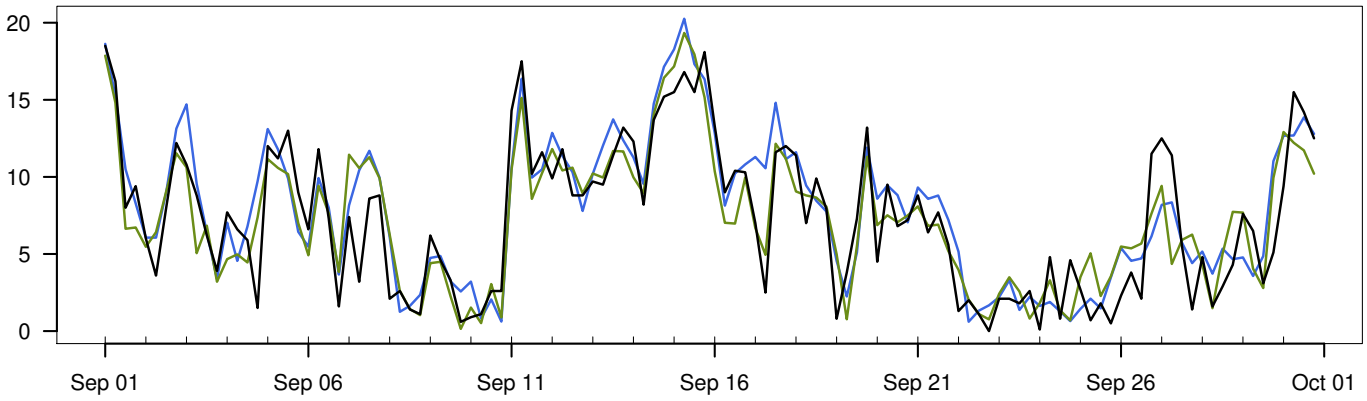
01.09.2019 – 30.11.2019

	Min	Mean	Max	Std	N
synop: 00,06,12,18	0	5.7	20.6	3.1	364
MEPSctrl: 12+18,+24,+30,+36	0.7	4.5	13	2.4	356
ECMWF: 12+18,+24,+30,+36	0.4	5.5	18	2.8	364

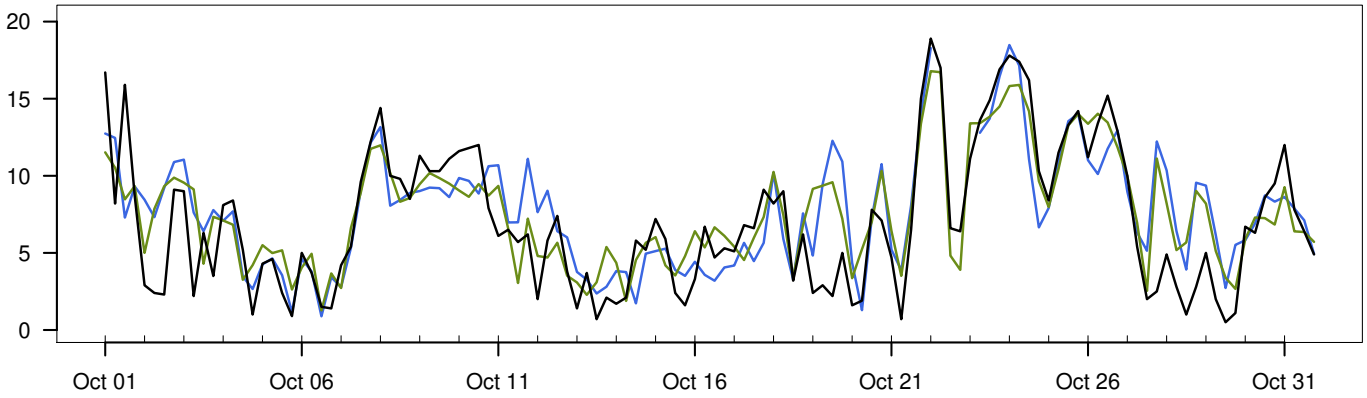
	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl – synop	–1.2	1.6	2	1.6	6.5	356
ECMWF – synop	–0.2	1.6	1.6	1.3	4.8	364

YTTERØYANE FYR

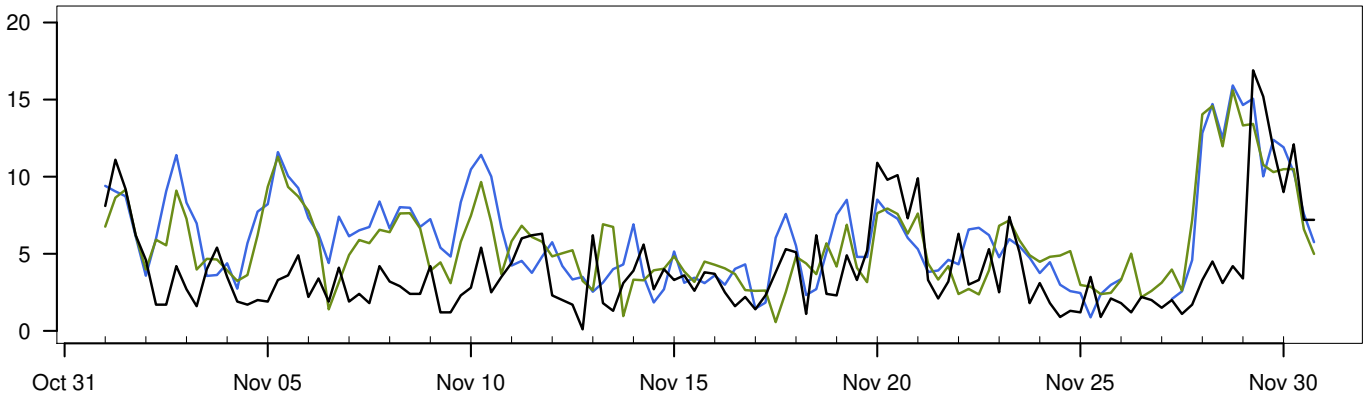
01.09.2019 – 30.09.2019



01.10.2019 – 31.10.2019



01.11.2019 – 30.11.2019



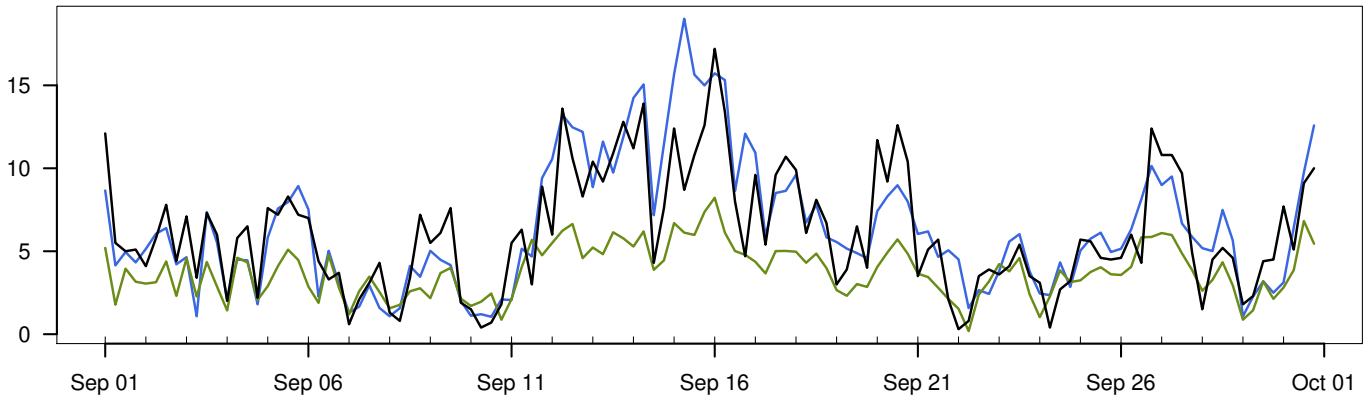
01.09.2019 – 30.11.2019

	Min	Mean	Max	Std	N
synop: 00,06,12,18	0	6.1	18.9	4.4	364
MEPSctrl: 12+18,+24,+30,+36	0.6	7.2	20.3	4	356
ECMWF: 12+18,+24,+30,+36	0.1	6.9	19.3	3.7	364

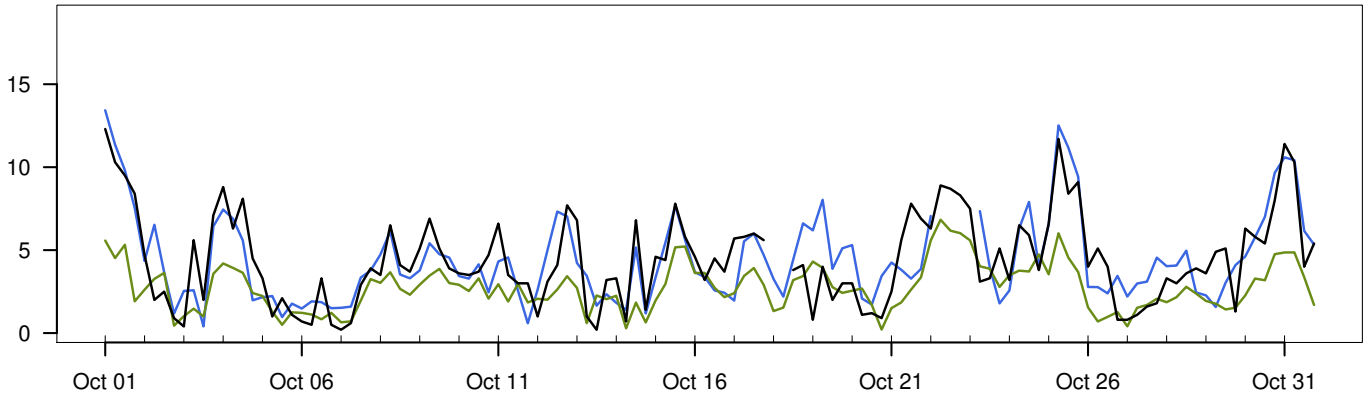
	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl – synop	1.1	3	3.2	2.3	11.7	356
ECMWF – synop	0.7	2.8	2.9	2.1	11.4	364

FINSEVATN

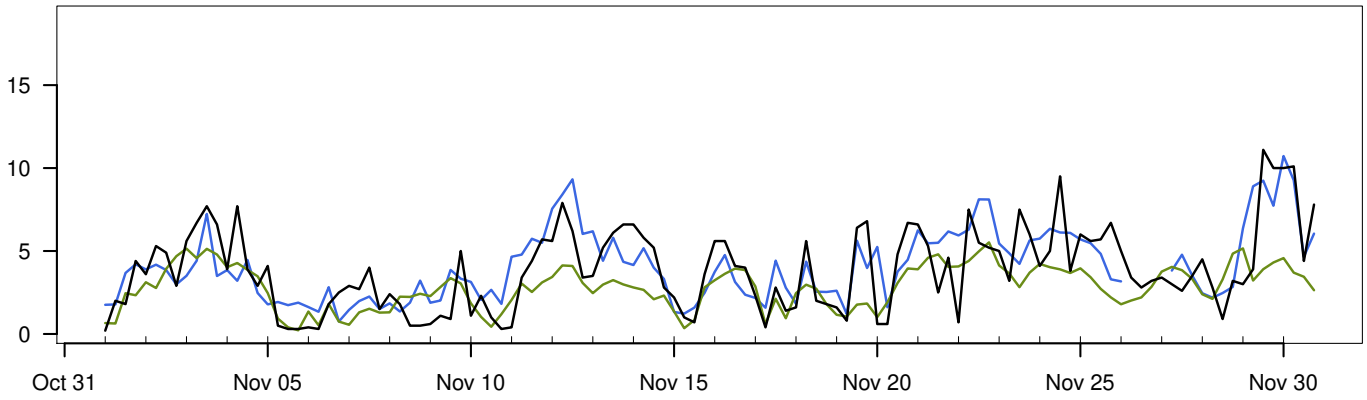
01.09.2019 – 30.09.2019



01.10.2019 – 31.10.2019



01.11.2019 – 30.11.2019

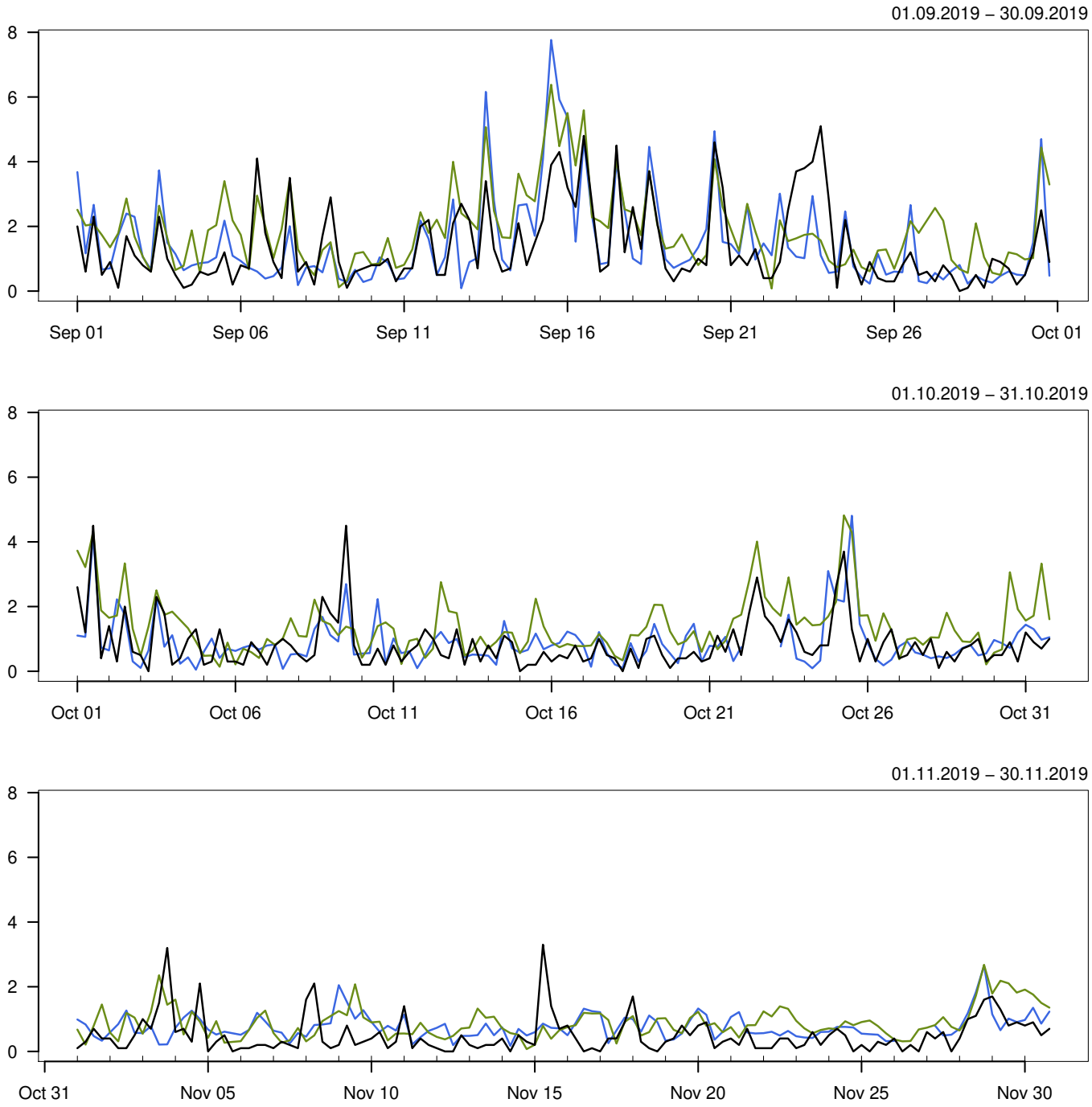


01.09.2019 – 30.11.2019

	Min	Mean	Max	Std	N
synop: 00,06,12,18	0.2	4.8	17.2	3.1	362
MEPSctrl: 12+18,+24,+30,+36	0.4	5	19	3.1	356
ECMWF: 12+18,+24,+30,+36	0.2	3.1	8.2	1.5	364

	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl – synop	0.2	2	2	1.5	10.3	354
ECMWF – synop	−1.7	2.2	2.8	2.1	9	362

NESBYEN – TODOKK



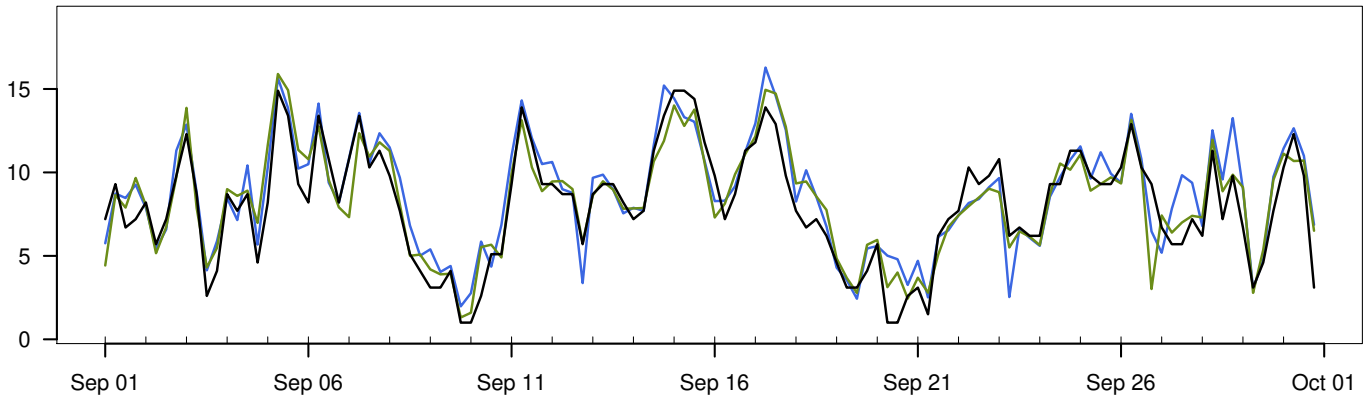
01.09.2019 – 30.11.2019

	Min	Mean	Max	Std	N
synop: 00,06,12,18	0	0.9	5.1	1	364
MEPSctrl: 12+18,+24,+30,+36	0	1	7.8	1	356
ECMWF: 12+18,+24,+30,+36	0.1	1.4	6.4	1	364

