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Verification of Operational Weather Prediction Models September to November 2023

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Lier. Photo: Lene Østvand

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More information...

Verification results are also available on internal web pages

- <https://metcoop-comm.smhi.se/> and <https://metcoop.smhi.se/> - MetCoOp Web Tools - including verification and observation monitoring
- <https://harp.smhi.se/> - MetCoOp verification visualized with harp
- <http://verif/vmap/> - timeseries and windroses - on Google map

About this report

This verification report indicates the quality of the main operational weather forecasting models used at the Norwegian Meteorological Institute for the period indicated. Another purpose of the verification report series is to provide a stable source of information suitable for monitoring longer trends in forecasting quality for interested readers. The report complements the verification and monitoring performed on individual models. Each model is monitored and developed according to the scientific method, where changes are only introduced when they can document a better likely prediction skill. Such documentation is available as research papers, consortium news, and presentations at team-, syndicate- and consortium-meetings. The skill of the forecasting service in severe weather situations is also documented with special emphasis on forecast failures, in order to learn from them and improve the system.

The report includes verification results for 3 Numerical Weather Prediction (NWP) models; MetCoOp ensemble system (MEPS) covering Norway, Sweden, Finland, Denmark and the Baltic states, AROME-Arctic covering Svalbard, Novaja Semlja, Frans Josefs land and the Northern part of Scandinavia and the global ECMWF. The models are further described in the Models section. The variables verified are mean sea level pressure, temperature, wind speed and precipitation. The results are grouped by variable. A short summary of the results and cases studies by forecasters are also included.

Verification results are shown for different groups of stations: Norwegian, Svalbard and North Scandinavian. For temperature there are additional groups with Norwegian coastal and Norwegian inland stations, for wind speed Norwegian coastal and Norwegian mountainous stations, and for precipitation coastal stations, stations more than 500 m above sea level, and stations with daily mean precipitation > 4 mm. For MEPSctrl statistics at the observing sites are also visualized on maps with model climatology. The text size of the statistics increases with the value. Time series with observations and available models are included for selected stations. Post processed variables are compared with MEPSctrl.

Models

The following Numerical Weather Prediction (NWP) models are verified in this report. The verification measures are plotted for each model with the colors indicated in the table below.

ECMWF

Global model (IFS) at the European Centre for Medium-Range Weather Forecasts. From 26 January 2010 horizontal resolution approximately $16 \times 16 \text{ km}^2$. From 8 March 2016 cycle 41r2 with horizontal resolution about 9 km. ECMWF is available about 5 hours later than models run at MET.

MetCoOp ensemble system (MEPSctrl)

MEPS has 30 lagged ensemble members, constructed from 5 members updated hourly and run up to 66 hours. Only member 0, the control, is verified in this report. MEPS is based on HARMONIE with AROME physics and non-hydrostatic dynamics, horizontal resolution defined by a $2.5 \times 2.5 \text{ km}^2$ grid. Experimental with cycle 37h1.1 from November 2012, on Yr since 1 October 2013, operational since March 2014, cycle 38h1.2 from December 2014, cycle 40h1.1 since November 2016 and cycle 43h2.1 from 23 March 2021. MEPS is run in cooperation with Swedish Meteorological and Hydrological Institute (SMHI), Finnish Meteorological Institute (FMI) and Estonian Environment Agency (ESTE).

AROME-Arctic (AA25)

HARMONIE with AROME physics, horizontal resolution defined by a $2.5 \times 2.5 \text{ km}^2$ grid. Experimental with cycle 38h1.2 from 15 October 2015, on Yr from 14 December 2016, cycle 40h1.1 since June 2017, cycle 43h2.1 since 5 May 2021.

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 multiple data sources using both conventional and citizen observations.

The MEPS 10 m wind speed forecast is post-processed by downscaling to 1 km resolution to better represent local topography, and called YrPP.

YrPP is plotted with the color below.

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 hirlam.github.io/HarmonieSystemDocumentation/dev/, www.accord-nwp.org and www.cnrm.meteo.fr/gmapdoc/.

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. Mode-S EHS, AMSU-A and MHS from METOP-C satellite were introduced June 2020, METOP-C IASI (deactivation of METOP-A IASI), June 2021, radar radial wind observations and German radars, June 2022.

Boundary fields

MEPS gets its boundary values (1-hourly) from the ECMWF model at approximately 9 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 quantified 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, \dots, f_n denote the forecasts and o_1, \dots, 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 f_i - o_i $	0 to ∞	0
Standard Deviation of Error	SDE	$\left(\frac{1}{n} \sum_{i=1}^n (f_i - o_i - ME)^2 \right)^{1/2}$	0 to ∞	0
Root Mean Square Error	RMSE	$\left(\frac{1}{n} \sum_{i=1}^n (f_i - o_i)^2 \right)^{1/2}$	0 to ∞	0
Correlation	COR	$\frac{\frac{1}{n} \sum_{i=1}^n (f_i - \bar{f})(o_i - \bar{o})}{SD(f)SD(o)}$	-1 to 1	1

In the formula for COR the following definitions are used

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

$$SD(f) = \left(\frac{1}{n} \sum_{i=1}^n (f_i - \bar{f})^2 \right)^{1/2}, \quad SD(o) = \left(\frac{1}{n} \sum_{i=1}^n (o_i - \bar{o})^2 \right)^{1/2}$$

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

For wind direction the probability density function (PDF) is used to show the distribution of observed and forecast wind directions. The PDF used here is a kernel density estimate, which is a smoothed version of the histogram.

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	<i>a</i>	<i>b</i>
	no	<i>c</i>	<i>d</i>

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 frost.met.no. Only synop stations are used. From June 1 2021, both the model wind speed and the post-processed wind speed are verified against mean wind observations, FF. The model wind gust is verified against the observed wind gust, FG. FF and FG are defined as follows:

- FF: Wind speed (10 meters above ground) - defined as the mean value for the last 10 minutes before the time of the observation.
- FG: Gust wind speed (10 m above ground) - defined as highest gust wind speed (3 second mean) the last 10 minutes before the time of the observation.

Summary of the results

Summarized statistics show that ECMWF in general forecast sea level pressure better than MEPSctrl/AA25, but the errors are small for both.

Temperature is on average better forecast by MEPSctrl/AA25 than ECMWF. ECMWF underestimate the temperature for the different groups of stations. For MEPSctrl and AA25, the mean error is very close to zero for the Norwegian stations and Svalbard stations respectively, while for the North Scandinavian stations they show a small overestimation. Still, the errors are small, indicating that the timing of the temperature changes is generally good. The temperature forecast is further improved by post processing, particularly for the shortest lead times. The improvement is larger for inland stations than coastal stations, which have less variation in temperature and smaller errors than inland stations for both MEPSctrl and post processed forecasts.

For wind speed and precipitation, a larger number of verification scores is used to assess model quality, including threshold statistics.

Wind speed is challenging to evaluate. MEPSctrl clearly performs better than ECMWF over land, and particularly in the mountains, where ECMWF underestimates the speed considerably as seen in the monthly mean error and mean absolute error. The maps show that underestimation also applies to coastal stations in strong wind events. The threshold scores indicate that wind speed is better forecast for lower than for higher wind speeds for all models. The near surface wind speeds are affected by the upgrade to cycle 43 both by modifications in the turbulence scheme and by the physiography upgrade. ECO-CLIMAP Second Generation has new tree heights and a more "binary" separation between patch 1 (low vegetation) and 2 (trees). The largest effect of the change is seen at coastal stations with increased diurnal cycle in wind speed and less underestimation during day. The mean absolute error indicates somewhat smaller errors in the wind speed after post processing, while the threshold scores show almost identical results for MEPSctrl and YrPP.

Precipitation also shows varying results, depending on the amount and location. ECMWF has on average more precipitation than MEPSctrl which this autumn had mean errors slightly above 0 for the Norwegian stations. Both have more errors for both very small amounts and very high amounts, than precipitation in the mid range.

The models generally perform better during summer months than during winter. A possible cause is that storm activity is challenging to predict accurately, and there are often more storms during fall and winter than during summer. Precipitation is an exception from this trend, as summer often comes with convective cases that are challenging to predict. AA25 and MEPSctrl show very similar results, which is expected since both are HARMONIE with AROME physics, horizontal resolution defined by a 2.5×2.5 km² grid.

Case studies by forecasters

Case 1. Precipitation

On 29 September a case of underforecasted convective and frontal precipitation was reported from the Ørlandet meteorological station (figure 1). MEPSctrl indicated just 0.2 mm between 06 and 12 UTC, while the measurements showed 18mm. The run at 00 UTC with 8 hours lead time had only slightly less rain than the 18 UTC run with 14 hours lead time, indicating that while there is some spin-up still at 8 hours lead time, this event was mainly due to other causes.

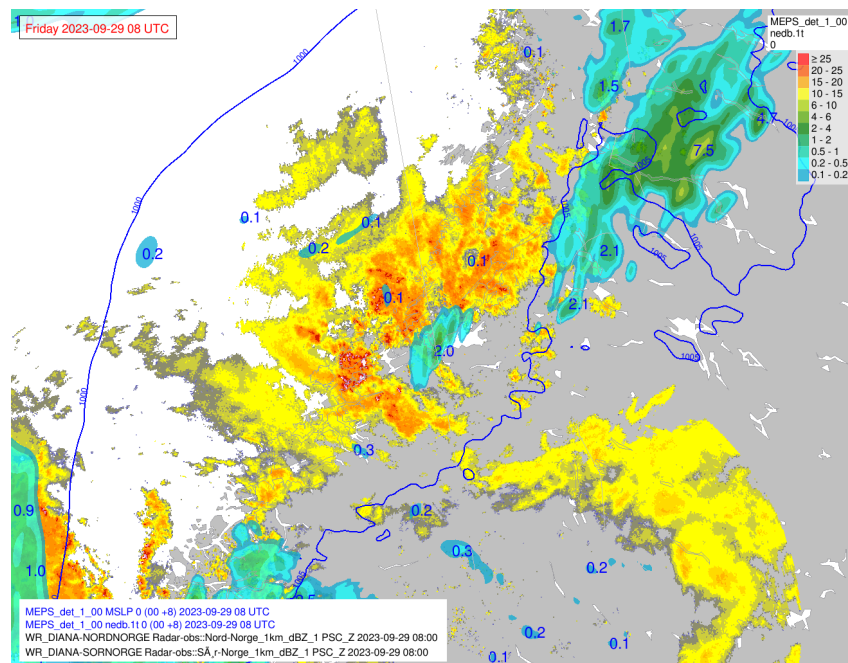


Figure 1: Both convective and frontal precipitation on 29 September as seen from the radar, and MEPSctrl 1hr precipitation in green shading. The extent of the rain as seen from the radar corresponded well with METAR observations from the local air base in this event.

A comparison to the actual soundings from Ørlandet (figure 2, left) shows good agreement at medium to high levels, e.g. the cloud base was correctly indicated at around 800 hPa, while MEPSctrl is too dry at low levels. A similar sounding from 14 UTC (figure 2, right) sheds light on a frequent difference between the ECMWF and MEPSctrl, in that the MEPSctrl is often fully moist in the layers producing precipitation without giving precipitation at the ground, where the ECMWF has a dew point depression of 1 to 2 degrees, but with precipitation at the ground (not shown in this plot). The actual sounding from 14 UTC shows an air mass that was indeed fully saturated in the layers that produced precipitation, and also enough liquid water to be well seen in the radar images. This may indicate that the MEPSctrl may be too slow to convert moisture to liquid water and ground reaching precipitation, corresponding to the finding that the MEPSctrl has in general less precipitation than the ECMWF.

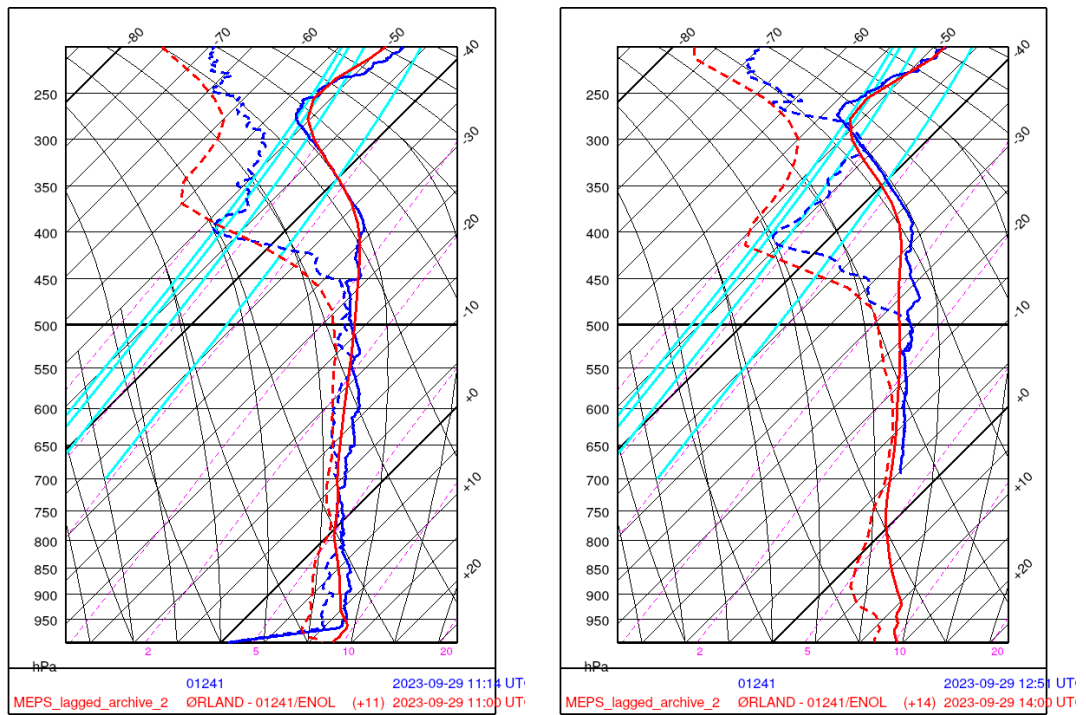


Figure 2: Soundings from the Ørlandet Air Base at 11 UTC (left) and a location 100 km to the north at 14 UTC (right). The actual sounding from a weather balloon (blue) is plotted together with the prognostic sounding from MEPSctrl (red).

Case 2. Clouds

There were several reports on missing stratus during this verification period. On 17 November a large part of Eastern Norway/Southwestern Sweden was covered in stratus for most of the day, without this being forecasted by MEPSctrl, as shown in figure 3. Examination of 2m temperature and 2m dew point temperature from the model shows that these were within 1 to 3 degrees of the observed temperatures at 12 hours lead time, independently of where the model had clouds or cloud free areas.

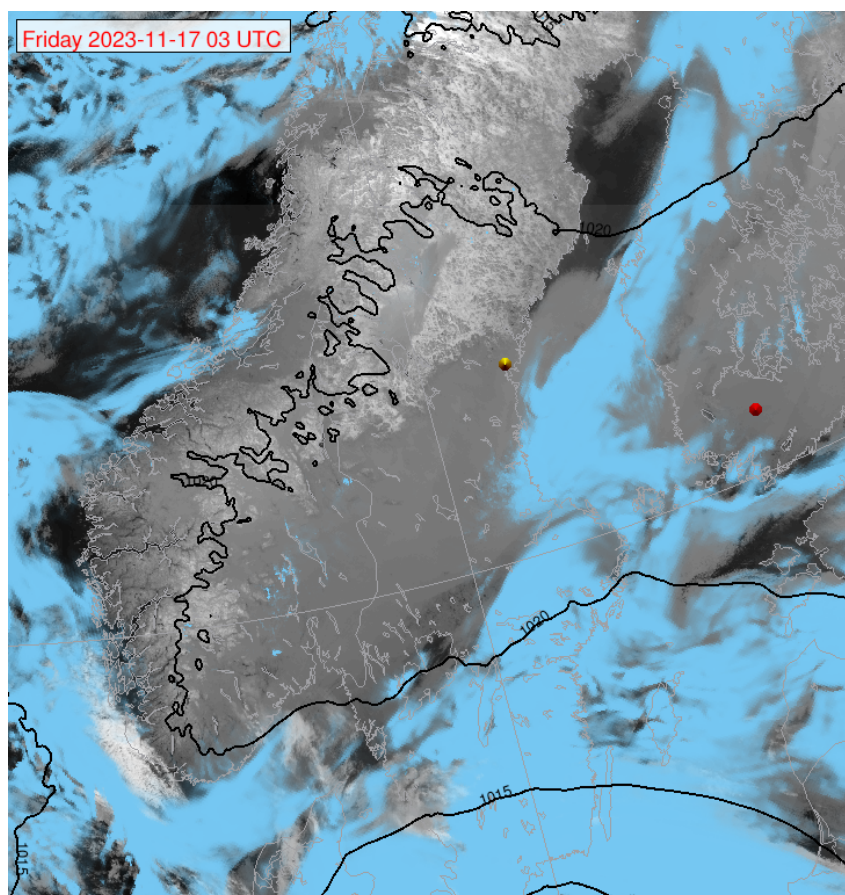


Figure 3: The weather situation at 03 UTC on 17 November 2023. A large high in the MSLP (black) over central Scandinavia with stratus clouds (seen as a smooth gray area) covering South East Scandinavia and Finland. The forecast low clouds from MEPSctrl are seen in light blue. The sounding stations are marked with bullet points with Sundsvall in yellow and Jokioinen in red.

Both Sundsvall and Joikoinen in Finland were in the same high pressure weather type and had the same lack of clouds. A comparison to the actual sounding from these sites shows that there is initially good agreement in the temperature and dew point temperature (figure 4). At 12 hours lead time the model temperature and dew point temperature deviates increasingly in the layers up to the inversion, mainly raising the temperature too much at the inversion layer at 850 hPa to 900 hPa. The dew point temperature is not increasing at surface levels the same amount in the model compared to the soundings. This indicates that there may be too much vertical mixing in the layers from the surface and up til the inversion layer.

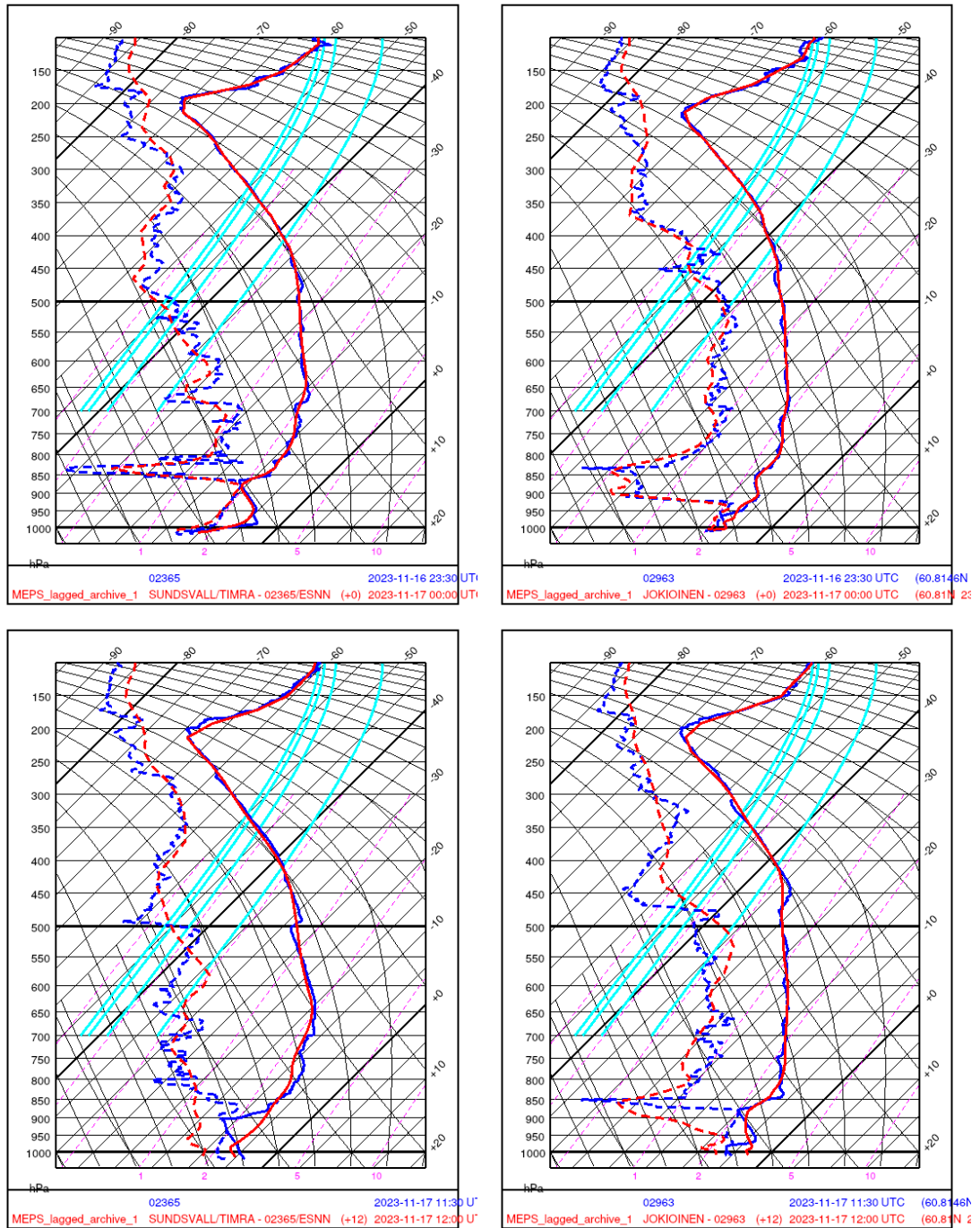


Figure 4: The vertical profiles from MEPSctrl (red) plotted together with the actual (blue) soundings from Sundsvall (left) and Jokioinen (right) at 0 hours lead time (top) and at 12 hours lead time (bottom).

Case 3. Temperature

The case from 17 November also illustrates the problem with too high temperatures in the winter night-time inversion minima. In the areas that in reality were cloud free, the model had a positive bias of up to 10 degrees in the inversion cold spots. Folldal is an inland station situated in a depression in the terrain, and is prone to have very low temperature minima on clear nights such as were the case during the period from 17 to 20 November. As seen in the timeseries plot in figure 5, even the post processed temperature YrPP forecasts were not able to capture the very low temperatures during this period.

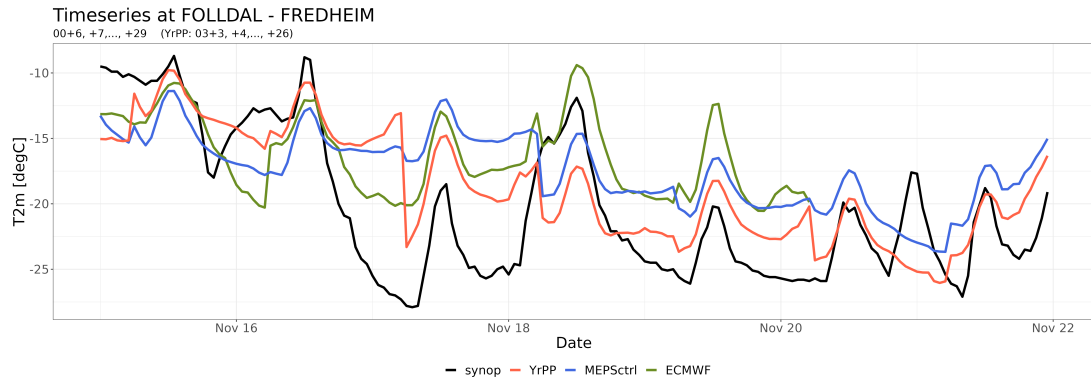
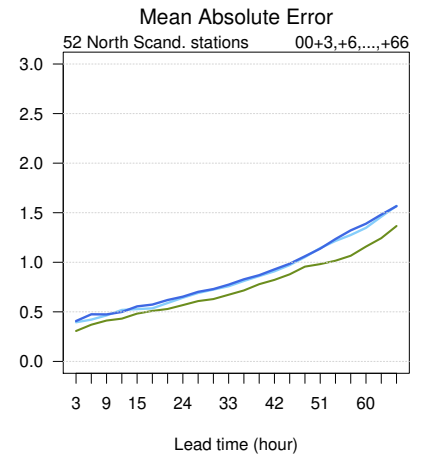
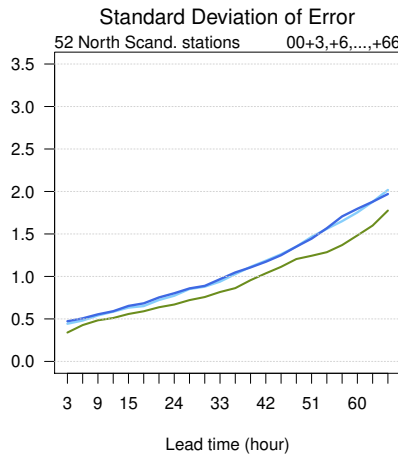
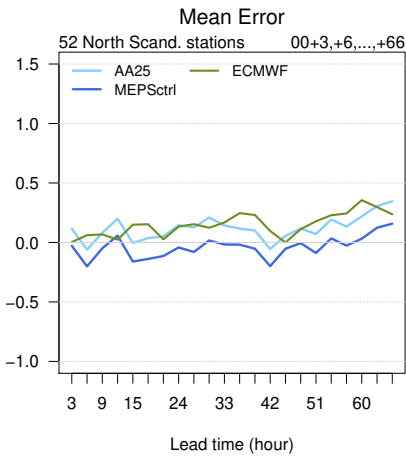
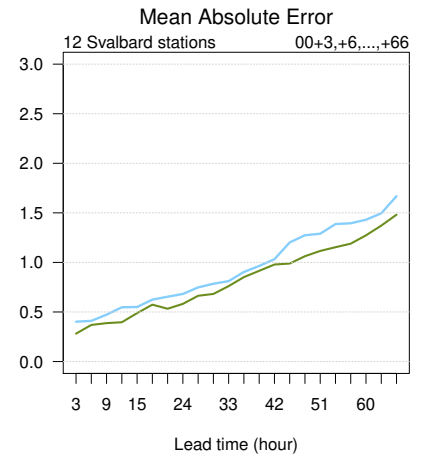
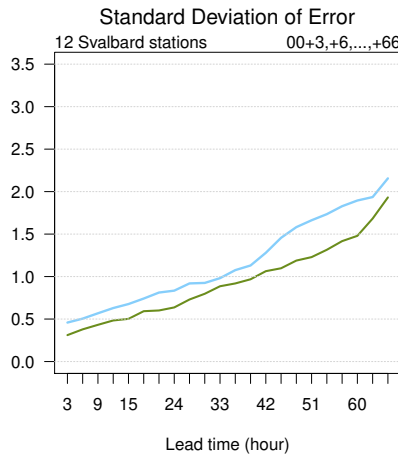
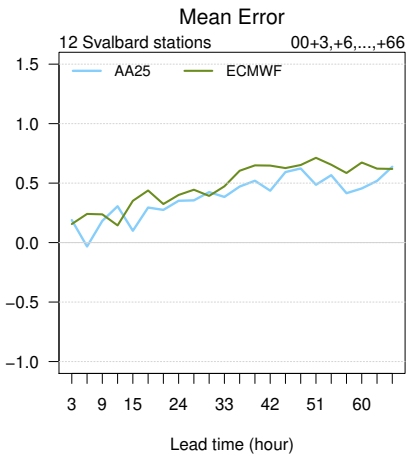
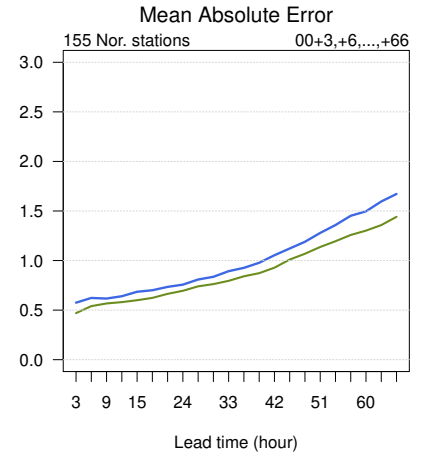
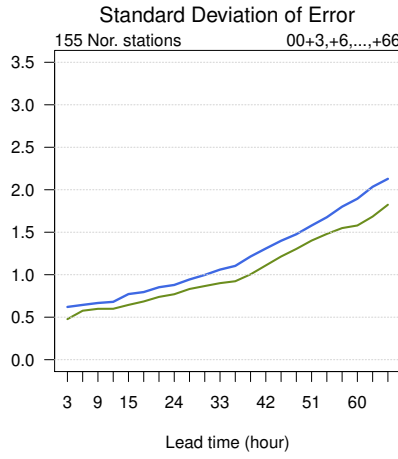
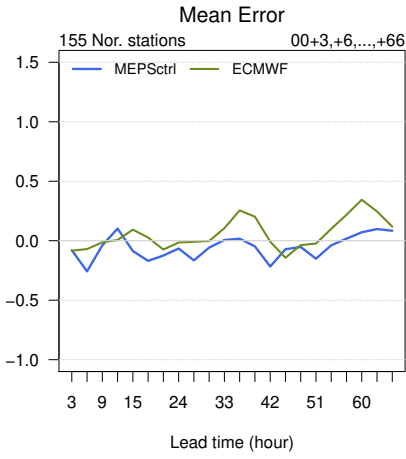


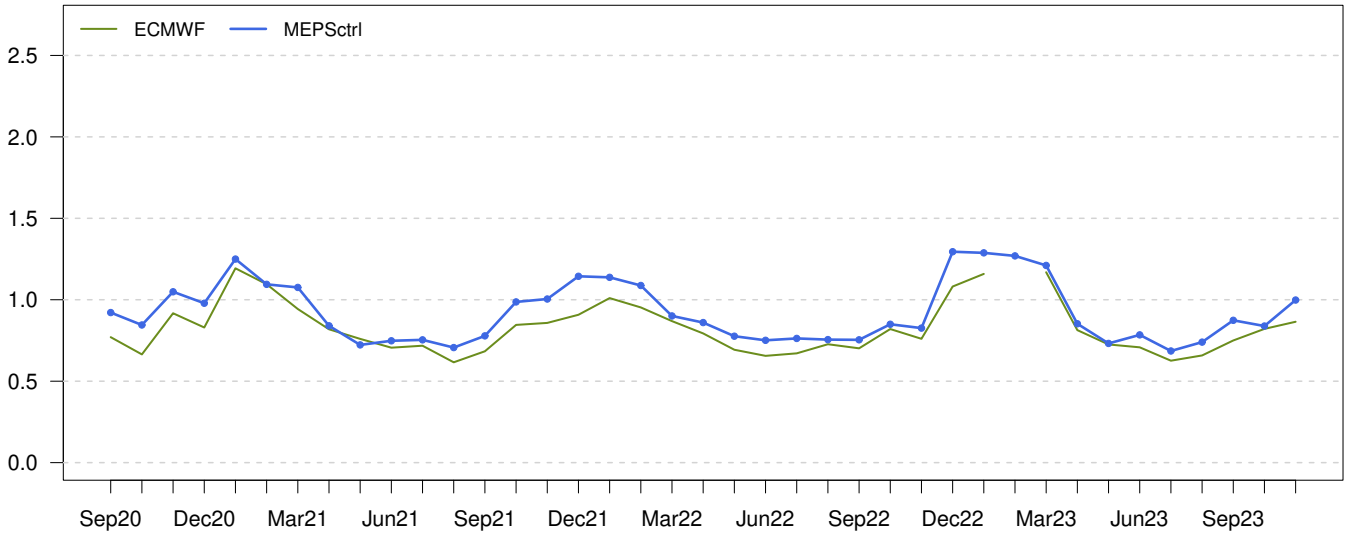
Figure 5: The timeseries plot from Folldal showing post processed temperature (YrPP) in red, MEPSctrl in blue and ECMWF in green against observations (black).

Summarized statistics

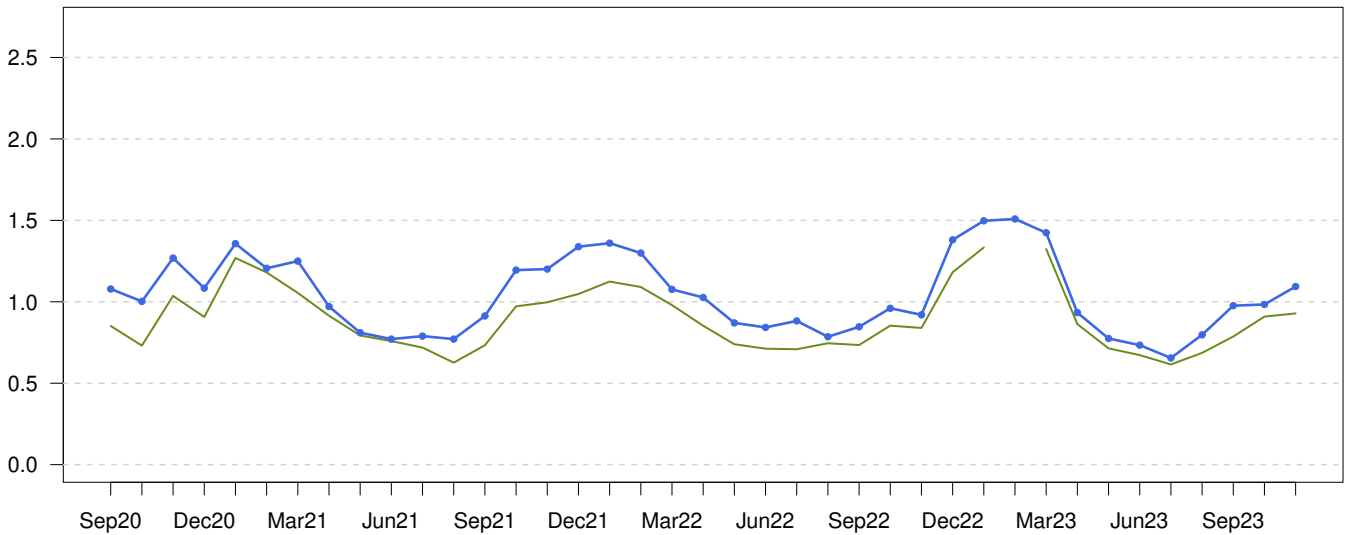


Mean Absolute Error
167 Norwegian stations

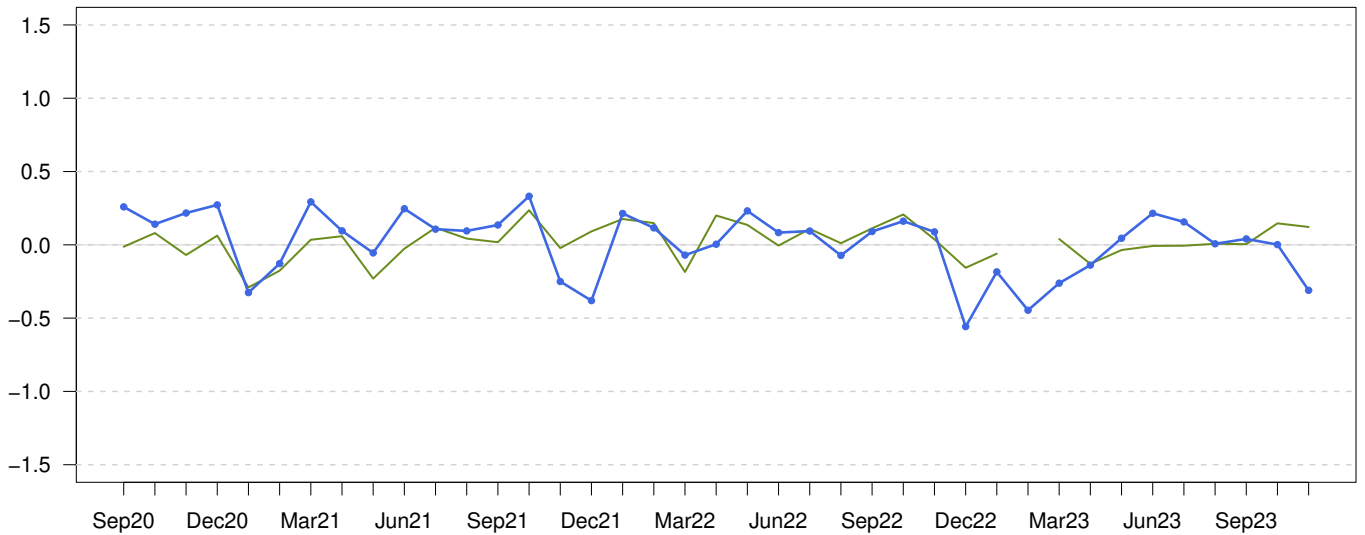
00+24,+30,+36,+42 UTC

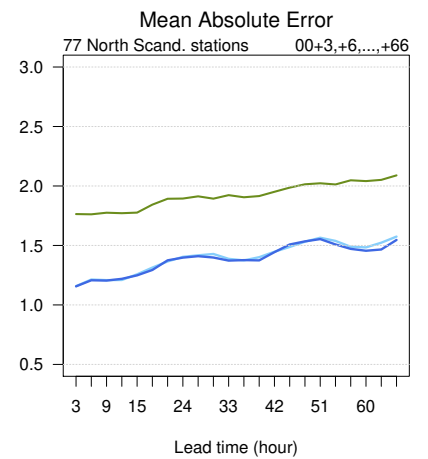
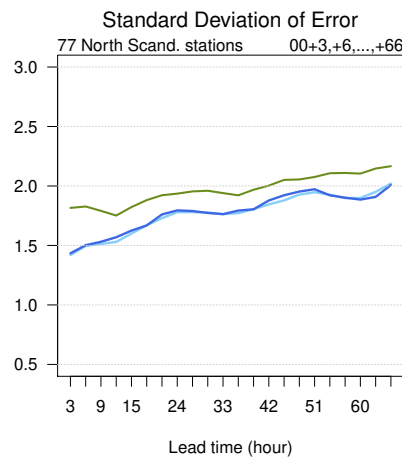
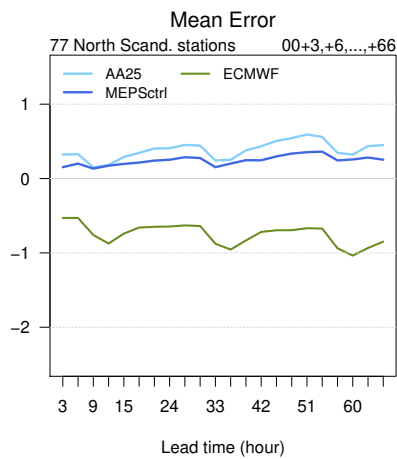
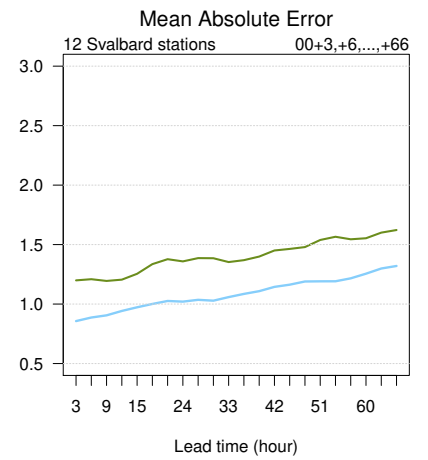
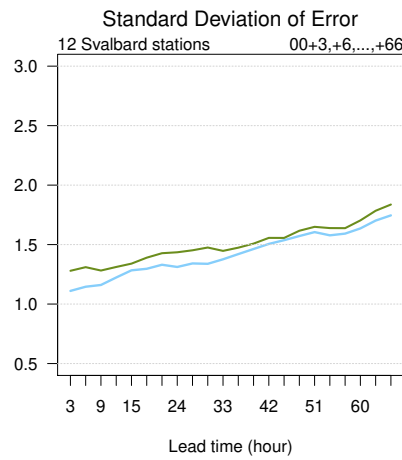
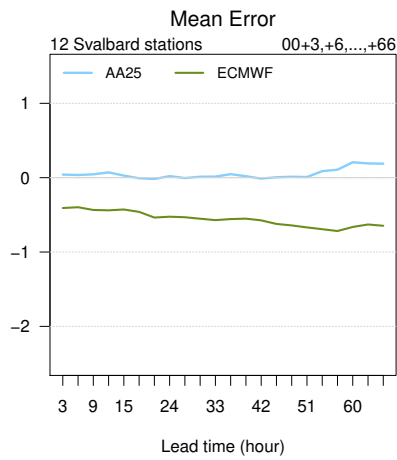
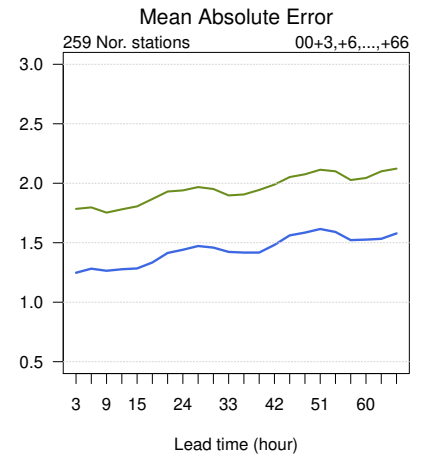
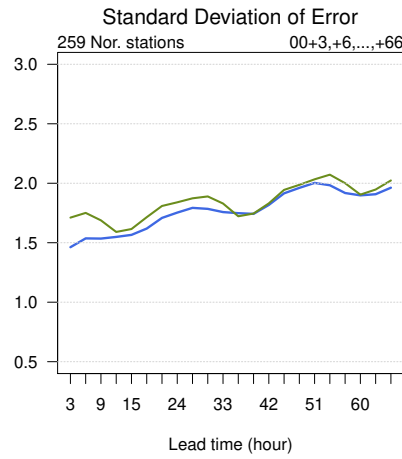
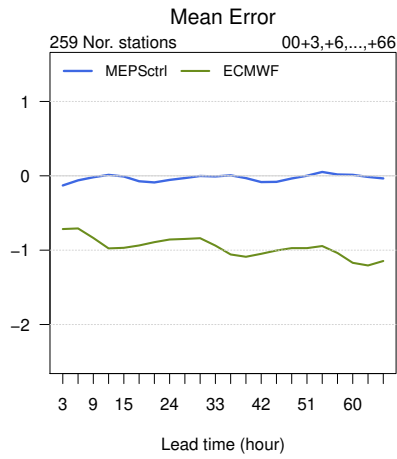


Standard Deviation of Error



Mean Error

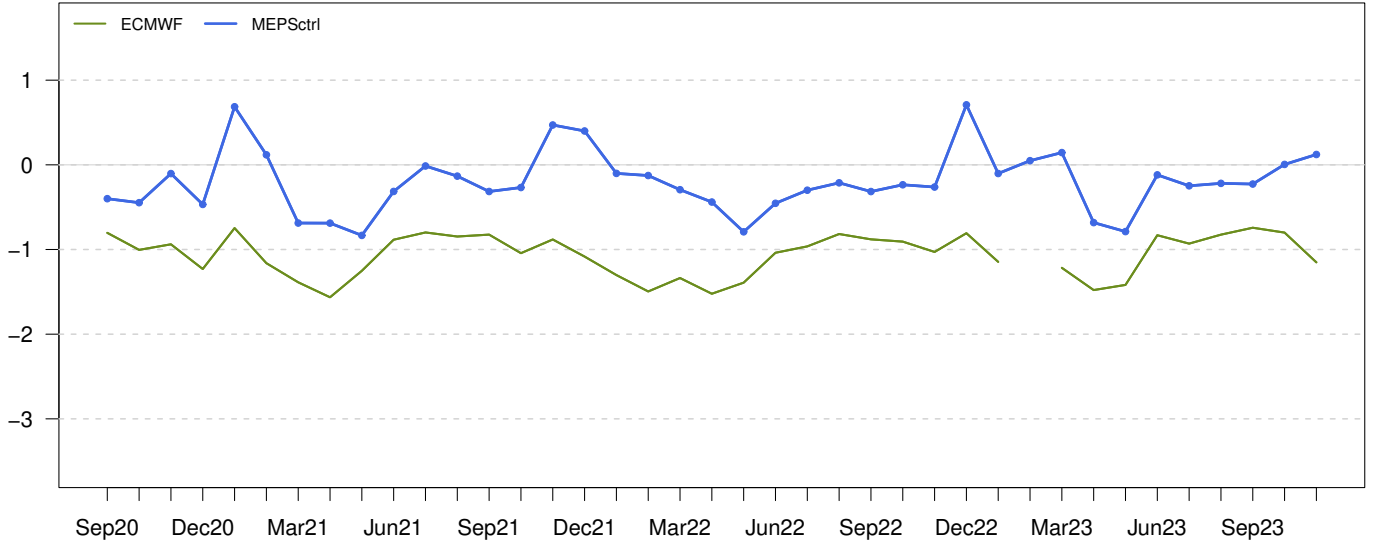




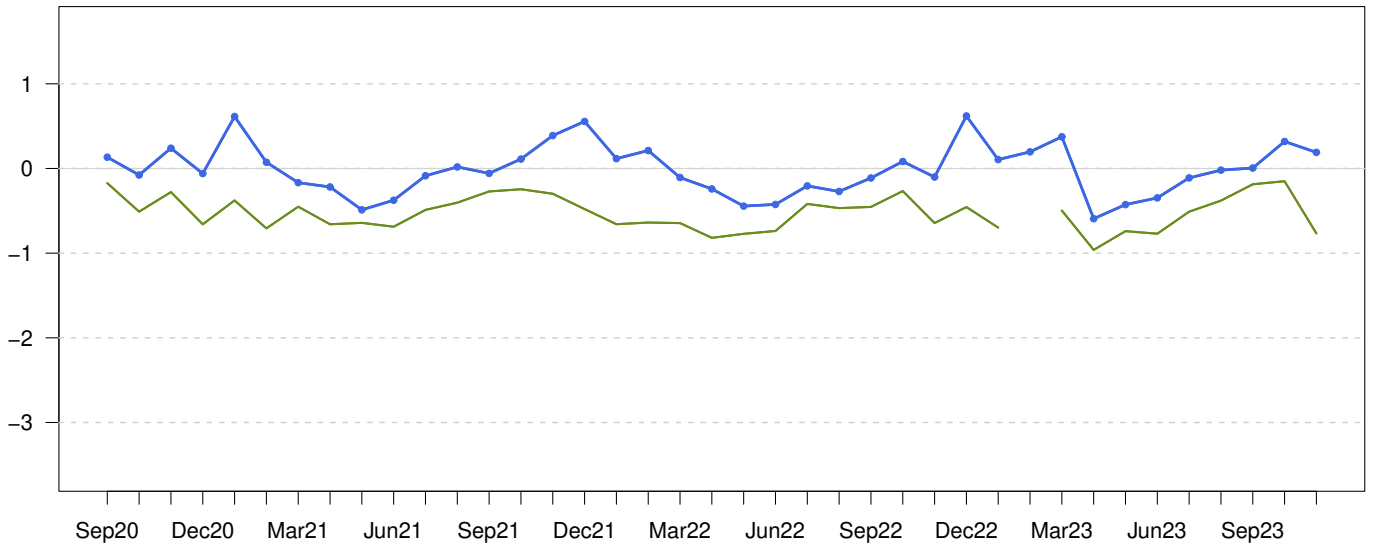
Mean Error

262 Norwegian stations

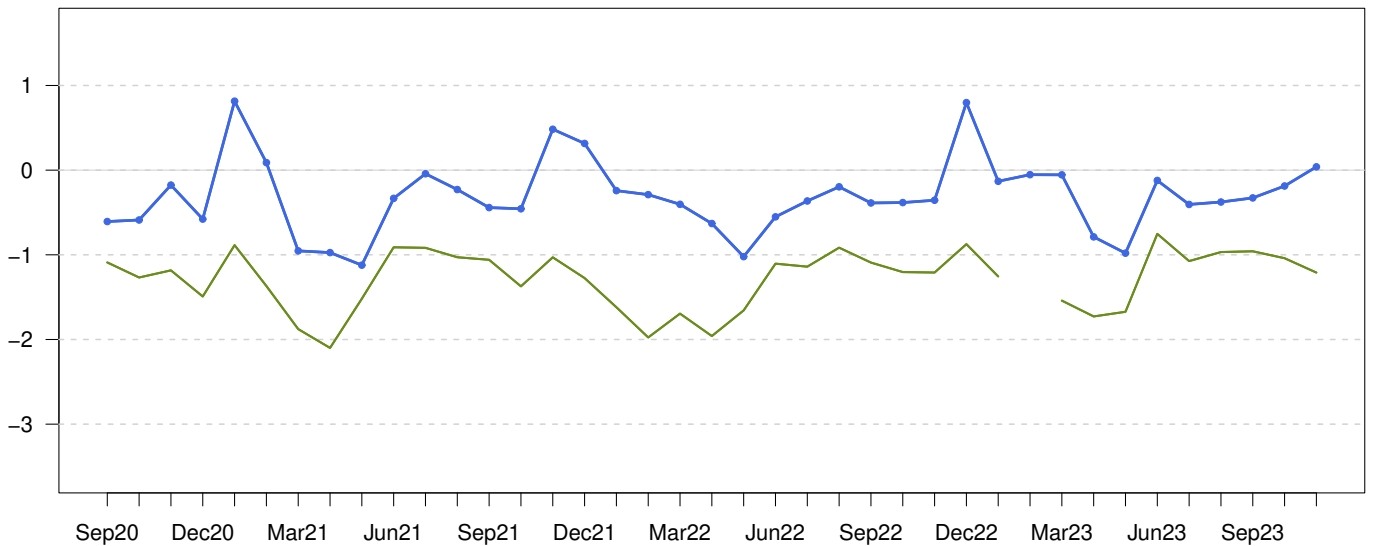
00+24,+30,+36,+42 UTC



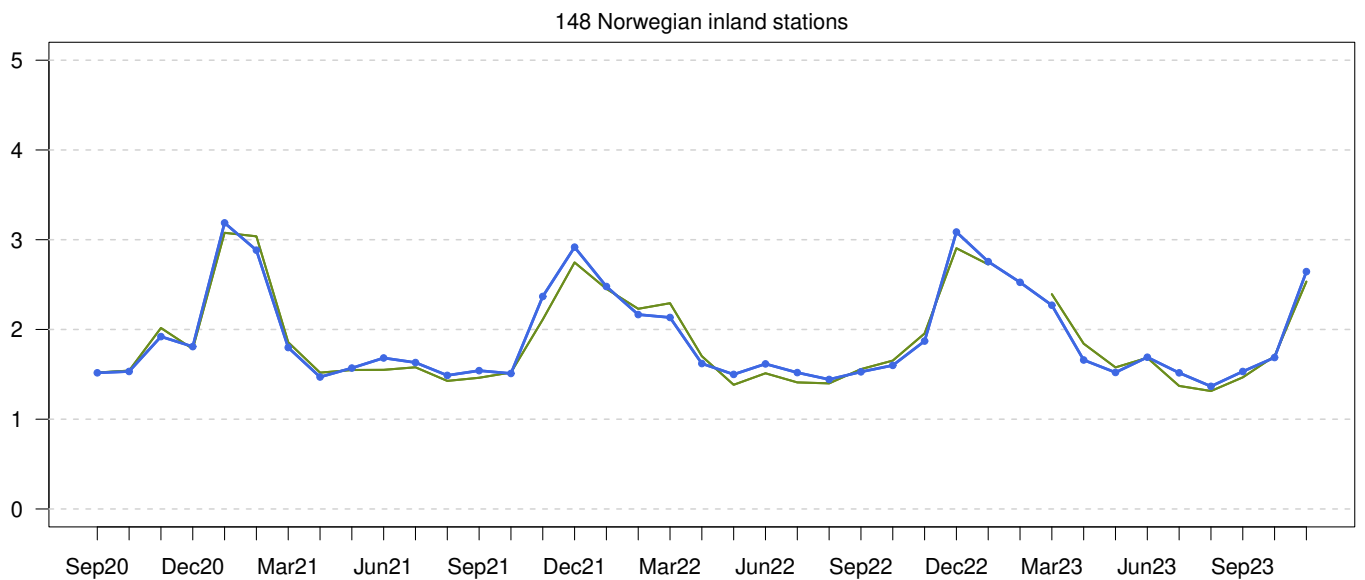
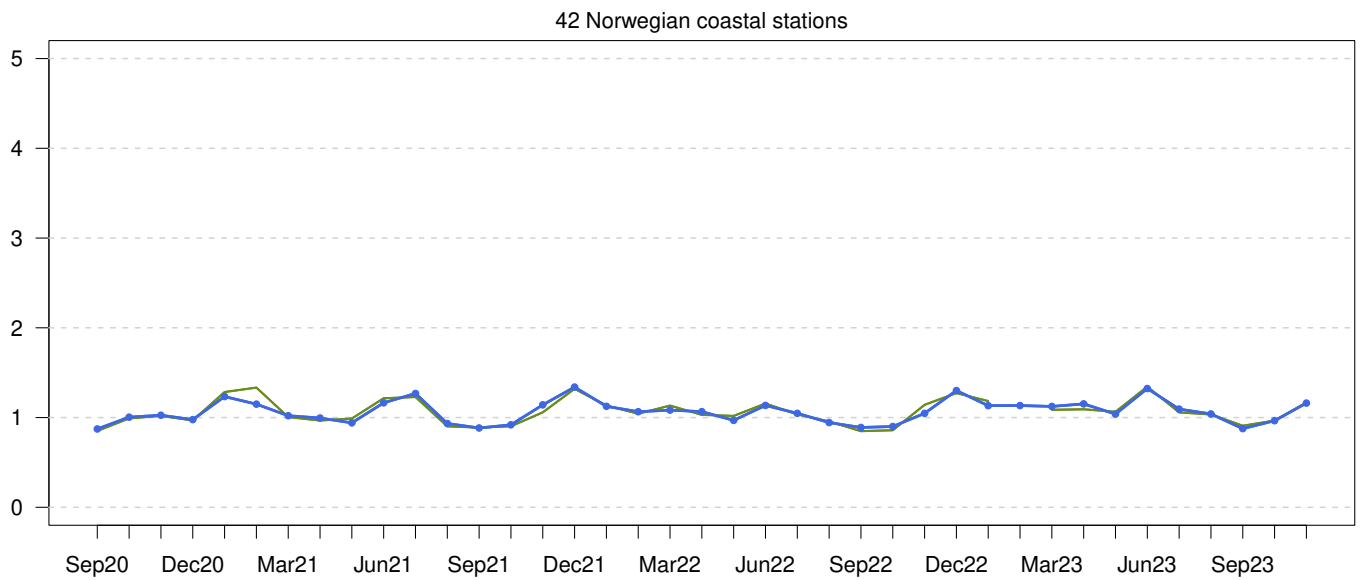
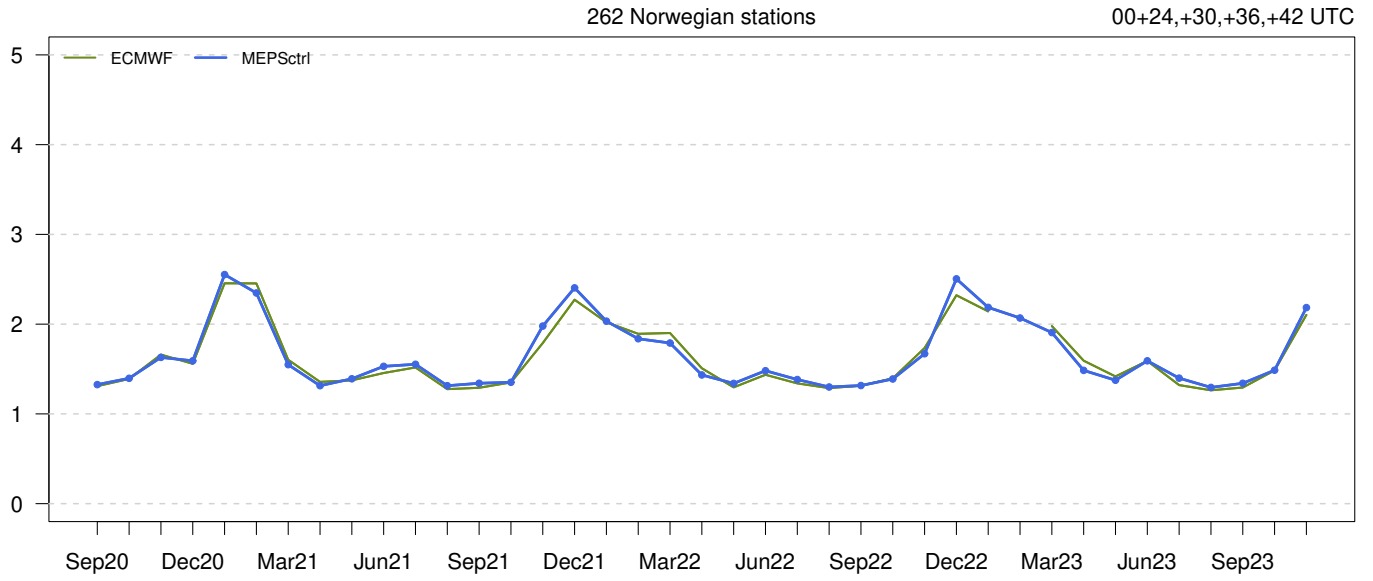
42 Norwegian coastal stations



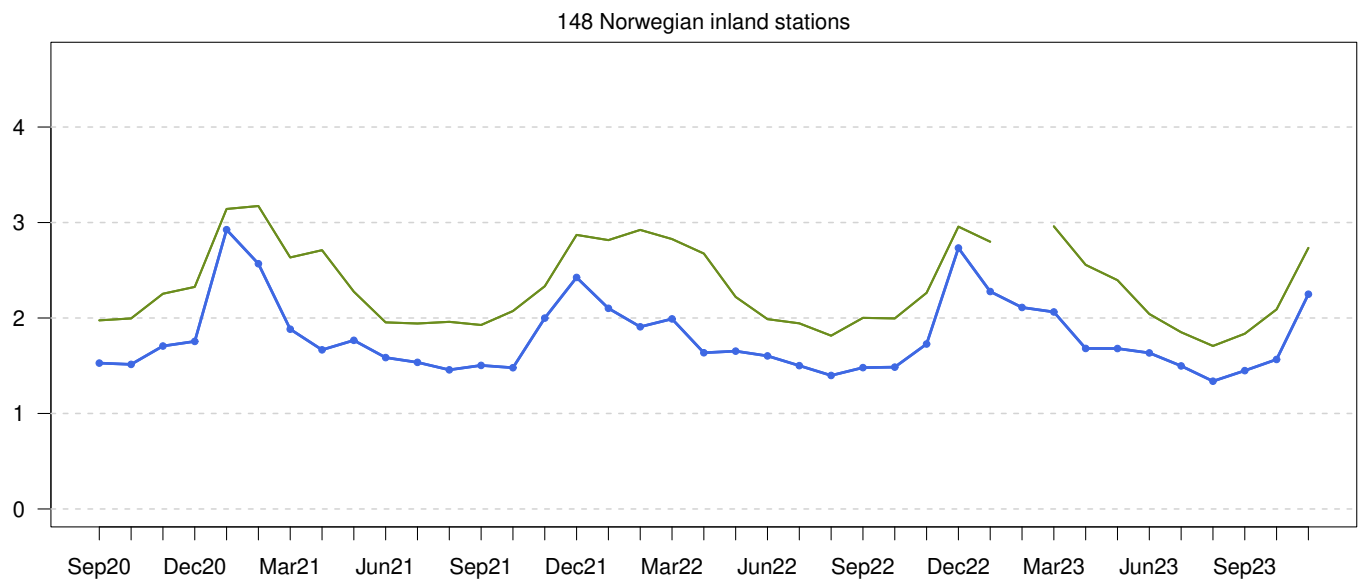
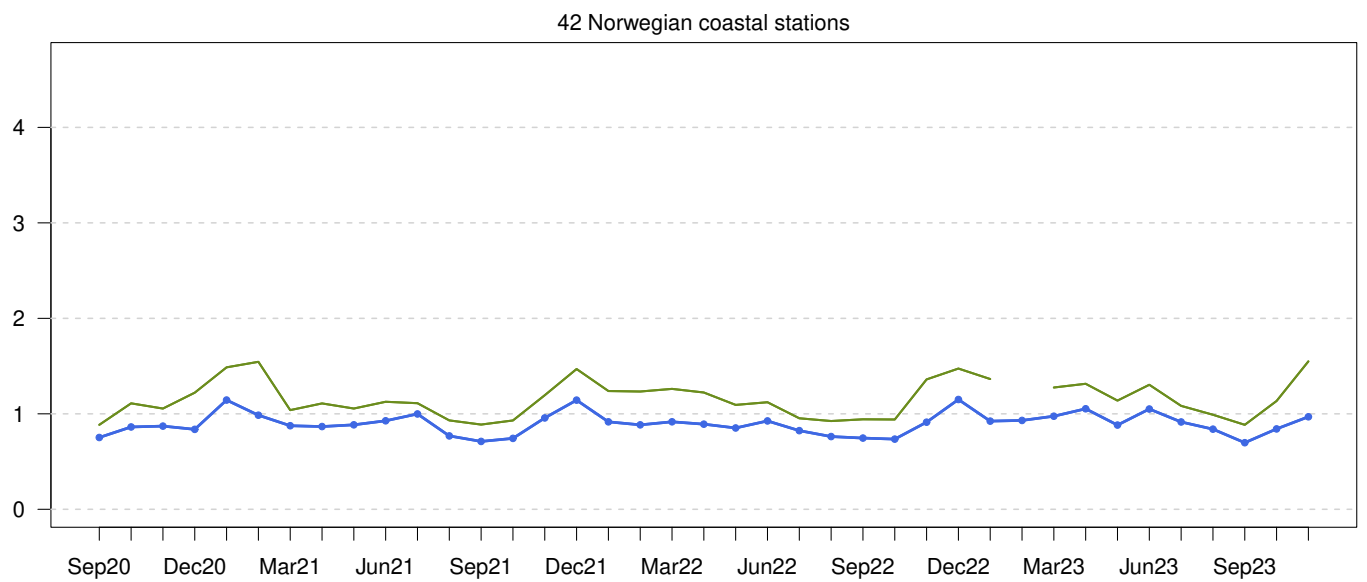
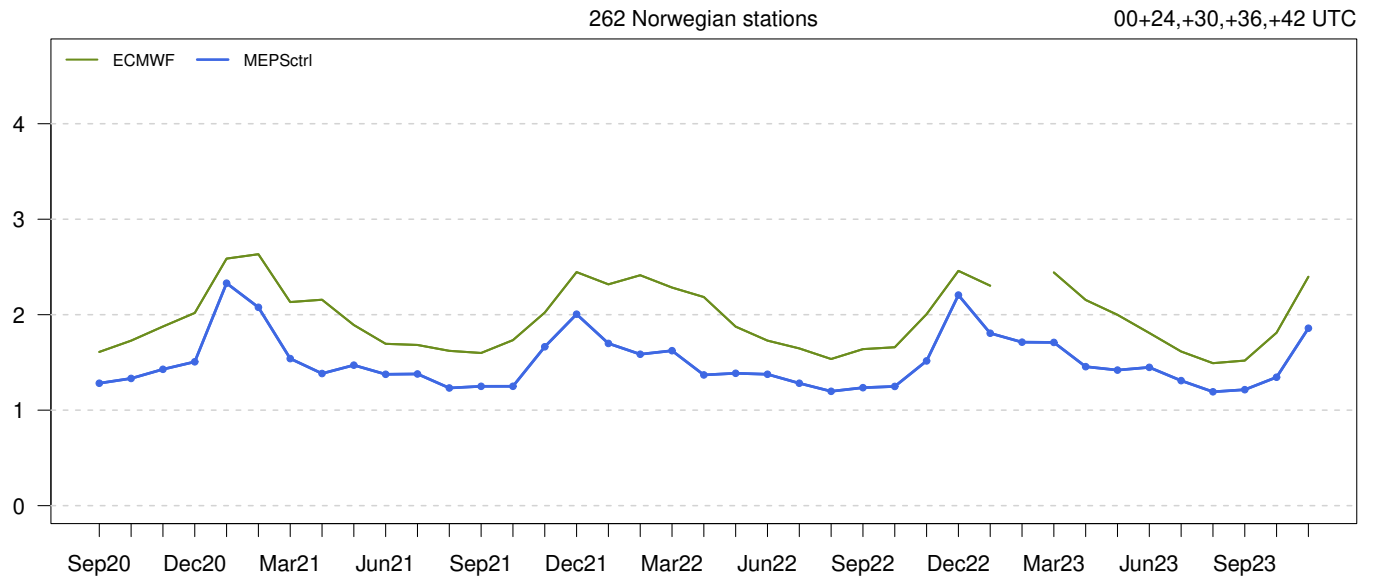
148 Norwegian inland stations



Standard Deviation of Error

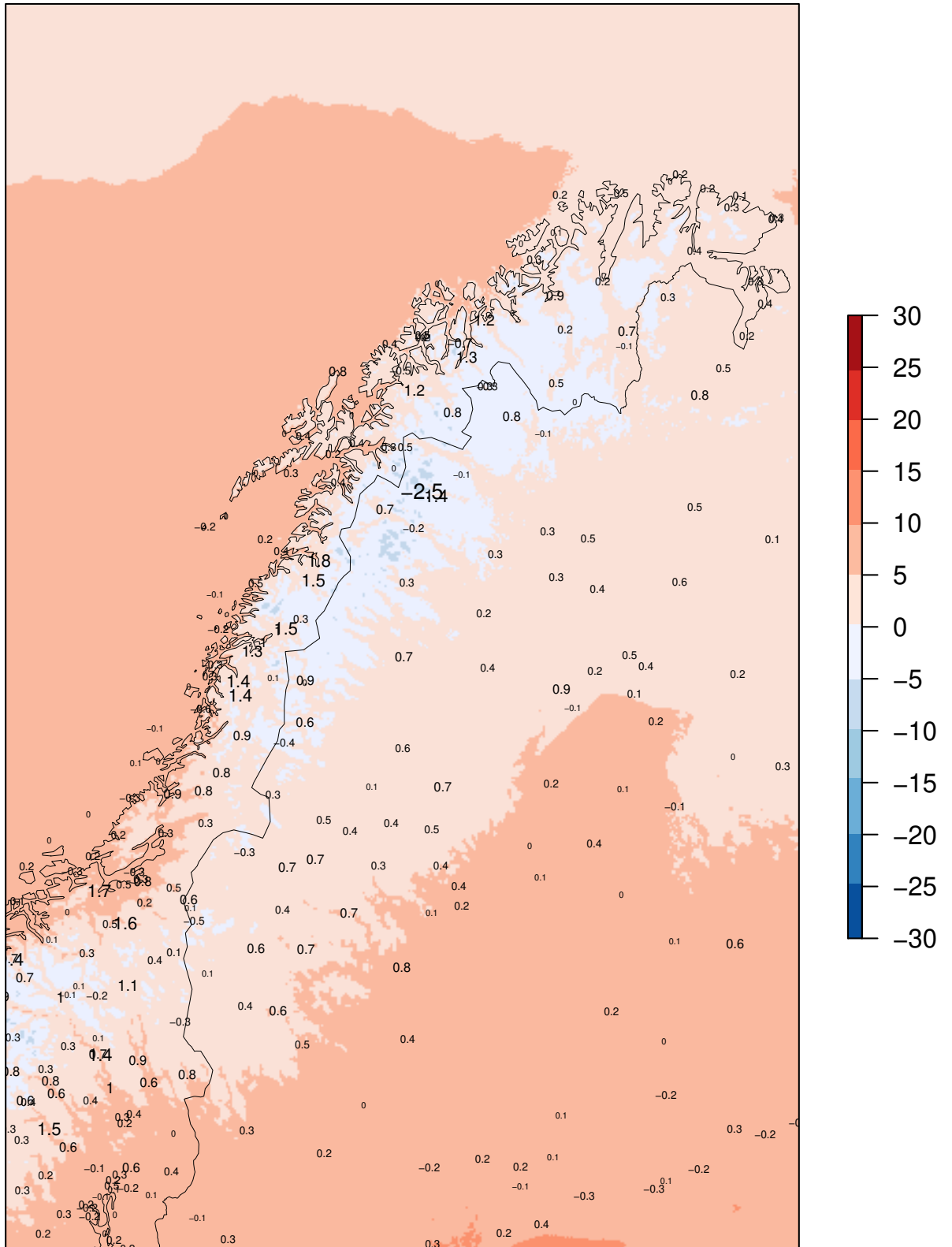


Mean Absolute Error



MEPSctrl 00+12

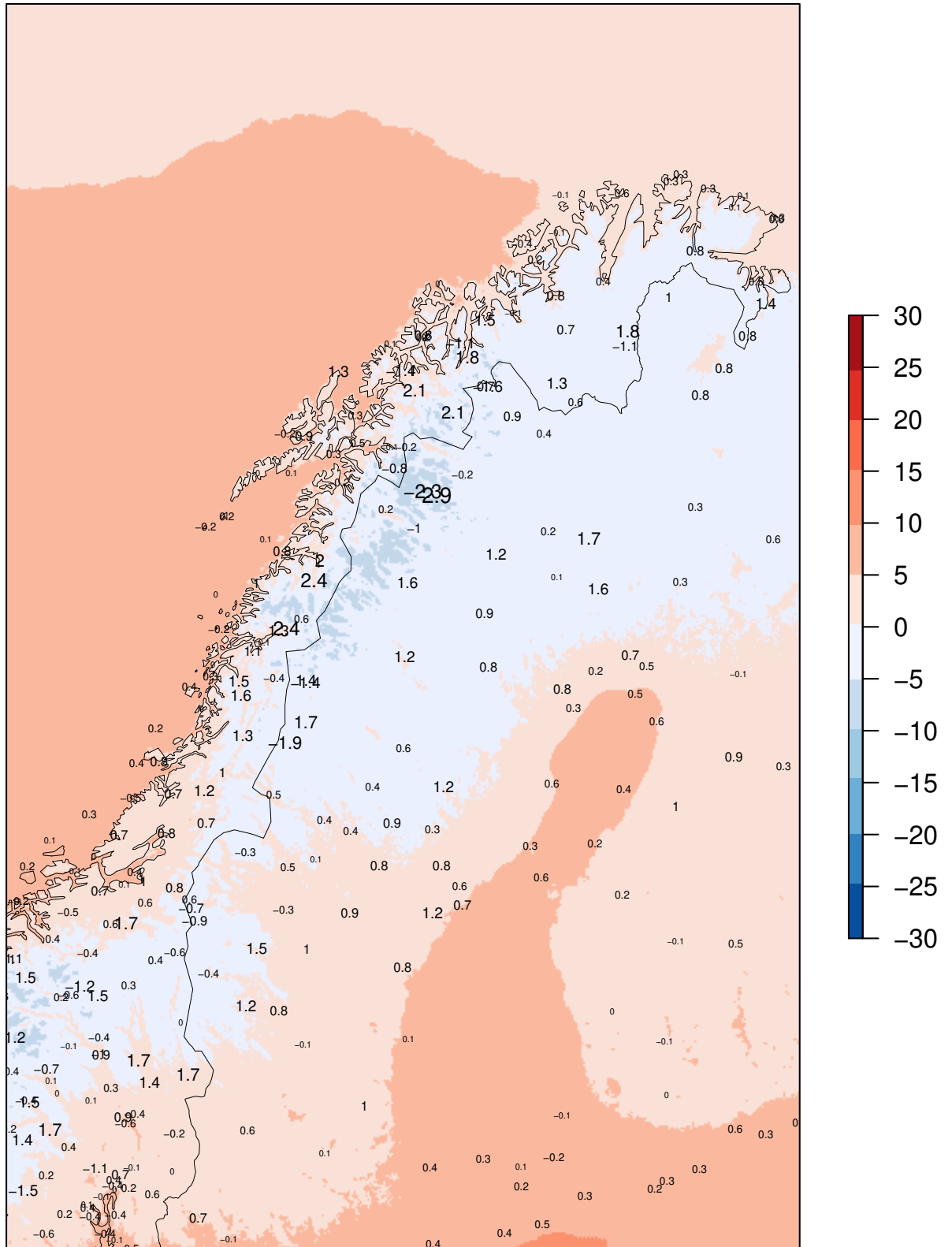
ME at observing sites
(numbers in black)