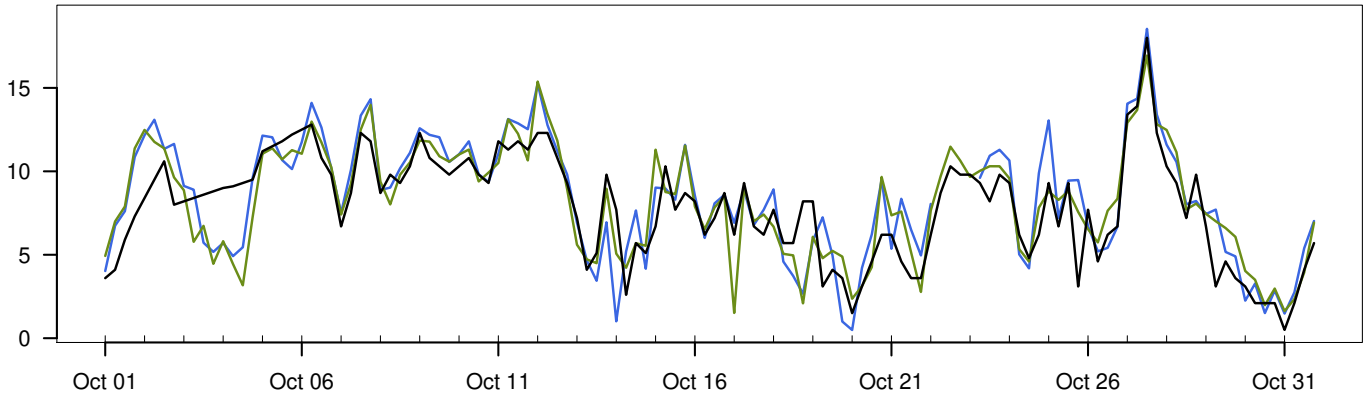
	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl – synop	0.1	0.9	0.9	0.6	4	356
ECMWF – synop	0.5	0.8	1	0.7	3.5	364

EKOFISK

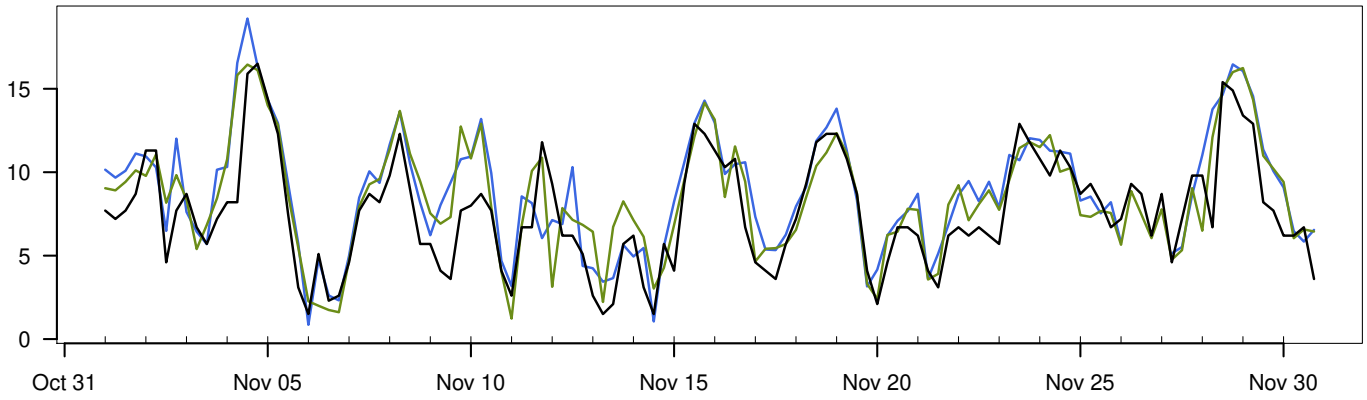
01.09.2019 – 30.09.2019



01.10.2019 – 31.10.2019



01.11.2019 – 30.11.2019

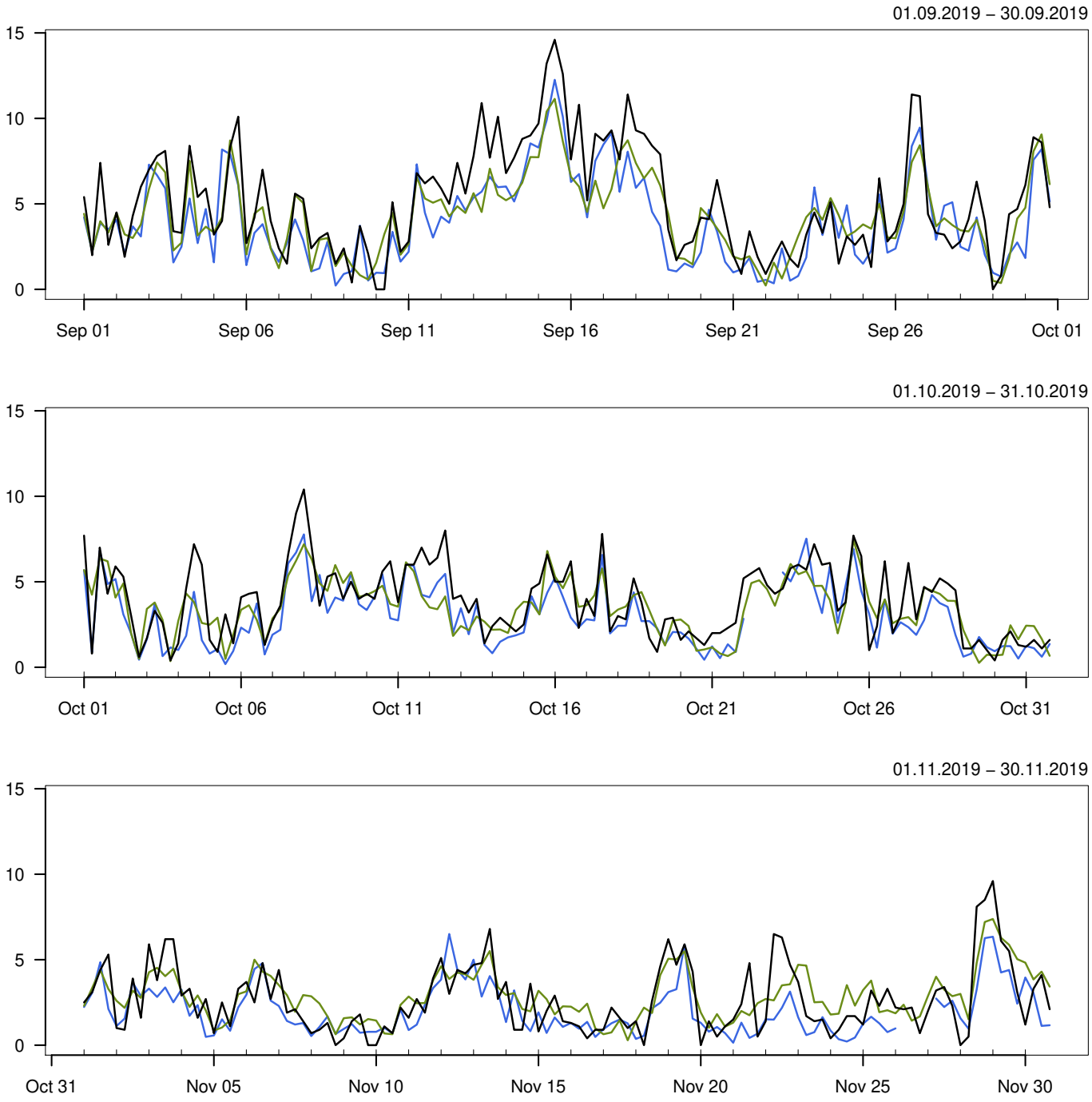


01.09.2019 – 30.11.2019

	Min	Mean	Max	Std	N
synop: 00,06,12,18	0.5	7.9	18	3.3	364
MEPSctrl: 12+18,+24,+30,+36	0.5	8.6	19.2	3.4	356
ECMWF: 12+18,+24,+30,+36	1.2	8.3	16.9	3.3	364

	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl – synop	0.8	1.8	1.9	1.5	8.3	356
ECMWF – synop	0.5	1.8	1.8	1.3	7.6	364

SOLA



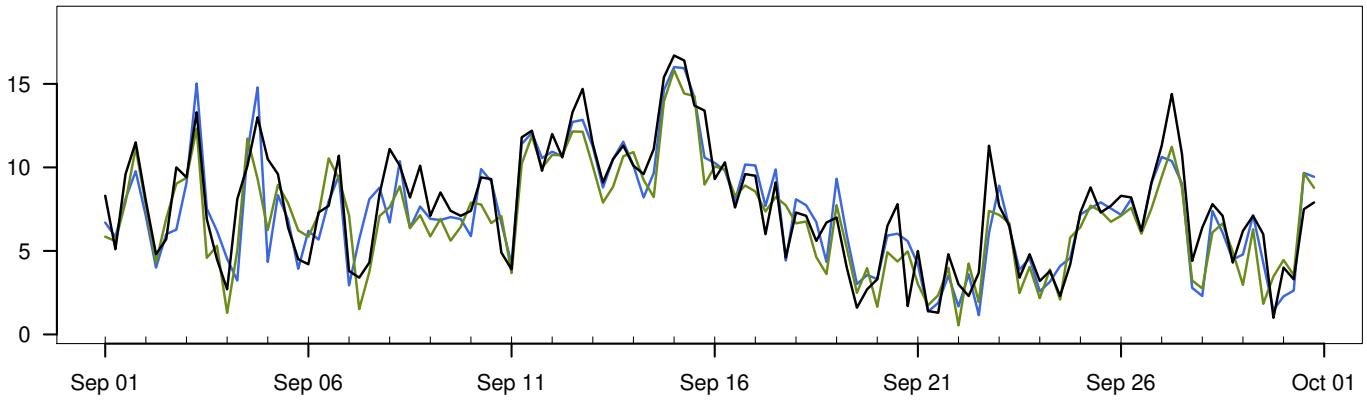
01.09.2019 – 30.11.2019

	Min	Mean	Max	Std	N
synop: 00,06,12,18	0	3.9	14.6	2.7	364
MEPSctrl: 12+18,+24,+30,+36	0.1	3	12.3	2.2	356
ECMWF: 12+18,+24,+30,+36	0.2	3.6	11.1	1.9	364

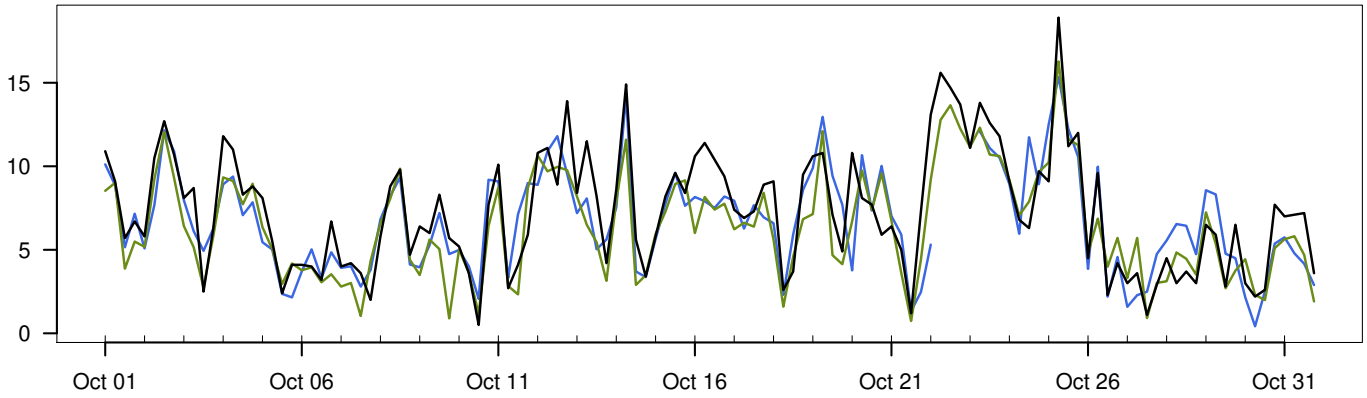
	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl – synop	−0.9	1.4	1.7	1.3	5.2	356
ECMWF – synop	−0.4	1.5	1.5	1.2	6.4	364

FÆRDER FYR

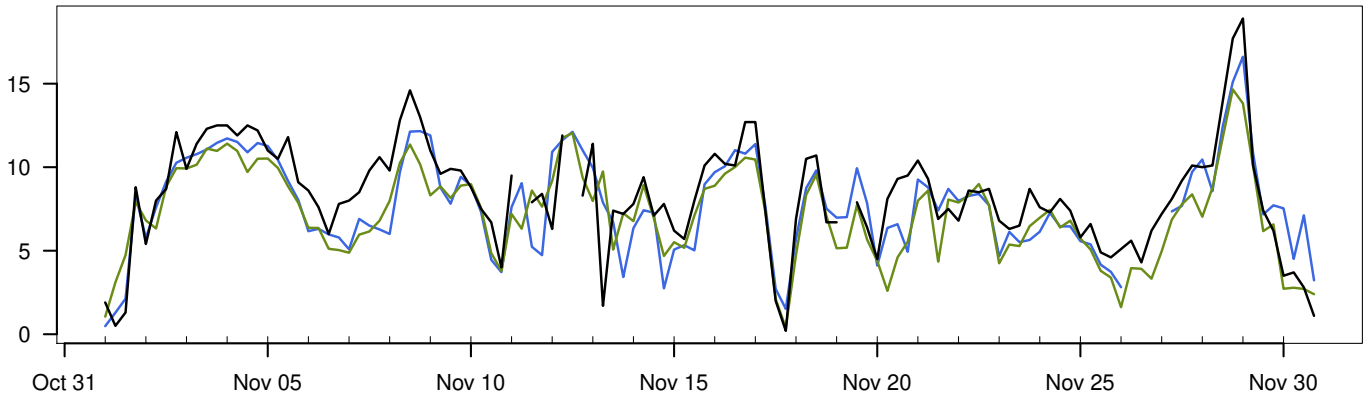
01.09.2019 – 30.09.2019



01.10.2019 – 31.10.2019



01.11.2019 – 30.11.2019

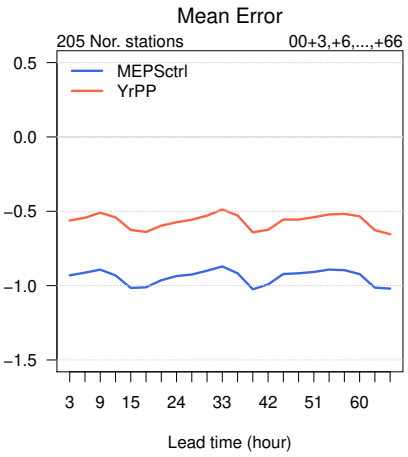


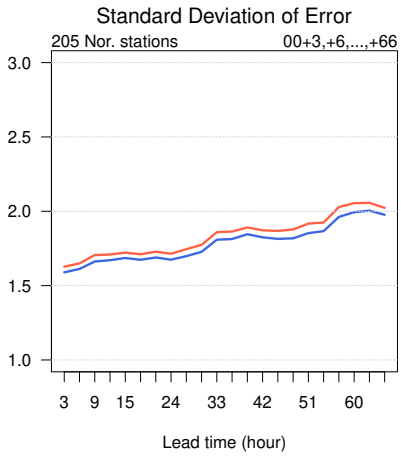
01.09.2019 – 30.11.2019

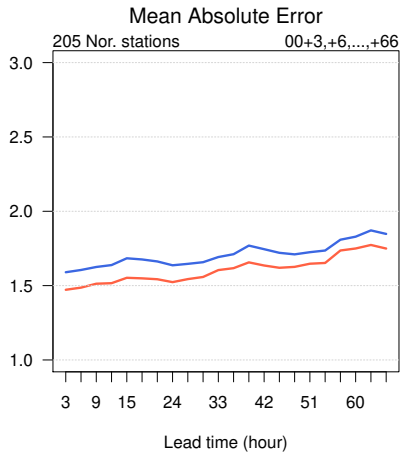
	Min	Mean	Max	Std	N
synop: 00,06,12,18	0.2	7.7	18.9	3.4	361
MEPSctrl: 12+18,+24,+30,+36	0.4	7.2	16.6	3.1	356
ECMWF: 12+18,+24,+30,+36	0.4	6.8	16.3	3	364

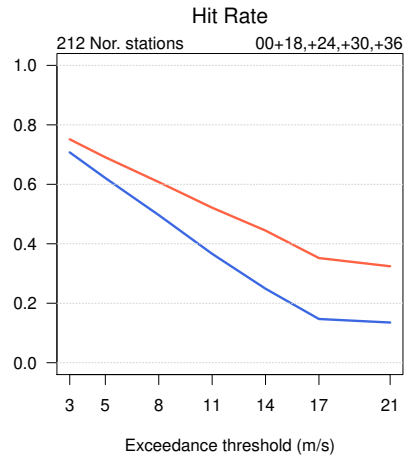
	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl – synop	−0.5	1.8	1.9	1.4	7.8	353
ECMWF – synop	−0.9	1.7	1.9	1.5	8	361

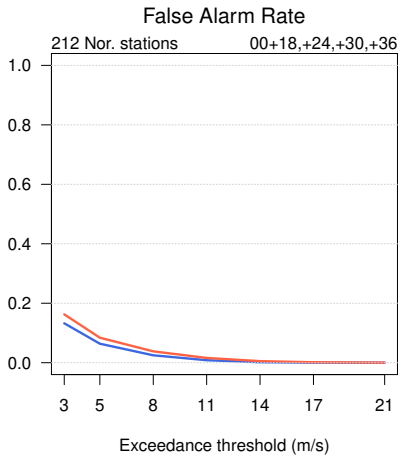
Post processed maximum mean wind speed 10m (YrPP)