Model "climatology" 01.09.2023 – 30.11.2023

MEPSctrl 00+24

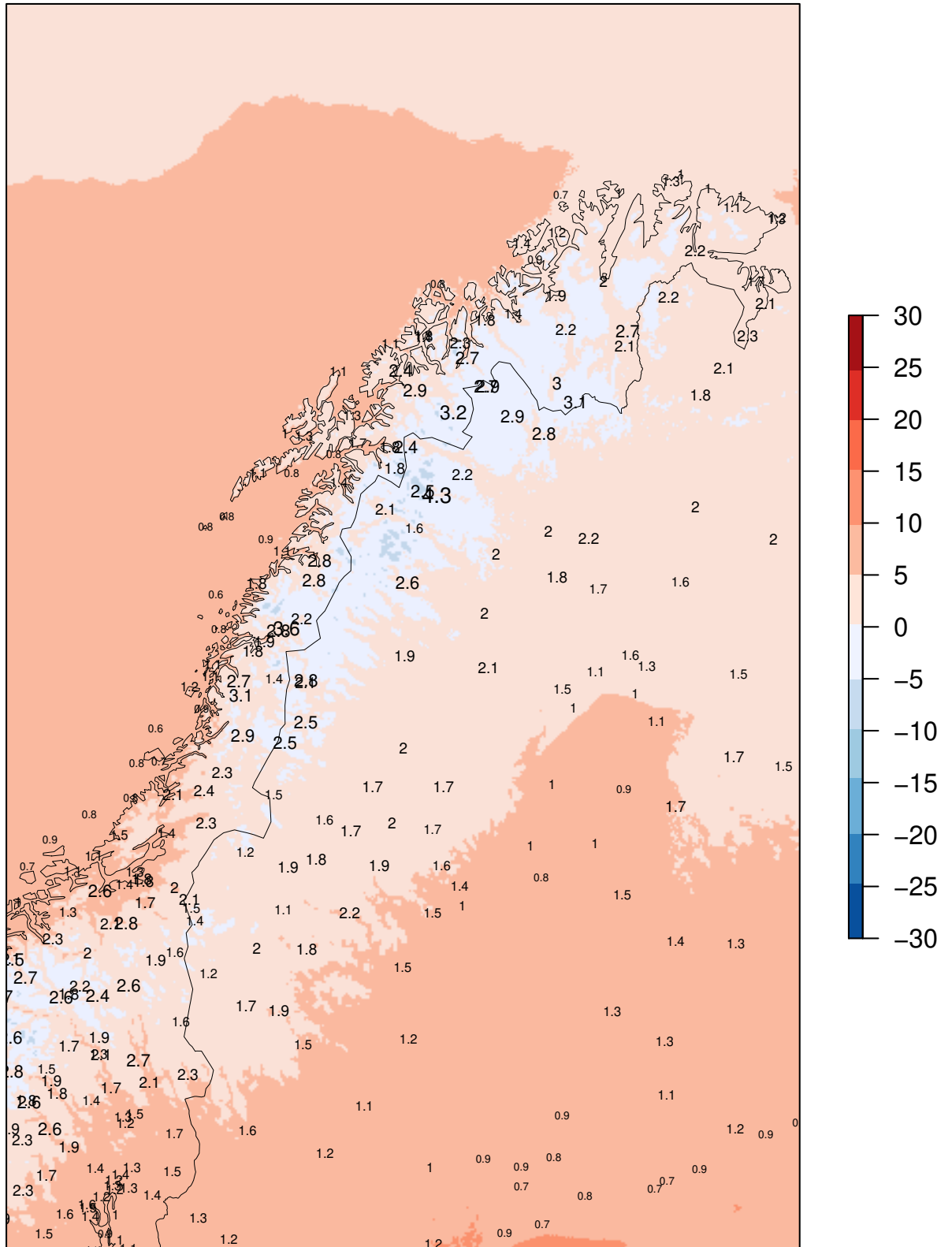
ME at observing sites
(numbers in black)



Model "climatology" 01.09.2023 – 30.11.2023

MEPSctrl 00+12

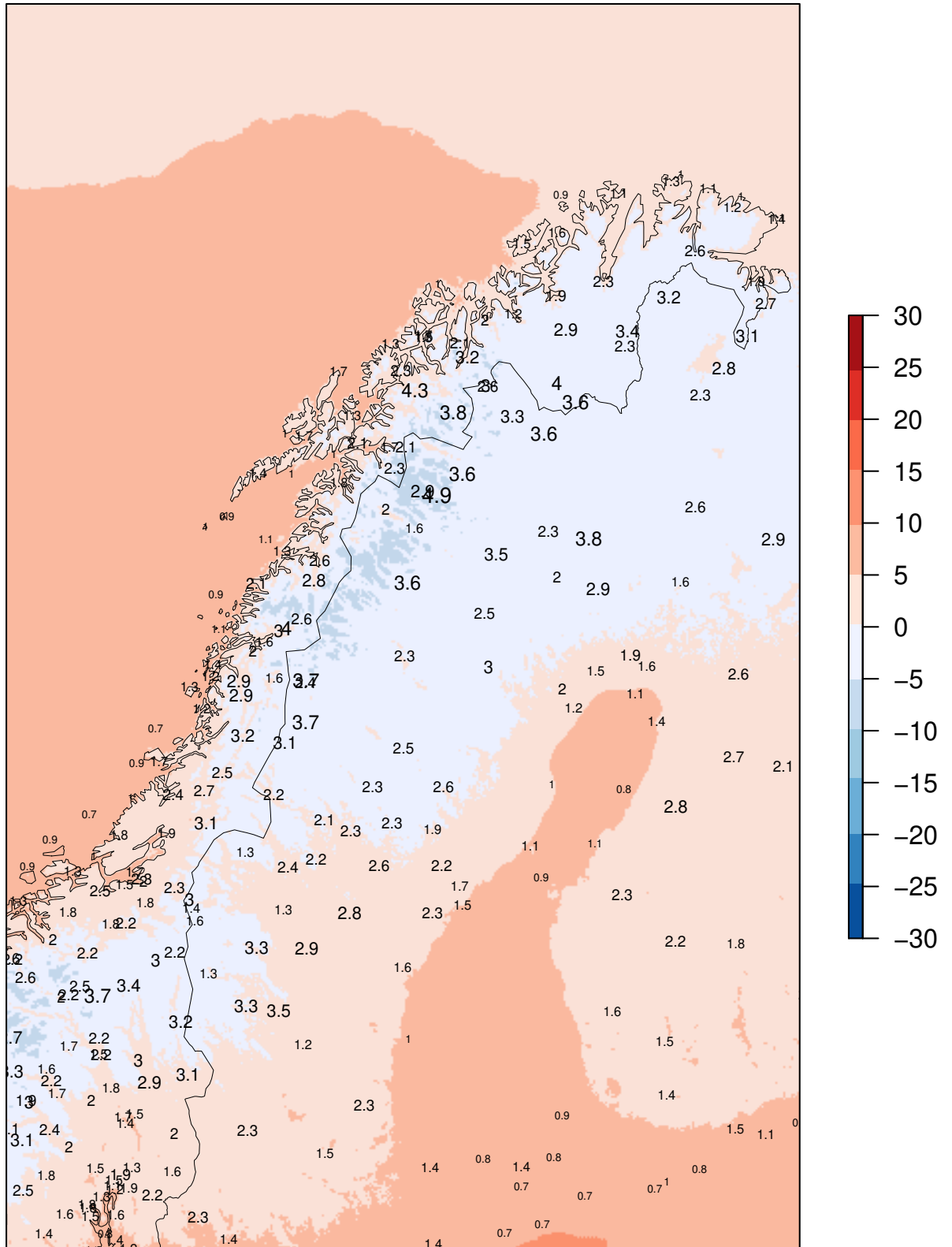
SDE at observing sites
(numbers in black)



Model "climatology" 01.09.2023 – 30.11.2023

MEPSctrl 00+24

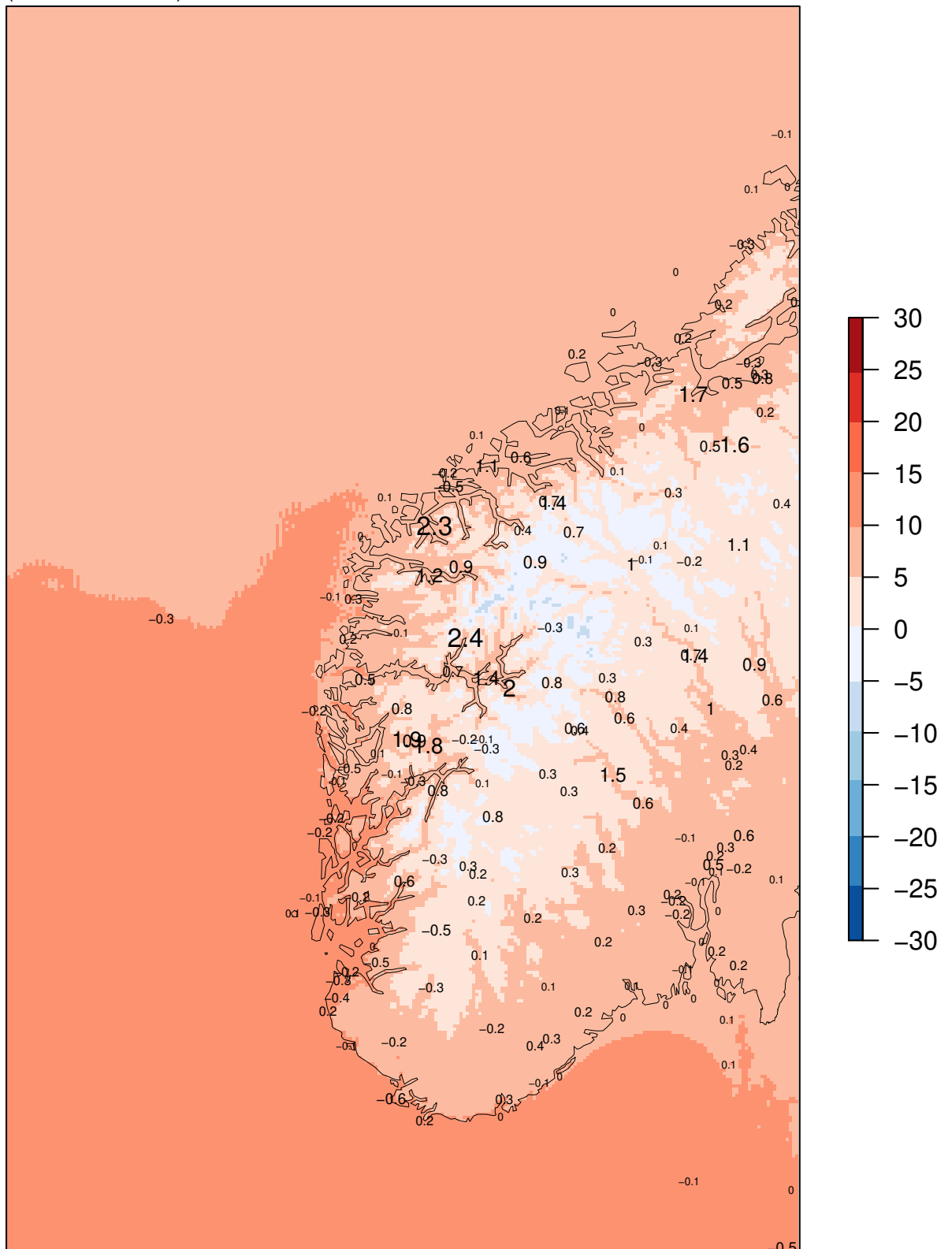
SDE at observing sites
(numbers in black)



Model "climatology" 01.09.2023 – 30.11.2023

MEPSctrl 00+12

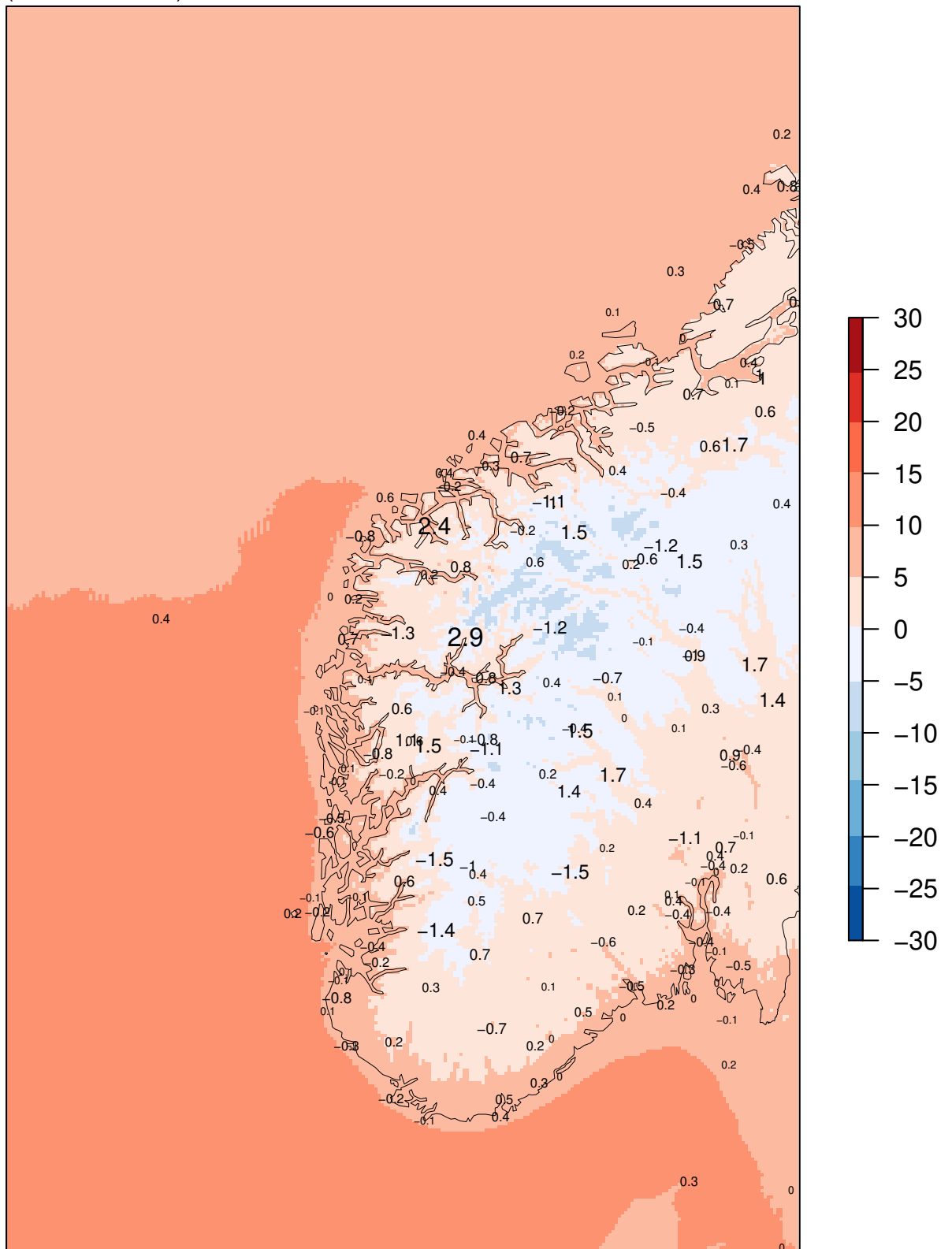
ME at observing sites
(numbers in black)



Model "climatology" 01.09.2023 – 30.11.2023

MEPSctrl 00+24

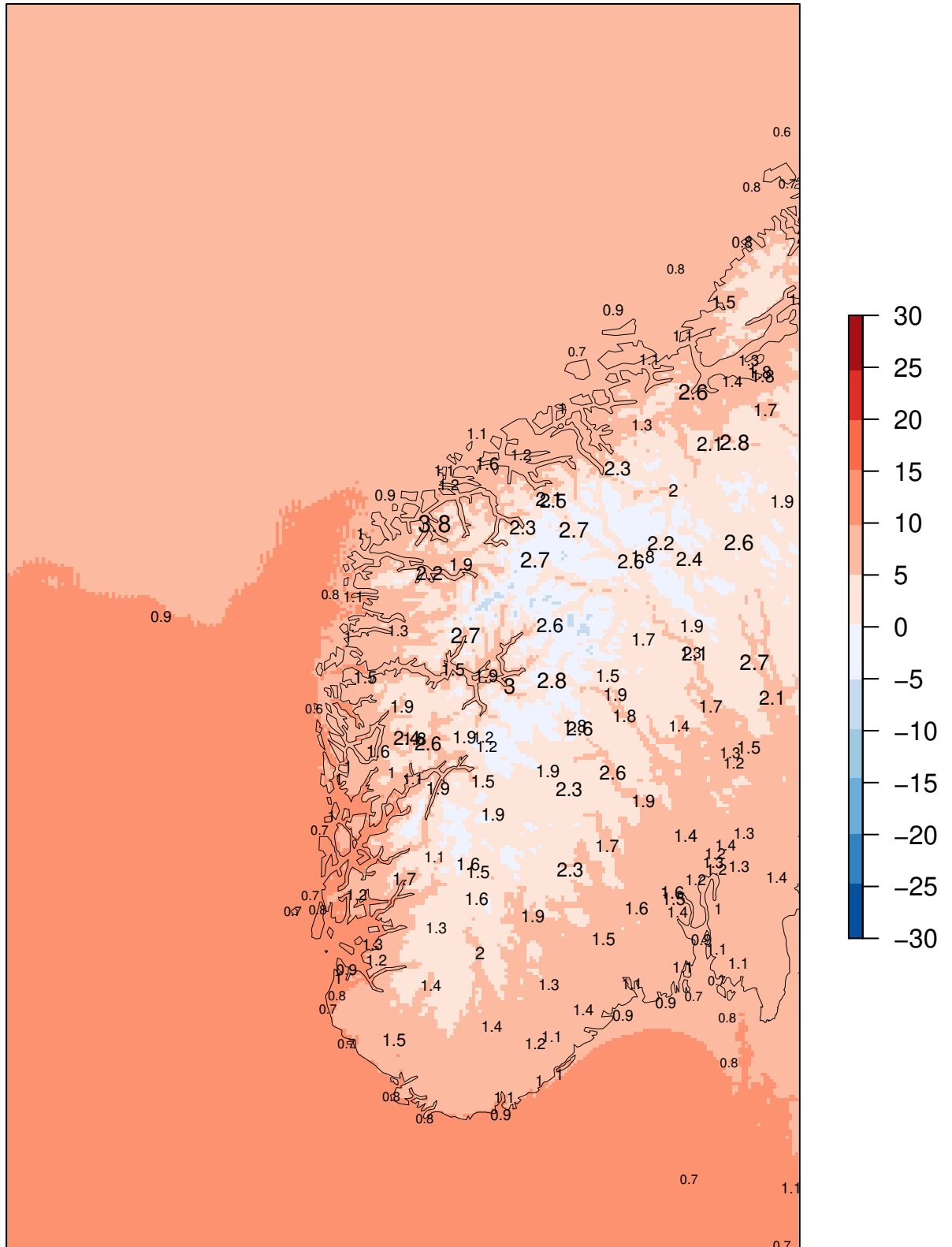
ME at observing sites
(numbers in black)



Model "climatology" 01.09.2023 – 30.11.2023

MEPSctrl 00+12

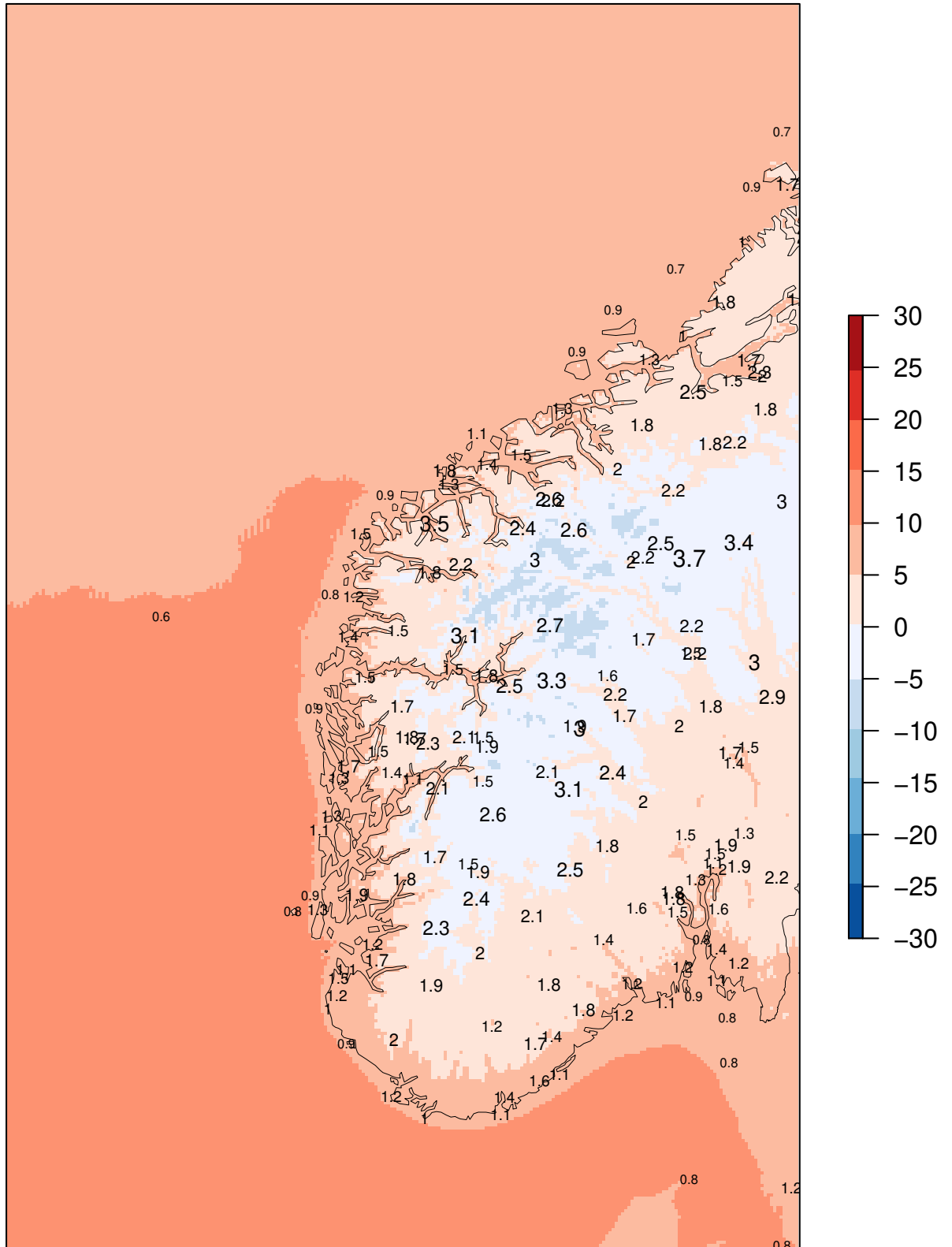
SDE at observing sites
(numbers in black)



Model "climatology" 01.09.2023 – 30.11.2023

MEPSctrl 00+24

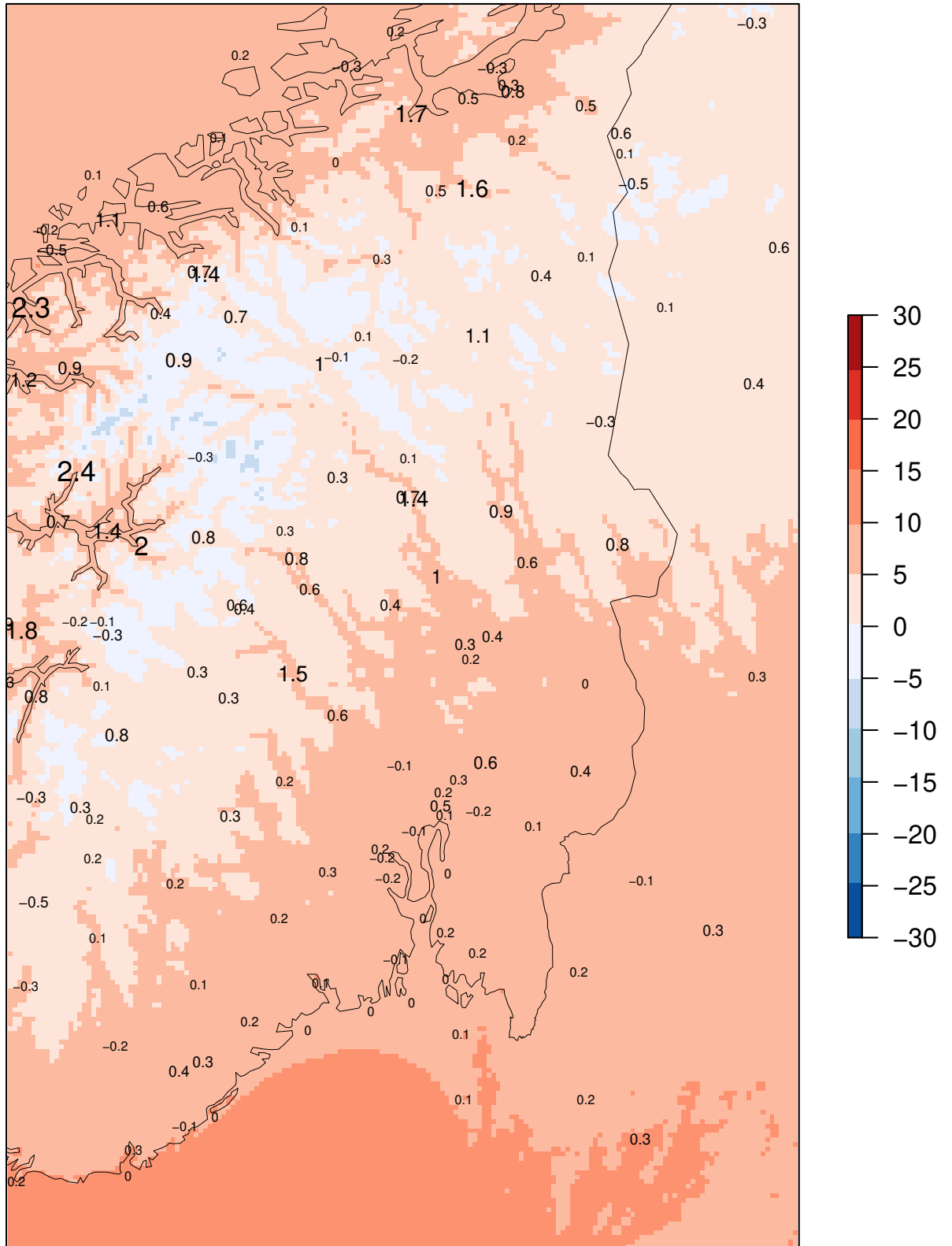
SDE at observing sites
(numbers in black)



Model "climatology" 01.09.2023 – 30.11.2023

MEPSctrl 00+12

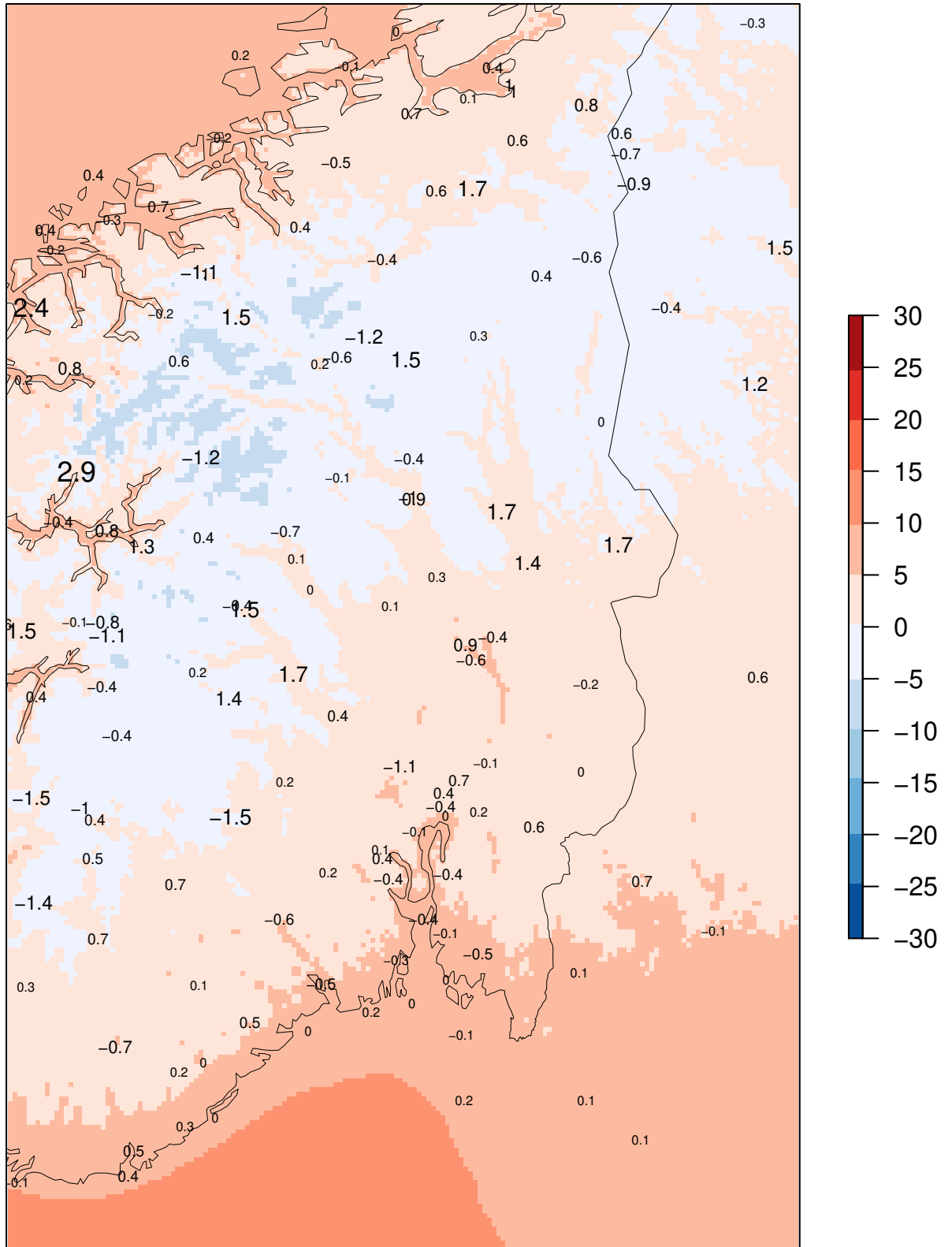
ME at observing sites
(numbers in black)



Model "climatology" 01.09.2023 – 30.11.2023

MEPSctrl 00+24

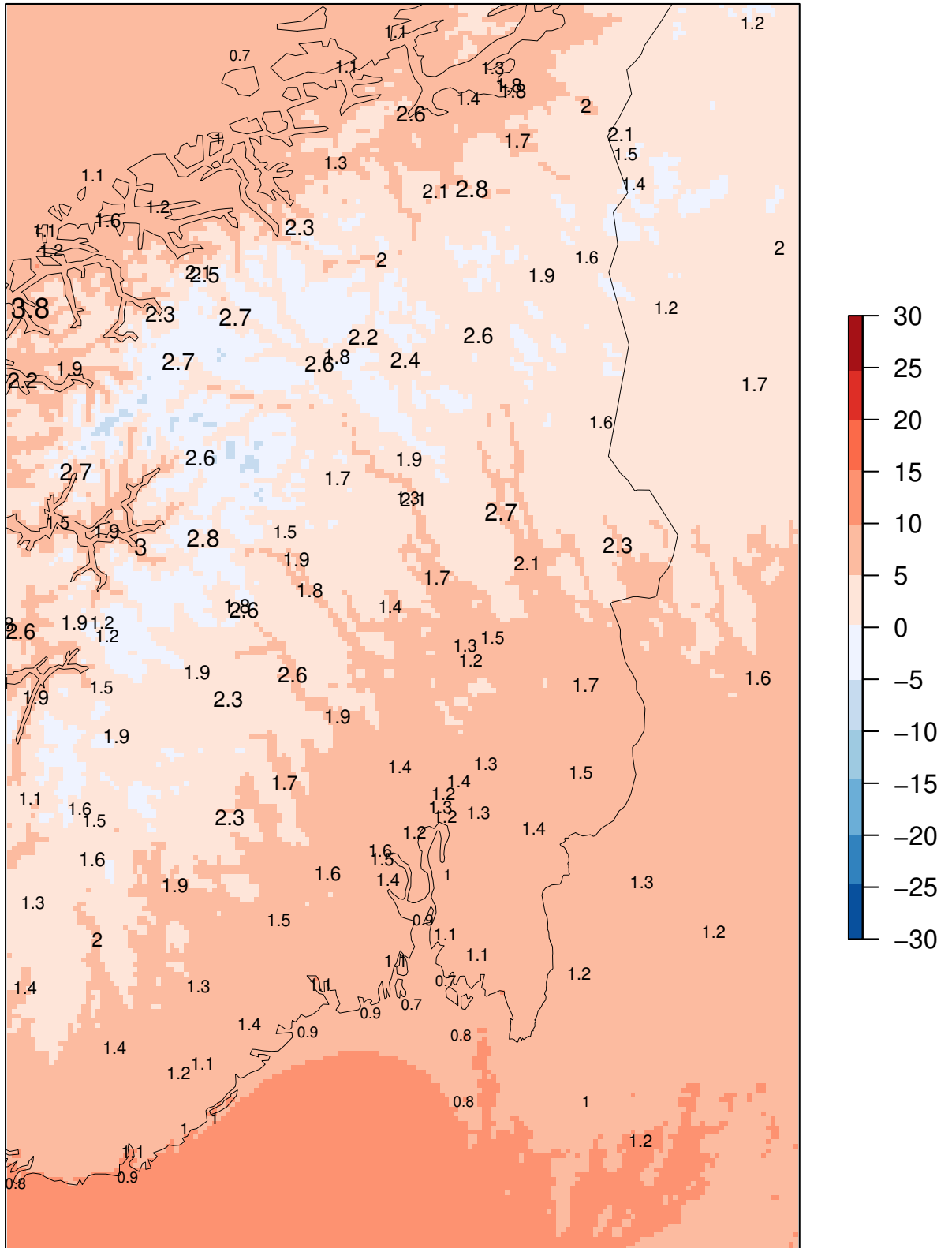
ME at observing sites
(numbers in black)



Model "climatology" 01.09.2023 – 30.11.2023

MEPSctrl 00+12

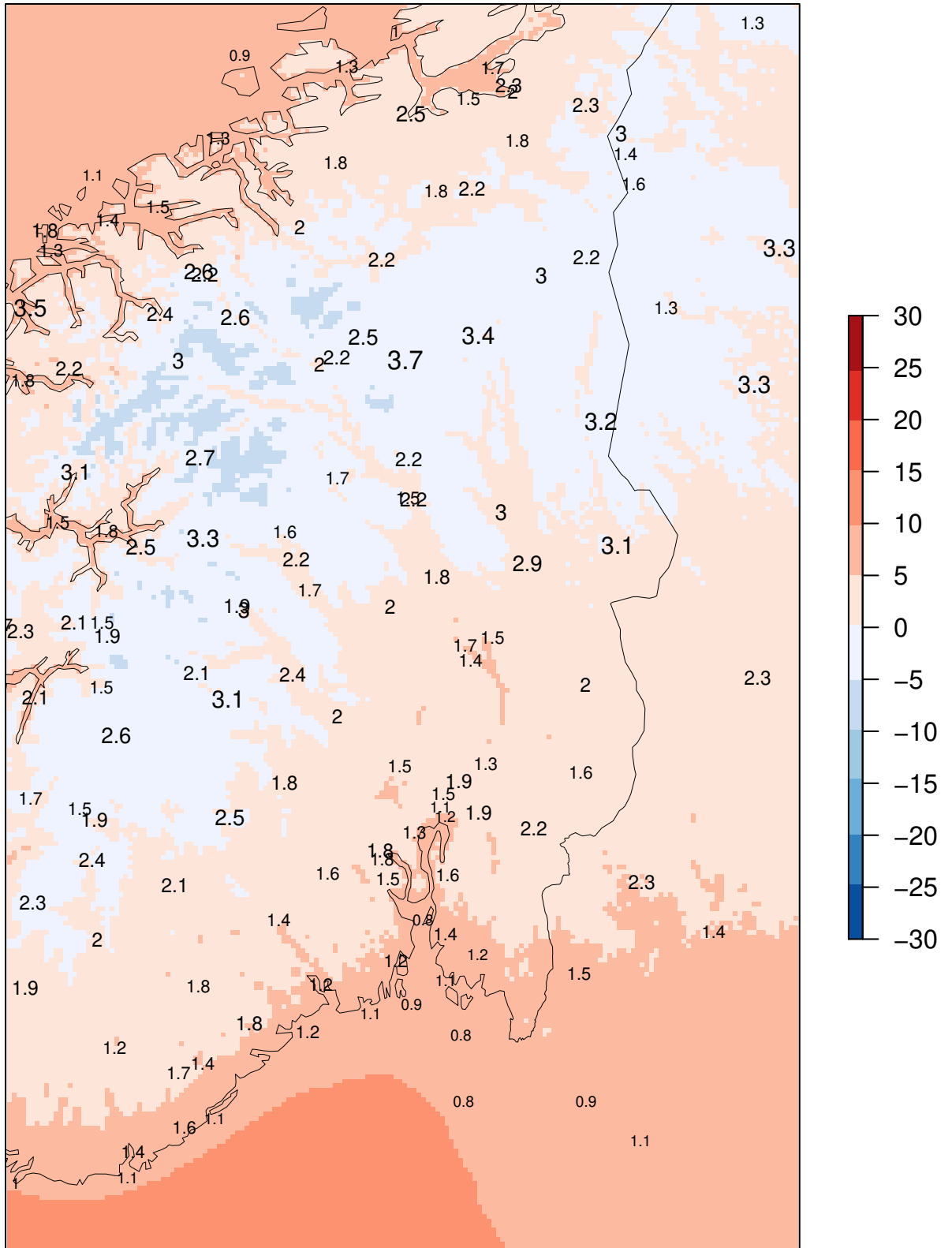
SDE at observing sites
(numbers in black)



Model "climatology" 01.09.2023 – 30.11.2023

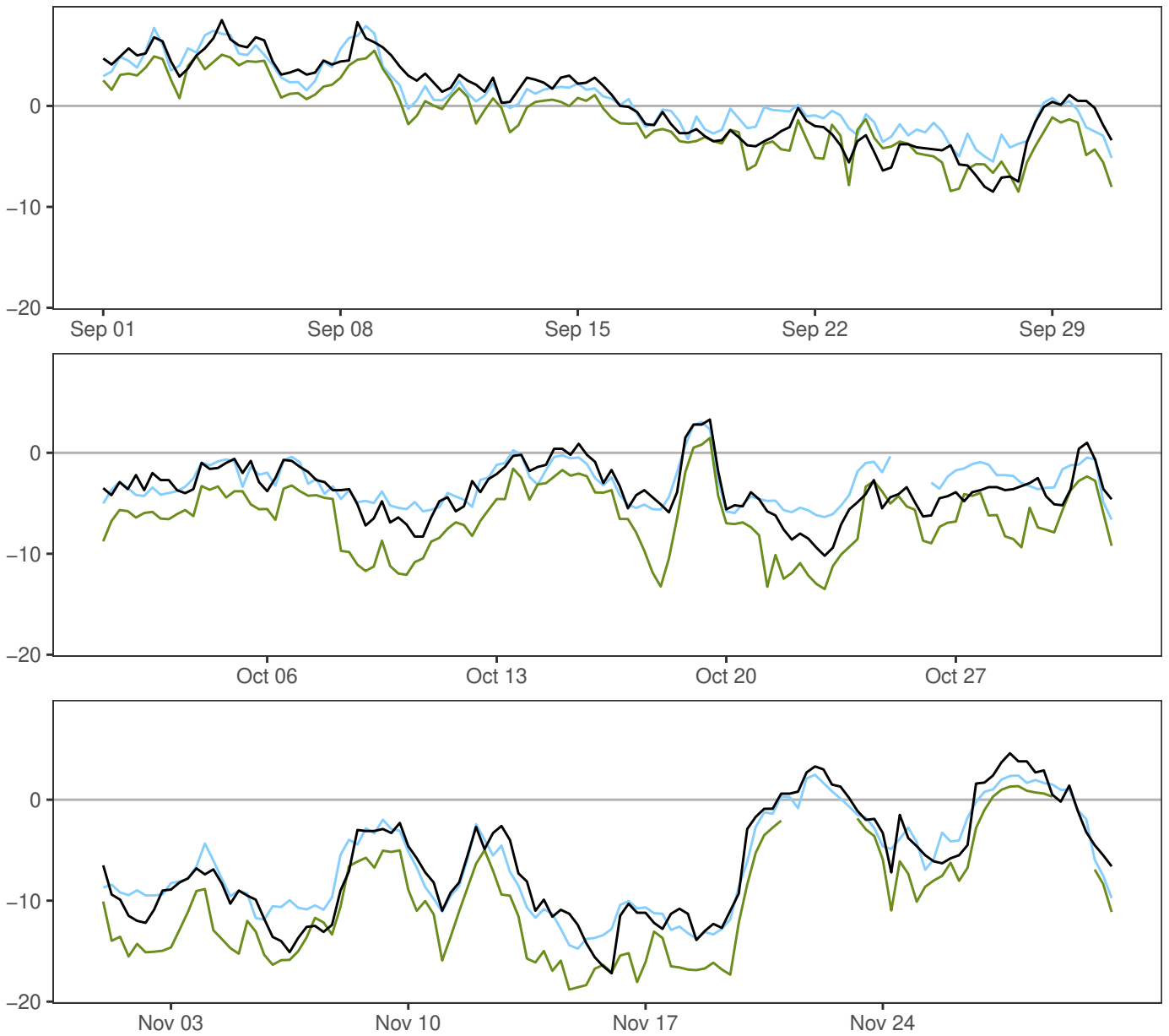
MEPSctrl 00+24

SDE at observing sites
(numbers in black)



Model "climatology" 01.09.2023 – 30.11.2023

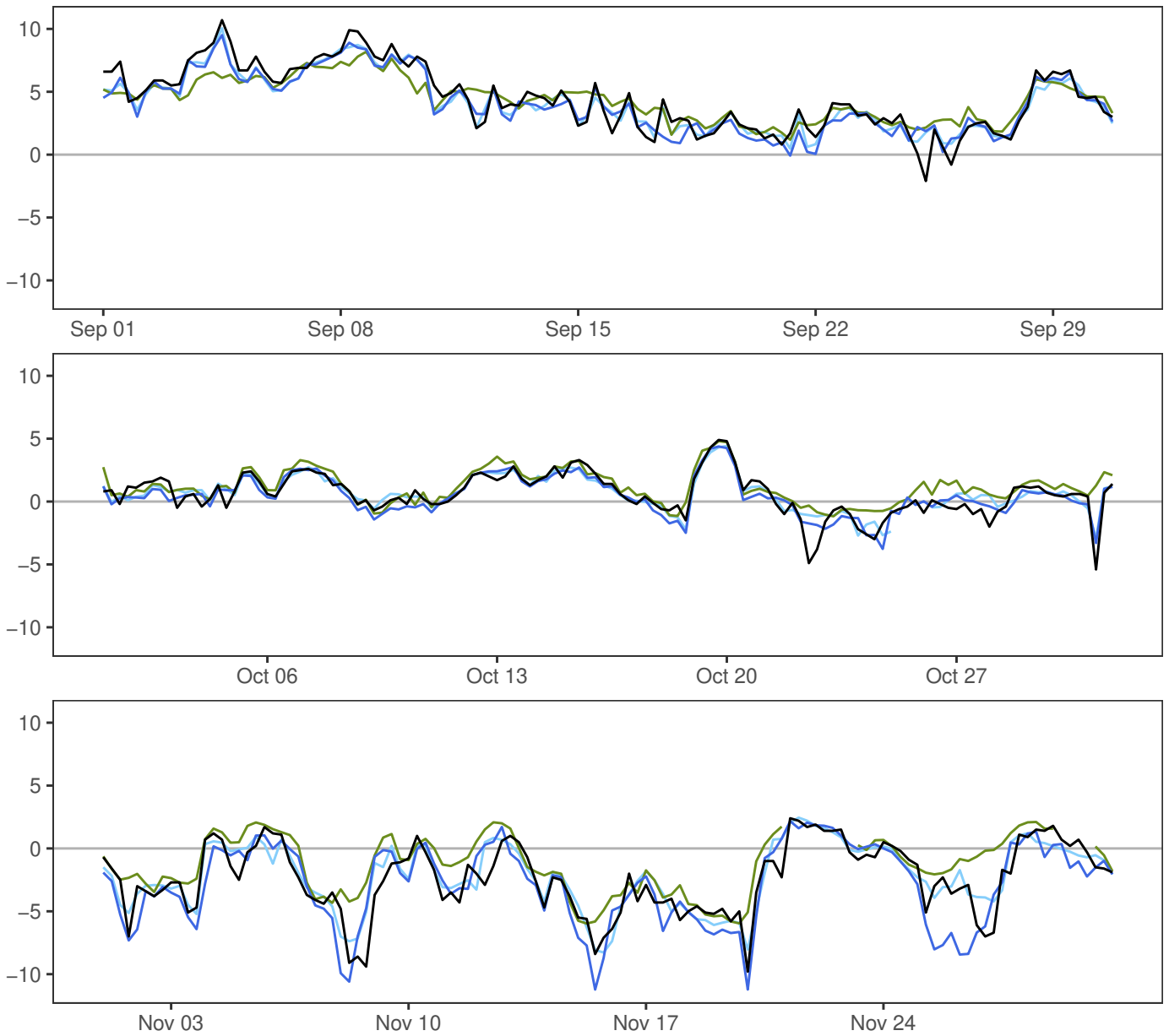
SVALBARD LUFTHAVN



	Min	Mean	Max	Std	N
— synop: 00,06,12,18	-17.2	-3.2	8.5	5.0	364
— AA25: 12+18,+24,+30,+36	-14.8	-2.9	7.9	4.6	360
— ECMWF: 12+18,+24,+30,+36	-18.8	-5.9	5.5	5.6	352

	ME	SDE	RMSE	MAE	Max.abs.err.	N
AA25–synop	0.3	1.6	1.7	1.3	5.1	348
ECMWF–synop	-2.6	1.8	3.1	2.7	8.1	348

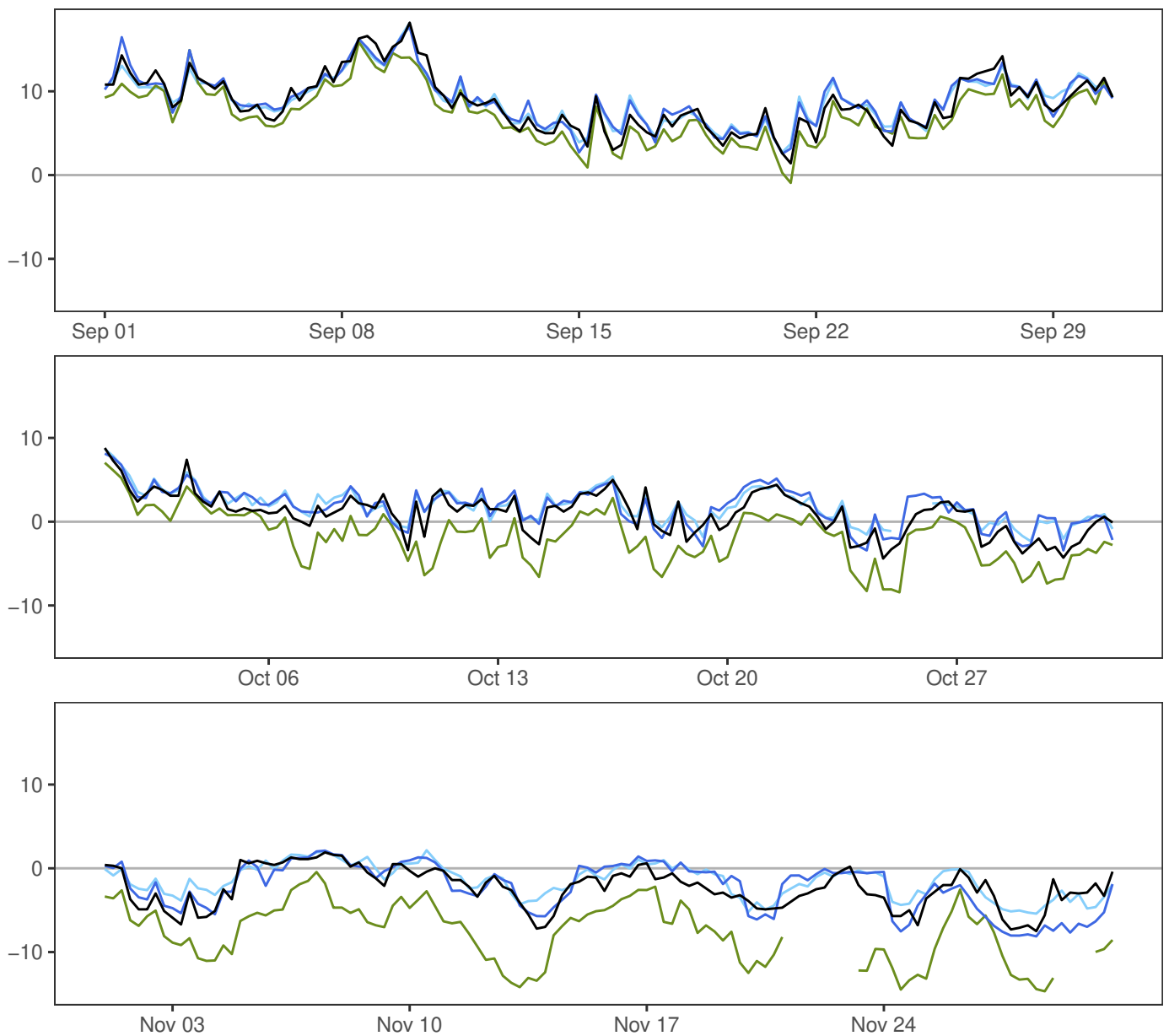
BJØRNØYA



	Min	Mean	Max	Std	N
— synop: 00,06,12,18	-9.8	0.9	10.7	3.6	364
— MEPSctrl: 12+18,+24,+30,+36	-11.2	0.6	9.5	3.7	364
— AA25: 12+18,+24,+30,+36	-8.3	0.9	10.1	3.3	360
— ECMWF: 12+18,+24,+30,+36	-6.0	1.5	8.2	2.9	352

	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl-synop	-0.3	1.2	1.3	0.9	5.5	348
AA25-synop	0.0	1.0	1.0	0.7	4.3	348
ECMWF-synop	0.6	1.5	1.6	1.1	6.8	348

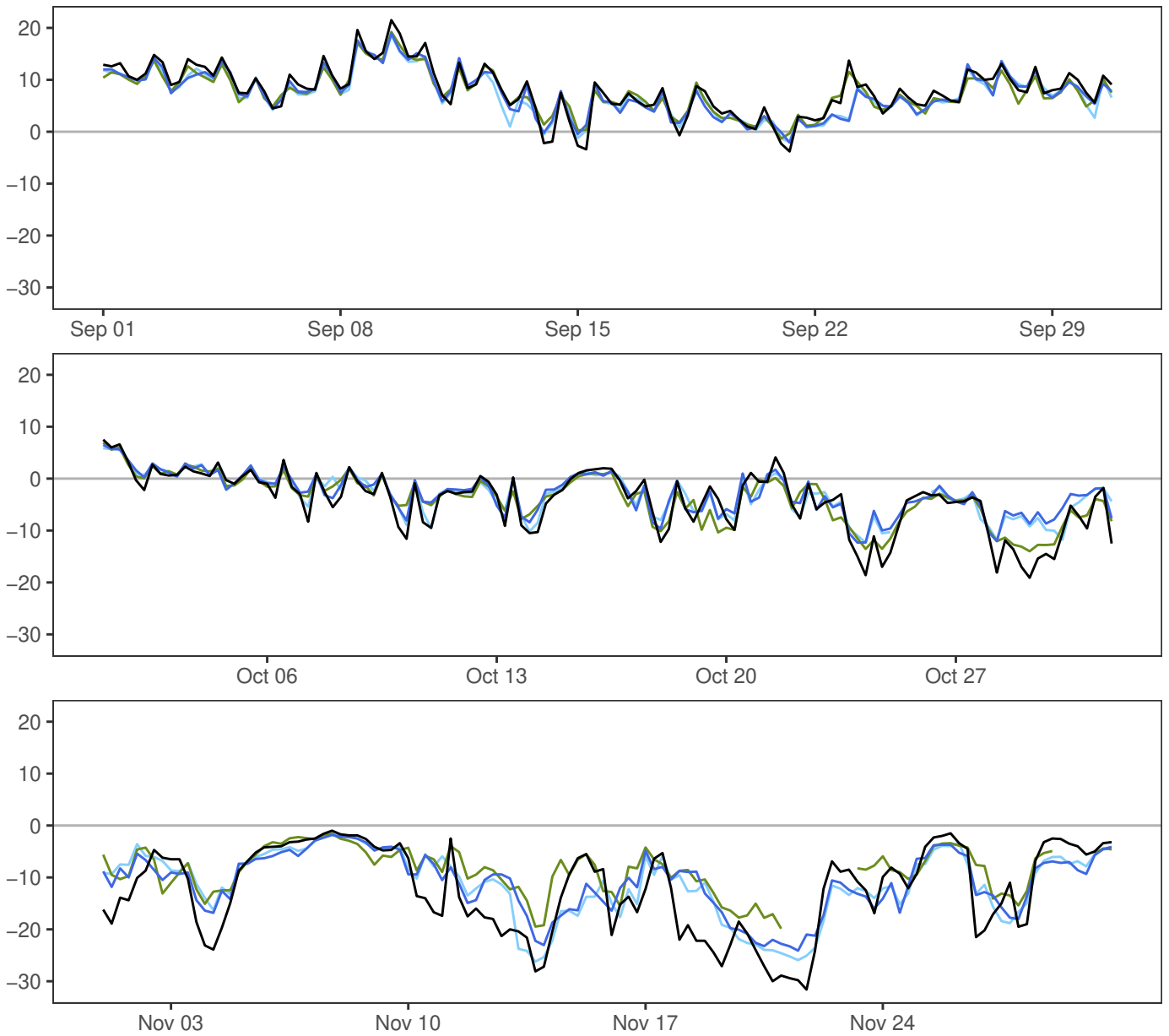
TROMSØ



	Min	Mean	Max	Std	N
— synop: 00,06,12,18	-7.5	2.4	18.2	5.4	364
— MEPSctrl: 12+18,+24,+30,+36	-8.1	2.8	17.7	5.4	364
— AA25: 12+18,+24,+30,+36	-5.4	3.1	18.2	5.0	360
— ECMWF: 12+18,+24,+30,+36	-14.7	-0.5	15.9	7.0	352

	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl-synop	0.4	1.3	1.4	1.1	6.2	348
AA25-synop	0.7	1.2	1.4	1.1	4.1	348
ECMWF-synop	-3.1	2.3	3.8	3.1	11.8	348

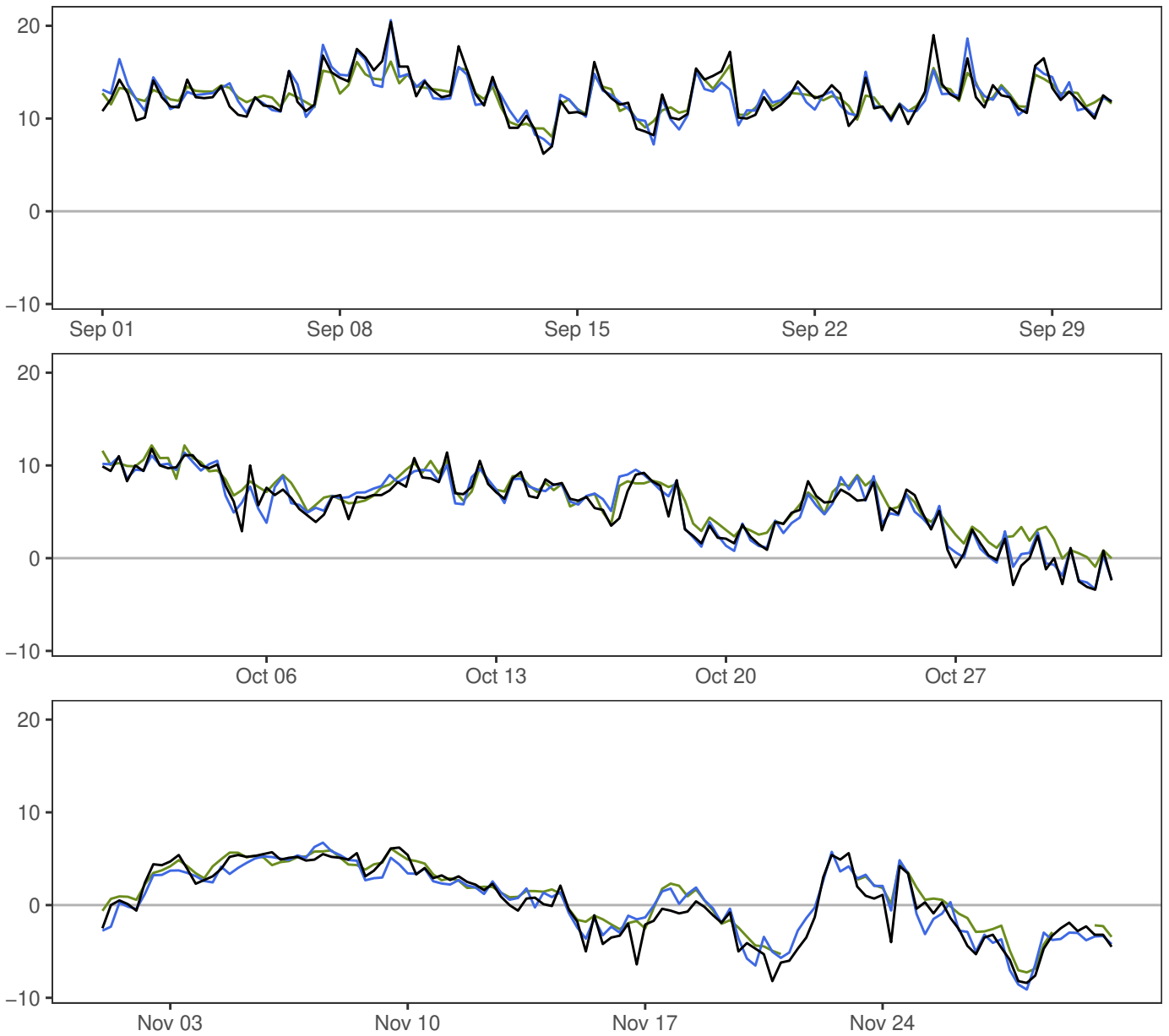
KAUTOKEINO



	Min	Mean	Max	Std	N
— synop: 00,06,12,18	-31.6	-2.9	21.5	10.6	364
— MEPSctrl: 12+18,+24,+30,+36	-24.1	-2.2	19.0	8.9	364
— AA25: 12+18,+24,+30,+36	-26.2	-2.4	18.6	9.1	360
— ECMWF: 12+18,+24,+30,+36	-19.9	-1.4	19.2	8.0	352

	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl-synop	0.7	3.5	3.5	2.4	13.3	348
AA25-synop	0.5	3.4	3.4	2.3	12.4	348
ECMWF-synop	1.1	3.7	3.8	2.5	13.9	348

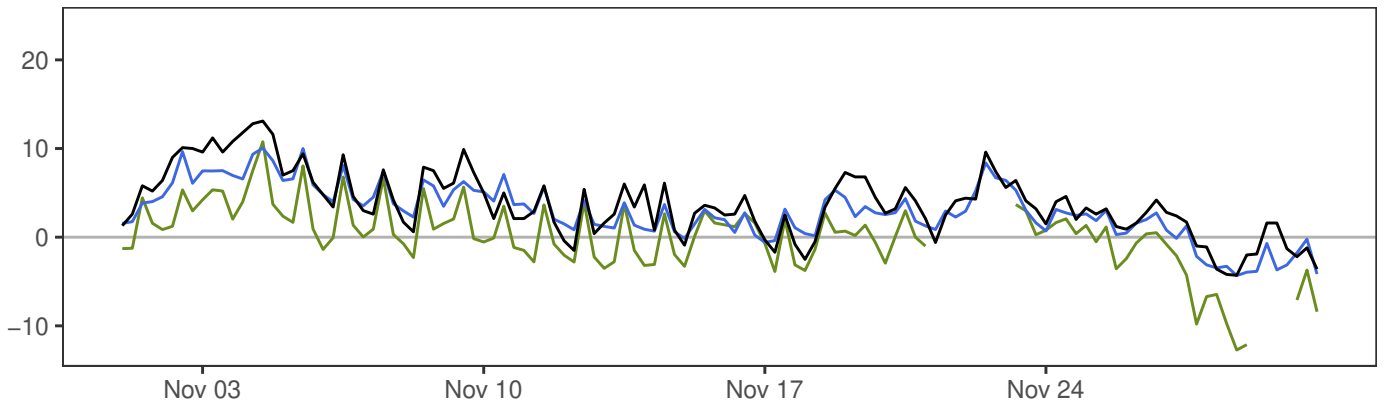
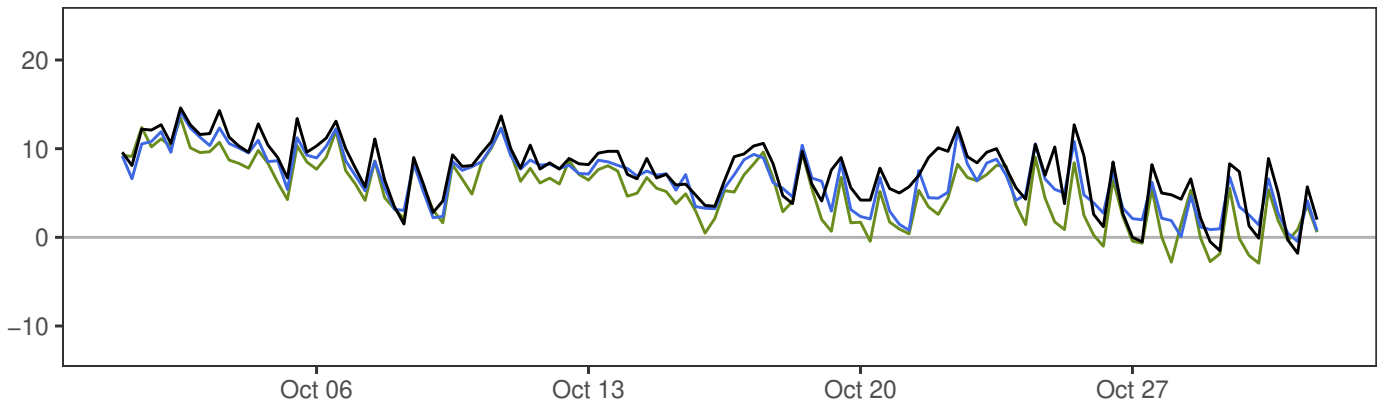
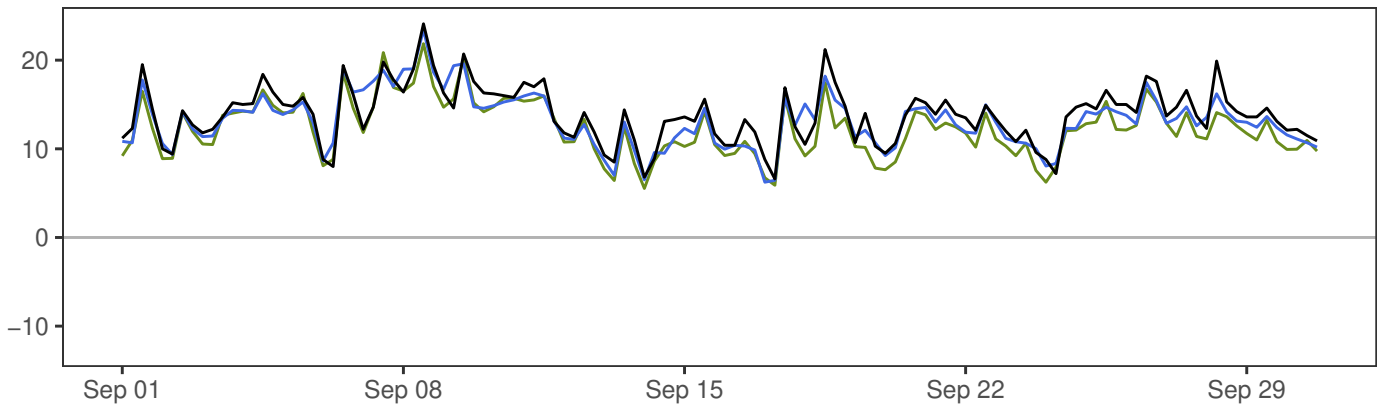
ØRLAND III



	Min	Mean	Max	Std	N
— synop: 00,06,12,18	-8.4	6.1	20.4	6.0	364
— MEPSctrl: 12+18,+24,+30,+36	-9.1	6.2	20.6	5.8	364
— ECMWF: 12+18,+24,+30,+36	-7.3	6.8	16.1	5.3	352

	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl-synop	0.1	1.1	1.1	0.8	4.9	352
ECMWF-synop	0.5	1.3	1.4	1.0	5.3	352

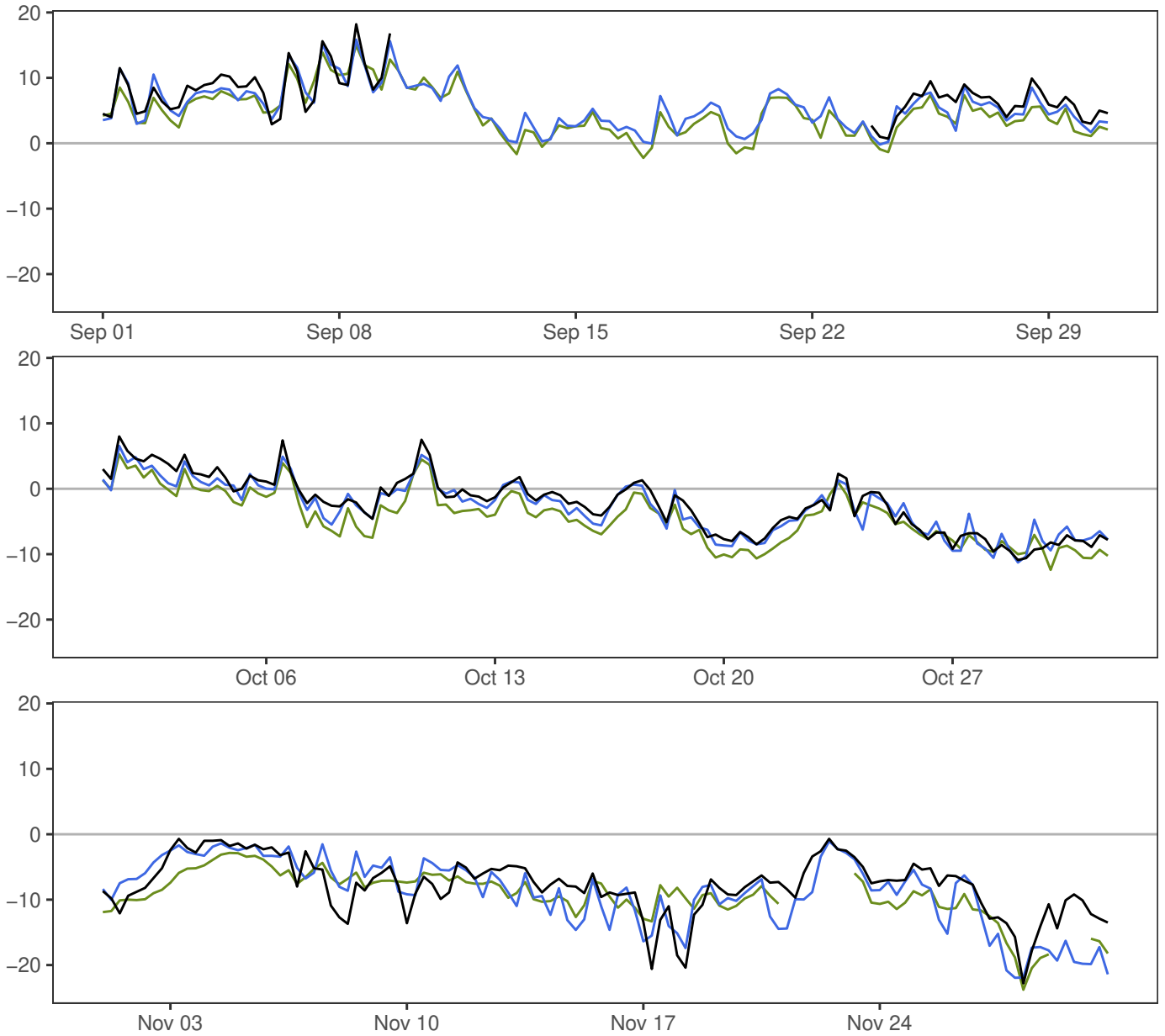
BERGEN – FLORIDA



	Min	Mean	Max	Std	N
— synop: 00,06,12,18	-4.3	8.4	24.1	5.4	364
— MEPSctrl: 12+18,+24,+30,+36	-4.3	7.5	23.4	5.3	364
— ECMWF: 12+18,+24,+30,+36	-12.7	6.1	21.9	6.1	352