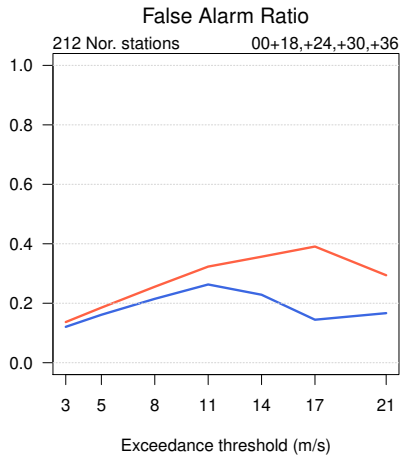


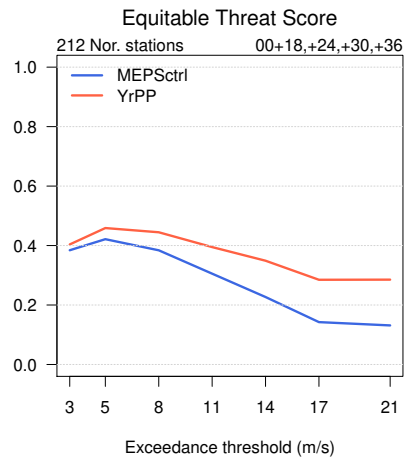


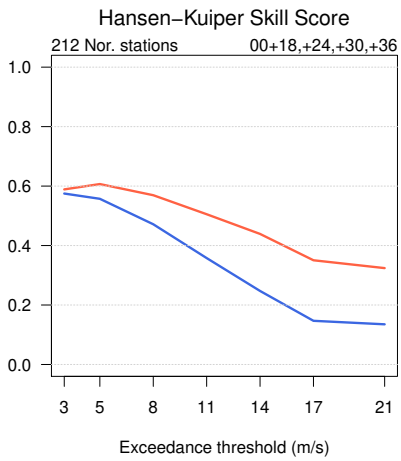


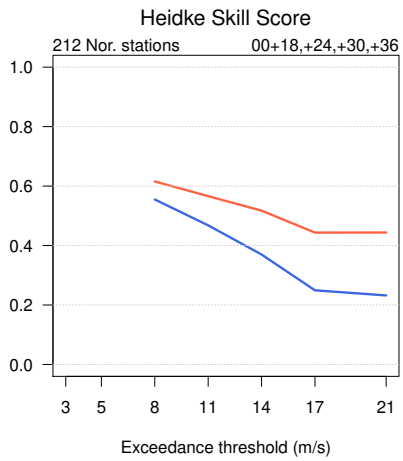




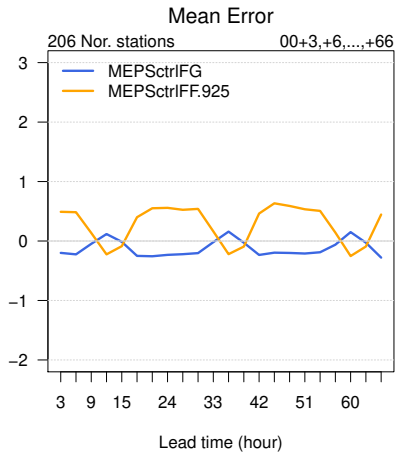


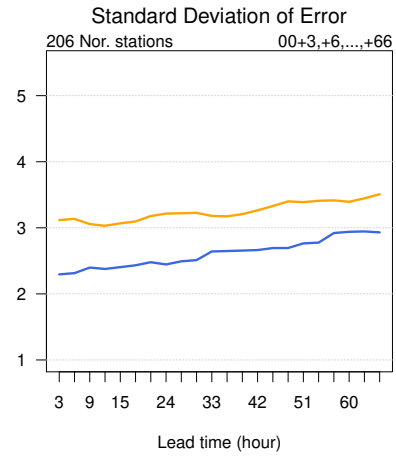


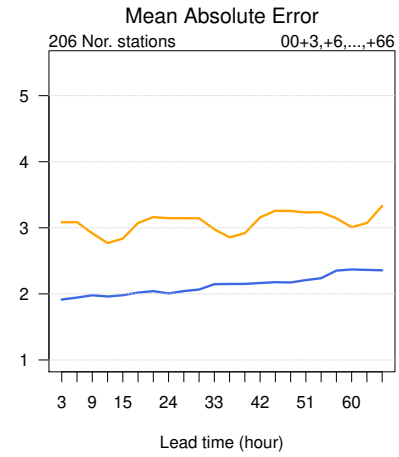


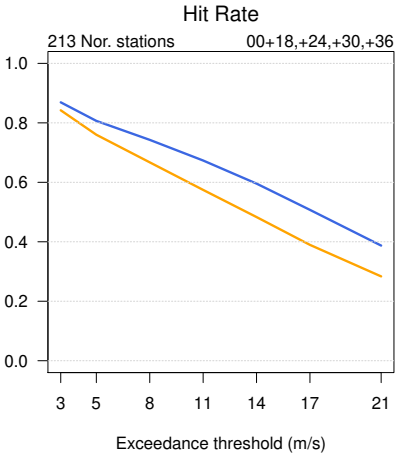


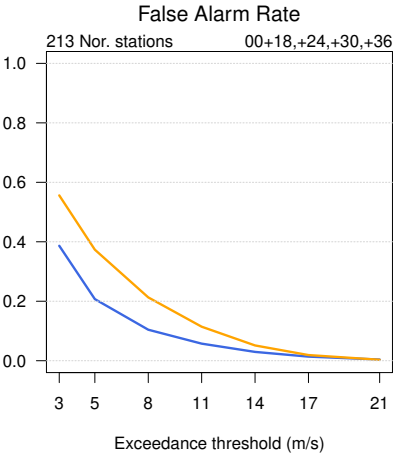
Wind gust (FG) and wind speed in 925 hpa (FF.925)

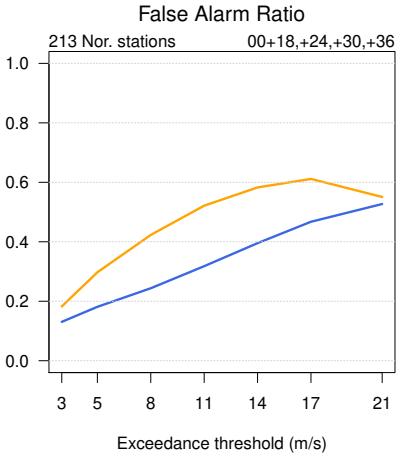


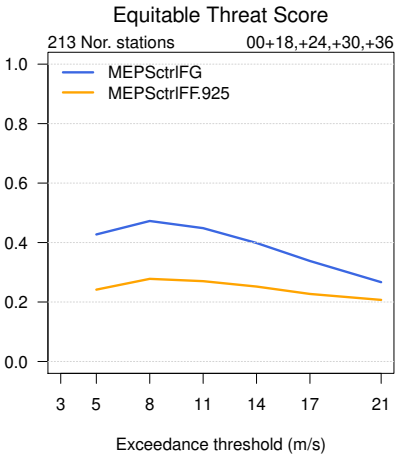


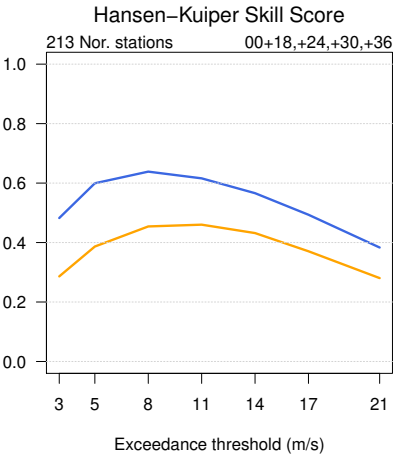


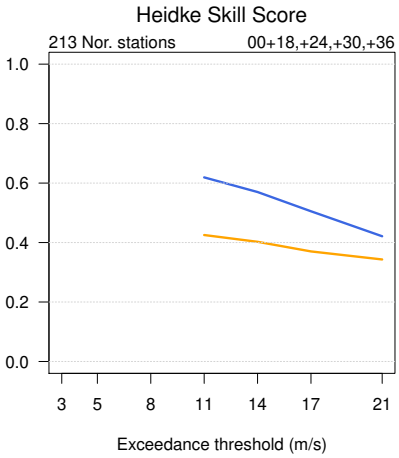


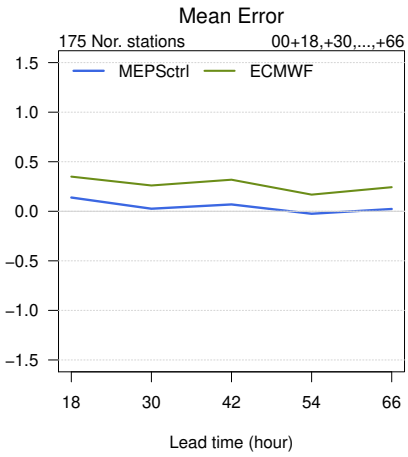


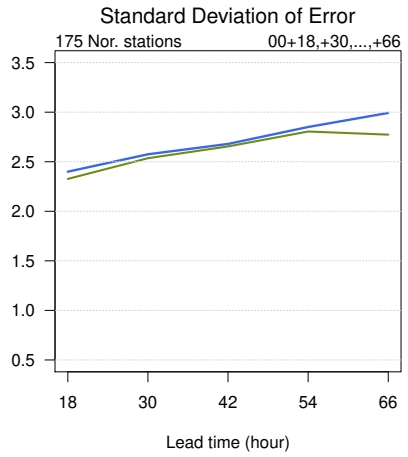


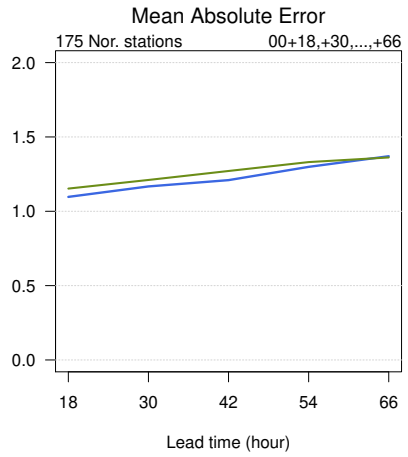


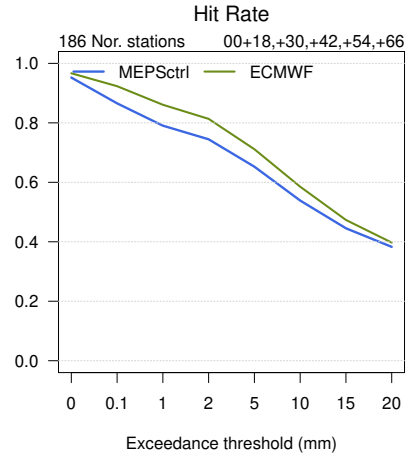


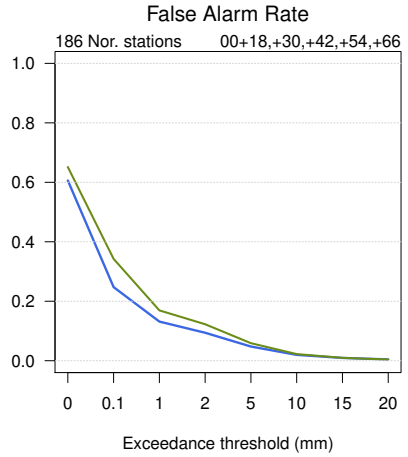


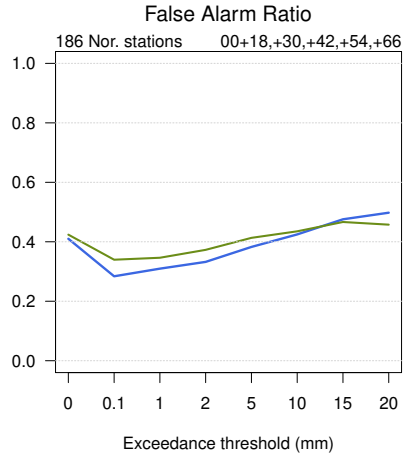

Mean Error
175 Nor. stations
00+18,+30,...,+66
MEPSctrl
ECMWF
1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5
18
30
42
54
66
Lead time (hour)

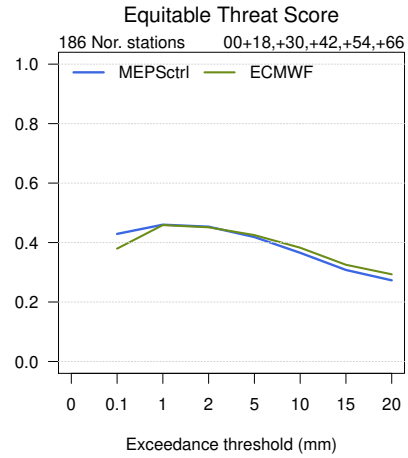

Standard Deviation of Error
175 Nor. stations
00+18,+30,...,+66
3.5
3.0
2.5
2.0
1.5
1.0
0.5
18
30
42
54
66
Lead time (hour)

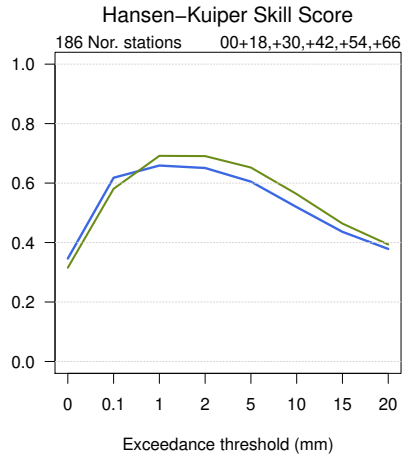

Mean Absolute Error
175 Nor. stations
00+18,+30,...,+66
2.0
1.5
1.0
0.5
0.0
18
30
42
54
66
Lead time (hour)

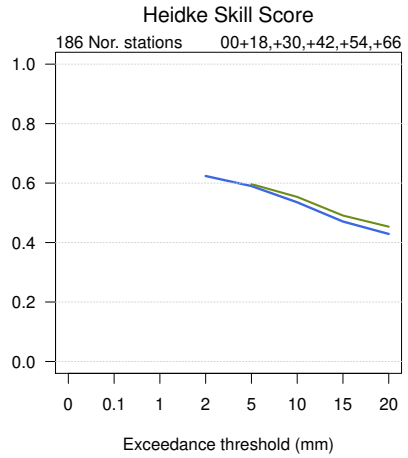

Hit Rate
186 Nor. stations
00+18,+30,+42,+54,+66
MEPSctrl
ECMWF
1.0
0.8
0.6
0.4
0.2
0.0
0
0.1
1
2
5
10
15
20
Exceedance threshold (mm)


False Alarm Rate
186 Nor. stations
00+18,+30,+42,+54,+66
1.0
0.8
0.6
0.4
0.2
0.0
0
0.1
1
2
5
10
15
20
Exceedance threshold (mm)


False Alarm Ratio
186 Nor. stations
00+18,+30,+42,+54,+66
1.0
0.8
0.6
0.4
0.2
0.0
0
0.1
1
2
5
10
15
20
Exceedance threshold (mm)

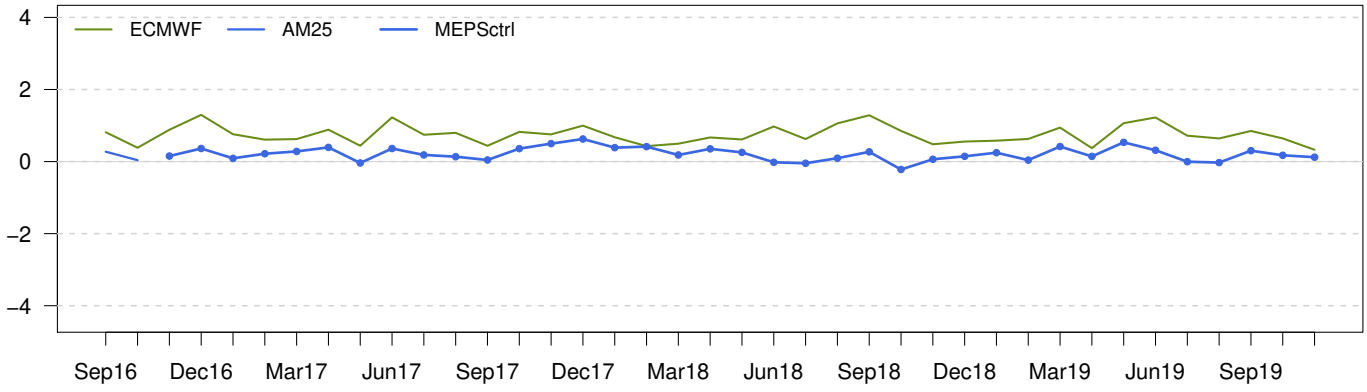

Equitable Threat Score
186 Nor. stations
00+18,+30,+42,+54,+66
MEPSctrl
ECMWF
1.0
0.8
0.6
0.4
0.2
0.0
0
0.1
1
2
5
10
15
20
Exceedance threshold (mm)


Hansen−Kuiper Skill Score
186 Nor. stations
00+18,+30,+42,+54,+66
1.0
0.8
0.6
0.4
0.2
0.0
0
0.1
1
2
5
10
15
20
Exceedance threshold (mm)

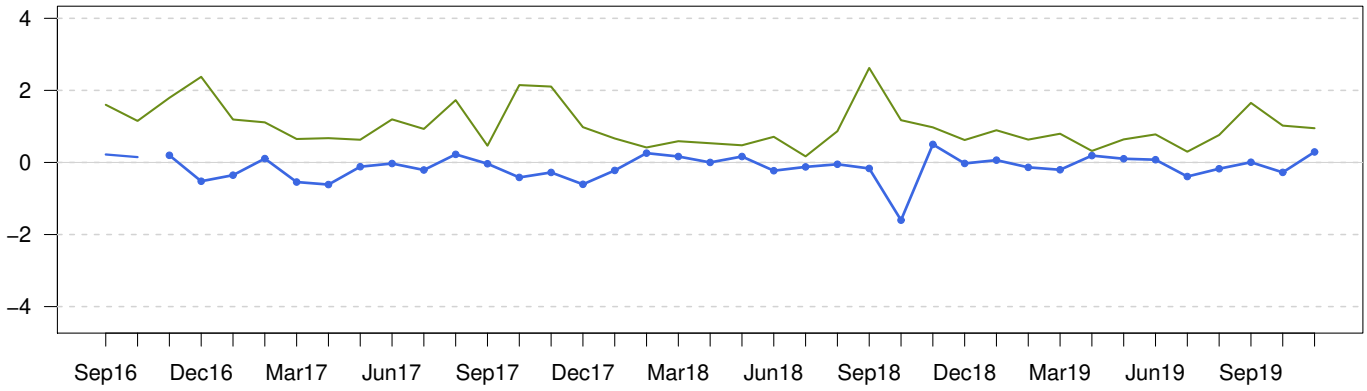

Heidke Skill Score
186 Nor. stations
00+18,+30,+42,+54,+66
1.0
0.8
0.6
0.4
0.2
0.0
0
0.1
1
2
5
10
15
20
Exceedance threshold (mm)

Mean Error

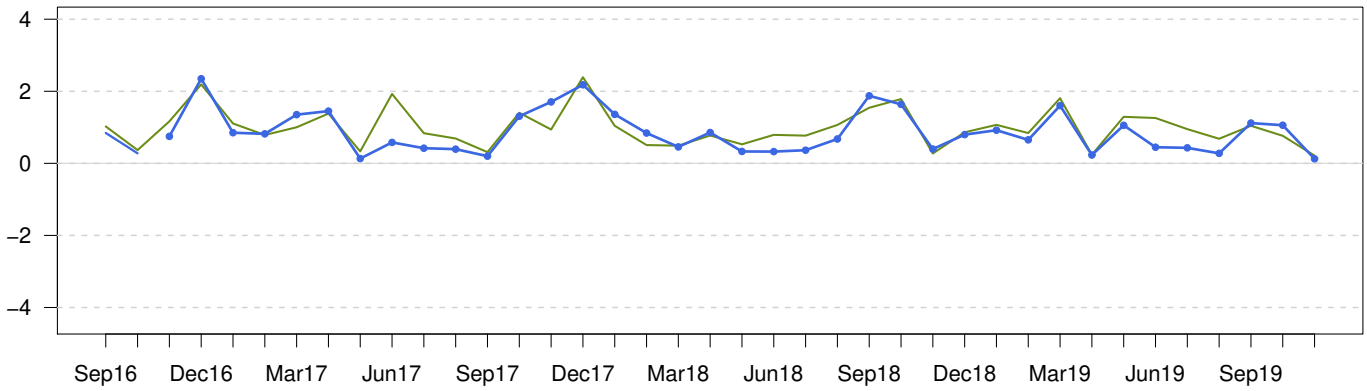
113 Norwegian stations 00+30 UTC



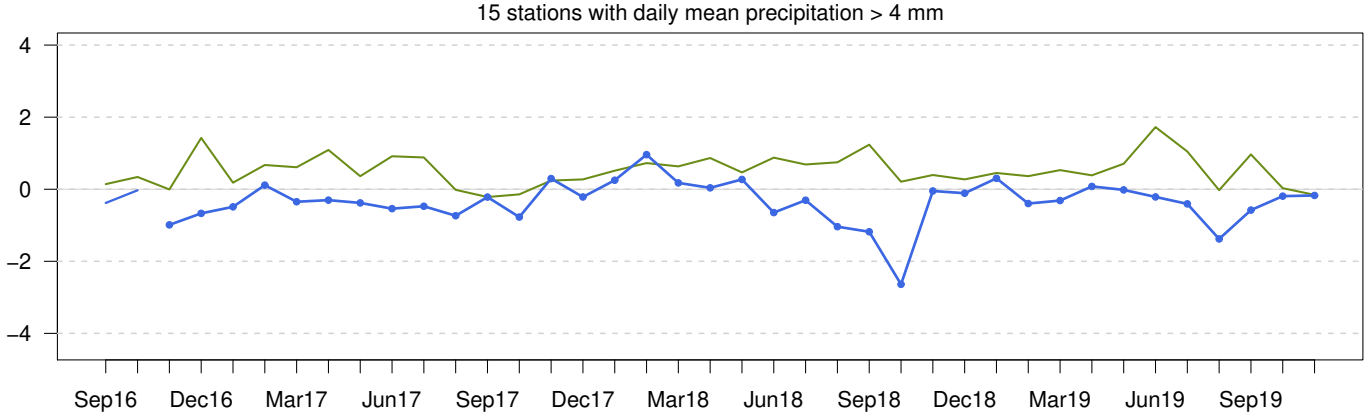
12 coastal stations



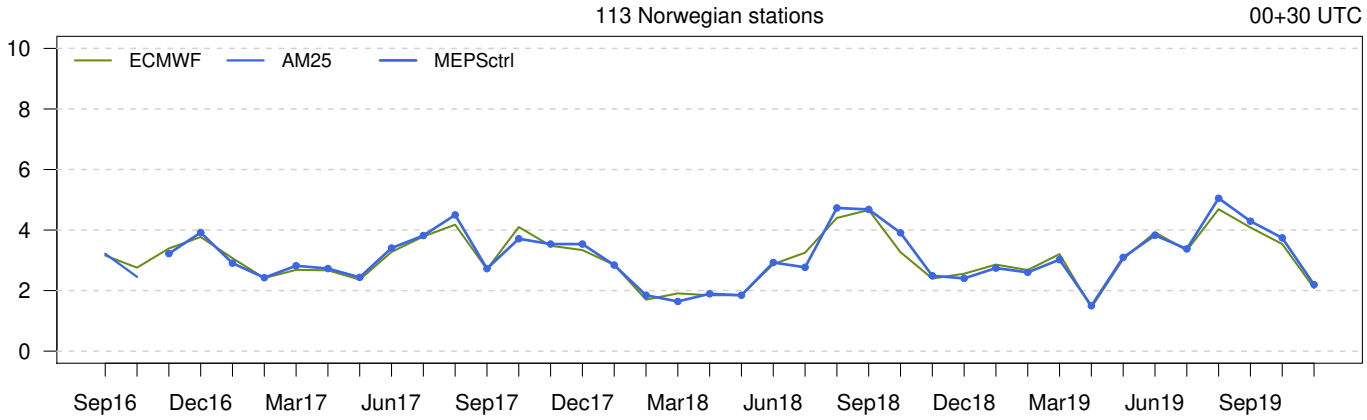
29 stations more than 500 m above sea level

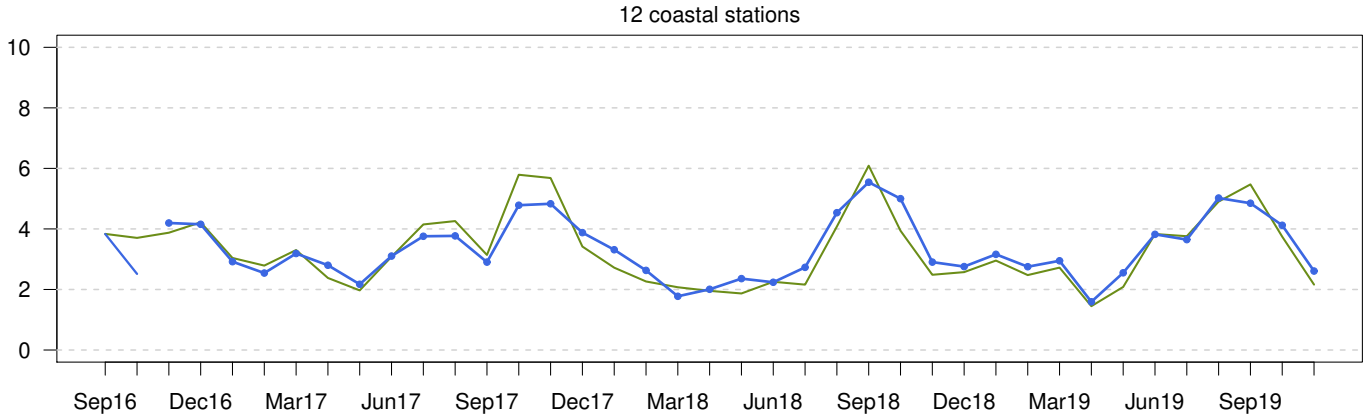


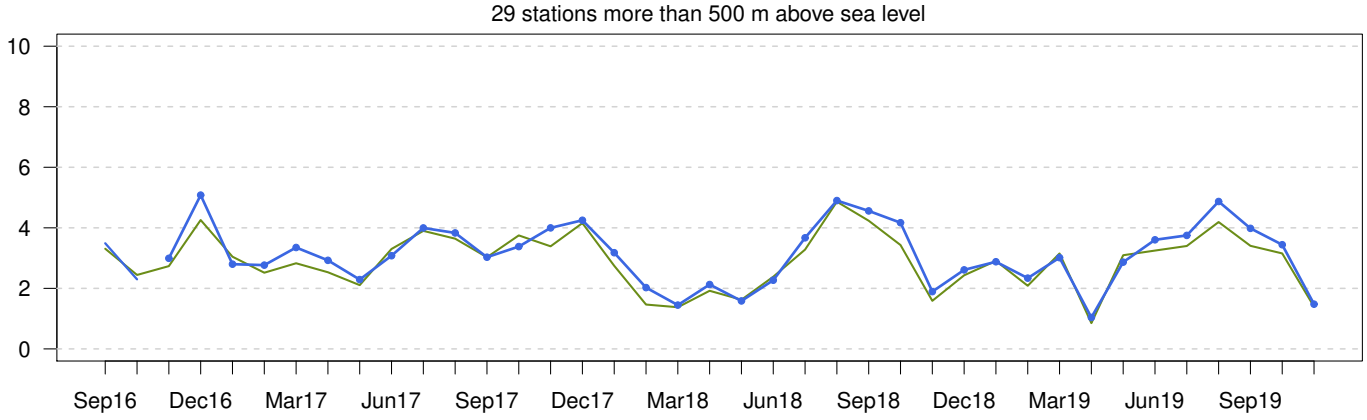
15 stations with daily mean precipitation > 4 mm