	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl-synop	-0.8	1.5	1.7	1.3	5.7	352
ECMWF-synop	-2.5	1.9	3.1	2.5	10.1	352

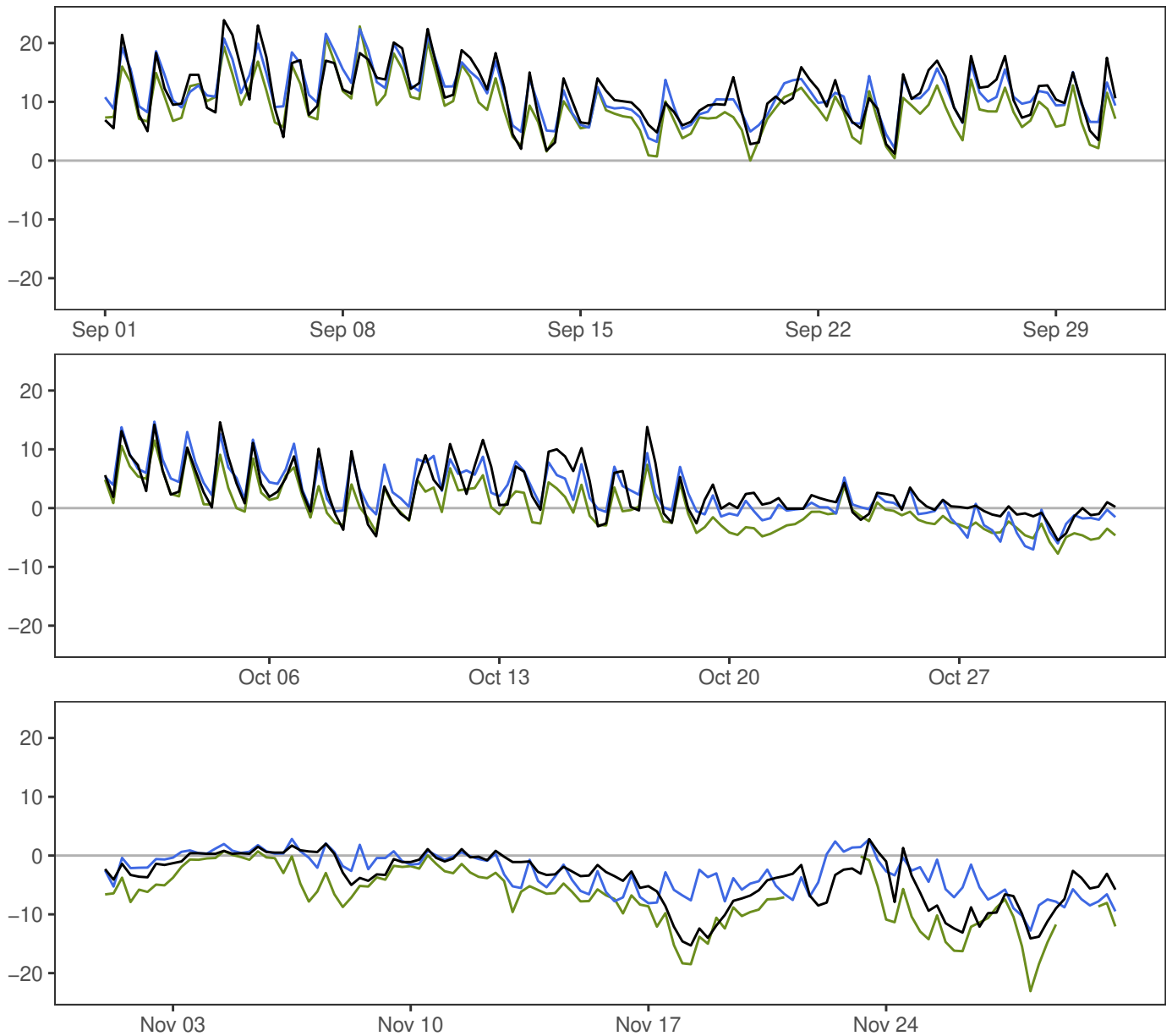
FINSEVATN



	Min	Mean	Max	Std	N
— synop: 00,06,12,18	-22.8	-2.4	18.2	7.0	308
— MEPSctrl: 12+18,+24,+30,+36	-21.9	-2.1	15.8	7.3	364
— ECMWF: 12+18,+24,+30,+36	-23.8	-2.8	15.0	6.9	352

	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl-synop	-0.7	2.2	2.3	1.6	8.9	296
ECMWF-synop	-1.7	2.2	2.7	2.4	10.6	296

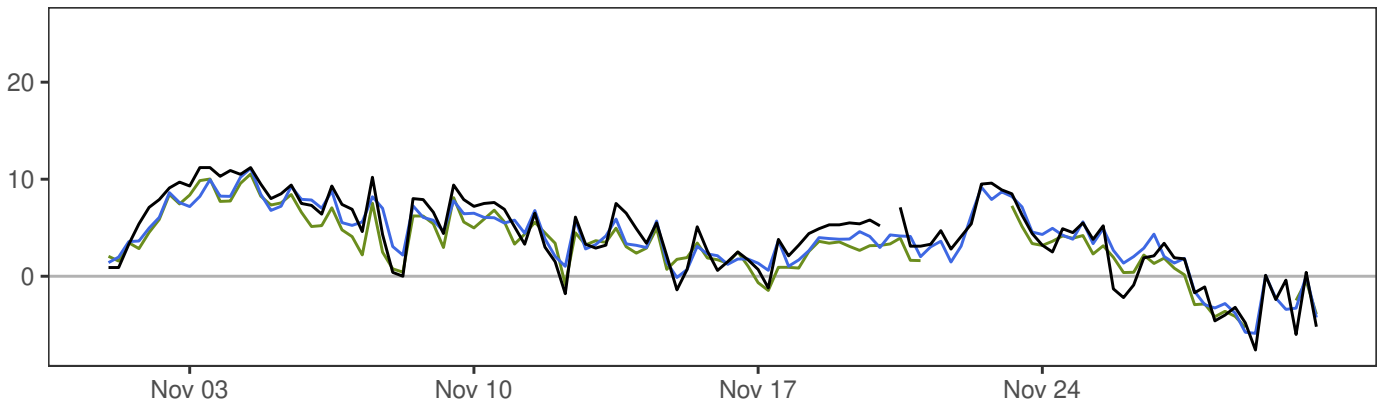
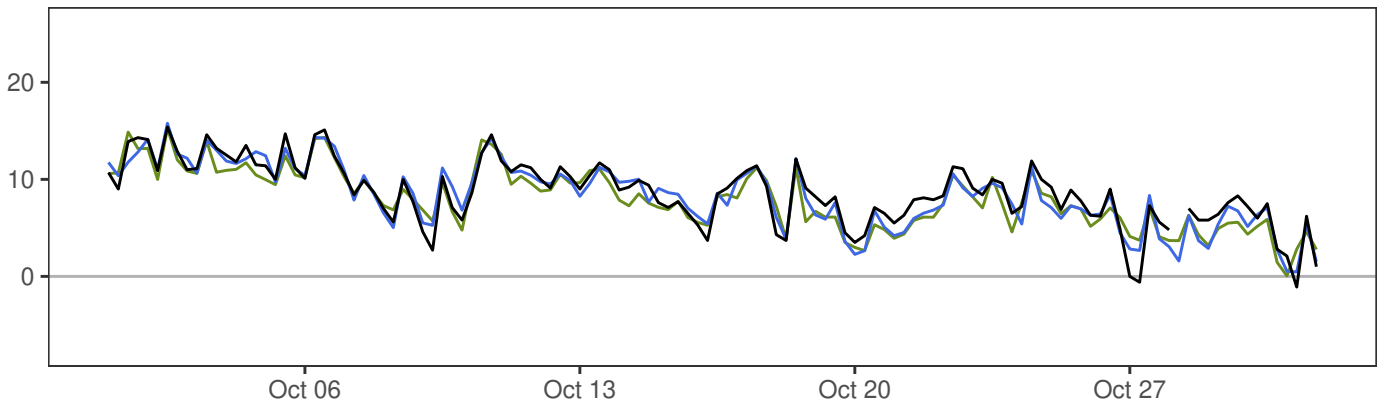
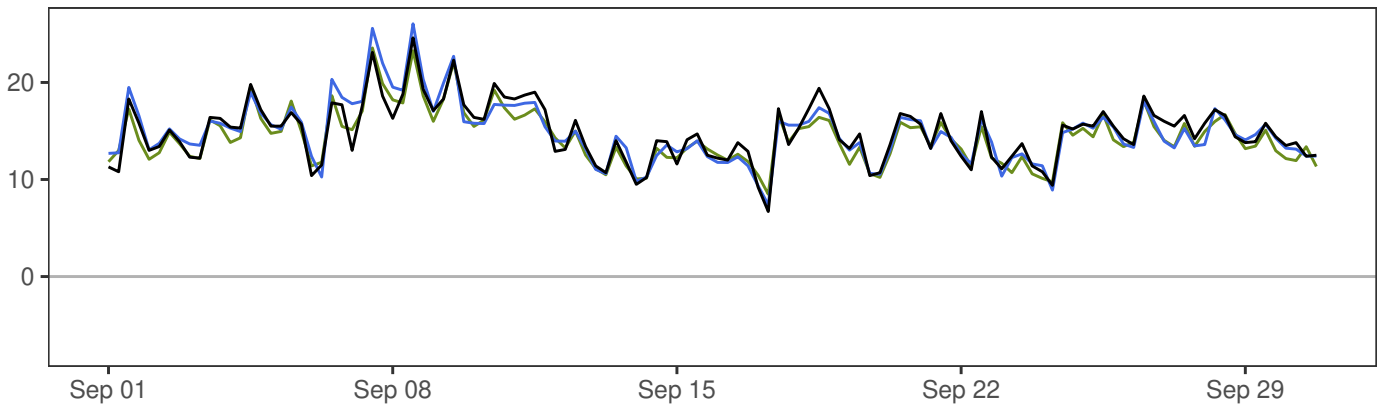
NESBYEN – TODOKK



	Min	Mean	Max	Std	N
— synop: 00,06,12,18	-15.3	3.4	23.9	7.8	364
— MEPSctrl: 12+18,+24,+30,+36	-12.8	3.6	22.4	7.2	364
— ECMWF: 12+18,+24,+30,+36	-23.1	1.0	22.8	7.9	352

	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl-synop	0.2	2.6	2.6	2.0	10.3	352
ECMWF-synop	-2.6	2.2	3.4	2.9	9.9	352

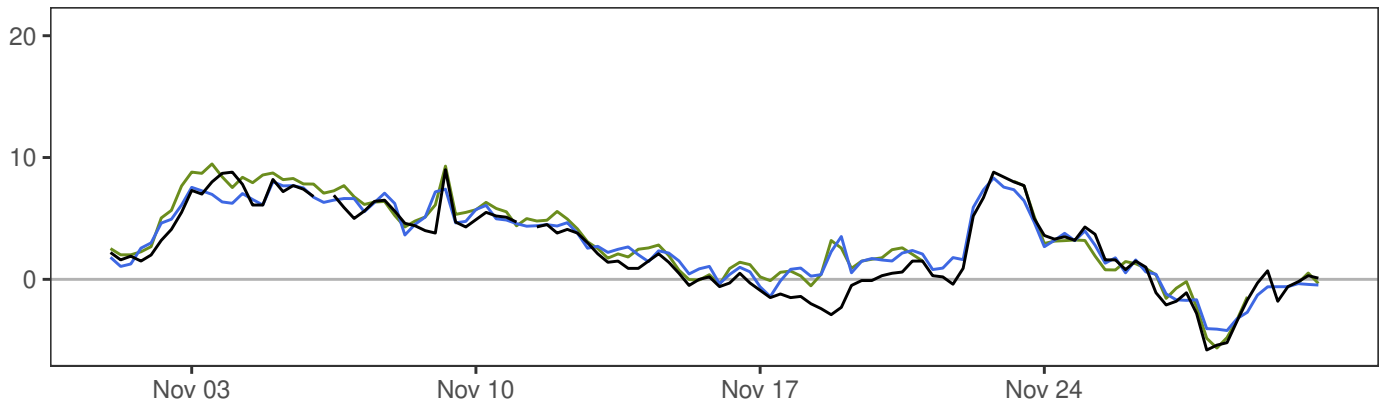
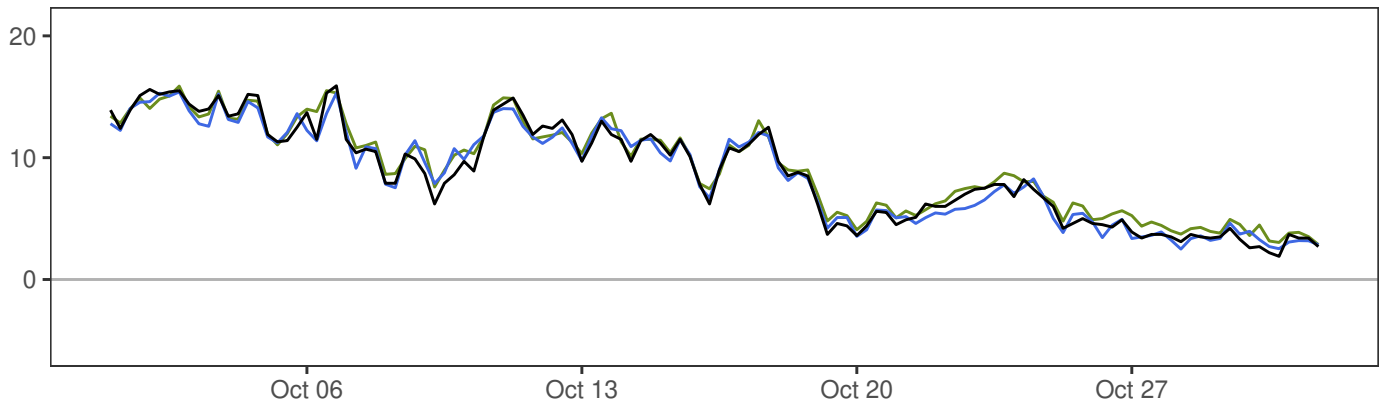
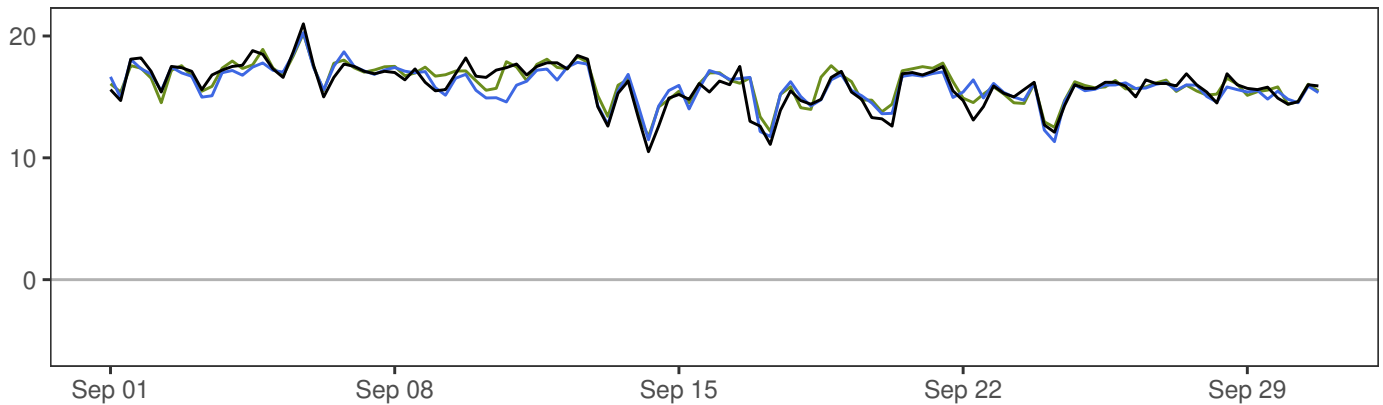
SOLA



	Min	Mean	Max	Std	N
— synop: 00,06,12,18	-7.6	9.2	24.6	5.6	362
— MEPSctrl: 12+18,+24,+30,+36	-5.9	9.0	26.0	5.6	364
— ECMWF: 12+18,+24,+30,+36	-5.3	8.7	23.6	5.4	352

	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl-synop	-0.2	1.3	1.3	1.0	4.8	350
ECMWF-synop	-0.7	1.3	1.4	1.2	4.3	350

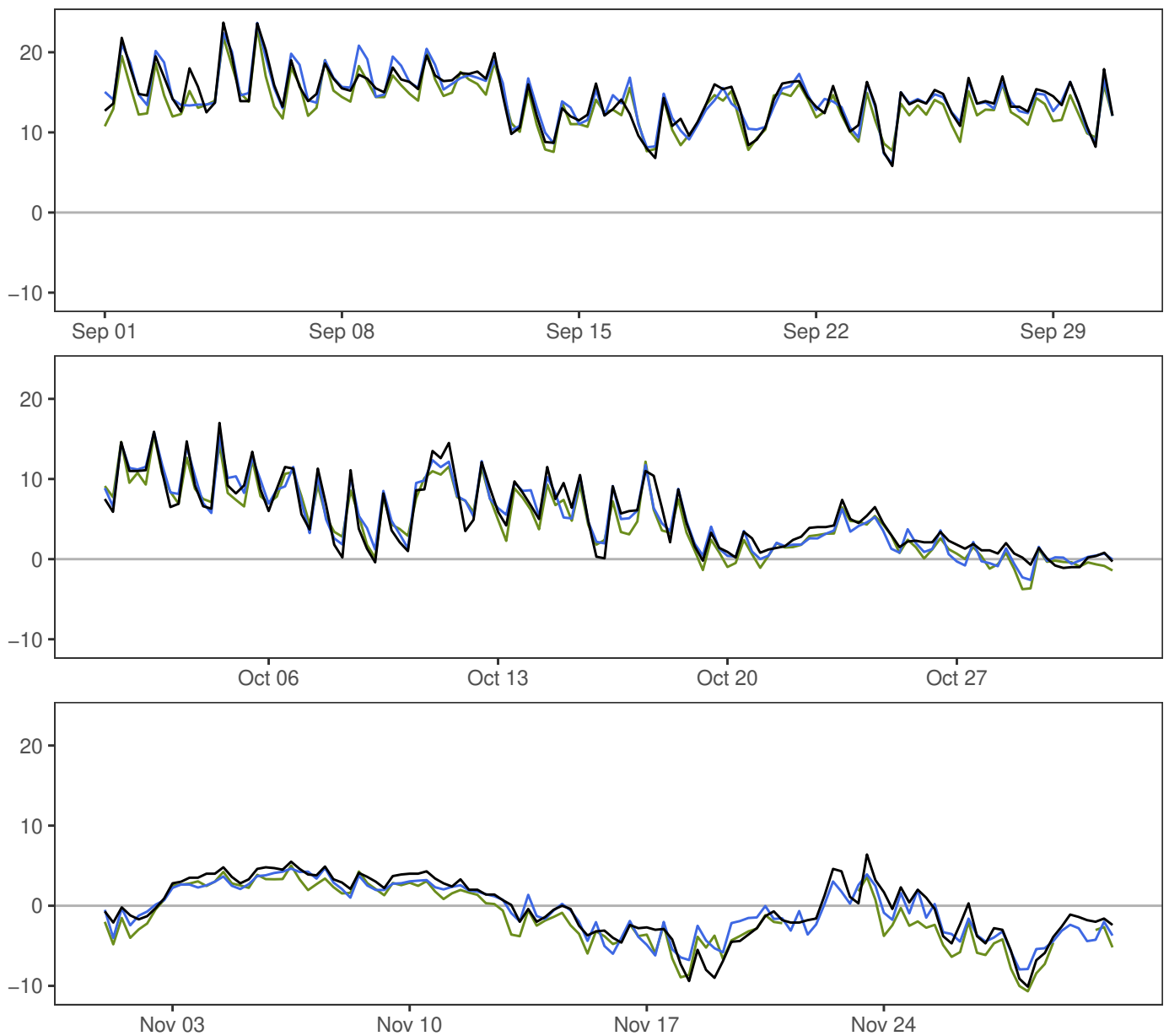
FÆRDER FYR



	Min	Mean	Max	Std	N
— synop: 00,06,12,18	-5.8	9.1	21.0	6.4	362
— MEPSctrl: 12+18,+24,+30,+36	-4.2	9.2	20.3	6.1	364
— ECMWF: 12+18,+24,+30,+36	-5.6	9.7	20.2	6.0	352

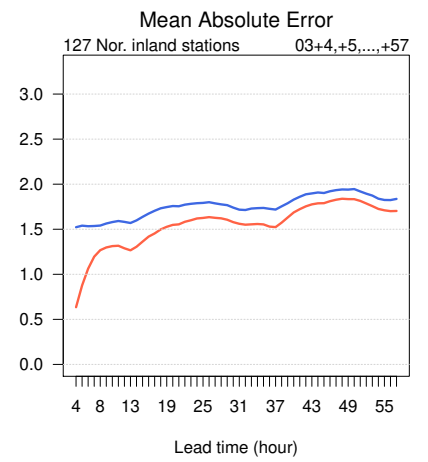
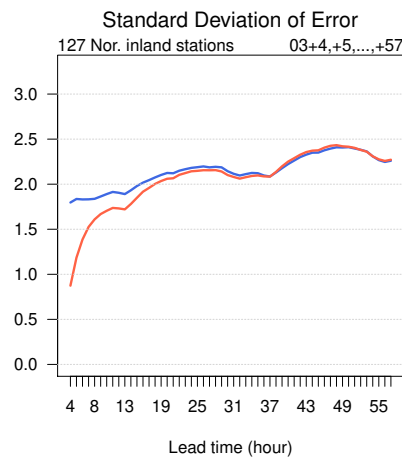
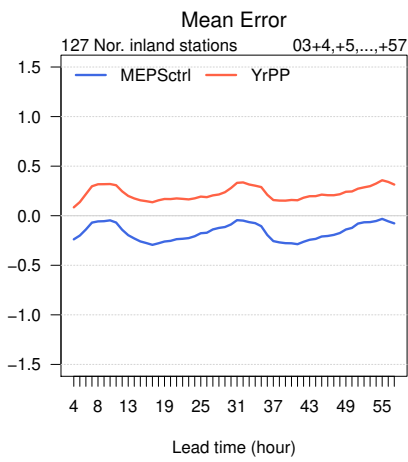
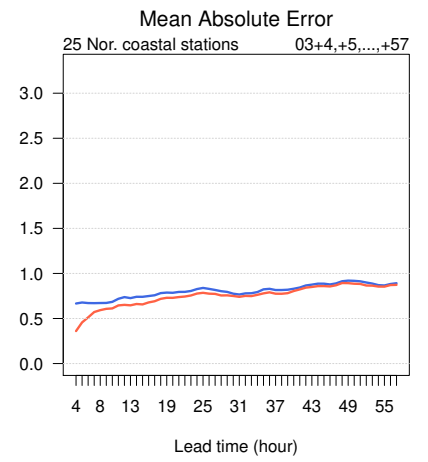
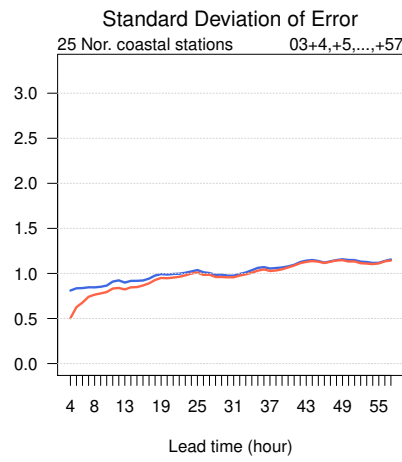
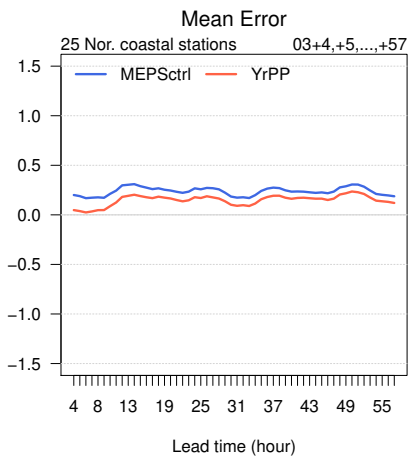
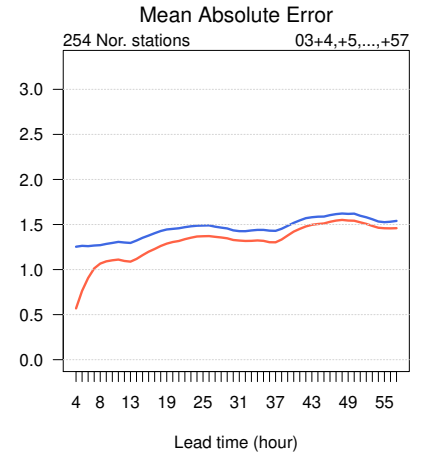
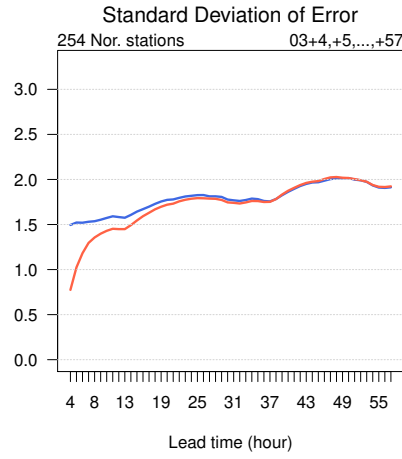
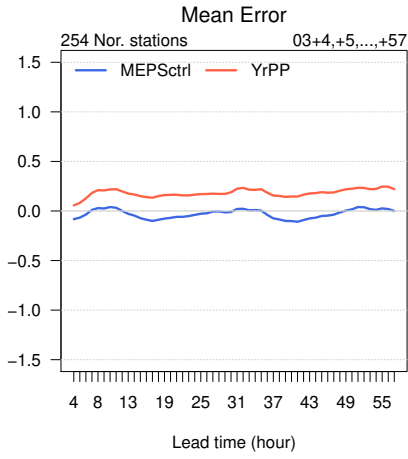
	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl-synop	0.1	1.0	1.0	0.7	5.8	350
ECMWF-synop	0.4	0.9	1.0	0.7	6.1	350

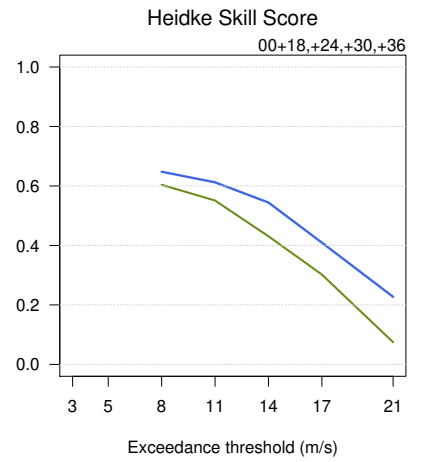
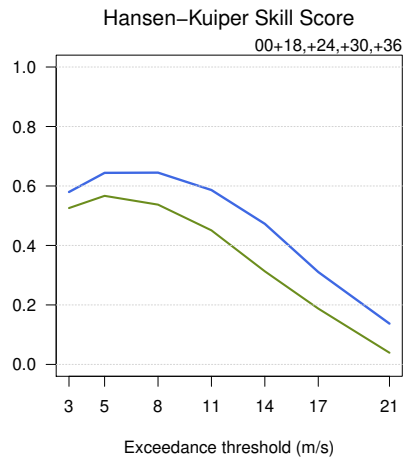
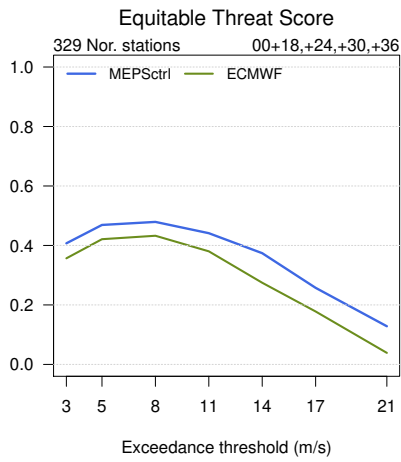
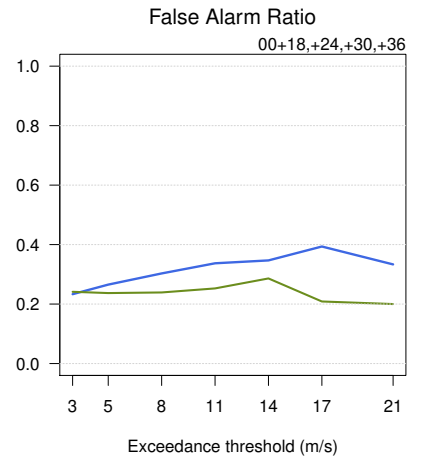
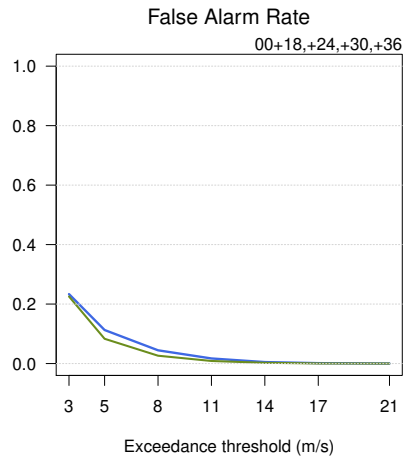
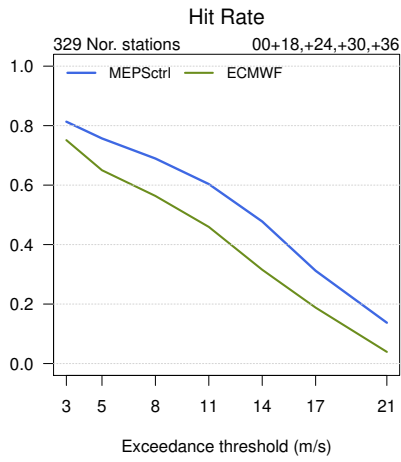
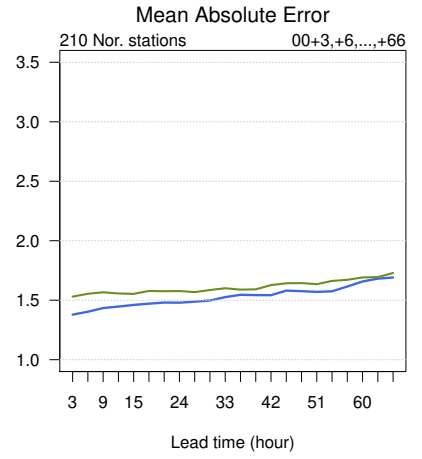
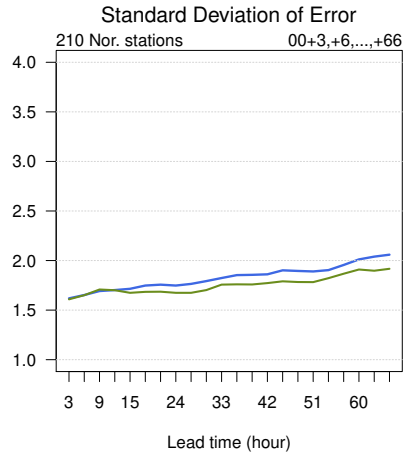
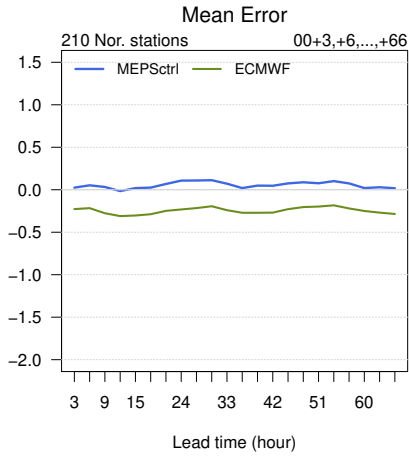
OSLO – BLINDERN