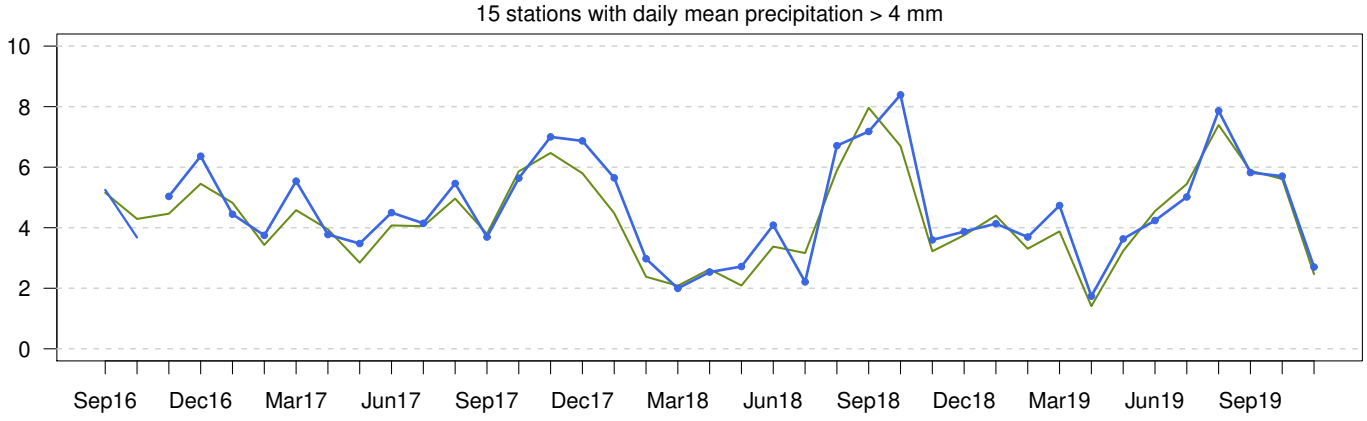


Standard Deviation of Error

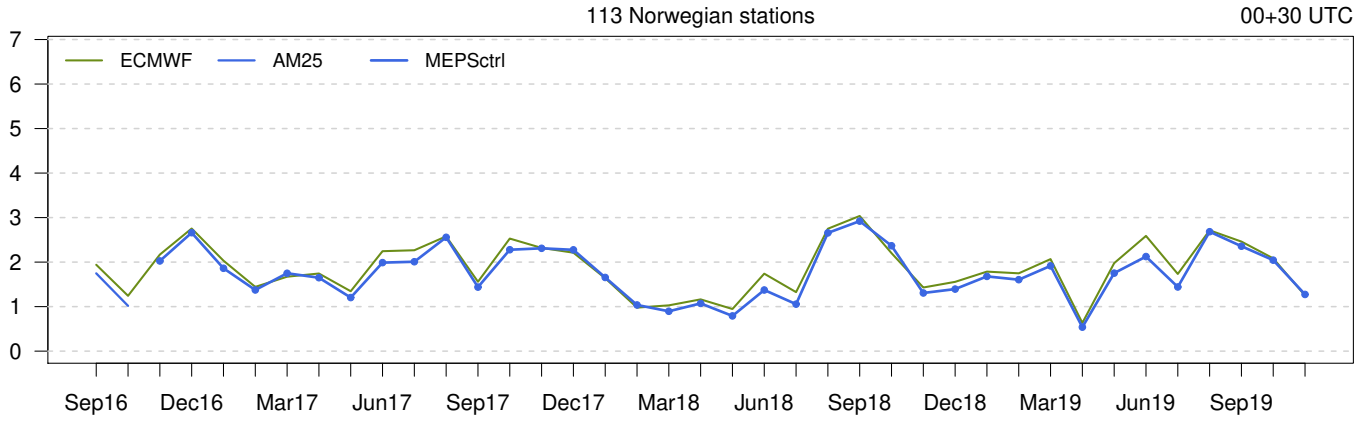


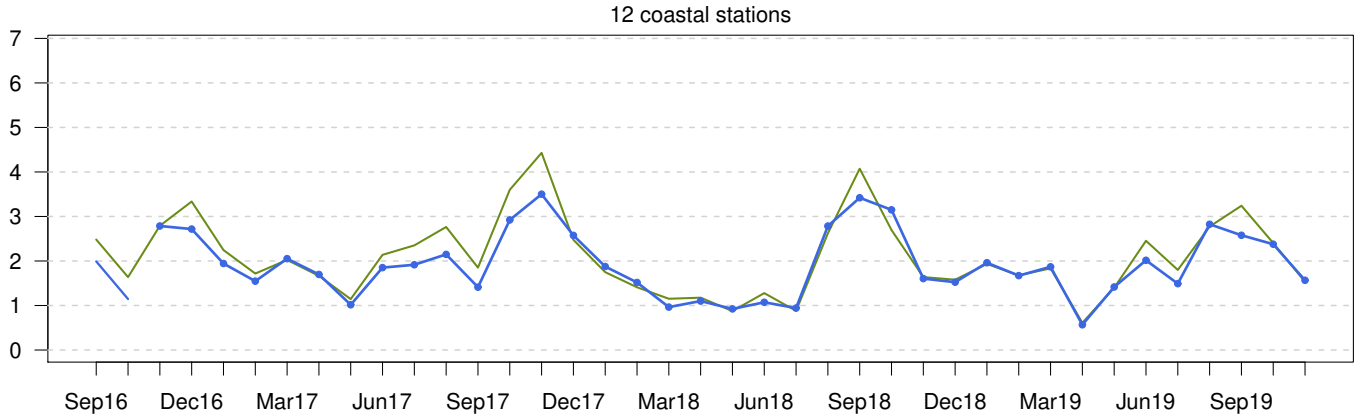


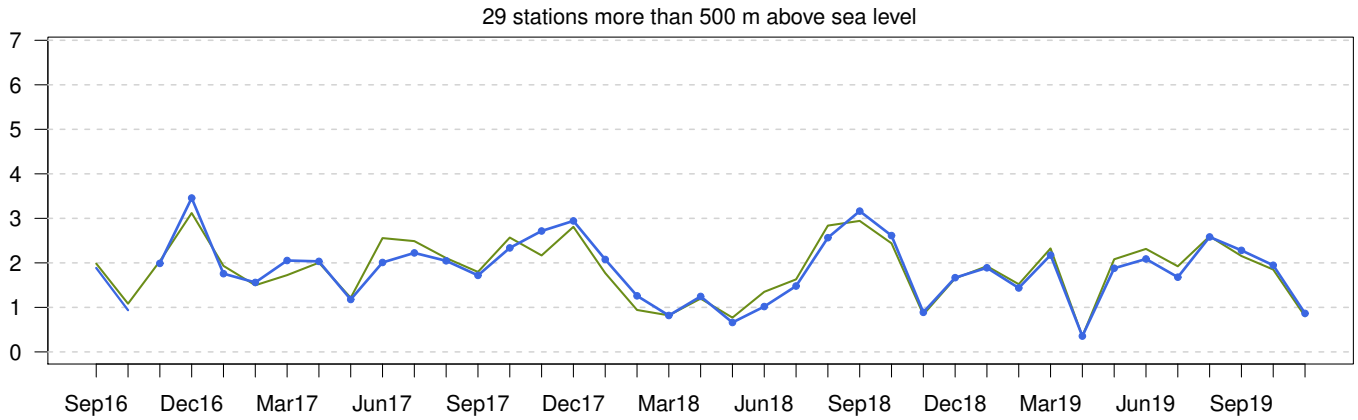


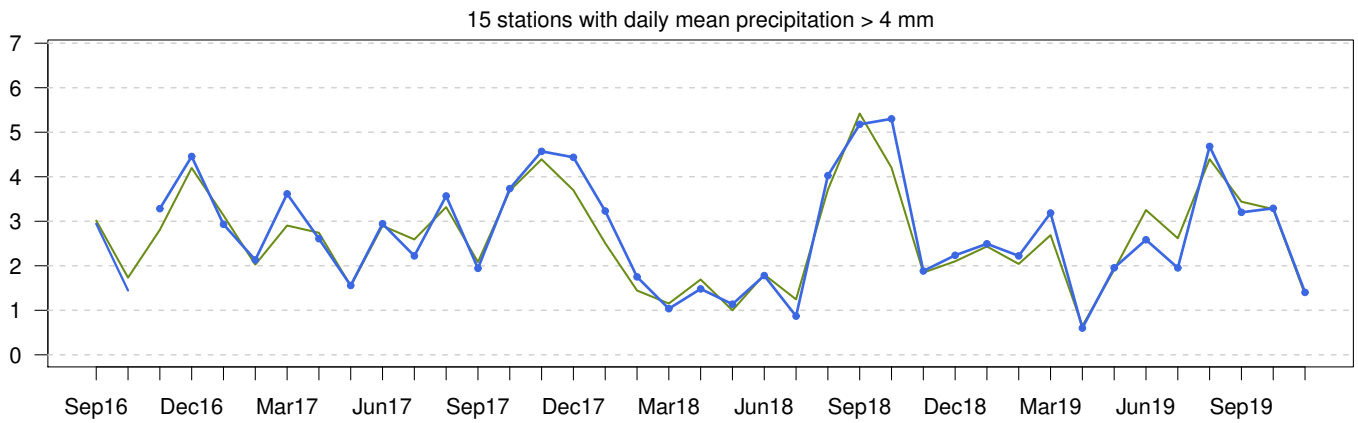


Mean Absolute Error



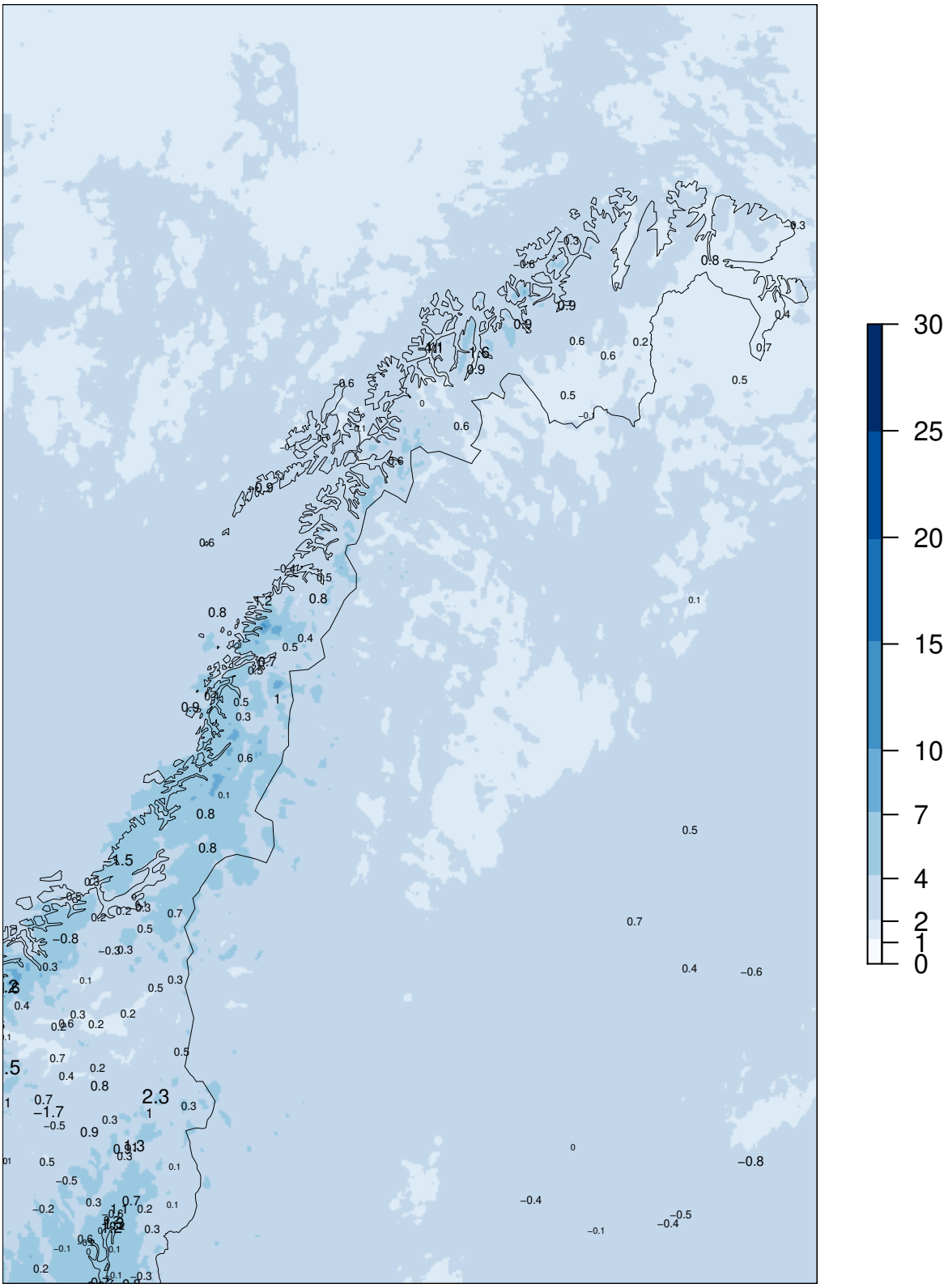






MEPSctrl 00+30

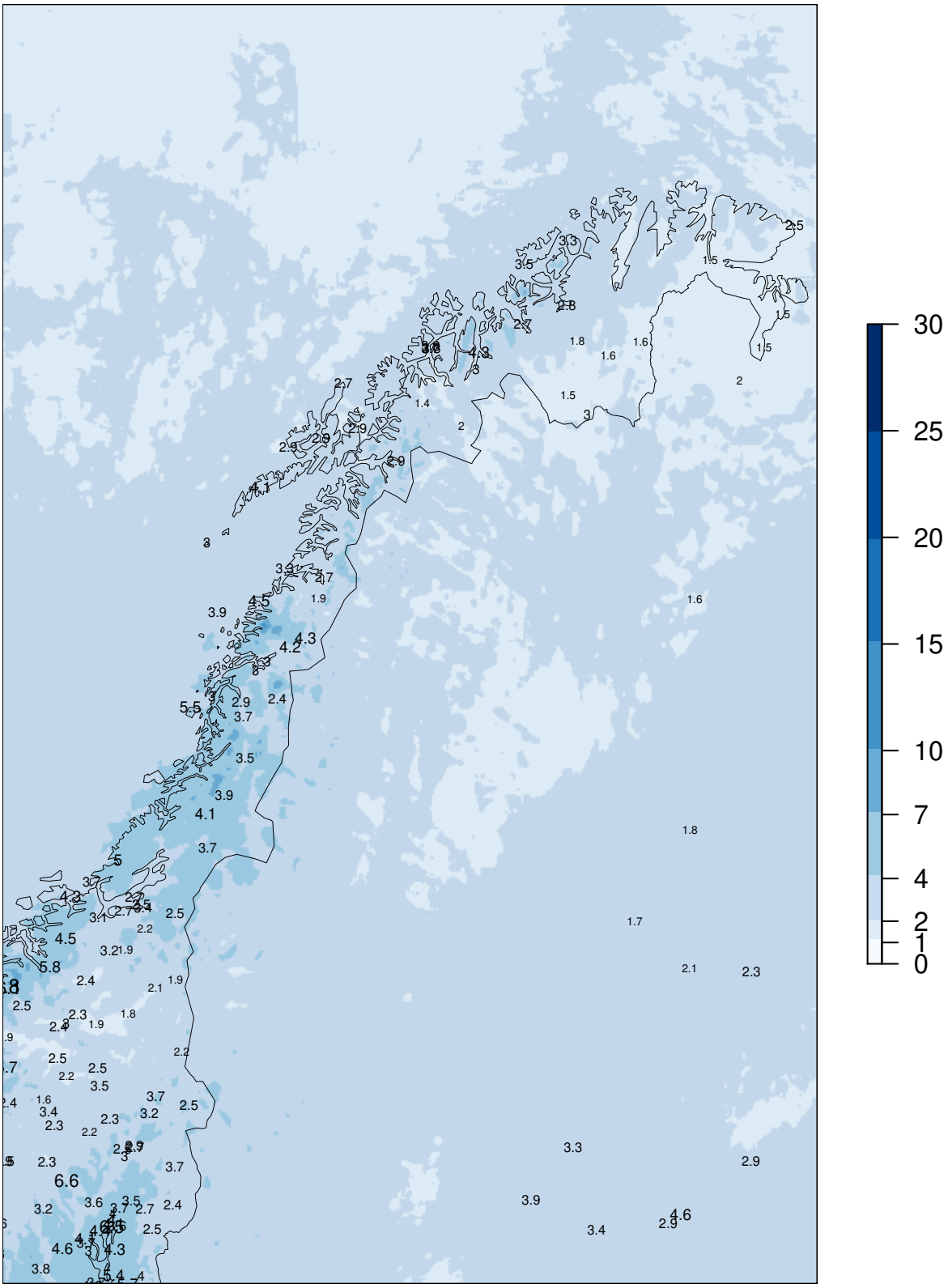
ME at observing sites
(numbers in black)



Model "climatology" 01.09.2019 – 30.11.2019

MEPSctrl 00+30

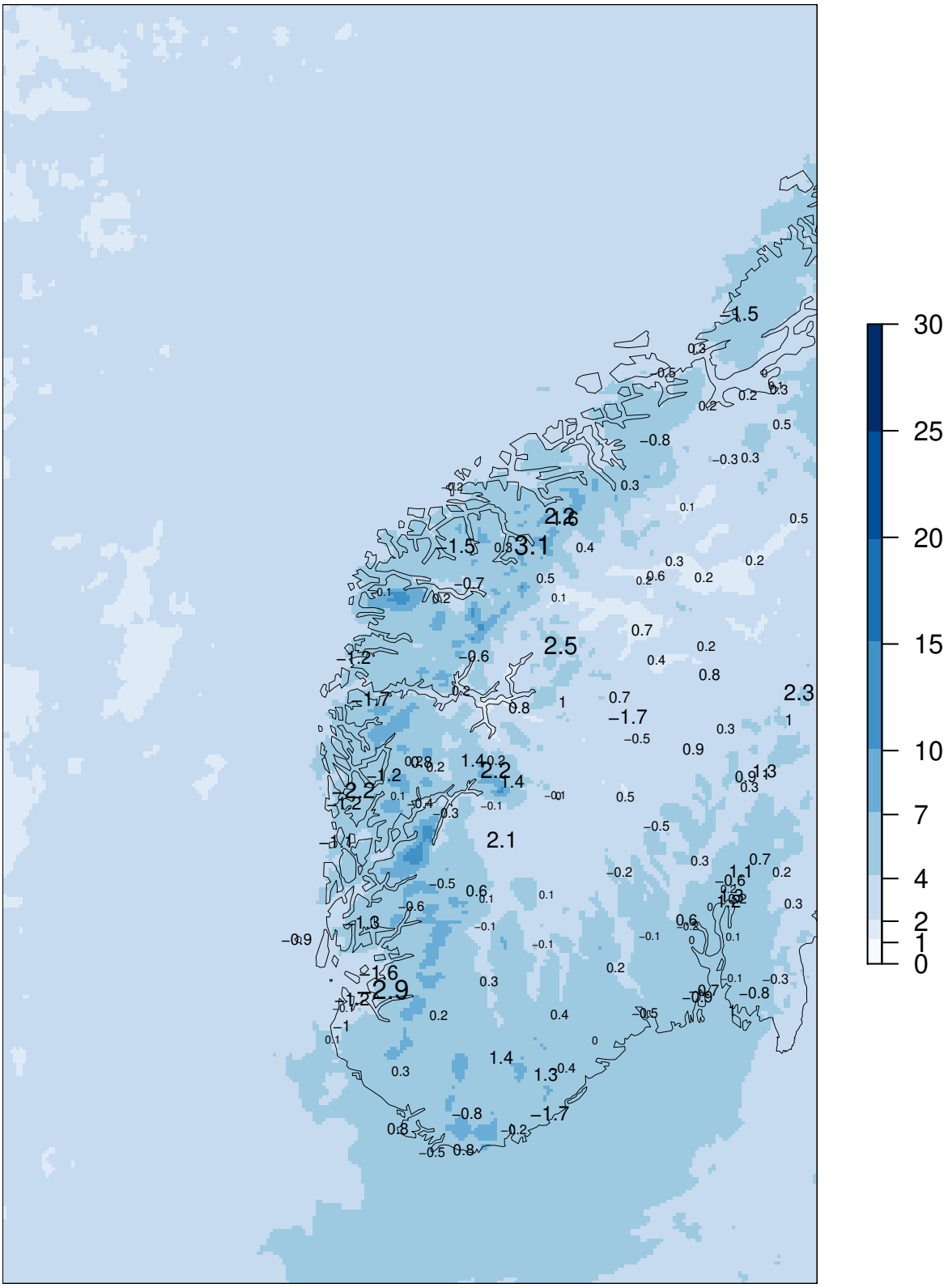
SDE at observing sites
(numbers in black)



Model "climatology" 01.09.2019 – 30.11.2019

MEPSctrl 00+30

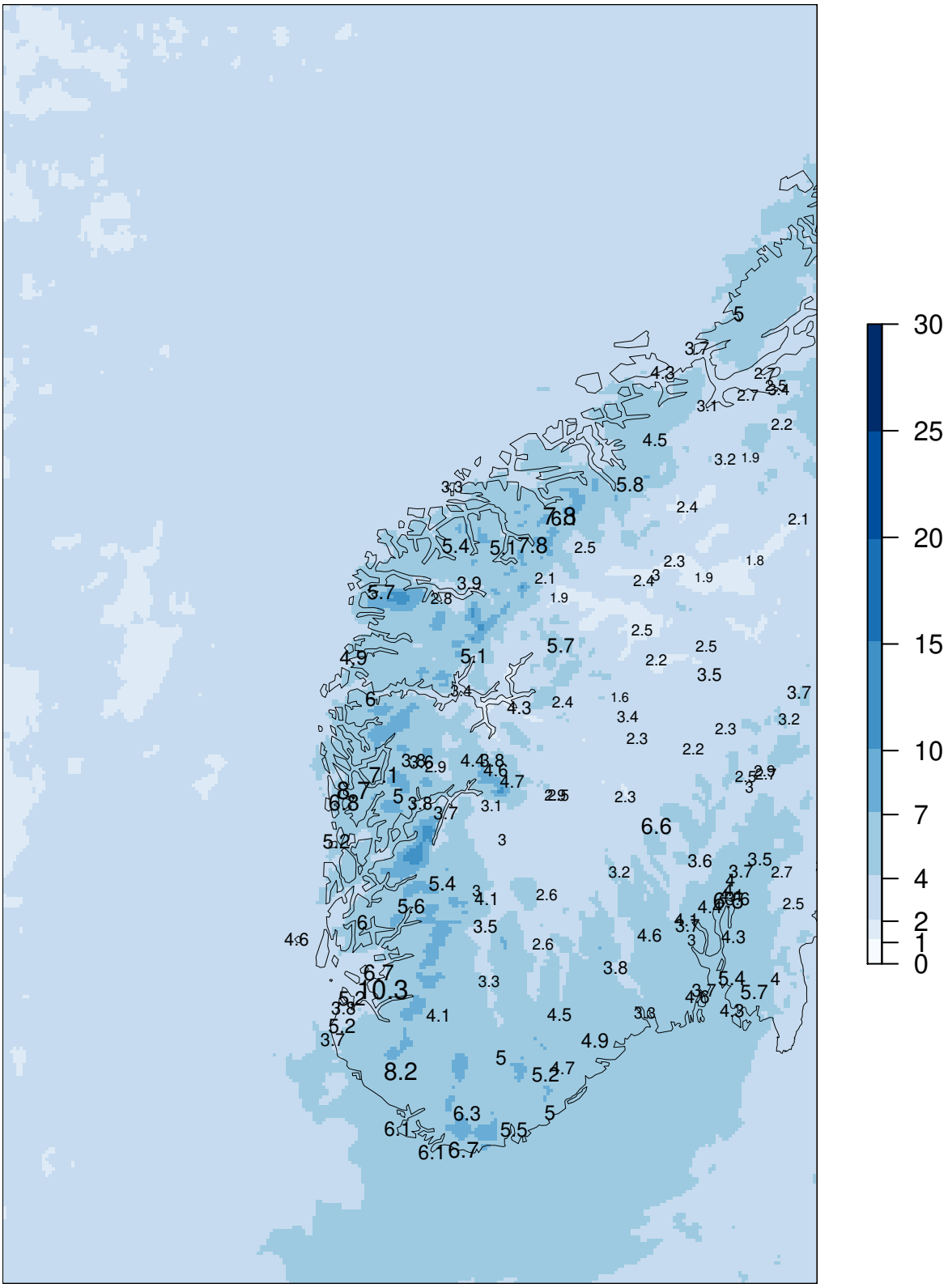
ME at observing sites
(numbers in black)



Model "climatology" 01.09.2019 – 30.11.2019

MEPSctrl 00+30

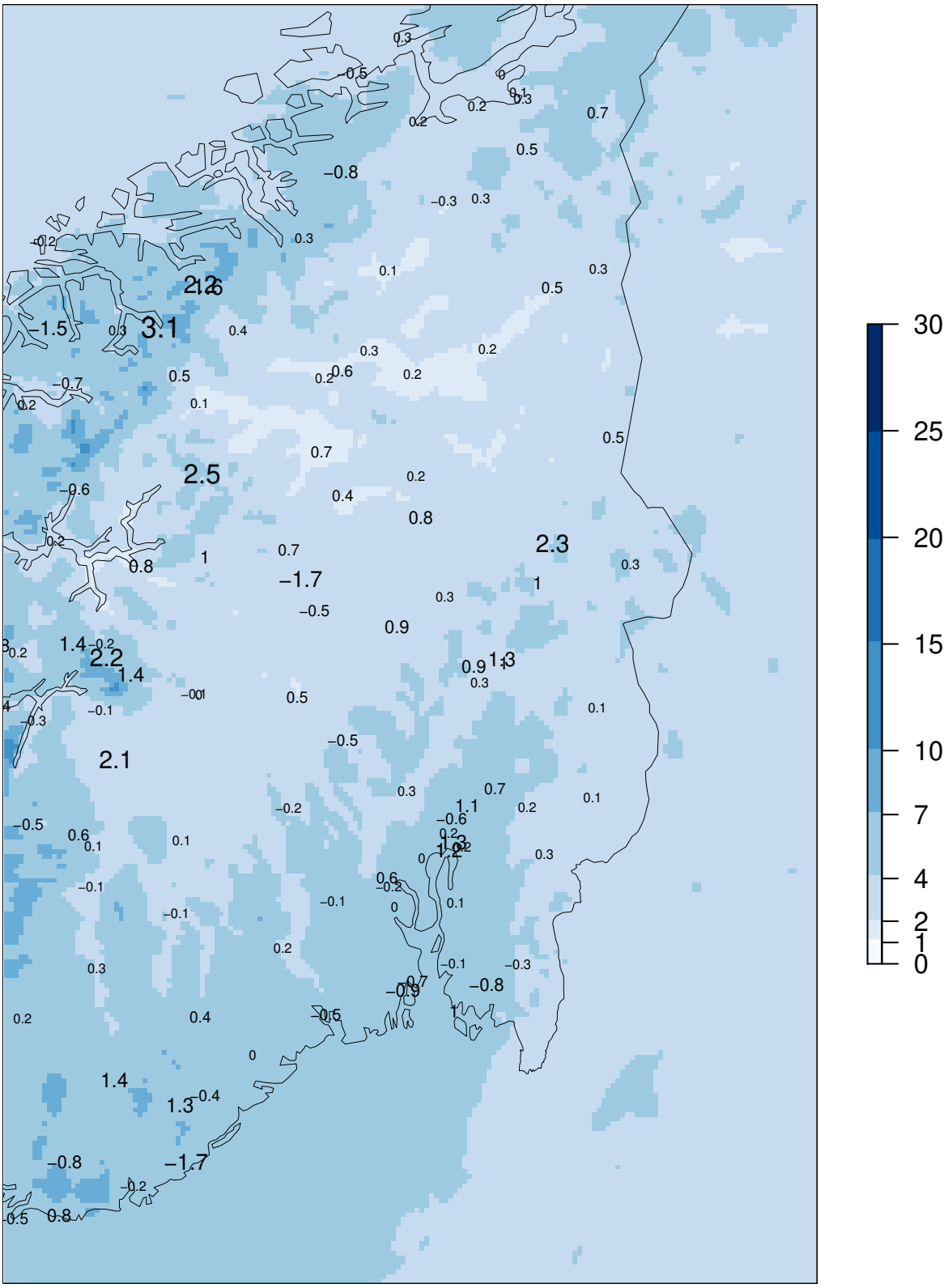
SDE at observing sites
(numbers in black)



Model "climatology" 01.09.2019 – 30.11.2019

MEPSctrl 00+30

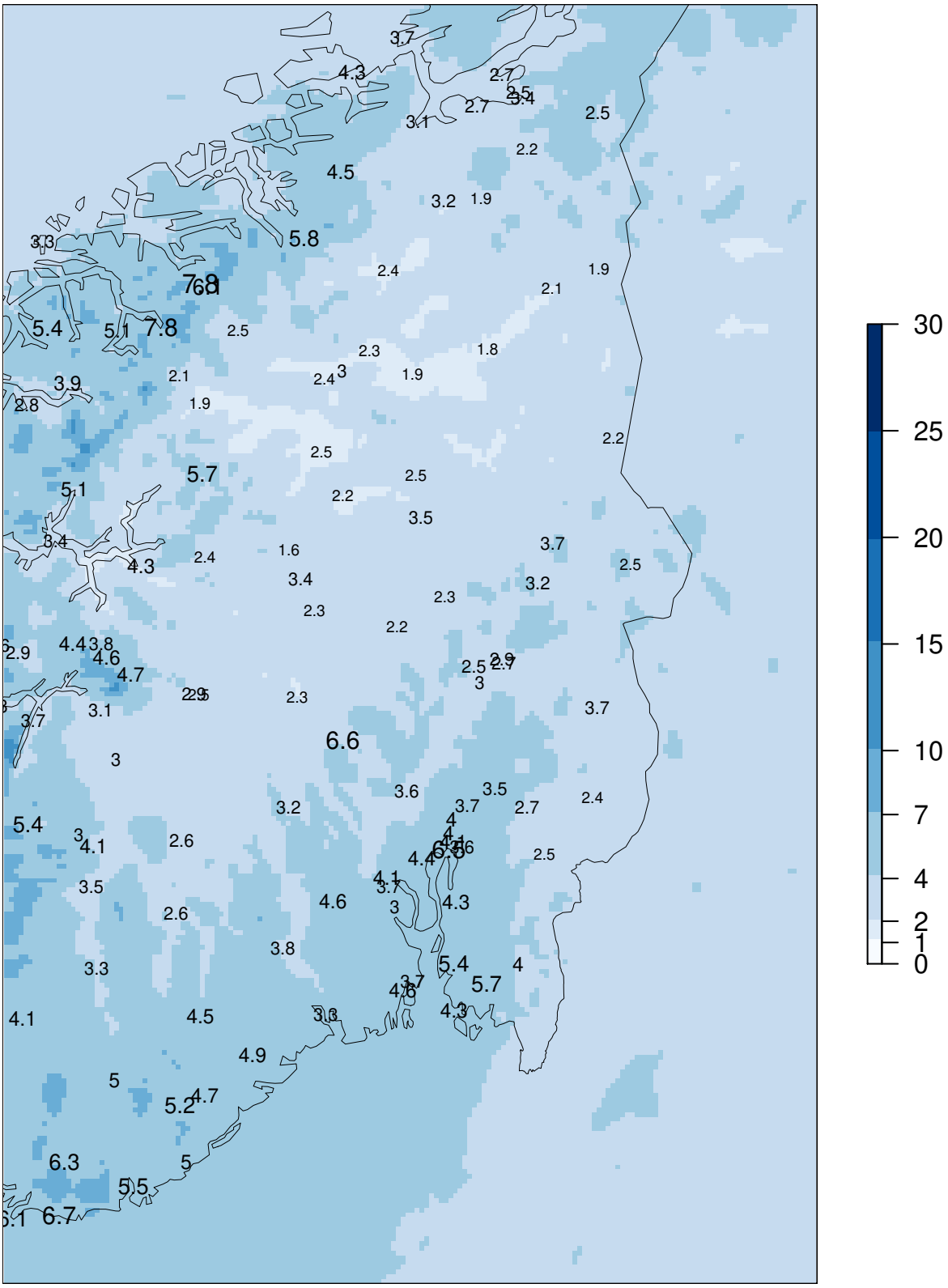
ME at observing sites
(numbers in black)



Model "climatology" 01.09.2019 – 30.11.2019

MEPSctrl 00+30

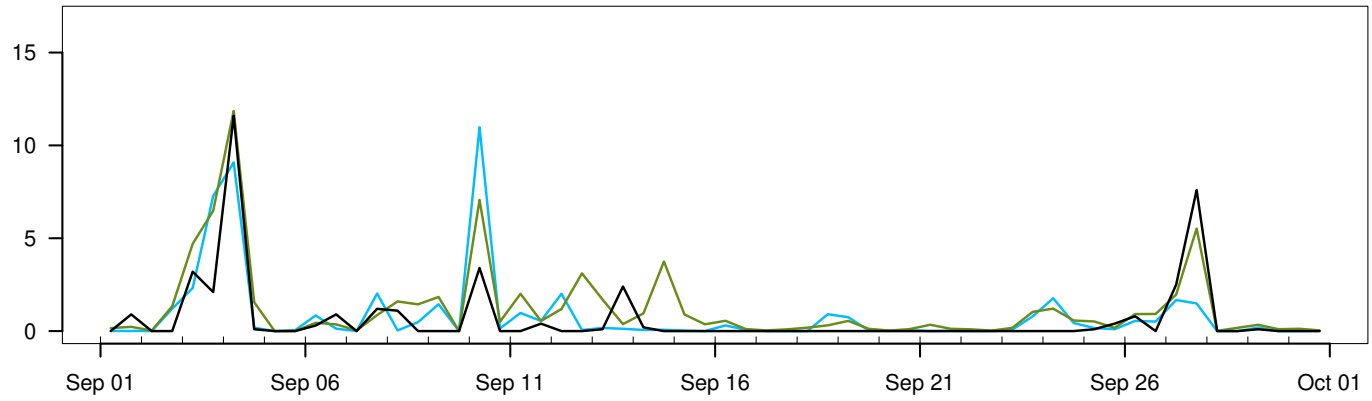
SDE at observing sites
(numbers in black)



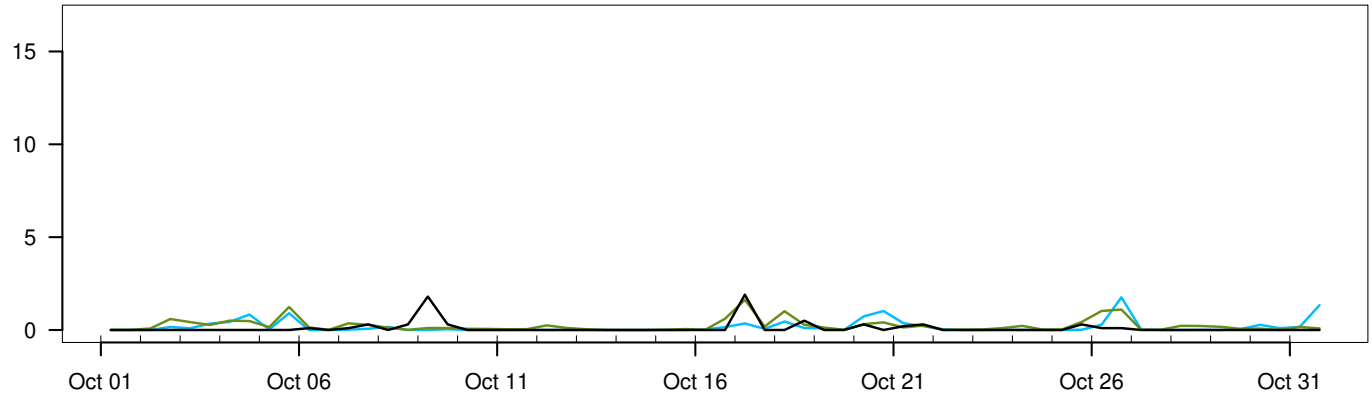
Model "climatology" 01.09.2019 – 30.11.2019

SVALBARD LUFTHAVN

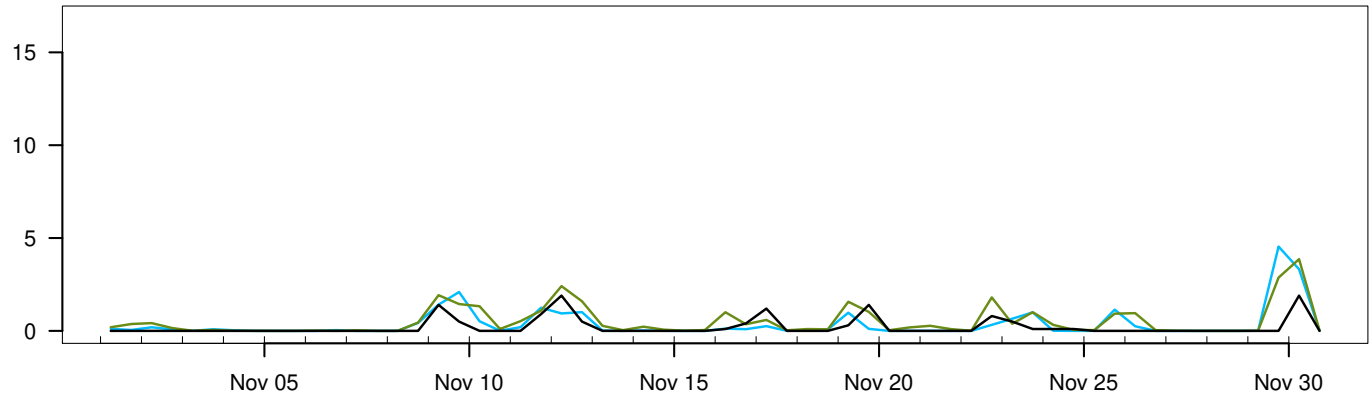
01.09.2019 – 30.09.2019



01.10.2019 – 31.10.2019



01.11.2019 – 30.11.2019



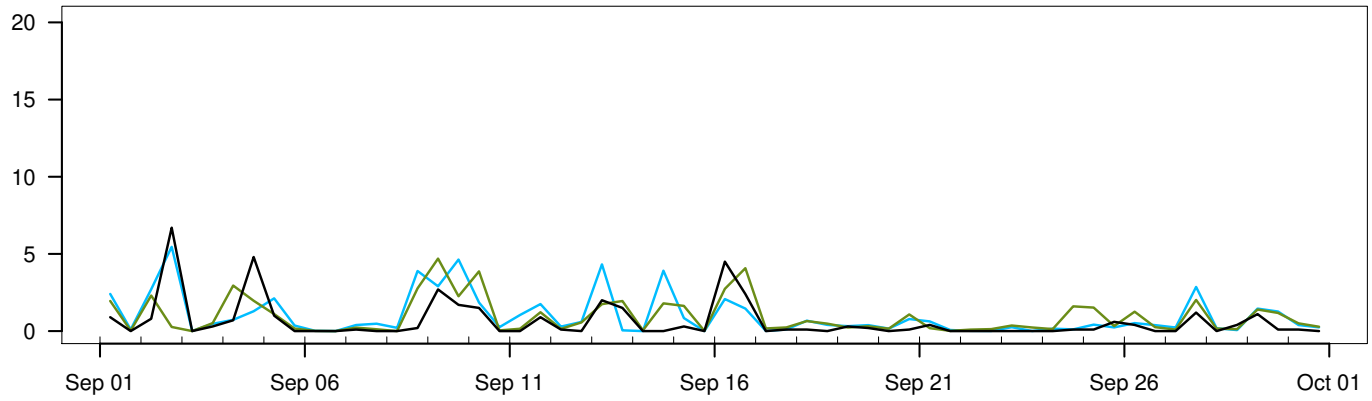
01.09.2019 – 30.11.2019

	Min	Mean	Max	Std	N
synop: 06,18	0	0.3	11.6	1.2	182
AA25: 12+18,+30	0	0.5	11	1.3	182
ECMWF: 12+18,+30	0	0.6	11.9	1.4	182

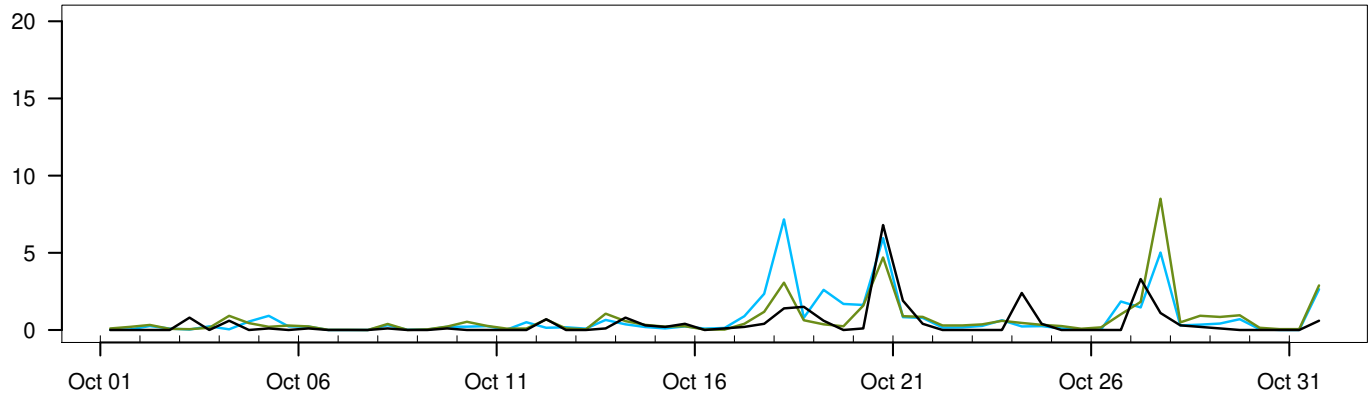
	ME	SDE	RMSE	MAE	Max.abs.err.	N
AA25 – synop	0.1	1	1	0.4	7.6	182
ECMWF – synop	0.3	0.8	0.8	0.4	4.4	182

BJØRNØYA

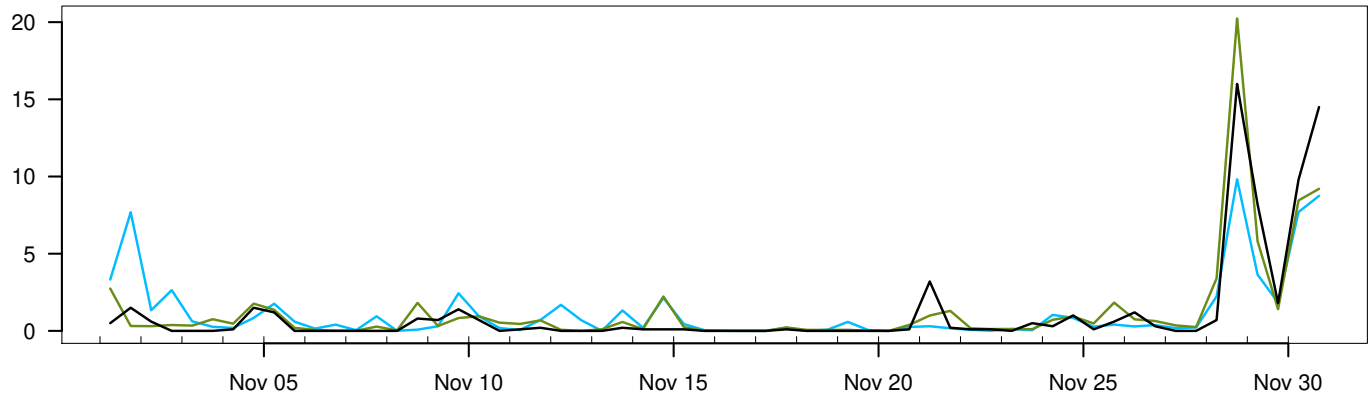
01.09.2019 – 30.09.2019



01.10.2019 – 31.10.2019



01.11.2019 – 30.11.2019

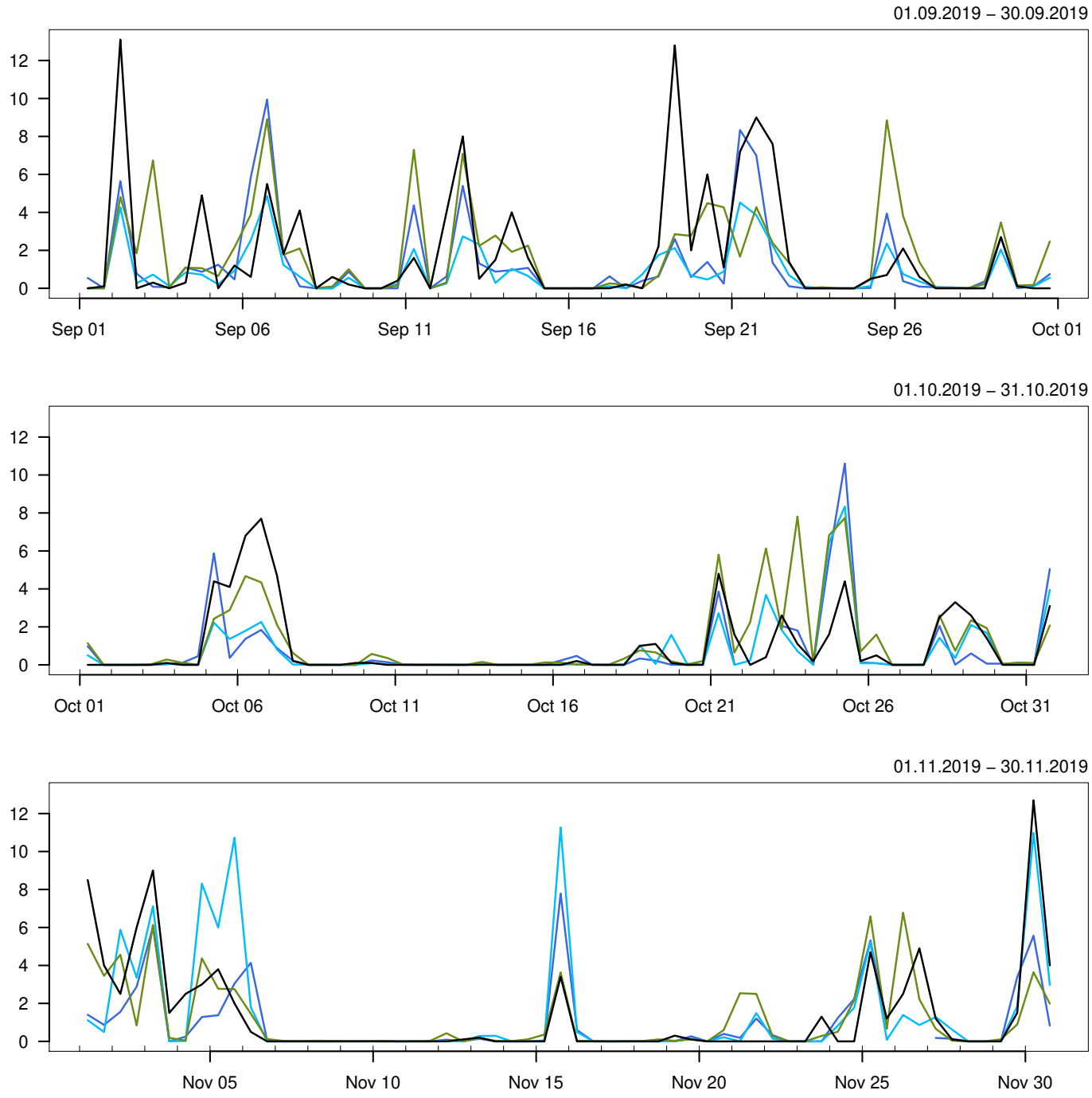


01.09.2019 – 30.11.2019

	Min	Mean	Max	Std	N
synop: 06,18	0	0.7	16	2	182
AA25: 12+18,+30	0	1	9.8	1.7	182
ECMWF: 12+18,+30	0	1	20.2	2	182