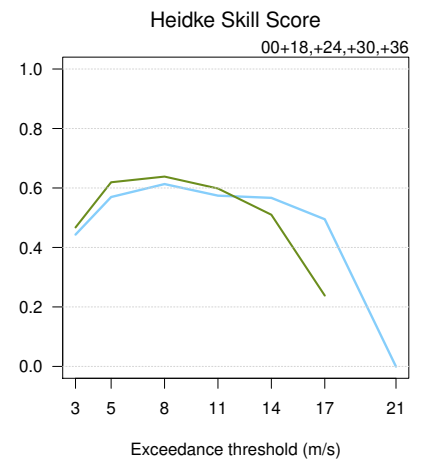
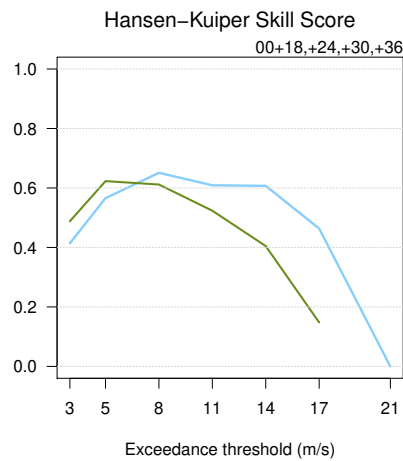
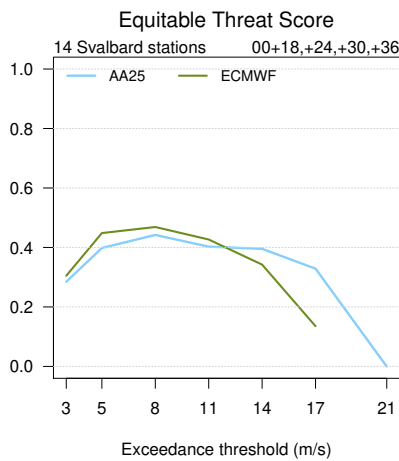
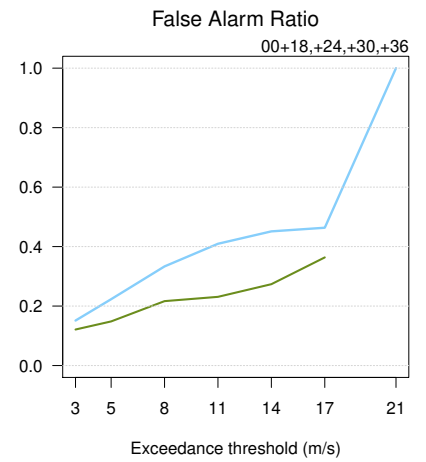
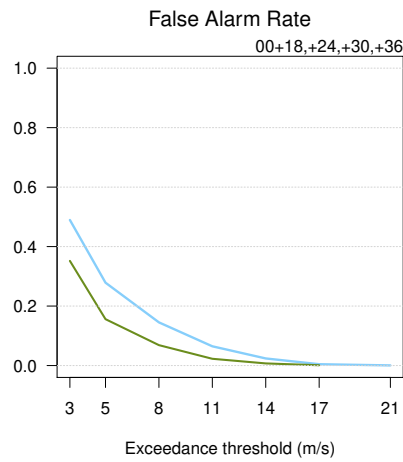
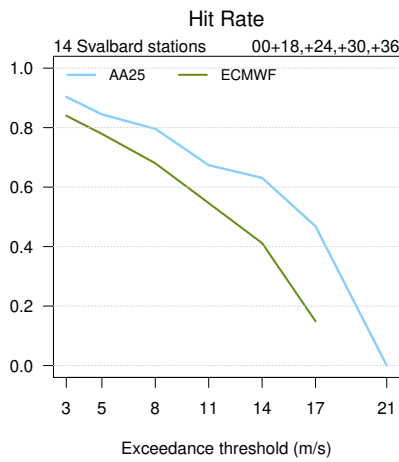
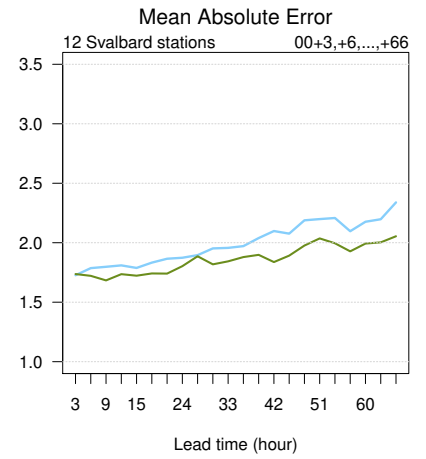
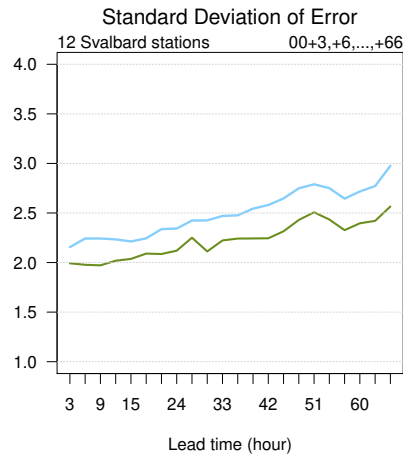
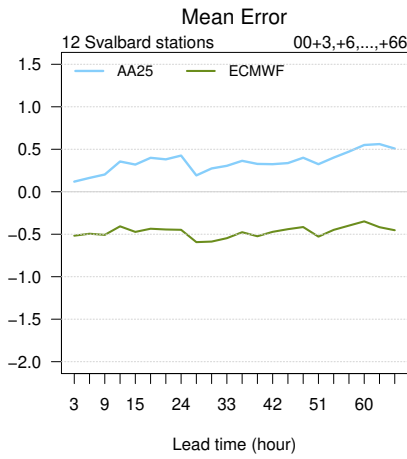


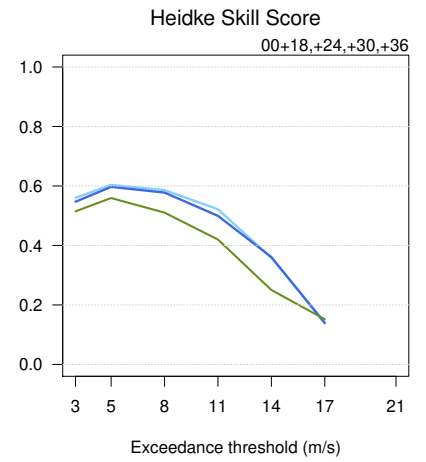
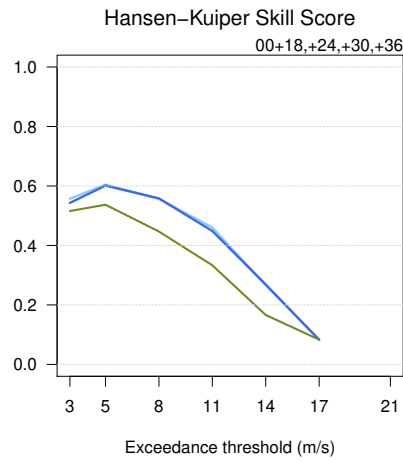
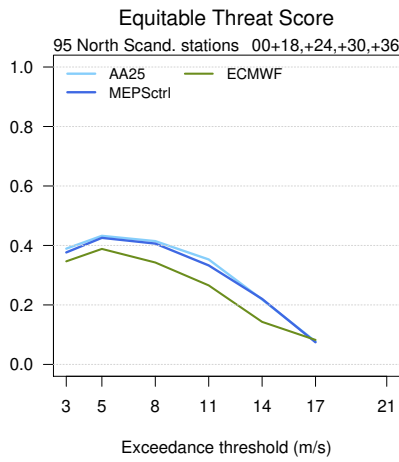
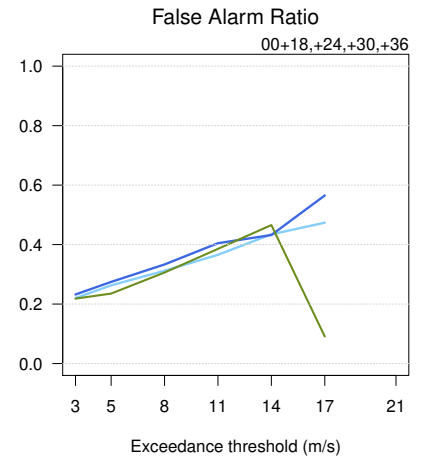
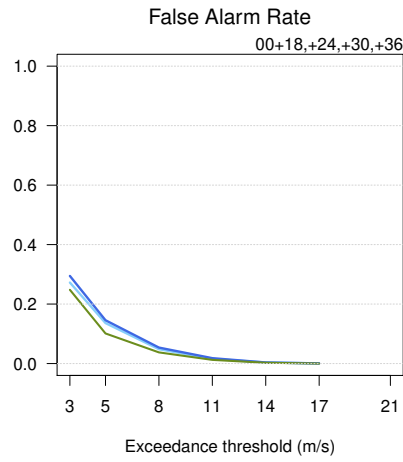
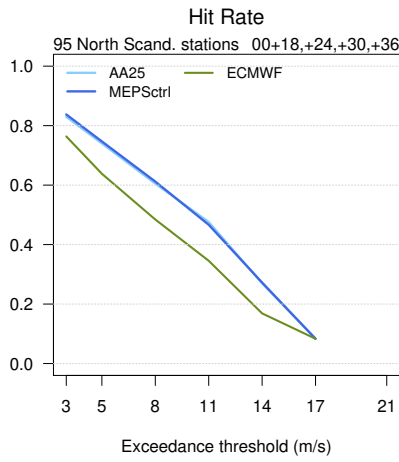
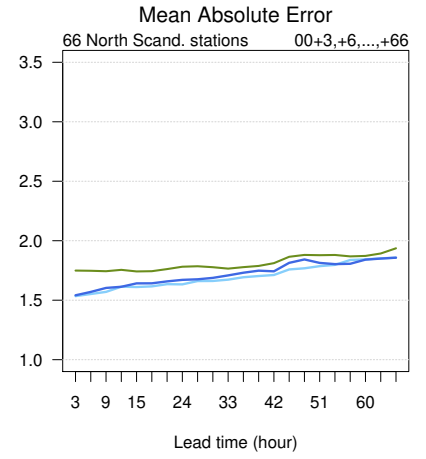
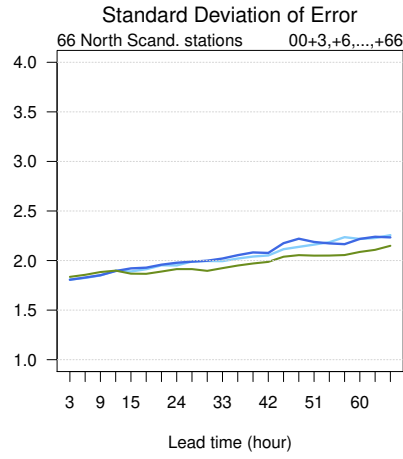
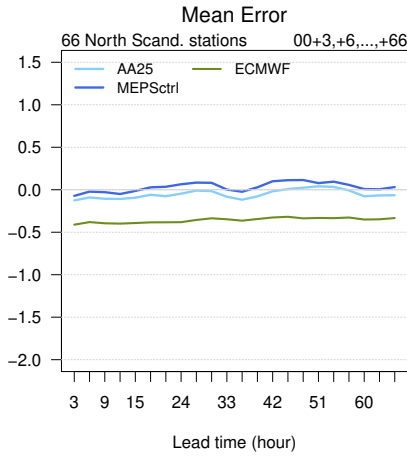
	Min	Mean	Max	Std	N
— synop: 00,06,12,18	-10.1	6.4	23.7	7.1	364
— MEPSctrl: 12+18,+24,+30,+36	-7.9	6.3	23.7	7.2	364
— ECMWF: 12+18,+24,+30,+36	-10.7	5.8	23.0	7.1	352

	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl-synop	-0.1	1.2	1.3	0.9	4.6	352
ECMWF-synop	-0.9	1.3	1.5	1.3	5.5	352





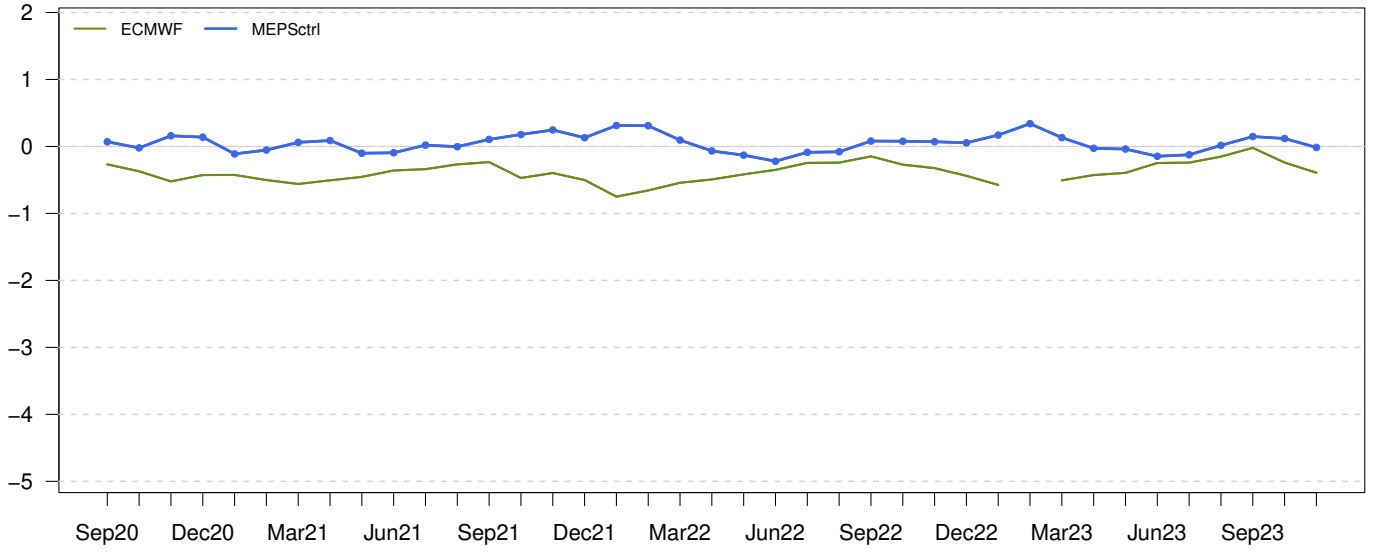




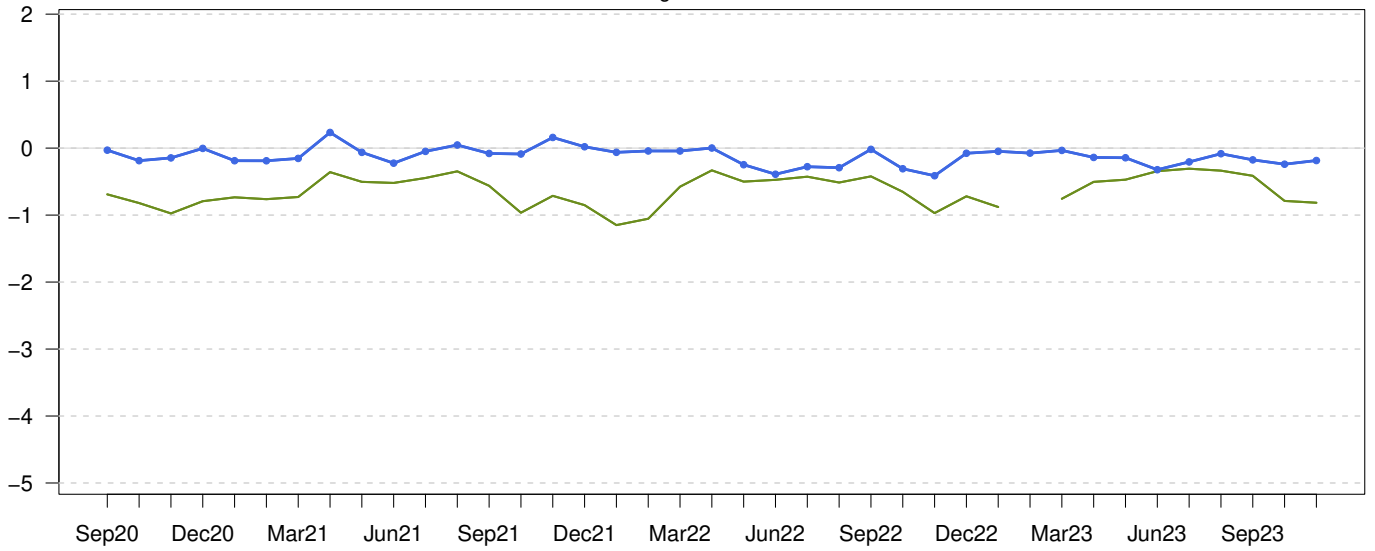
Mean Error

224 Norwegian stations

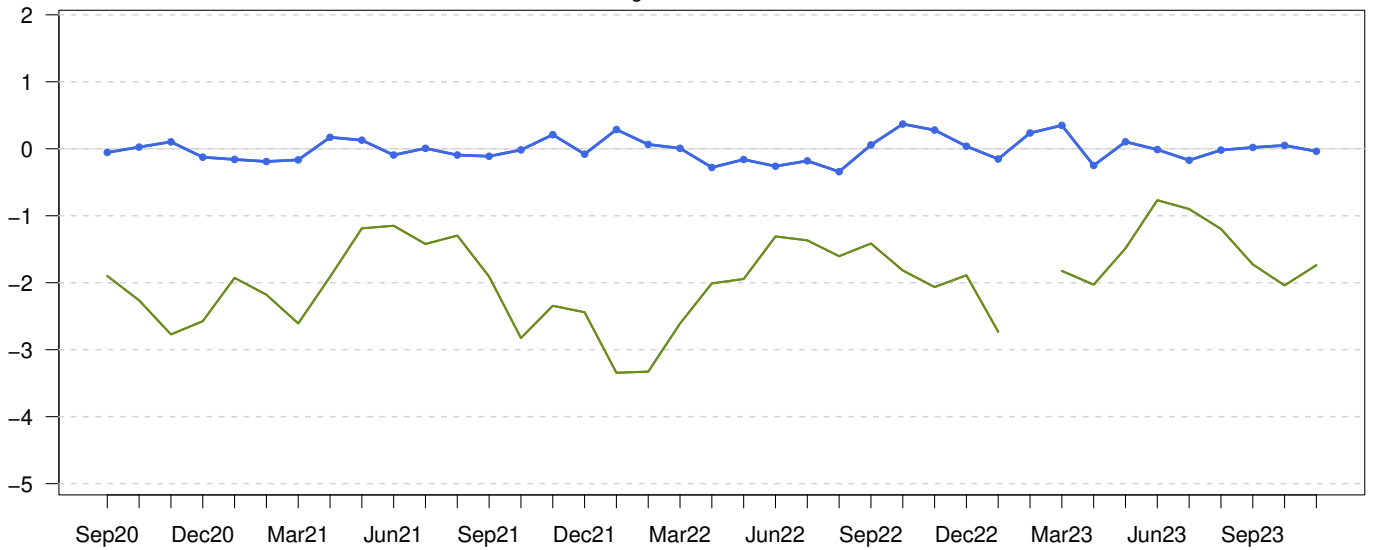
00+24,+30,+36,+42 UTC



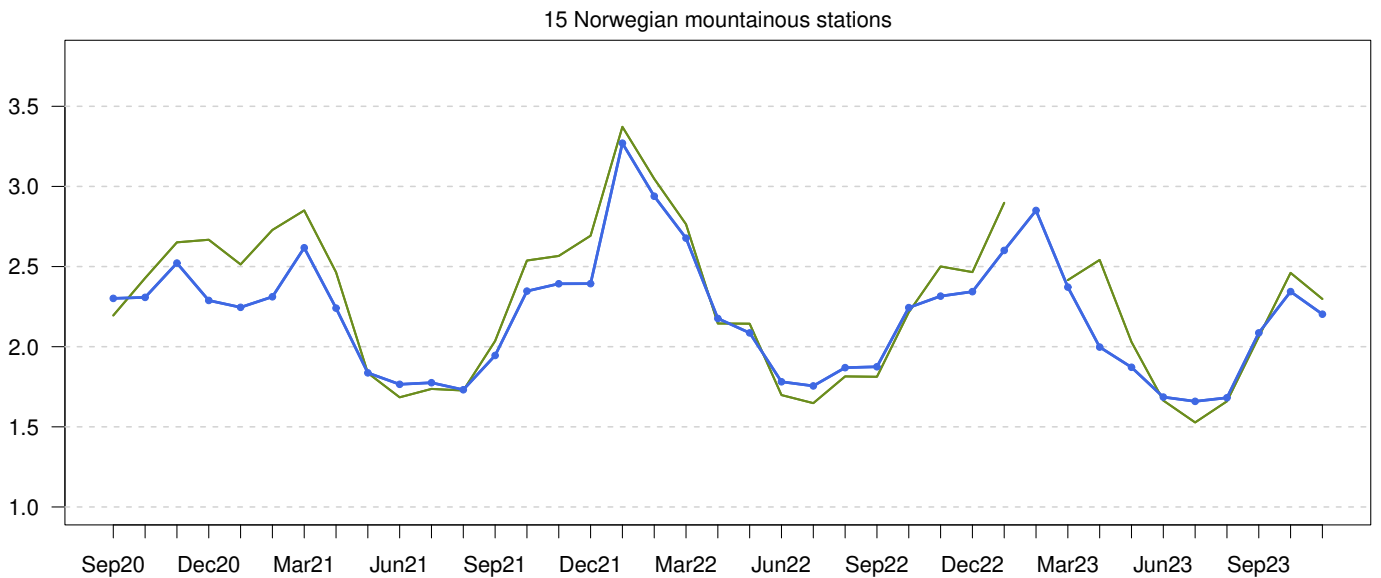
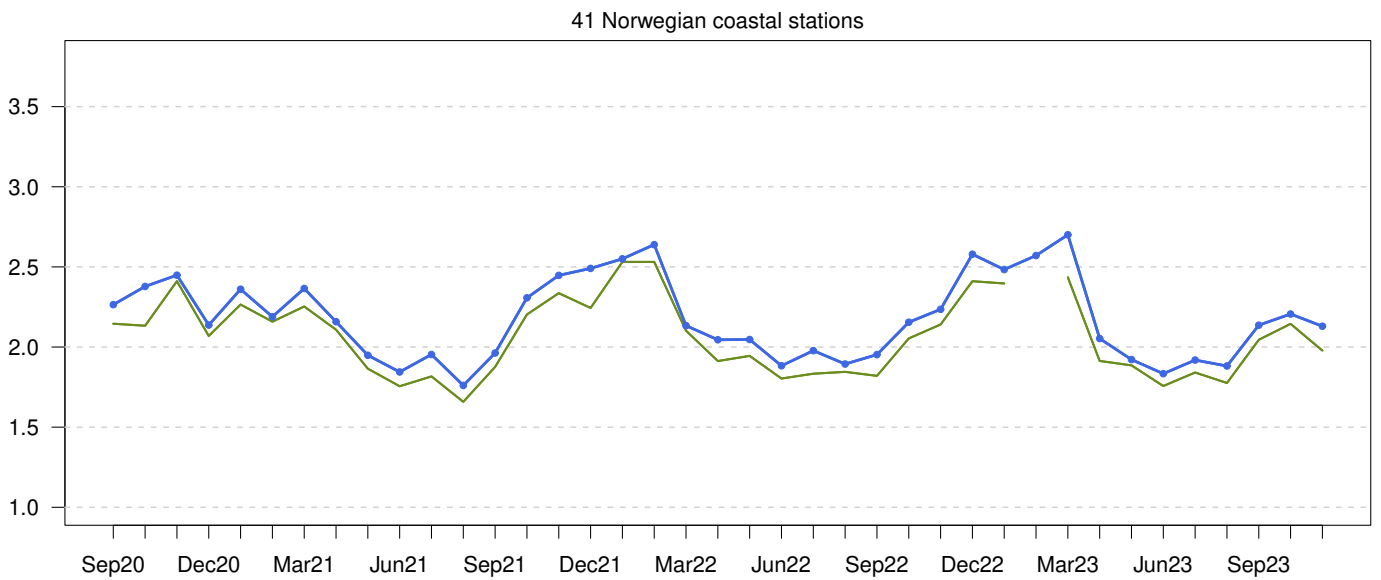
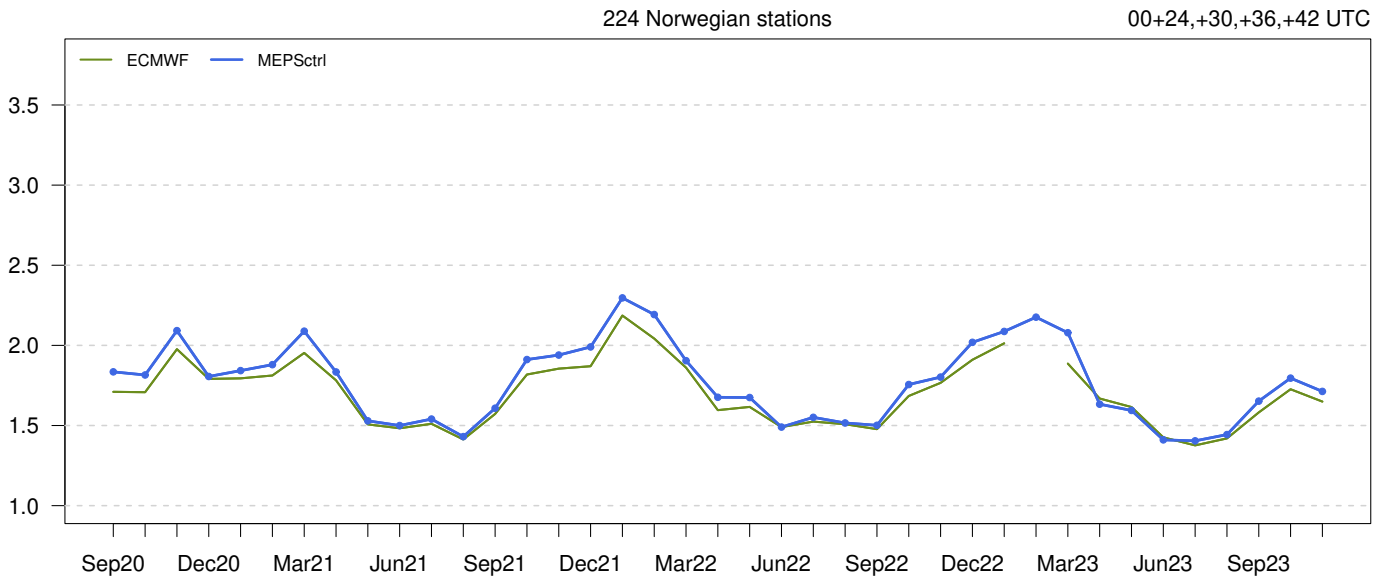
41 Norwegian coastal stations



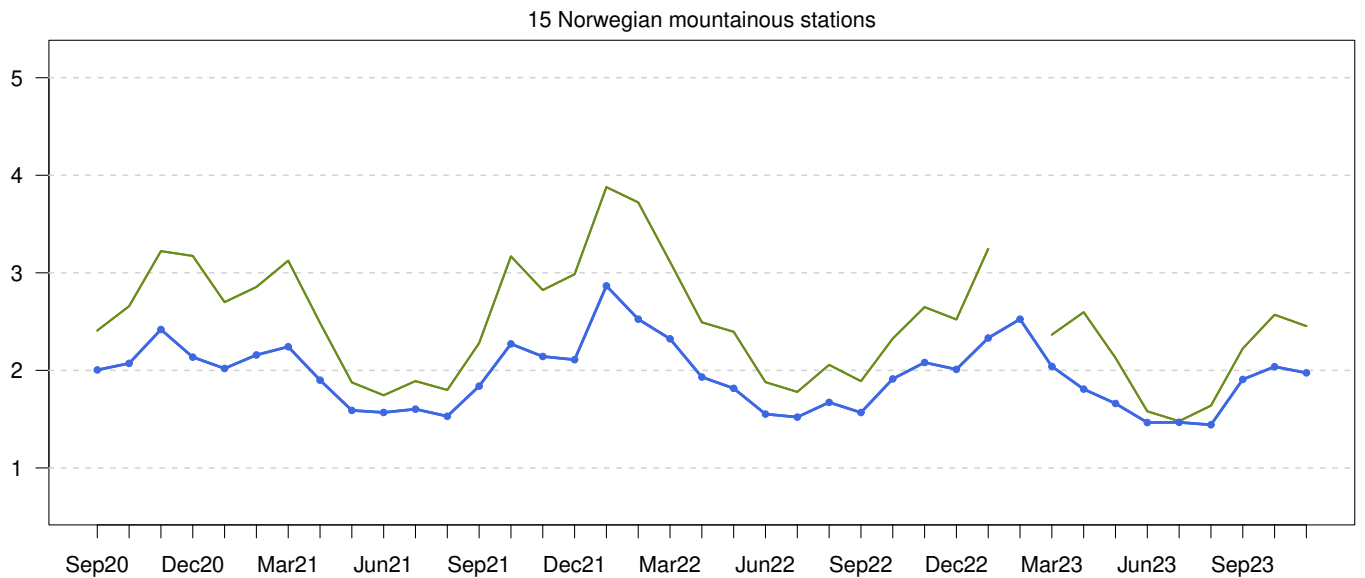
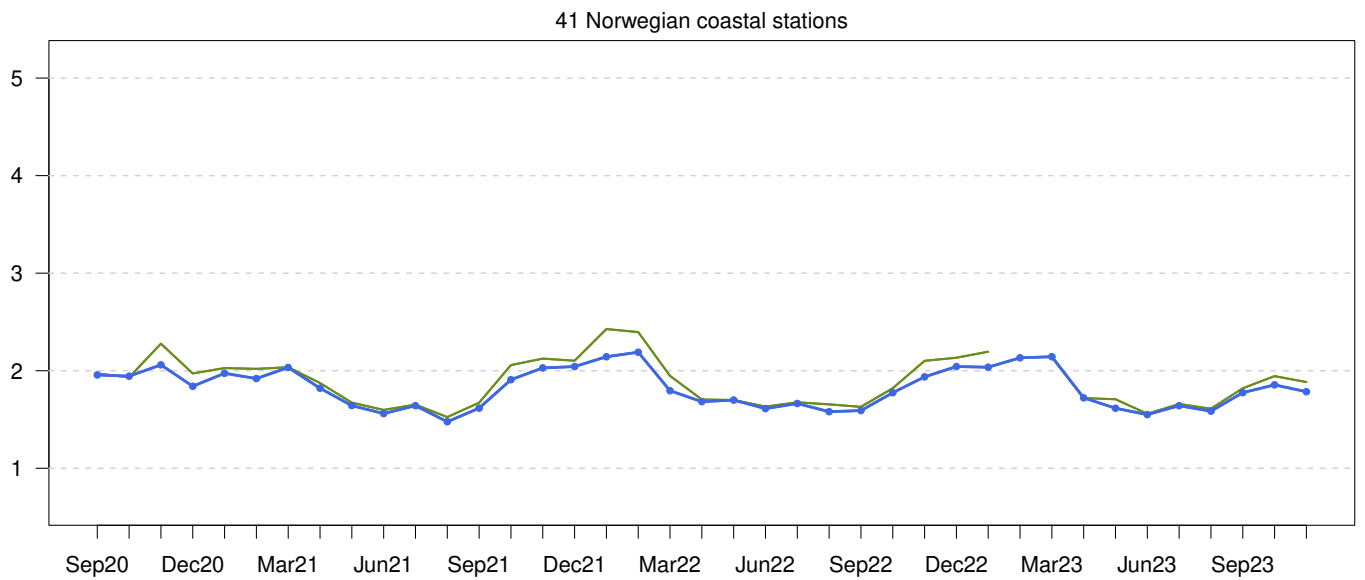
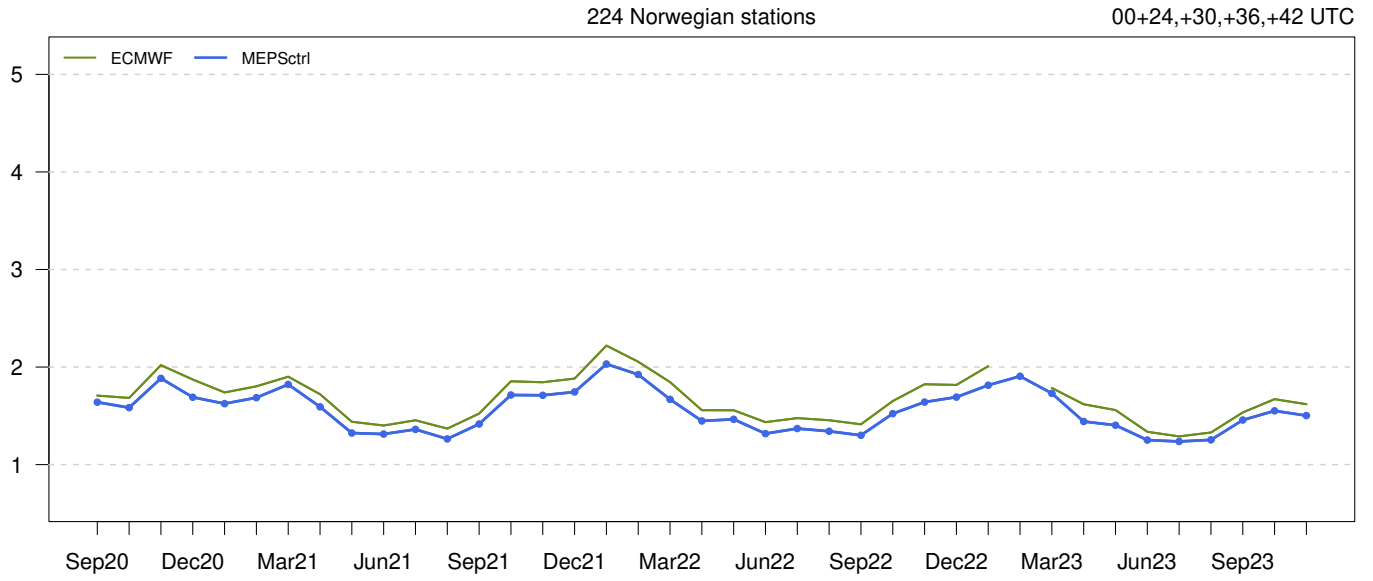
15 Norwegian mountainous stations