	ME	SDE	RMSE	MAE	Max.abs.err.	N
AA25 – synop	0.2	1.4	1.4	0.7	6.2	182
ECMWF – synop	0.2	1.2	1.2	0.6	7.4	182

TROMSØ

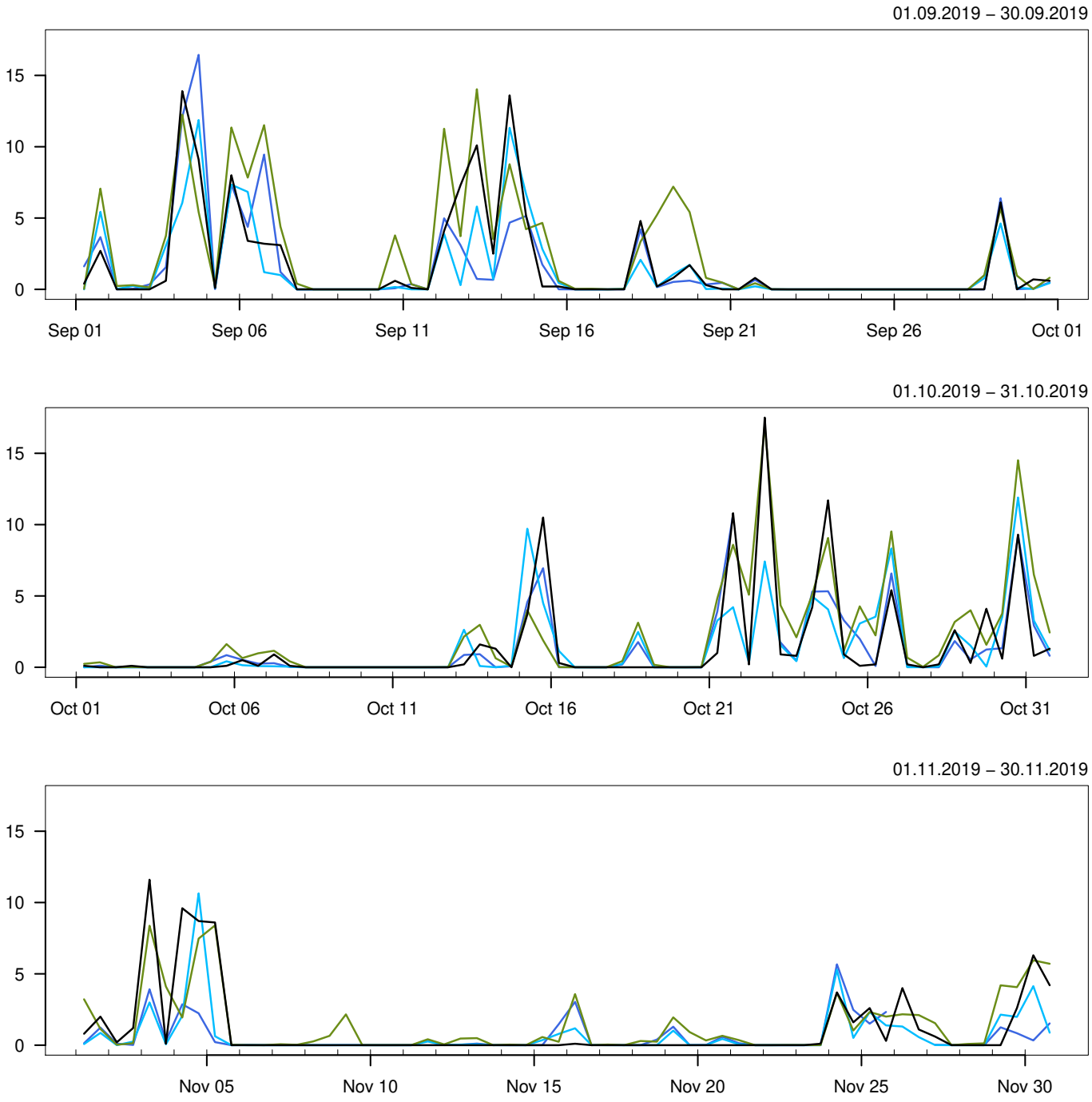


01.09.2019 – 30.11.2019

	Min	Mean	Max	Std	N
synop: 06,18	0	1.4	13.1	2.5	182
MEPSctrl: 12+18,+30	0	1	10.6	1.9	178
AA25: 12+18,+30	0	1	11.3	2	182
ECMWF: 12+18,+30	0	1.4	8.9	2.1	182

	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl – synop	–0.4	2	2.1	1.1	10.2	178
AA25 – synop	–0.4	2.1	2.2	1	10.7	182
ECMWF – synop	0	2.2	2.2	1.1	9.9	182

BODØ VI



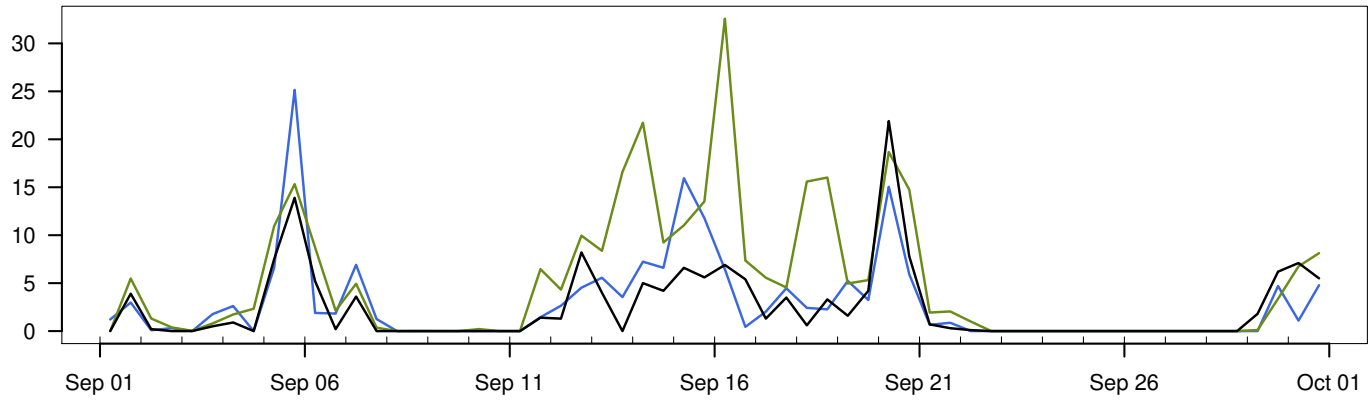
01.09.2019 – 30.11.2019

	Min	Mean	Max	Std	N
synop: 06,18	0	1.5	17.5	3.1	182
MEPSctrl: 12+18,+30	0	1.1	16.4	2.4	178
AA25: 12+18,+30	0	1.2	11.9	2.4	182
ECMWF: 12+18,+30	0	2	17	3.2	182

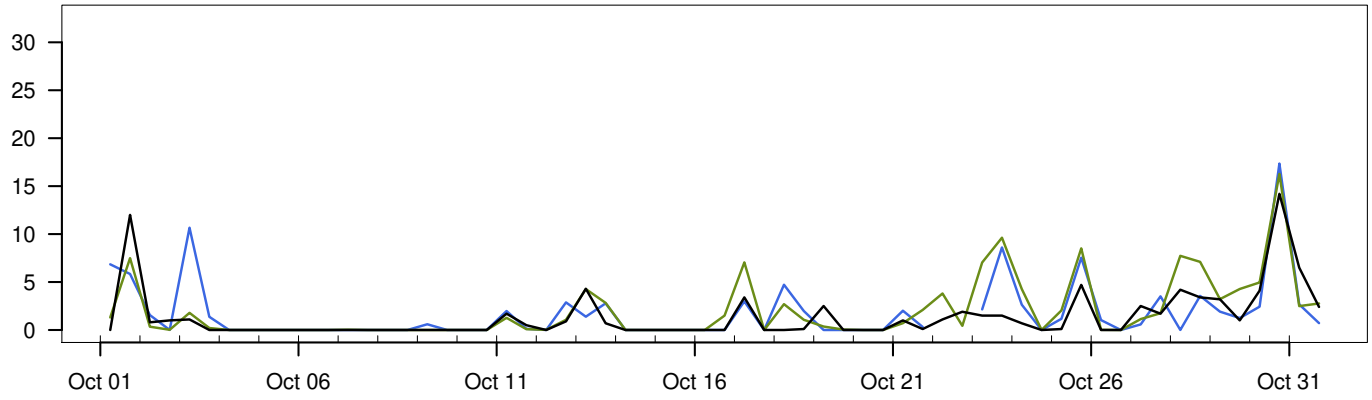
	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl – synop	–0.2	2	2	0.8	9.4	178
AA25 – synop	–0.3	2.1	2.1	1	10.1	182
ECMWF – synop	0.5	2	2.1	1.1	8.6	182

ØRLAND III

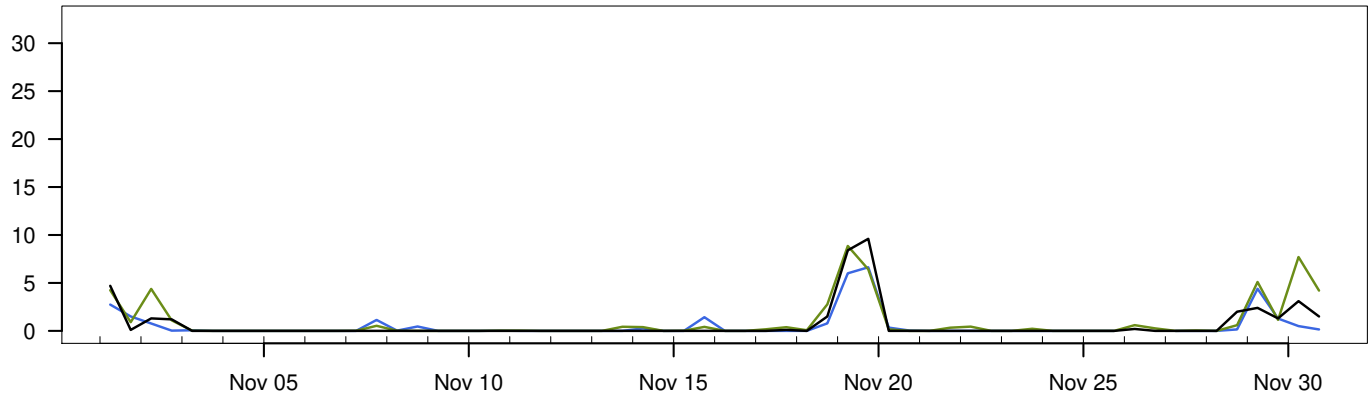
01.09.2019 – 30.09.2019



01.10.2019 – 31.10.2019



01.11.2019 – 30.11.2019



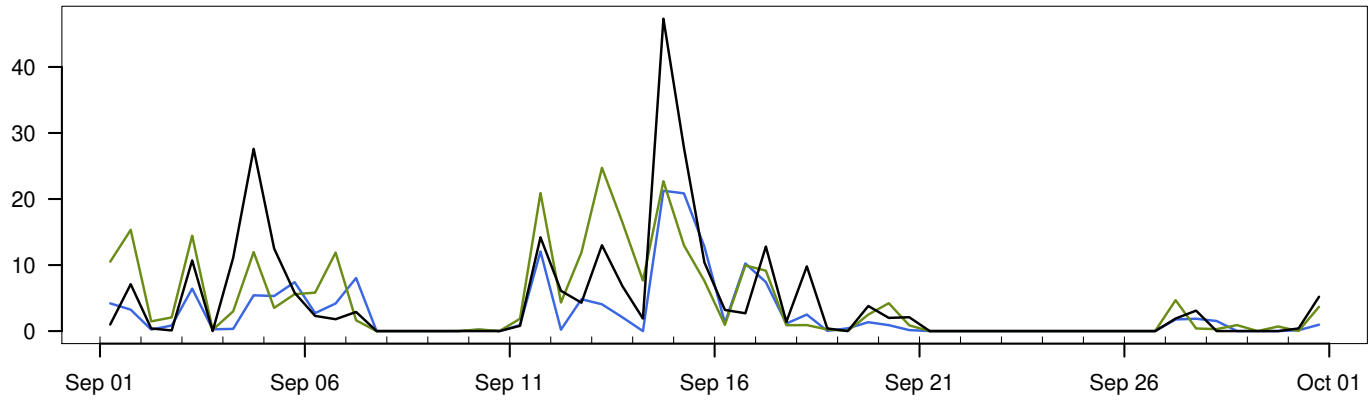
01.09.2019 – 30.11.2019

	Min	Mean	Max	Std	N
synop: 06,18	0	1.5	21.9	3	182
MEPSctrl: 12+18,+30	0	1.7	25.2	3.4	178
ECMWF: 12+18,+30	0	2.6	32.6	4.8	182

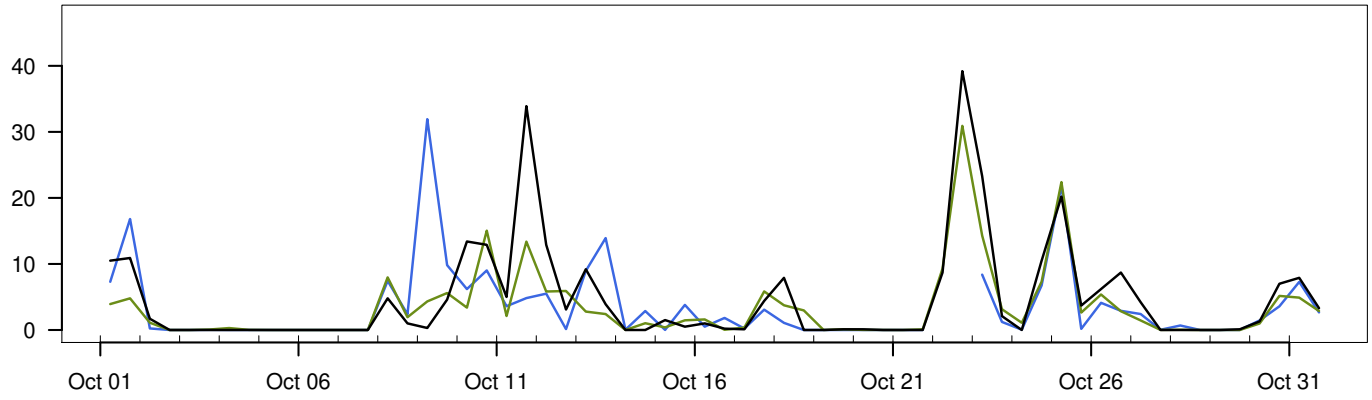
	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl – synop	0.2	2.2	2.2	1.1	11.3	178
ECMWF – synop	1.1	3.3	3.5	1.5	25.7	182