Standard Deviation of Error

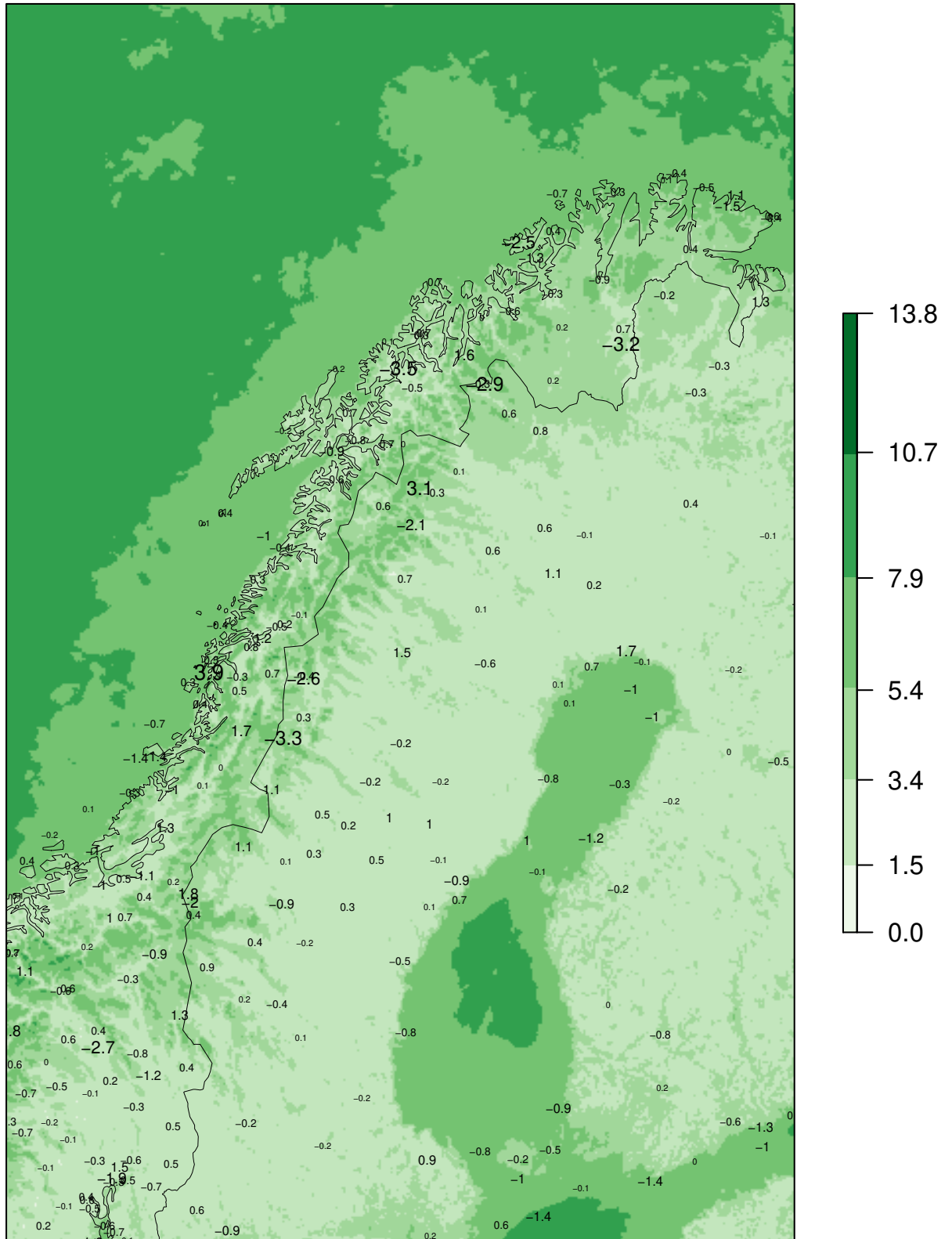


Mean Absolute Error



MEPSctrl 00+12

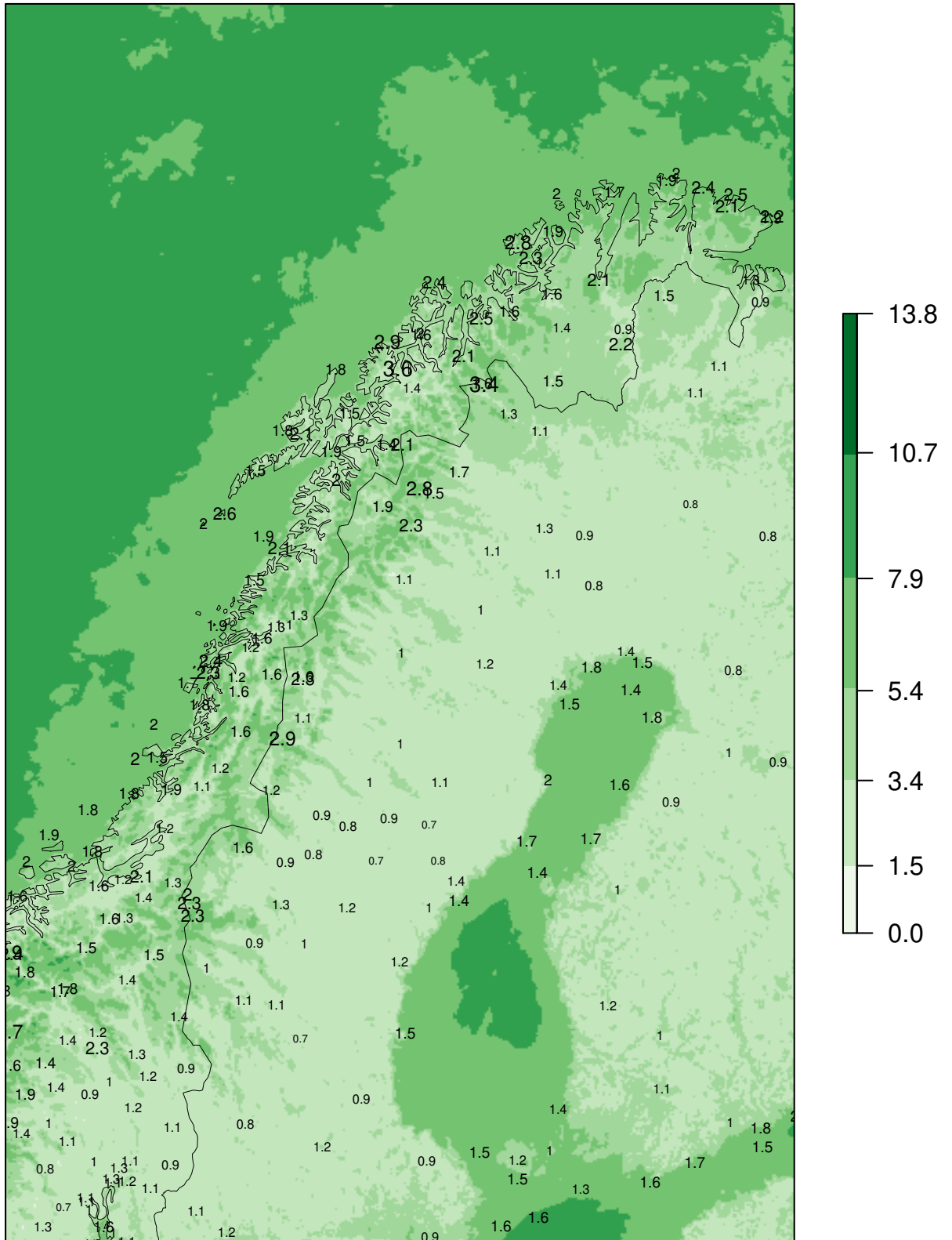
ME at observing sites
(numbers in black)



Model "climatology" 01.09.2023 – 30.11.2023

MEPSctrl 00+12

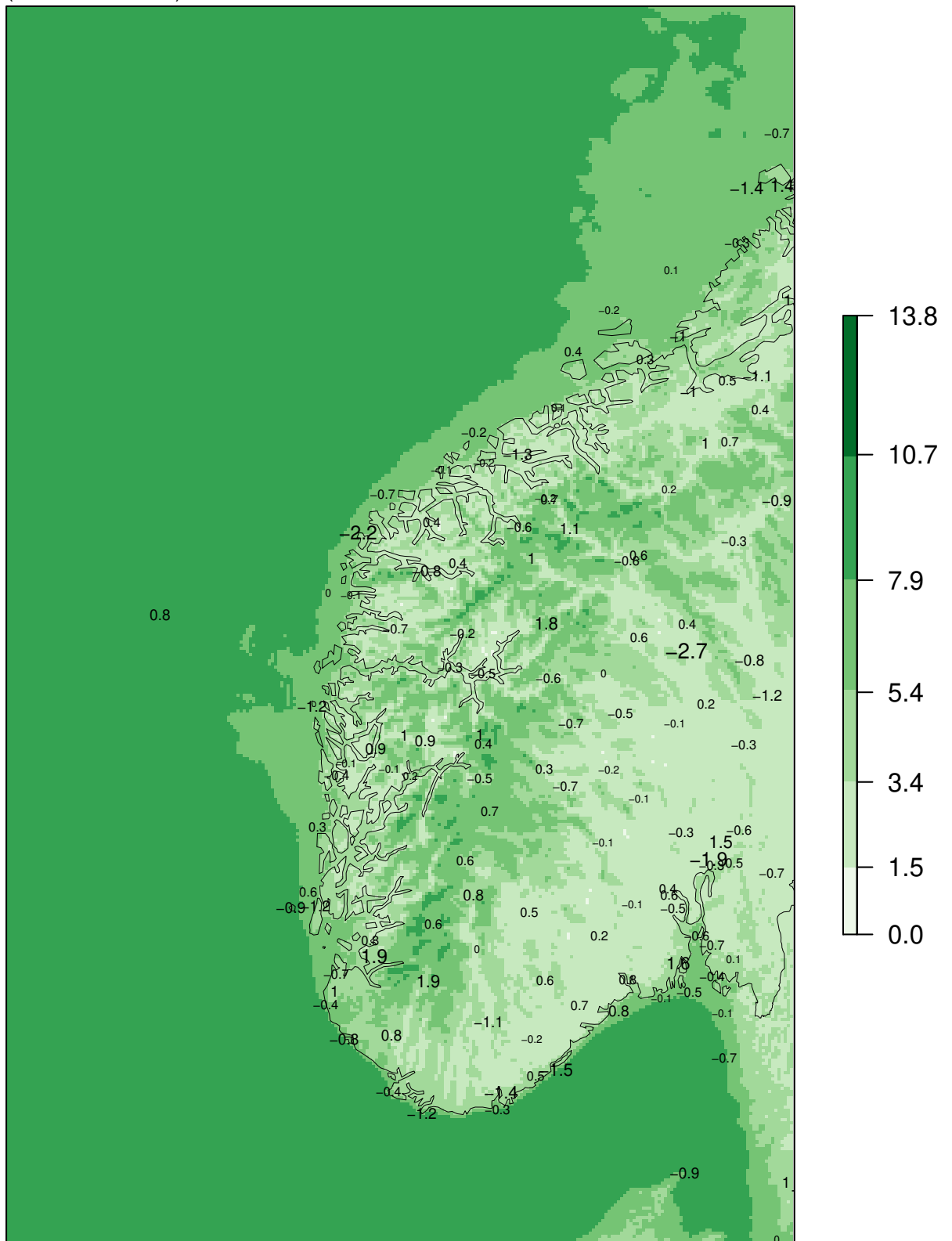
SDE at observing sites
(numbers in black)



Model "climatology" 01.09.2023 – 30.11.2023

MEPSctrl 00+12

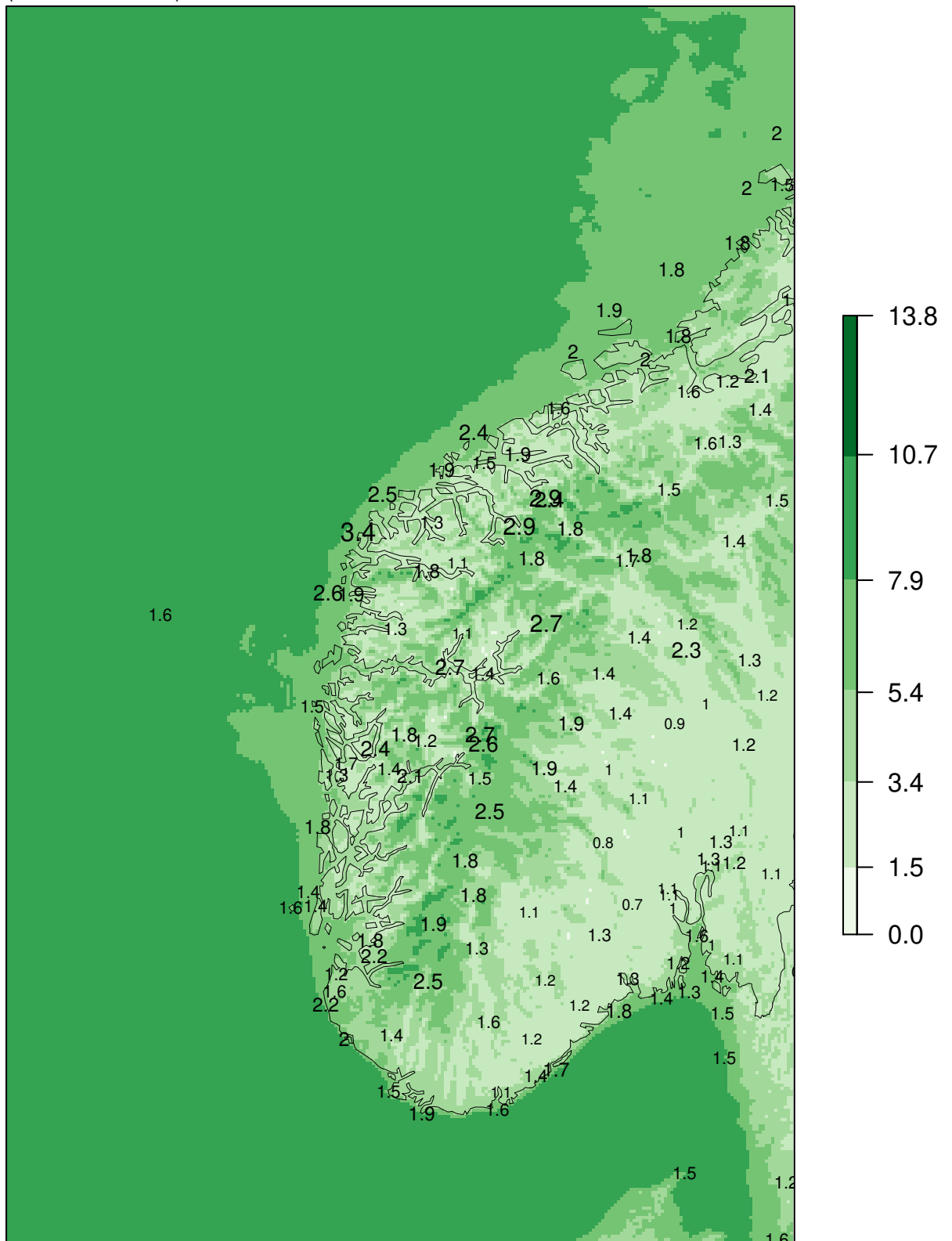
ME at observing sites
(numbers in black)



Model "climatology" 01.09.2023 – 30.11.2023

MEPSctrl 00+12

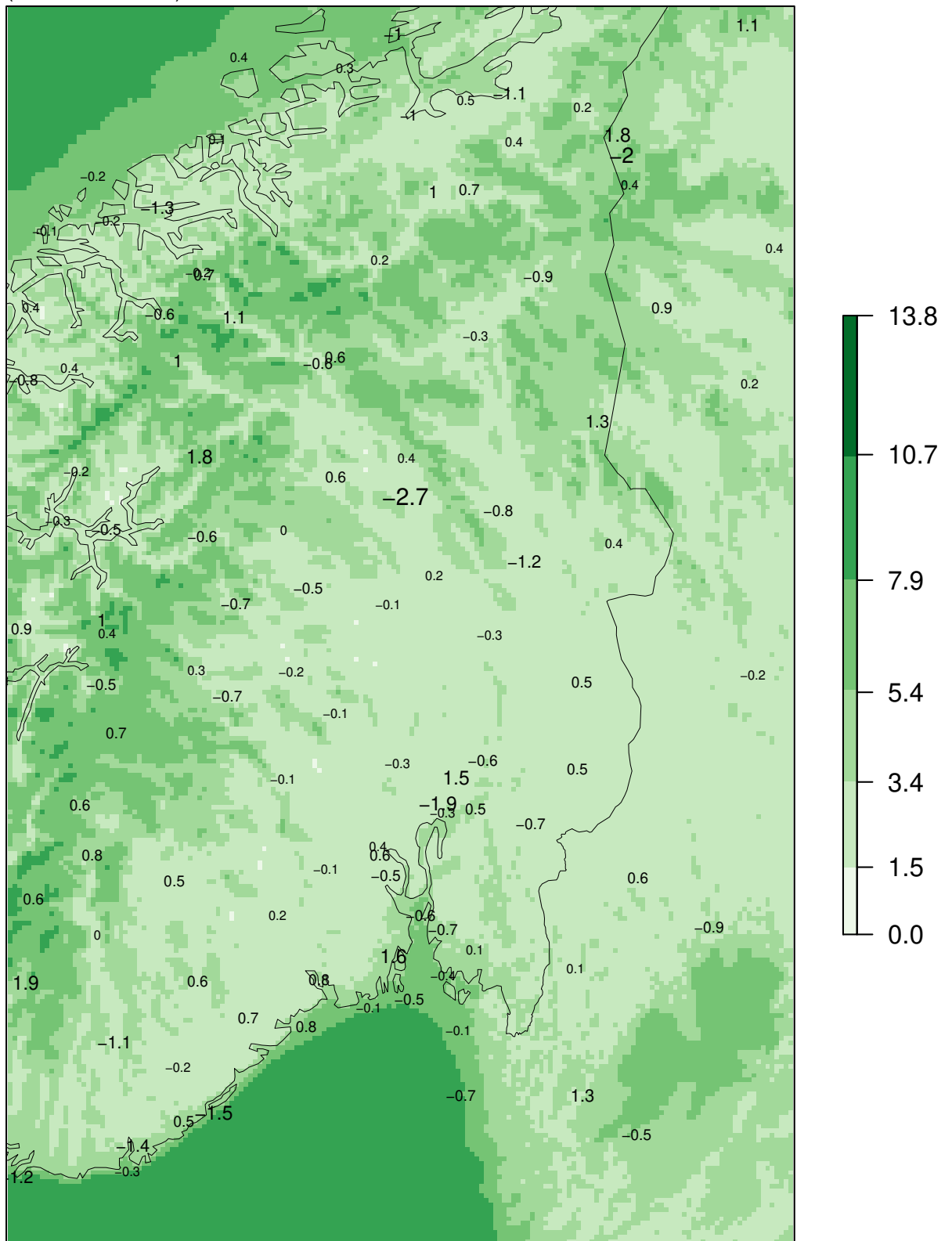
SDE at observing sites
(numbers in black)



Model "climatology" 01.09.2023 – 30.11.2023

MEPSctrl 00+12

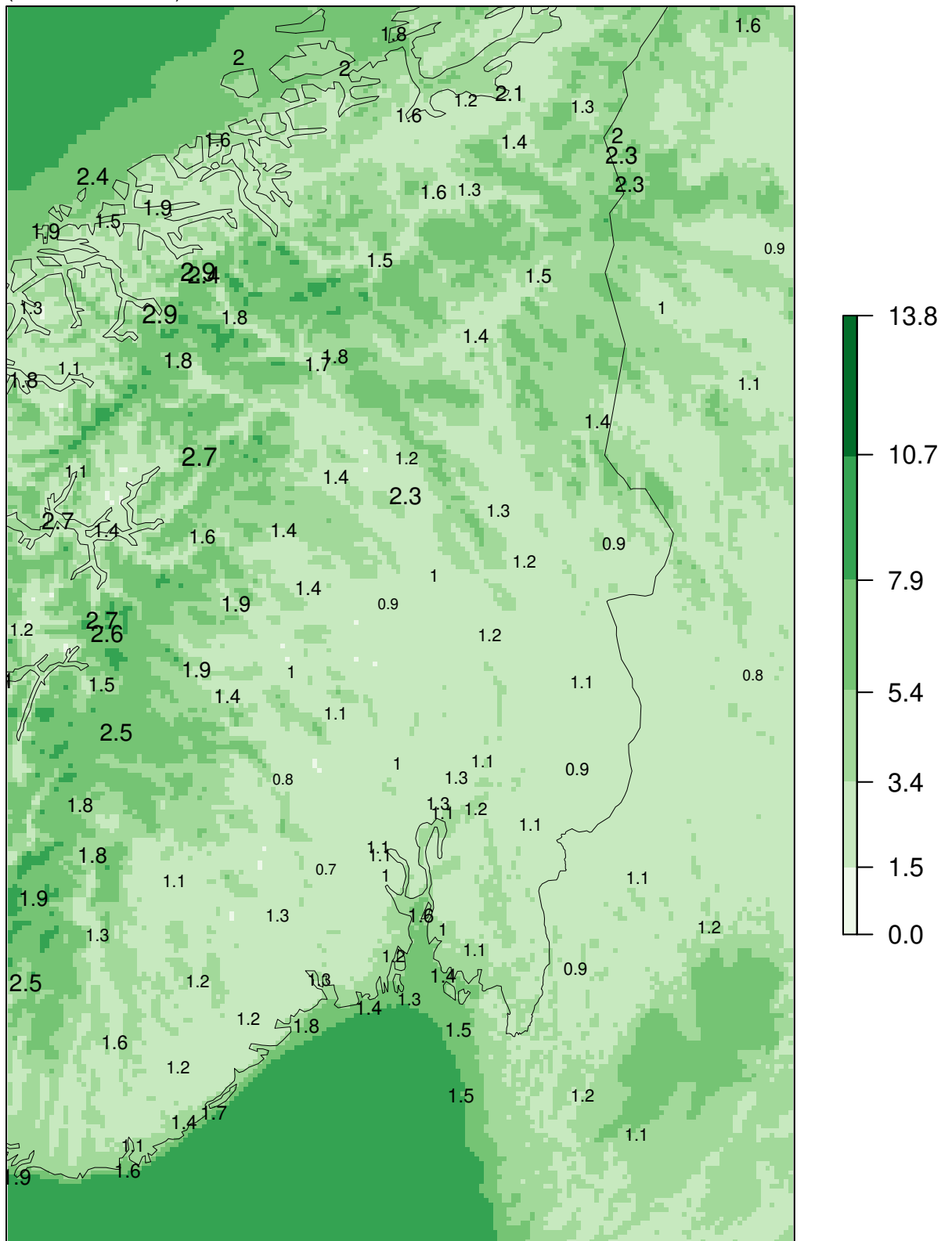
ME at observing sites
(numbers in black)



Model "climatology" 01.09.2023 – 30.11.2023

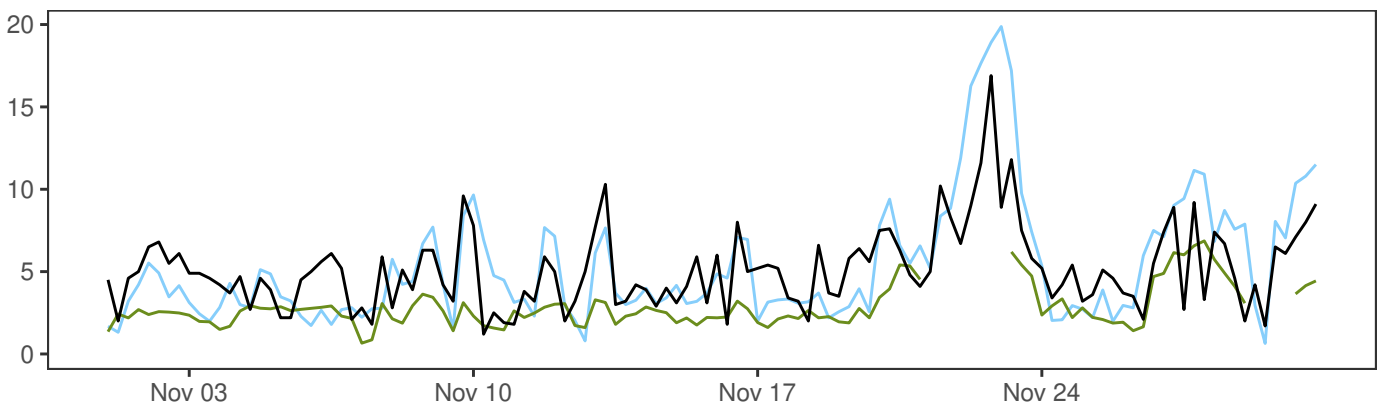
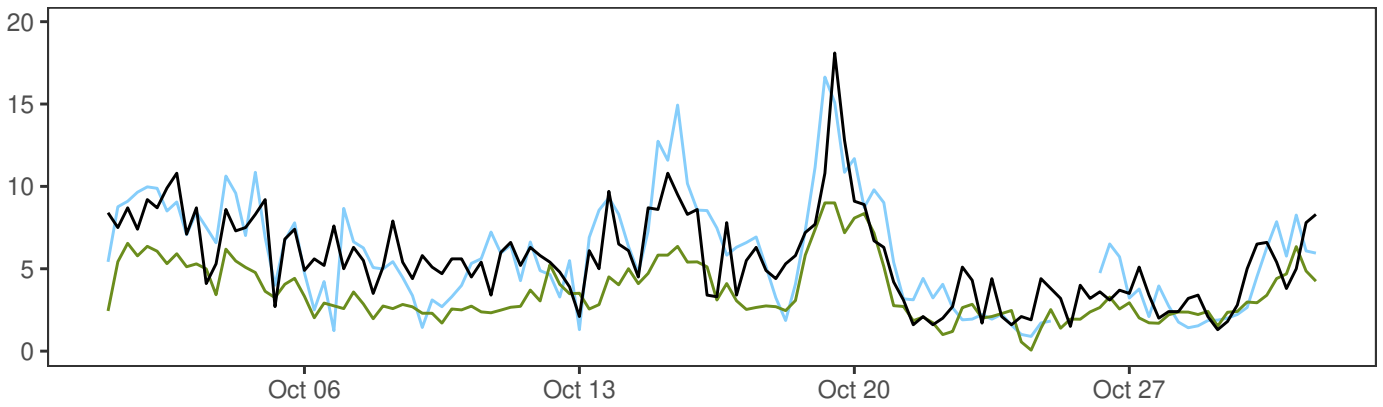
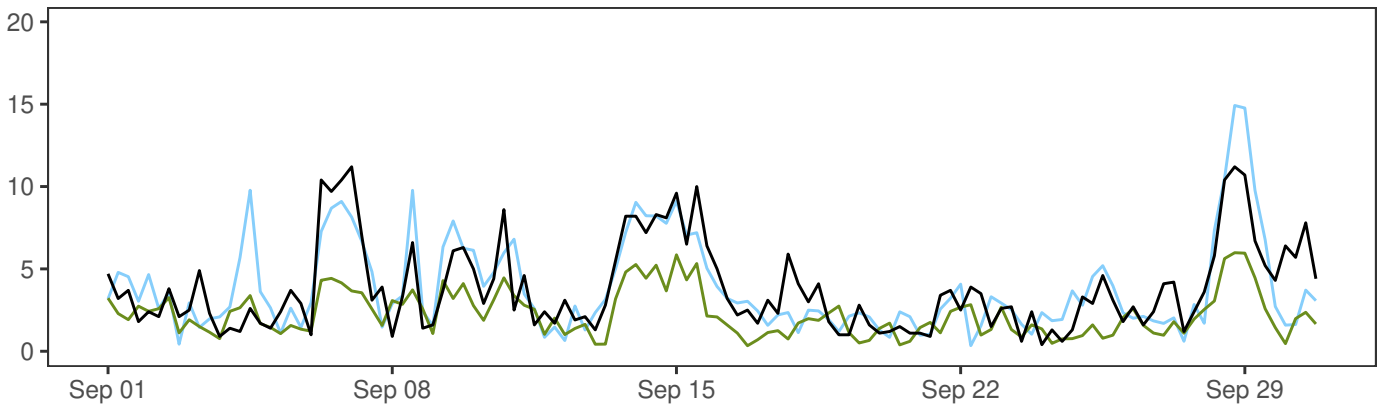
MEPSctrl 00+12

SDE at observing sites
(numbers in black)



Model "climatology" 01.09.2023 – 30.11.2023

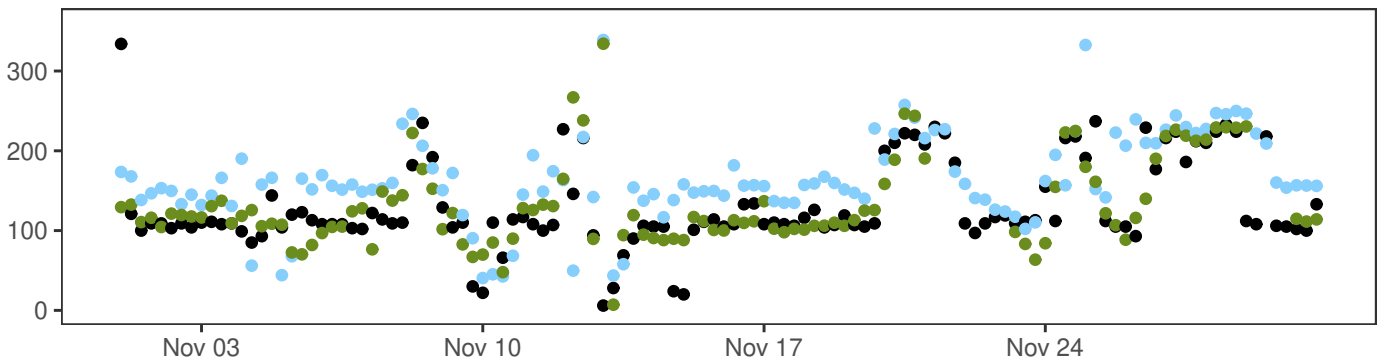
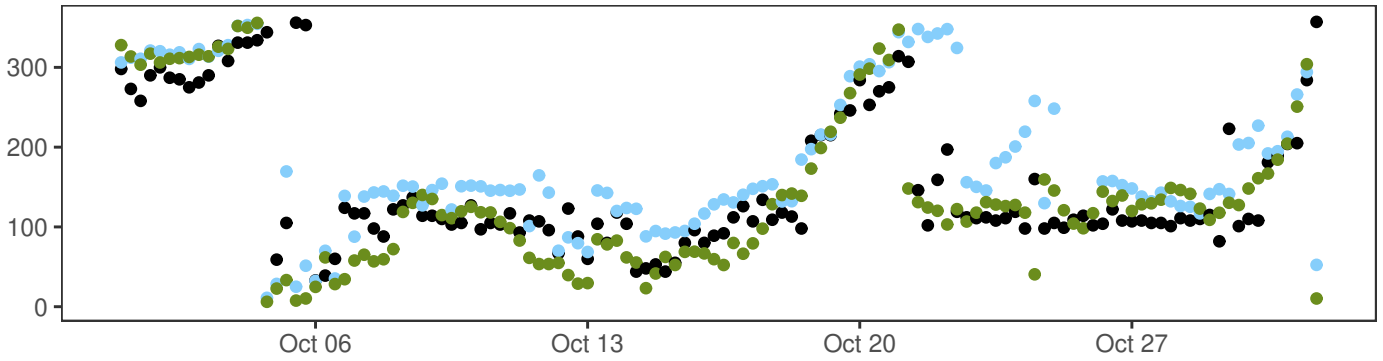
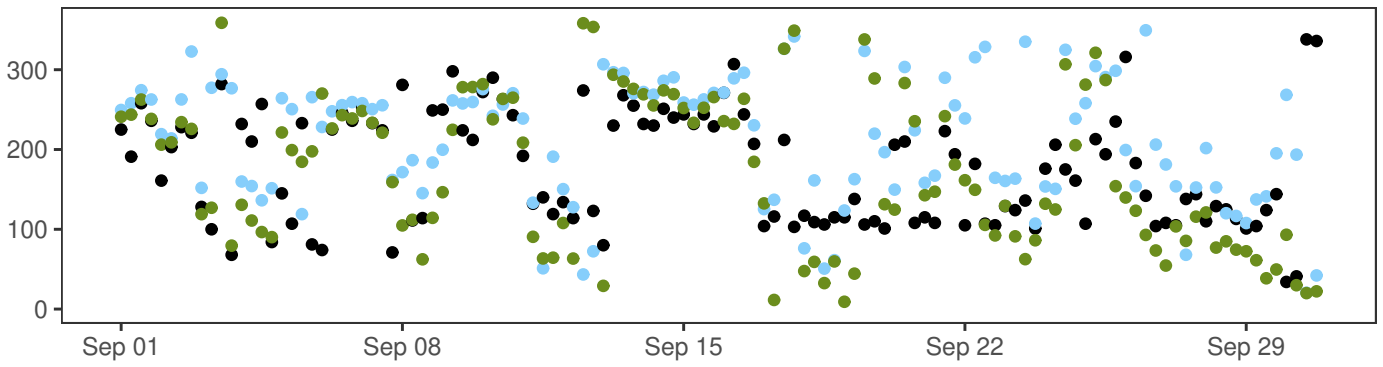
SVALBARD LUFTHAVN



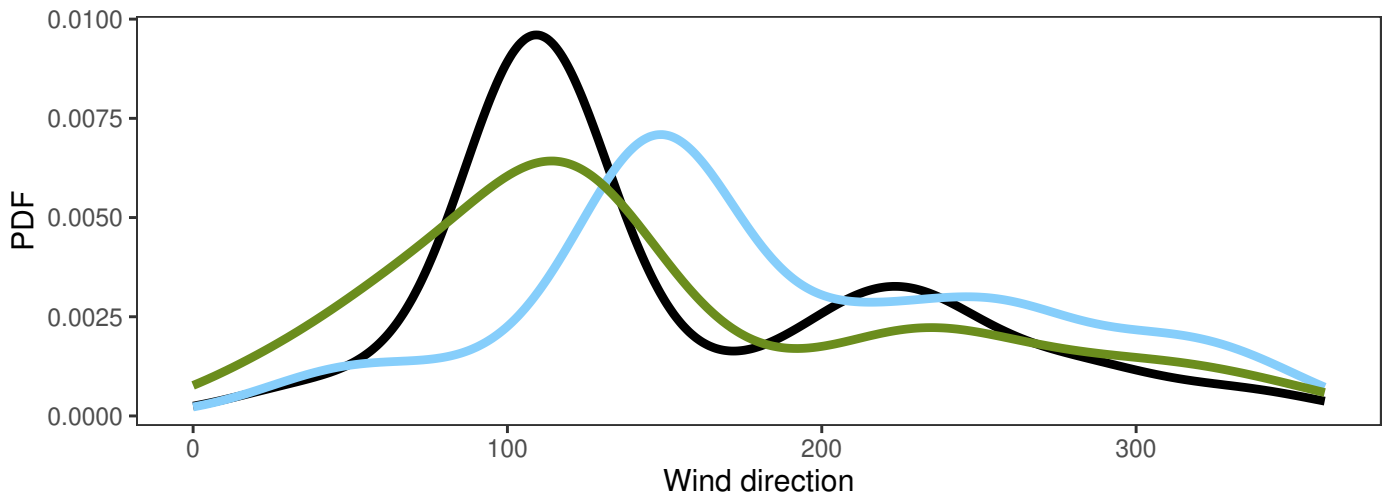
	Min	Mean	Max	Std	N
— synop: 00,06,12,18	0.4	4.8	18.1	2.7	364
— AA25: 12+18,+24,+30,+36	0.3	5.0	19.9	3.4	360
— ECMWF: 12+18,+24,+30,+36	0.1	2.9	9.0	1.6	352

	ME	SDE	RMSE	MAE	Max.abs.err.	N
AA25–synop	0.1	2.1	2.1	1.6	7.6	348
ECMWF–synop	-1.8	1.8	2.6	2.1	9.1	348