BERGEN – FLORIDA

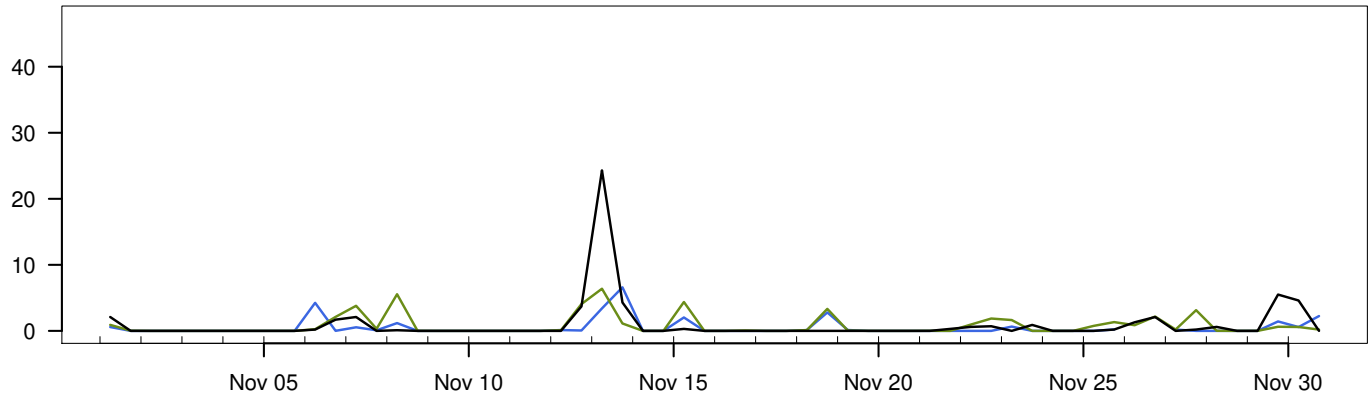
01.09.2019 – 30.09.2019



01.10.2019 – 31.10.2019



01.11.2019 – 30.11.2019



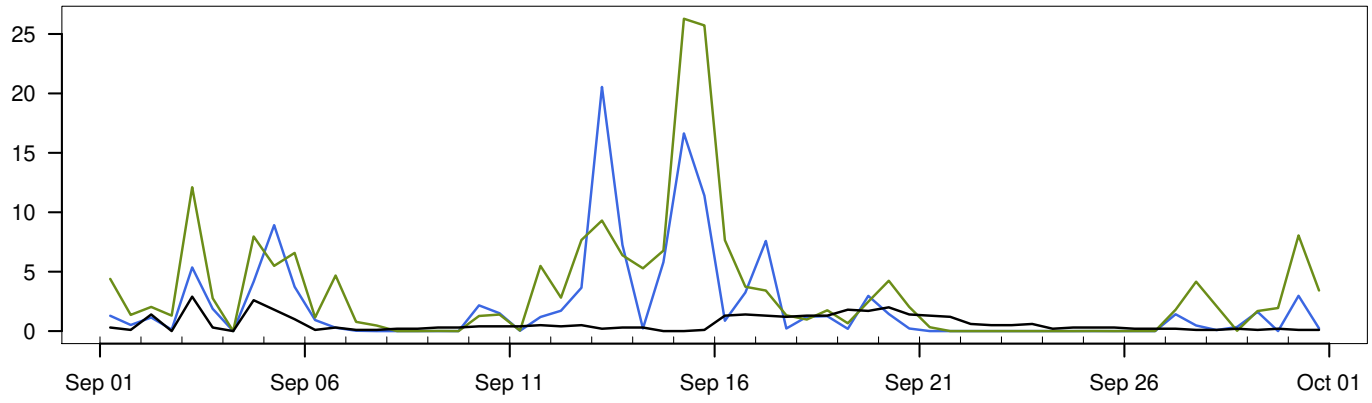
01.09.2019 – 30.11.2019

	Min	Mean	Max	Std	N
synop: 06,18	0	3.4	47.3	7	182
MEPSctrl: 12+18,+30	0	2.2	31.9	4.5	178
ECMWF: 12+18,+30	0	2.9	30.9	5.1	182

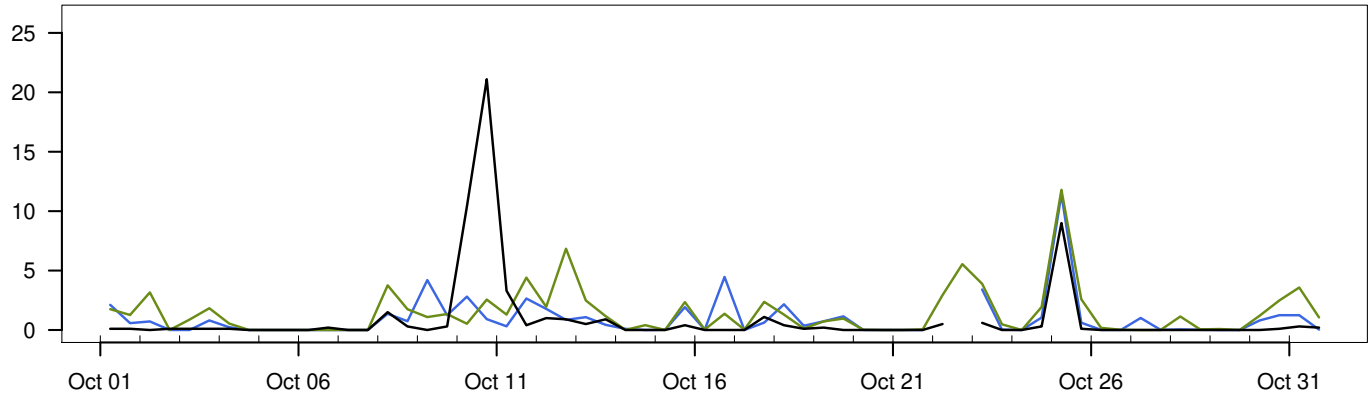
	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl – synop	−0.9	5.2	5.2	2.2	31.6	178
ECMWF – synop	−0.5	4.4	4.4	2.1	24.6	182

LÆRDAL IV

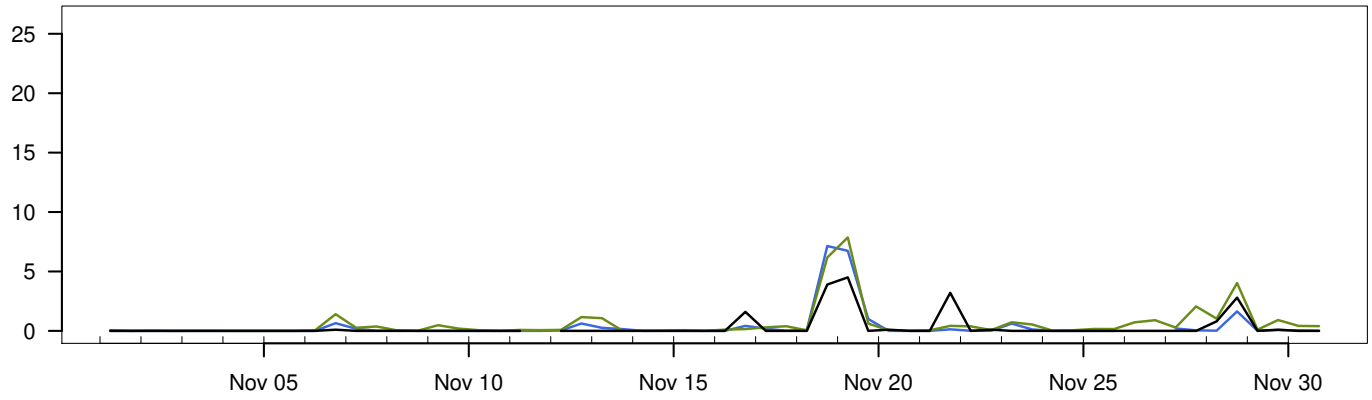
01.09.2019 – 30.09.2019



01.10.2019 – 31.10.2019



01.11.2019 – 30.11.2019



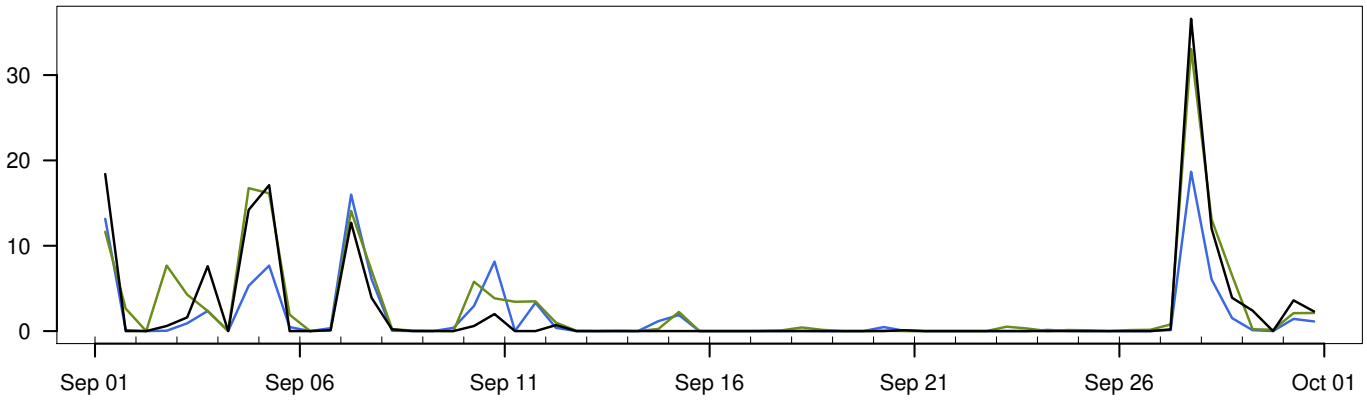
01.09.2019 – 30.11.2019

	Min	Mean	Max	Std	N
synop: 06,18	0	0.6	21.1	2	180
MEPSctrl: 12+18,+30	0	1.1	20.5	2.7	178
ECMWF: 12+18,+30	0	1.8	26.3	3.4	182

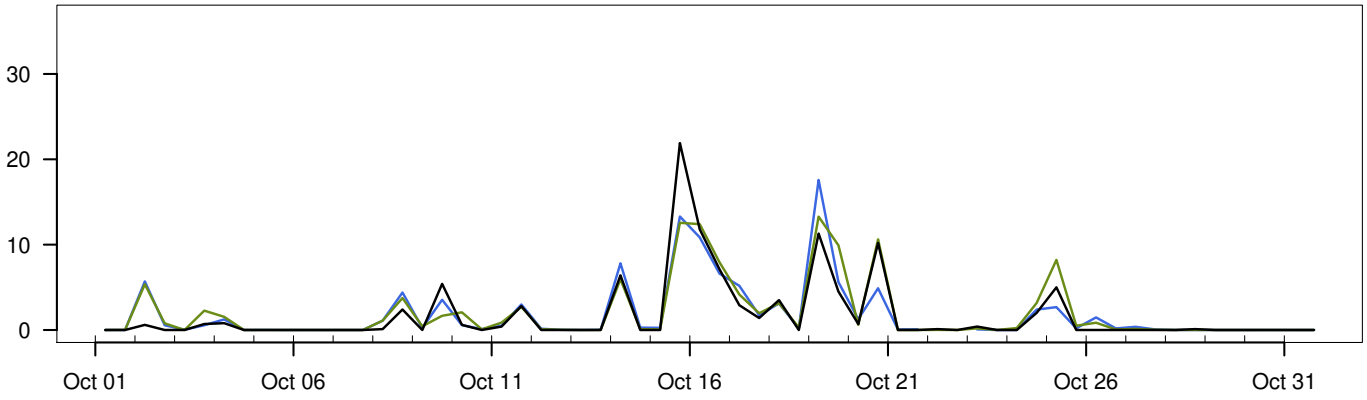
	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl – synop	0.5	3	3	1.1	20.3	177
ECMWF – synop	1.2	3.6	3.8	1.6	26.3	180

GARDERMOEN

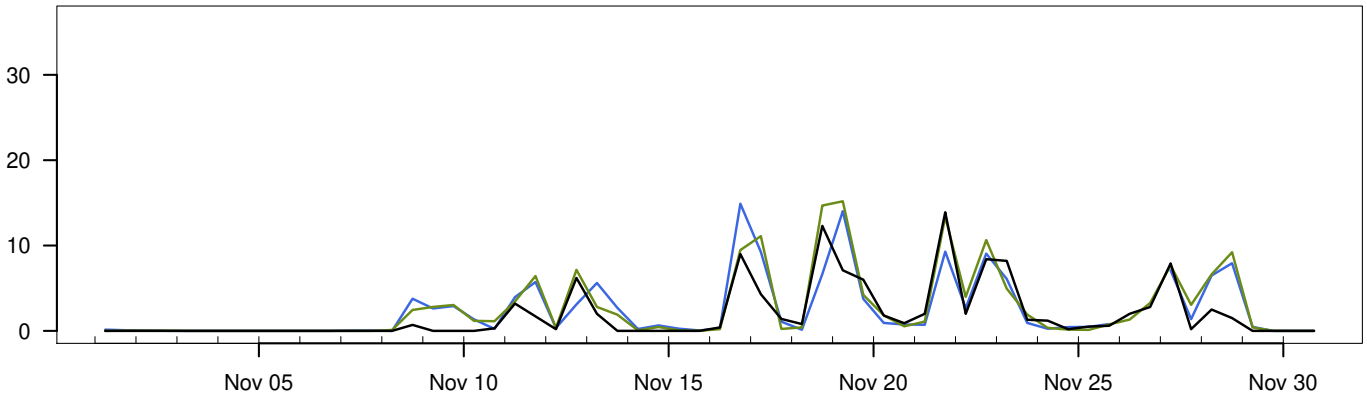
01.09.2019 – 30.09.2019



01.10.2019 – 31.10.2019



01.11.2019 – 30.11.2019



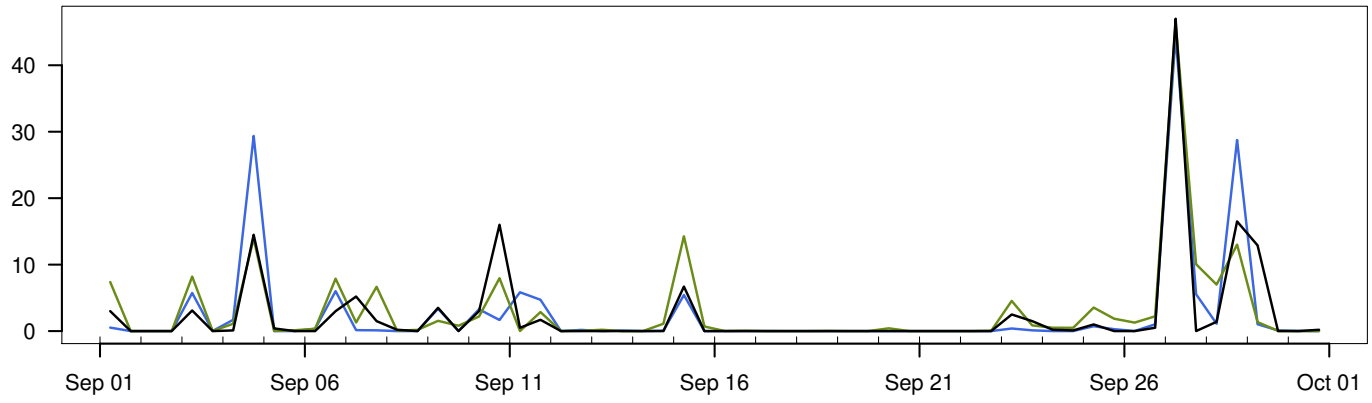
01.09.2019 – 30.11.2019

	Min	Mean	Max	Std	N
synop: 06,18	0	2	36.6	4.6	182
MEPSctrl: 12+18,+30	0	2	18.7	3.6	178
ECMWF: 12+18,+30	0	2.4	33.1	4.5	182

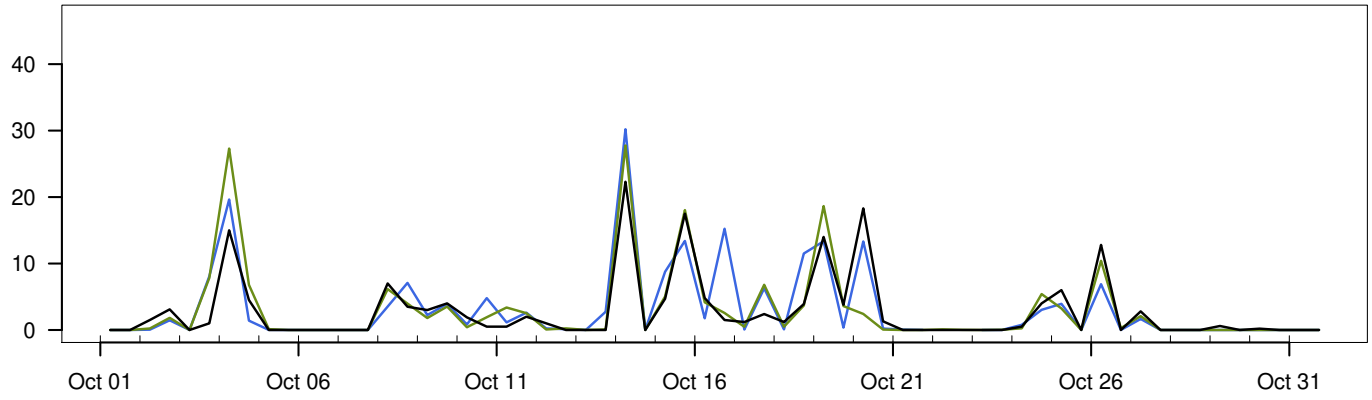
	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl – synop	0	2.6	2.6	1.2	17.9	178
ECMWF – synop	0.5	1.9	2	1	9.3	182

NELAUG

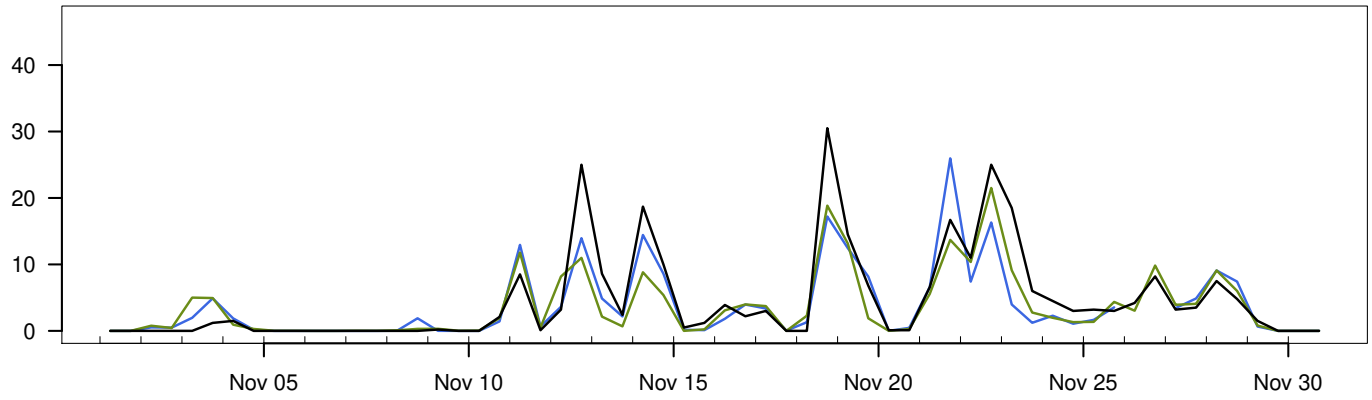
01.09.2019 – 30.09.2019



01.10.2019 – 31.10.2019



01.11.2019 – 30.11.2019



01.09.2019 – 30.11.2019

	Min	Mean	Max	Std	N
synop: 06,18	0	3.3	47	6.4	182
MEPSctrl: 12+18,+30	0	3.2	44.4	6.4	178
ECMWF: 12+18,+30	0	3.2	46.3	5.9	182

	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl – synop	–0.1	3.6	3.6	1.8	14.9	178
ECMWF – synop	–0.1	3.2	3.2	1.6	15.9	182