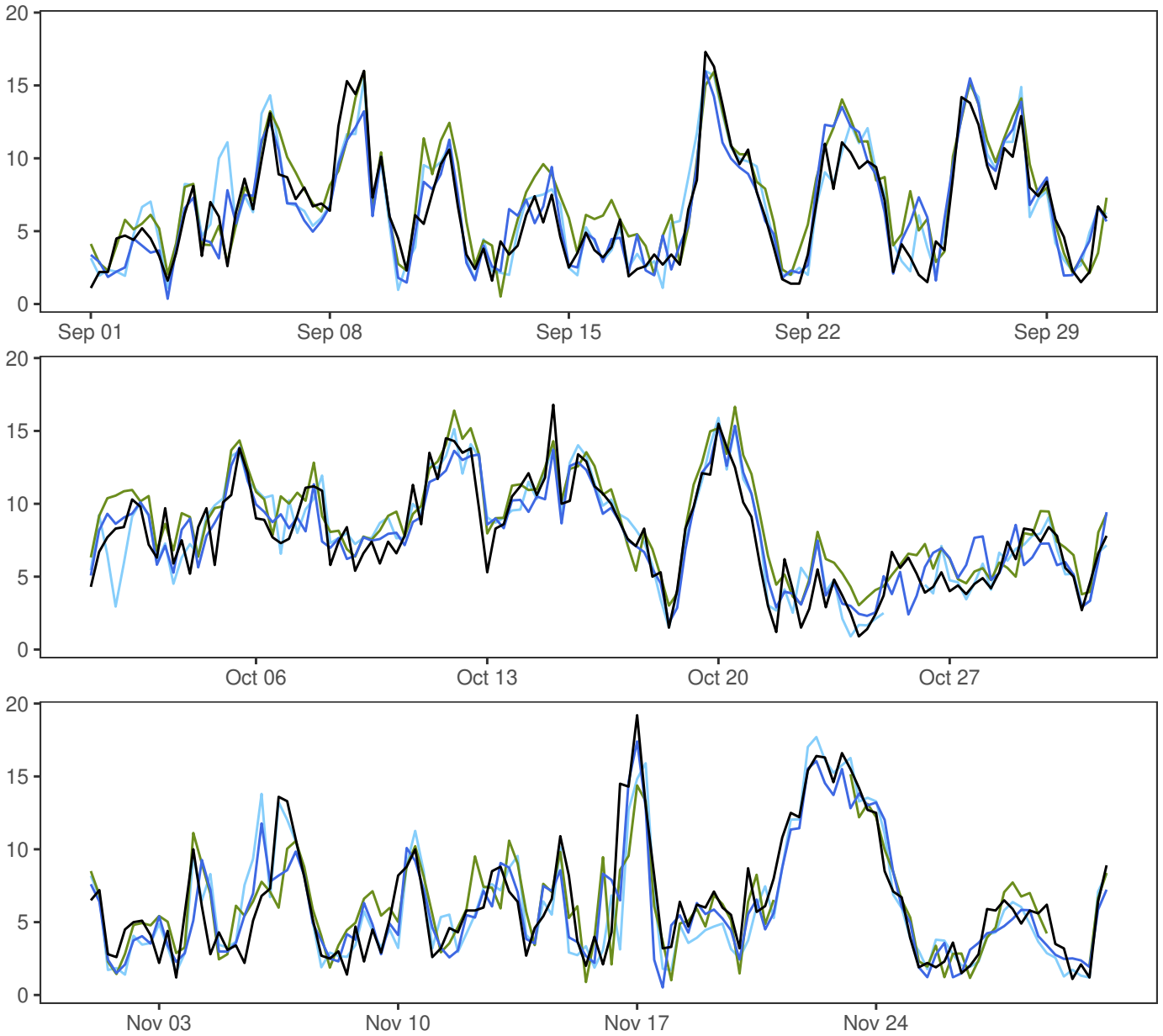
SVALBARD LUFTHAVN



- synop: 00,06,12,18
- AA25: 12+18,+24,+30,+36
- ECMWF: 12+18,+24,+30,+36



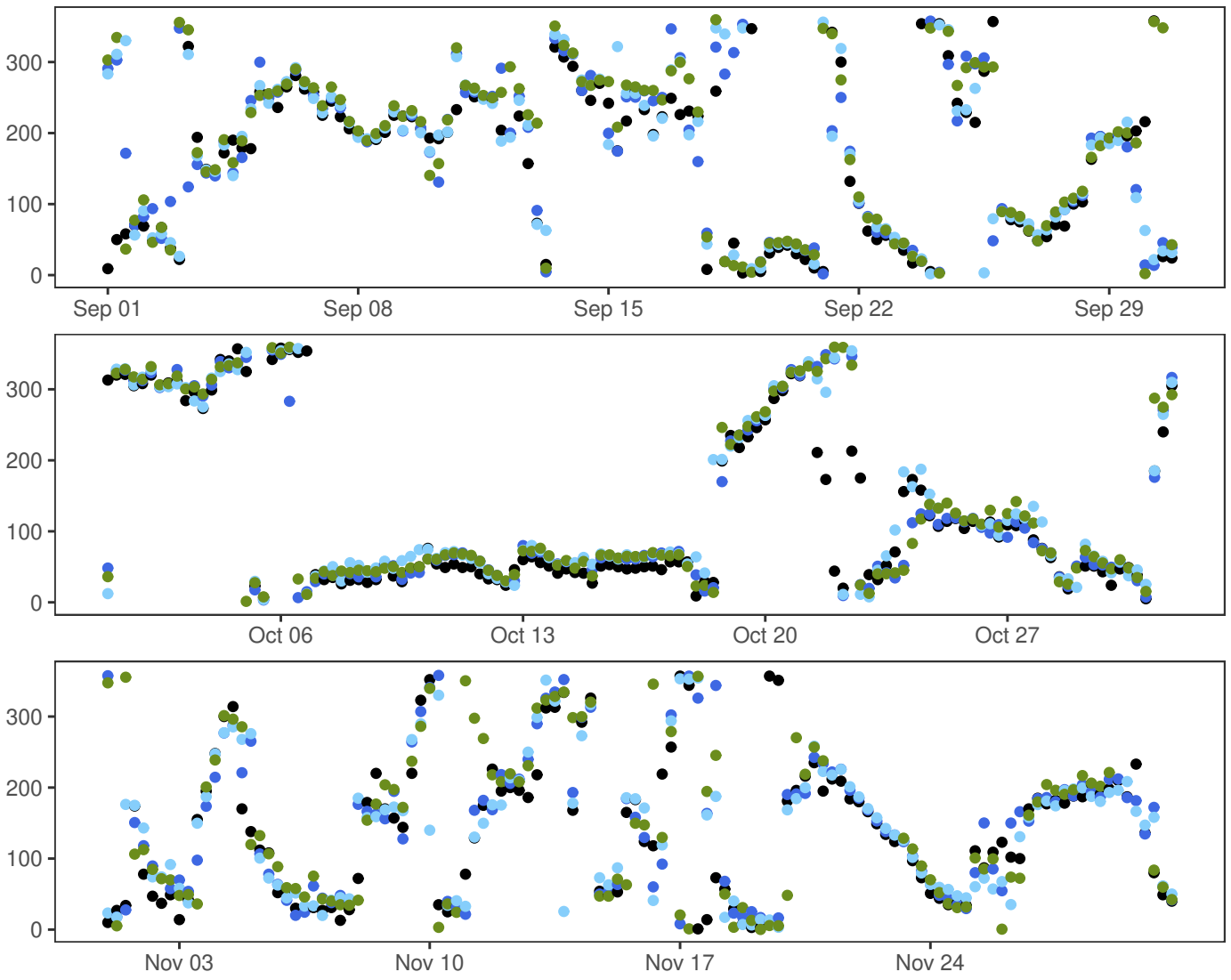
BJØRNØYA



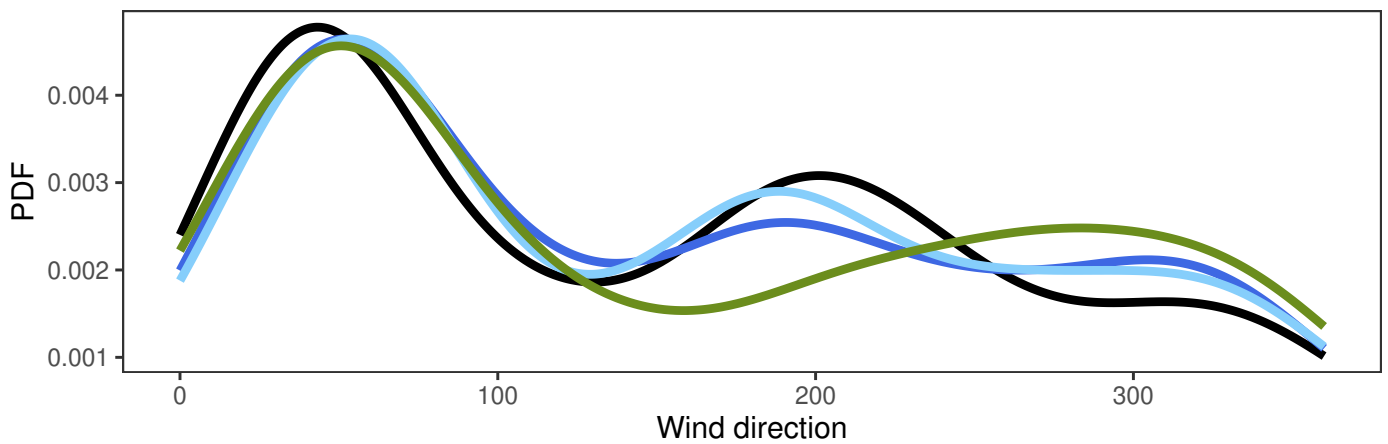
	Min	Mean	Max	Std	N
— synop: 00,06,12,18	0.9	6.9	19.2	3.8	364
— MEPSctrl: 12+18,+24,+30,+36	0.4	6.8	17.4	3.6	364
— AA25: 12+18,+24,+30,+36	0.9	7.0	17.7	3.9	360
— ECMWF: 12+18,+24,+30,+36	0.5	7.5	16.7	3.5	352

	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl-synop	0.0	1.8	1.8	1.4	8.0	348
AA25-synop	0.1	1.9	1.9	1.3	11.4	348
ECMWF-synop	0.7	1.8	1.9	1.5	7.6	348

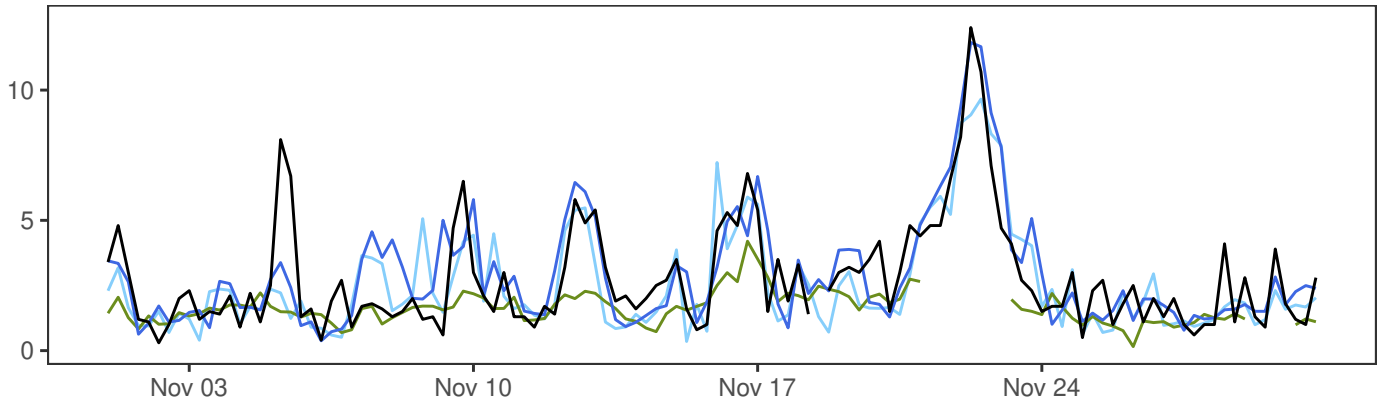
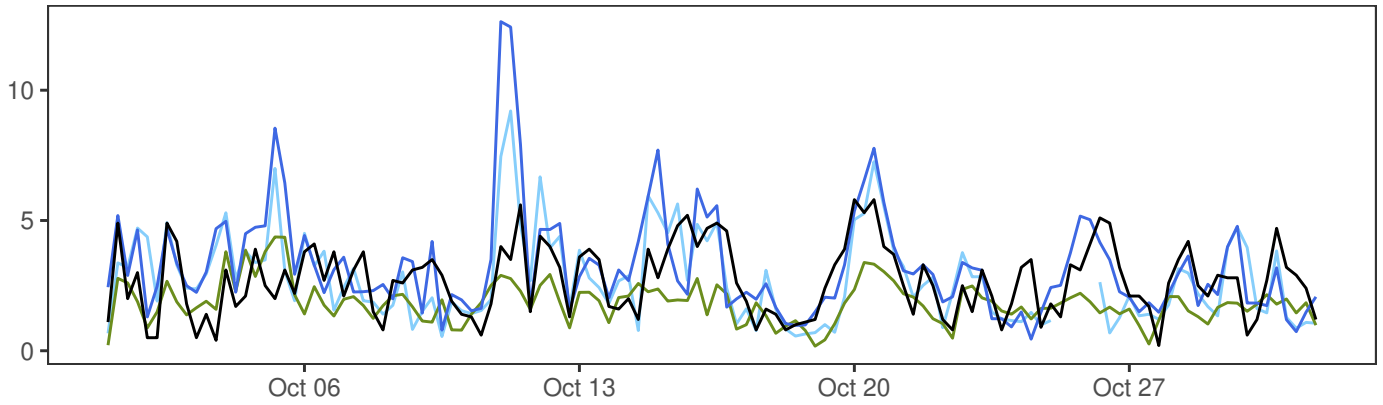
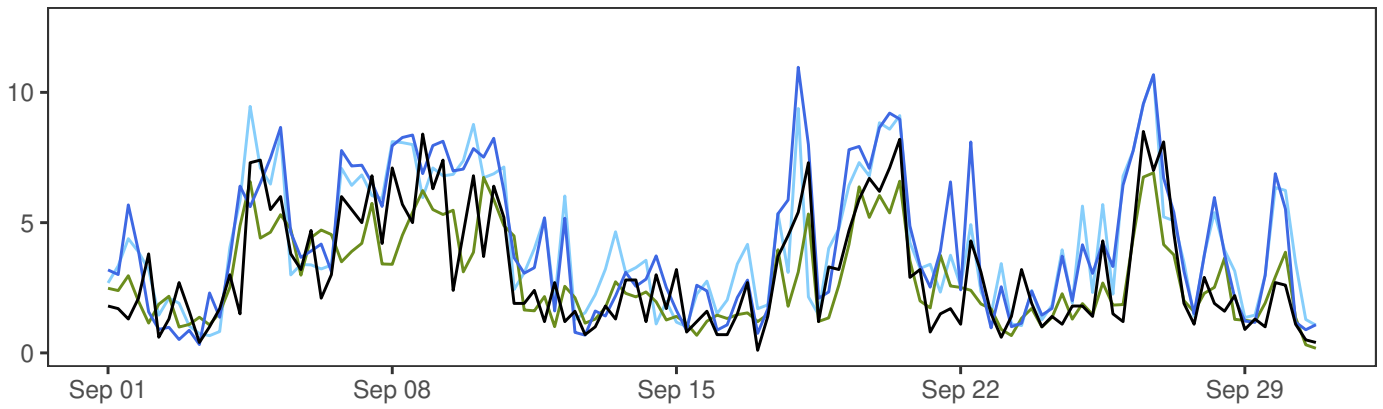
BJØRNØYA



- synop: 00,06,12,18
- MEPSctrl: 12+18,+24,+30,+36
- AA25: 12+18,+24,+30,+36
- ECMWF: 12+18,+24,+30,+36



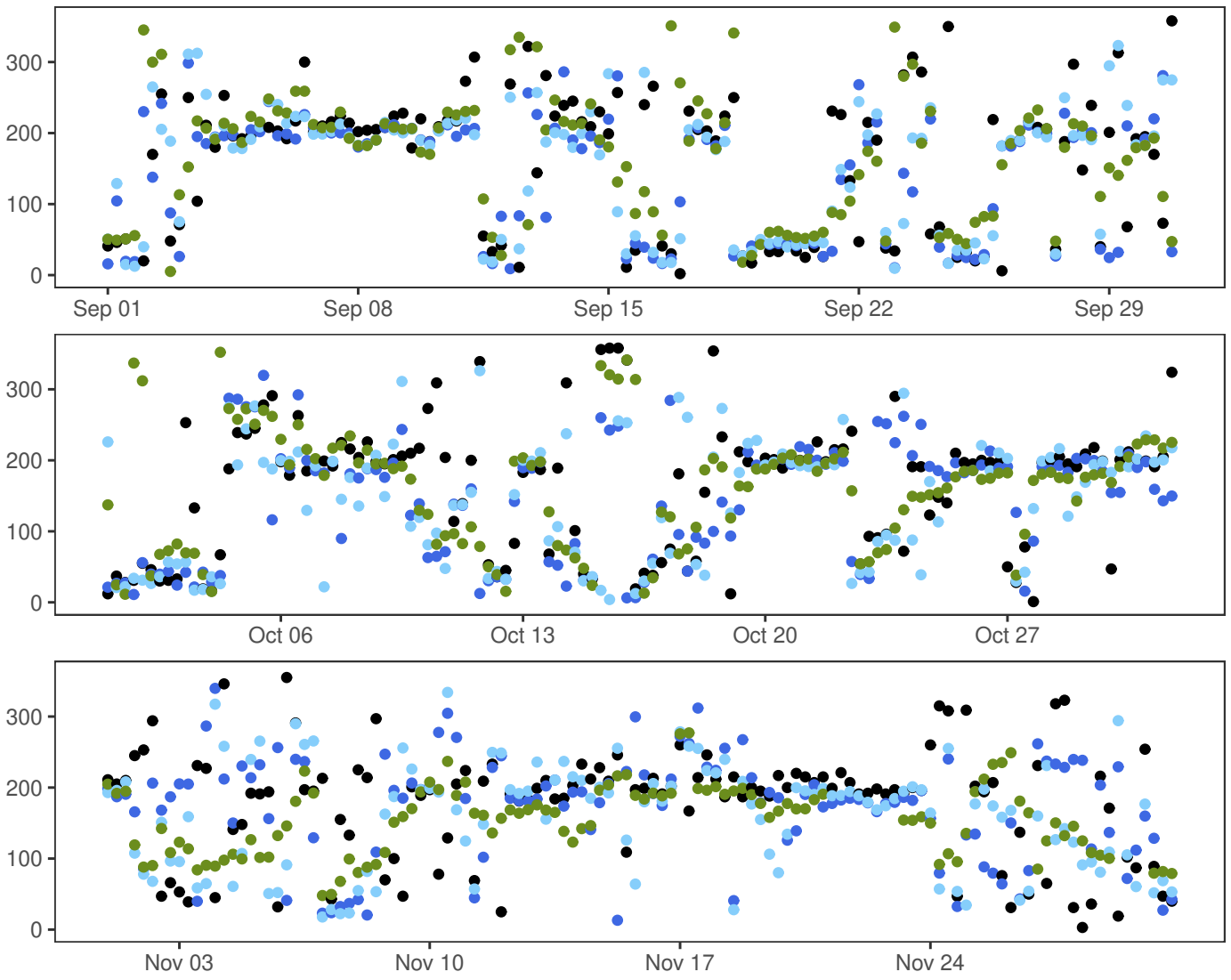
TROMSØ



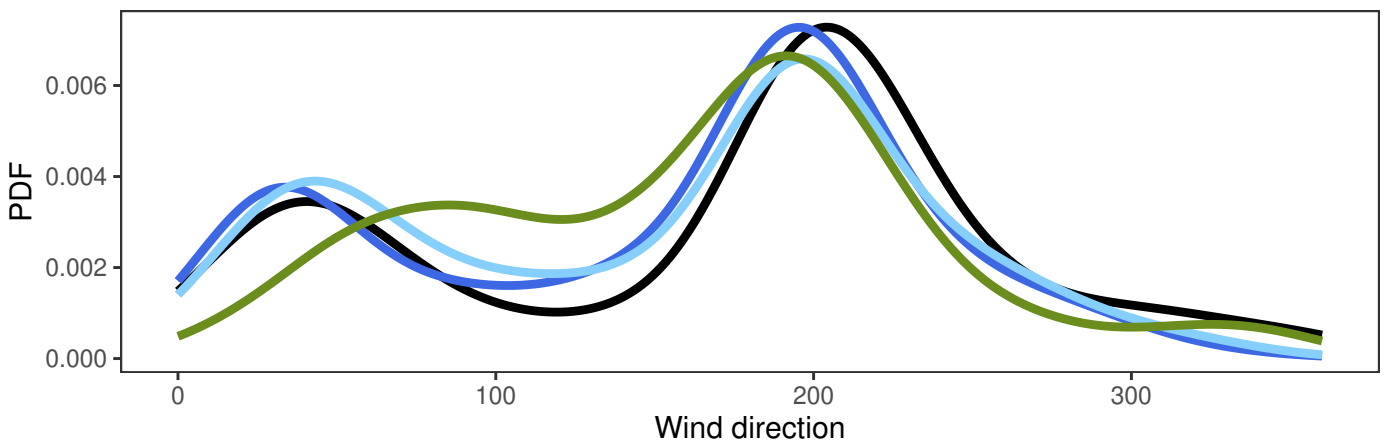
	Min	Mean	Max	Std	N
— synop: 00,06,12,18	0.1	2.8	12.4	1.9	363
— MEPSctrl: 12+18,+24,+30,+36	0.3	3.5	12.6	2.4	364
— AA25: 12+18,+24,+30,+36	0.4	3.2	10.7	2.2	360
— ECMWF: 12+18,+24,+30,+36	0.2	2.1	6.9	1.3	352

	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl-synop	0.6	1.7	1.8	1.3	8.9	347
AA25-synop	0.3	1.6	1.7	1.3	5.9	347
ECMWF-synop	-0.6	1.3	1.5	1.1	6.6	347

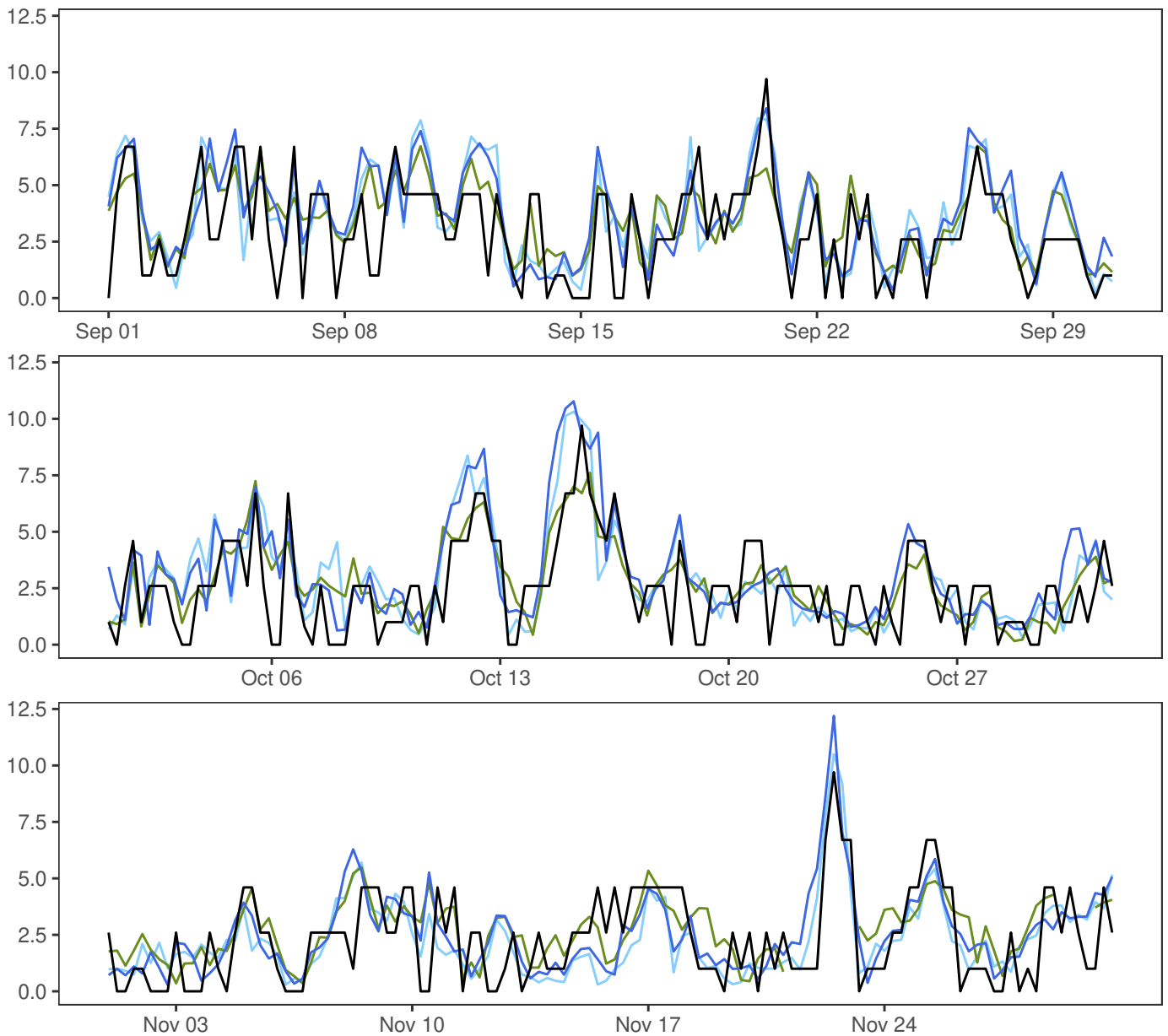
TROMSØ



- synop: 00,06,12,18
- MEPSctrl: 12+18,+24,+30,+36
- AA25: 12+18,+24,+30,+36
- ECMWF: 12+18,+24,+30,+36



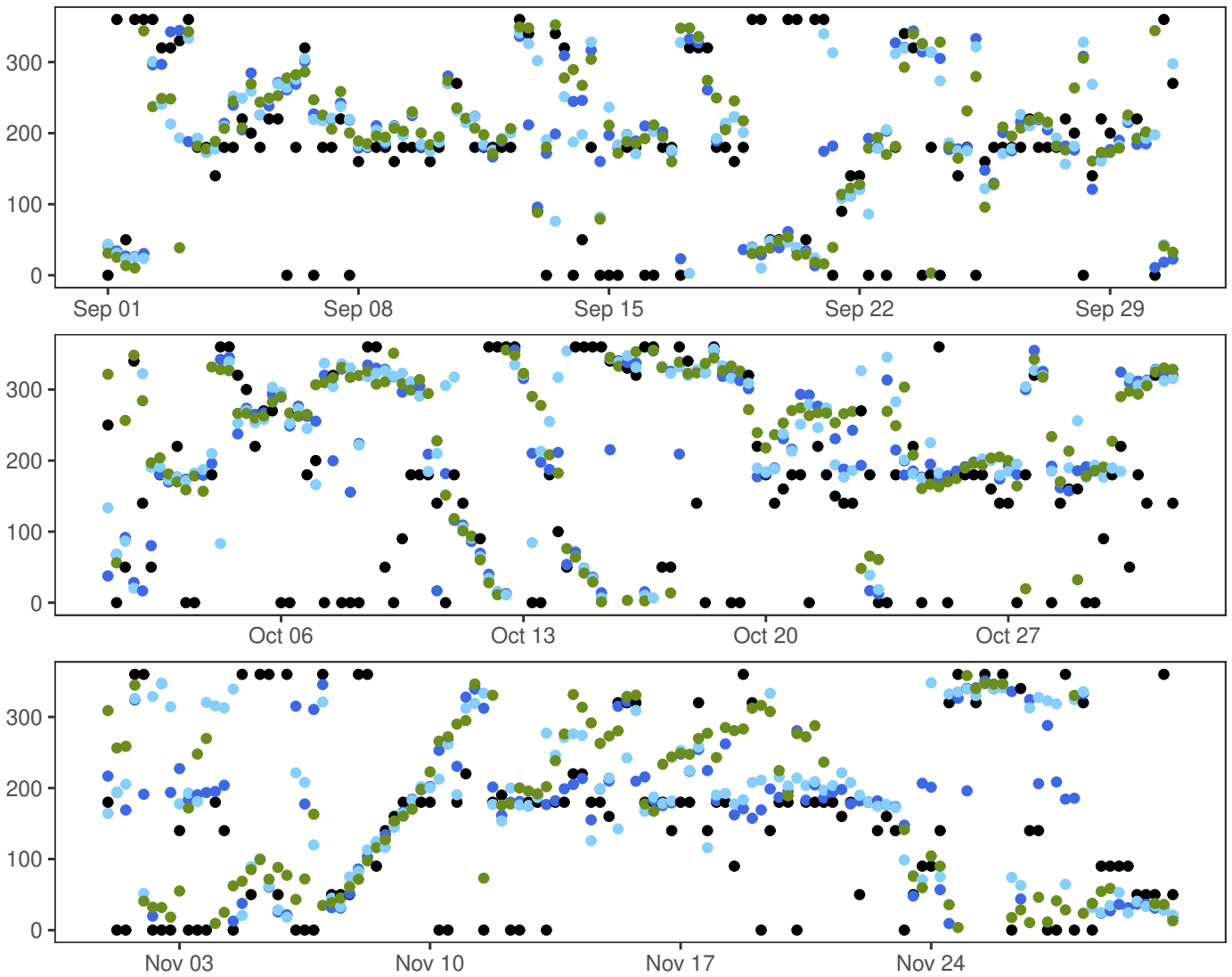
KAUTOKEINO



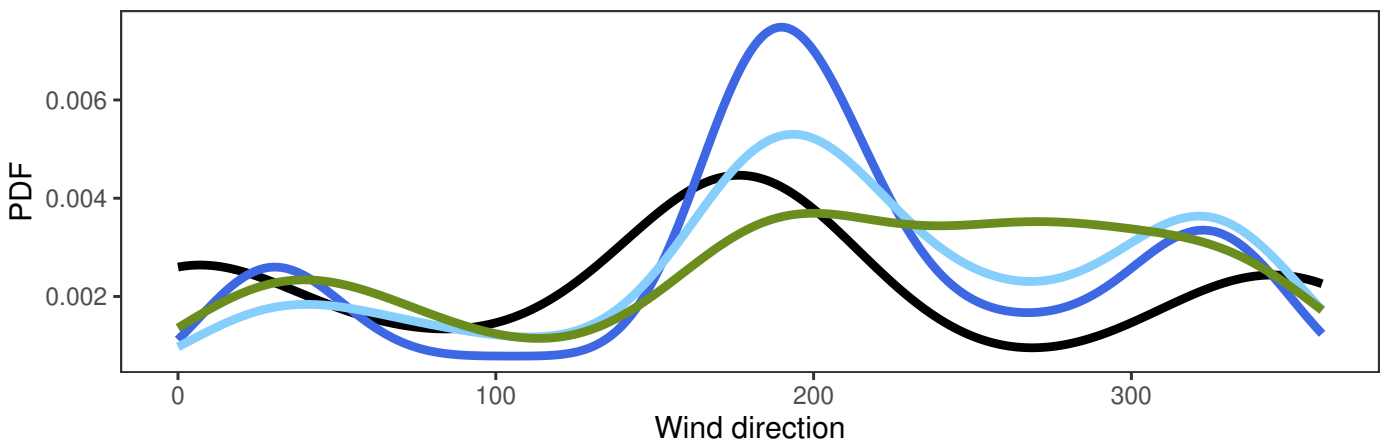
	Min	Mean	Max	Std	N
— synop: 00,06,12,18	0.0	2.6	9.7	2.1	364
— MEPSctrl: 12+18,+24,+30,+36	0.3	3.2	12.2	2.1	364
— AA25: 12+18,+24,+30,+36	0.2	3.0	10.5	2.1	360
— ECMWF: 12+18,+24,+30,+36	0.2	3.0	7.6	1.5	352

	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl-synop	0.5	1.7	1.8	1.4	5.3	348
AA25-synop	0.4	1.7	1.8	1.4	5.6	348
ECMWF-synop	0.4	1.5	1.6	1.3	4.9	348

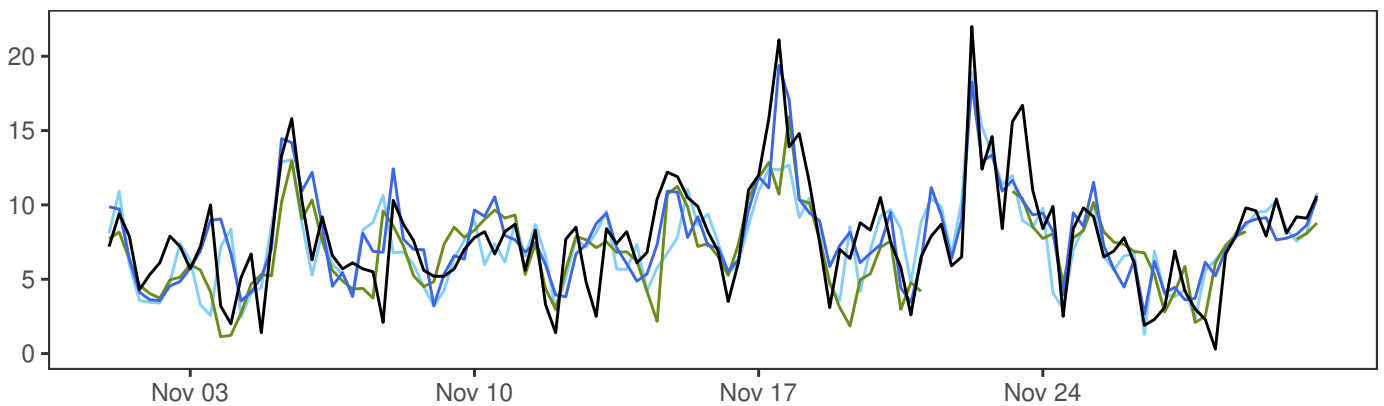
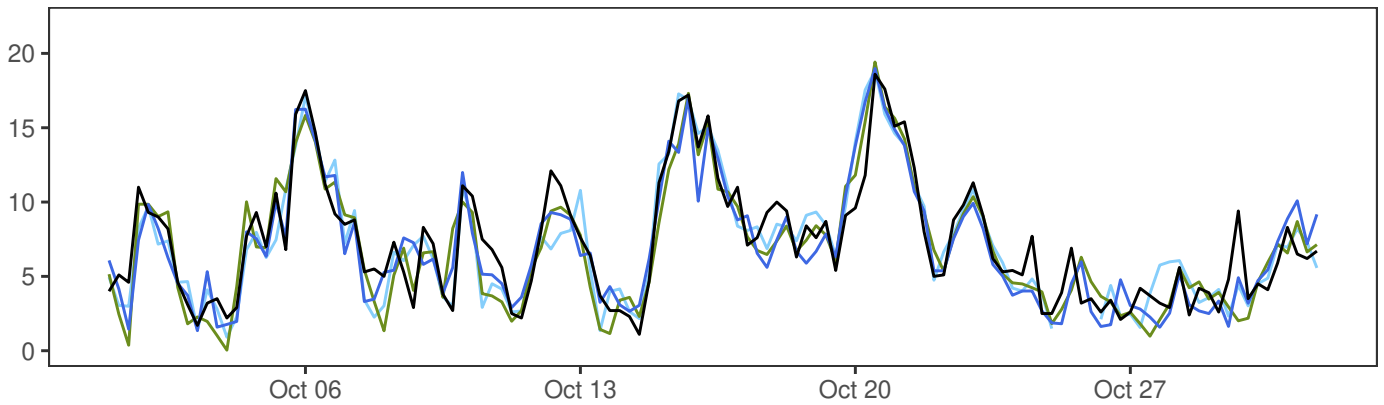
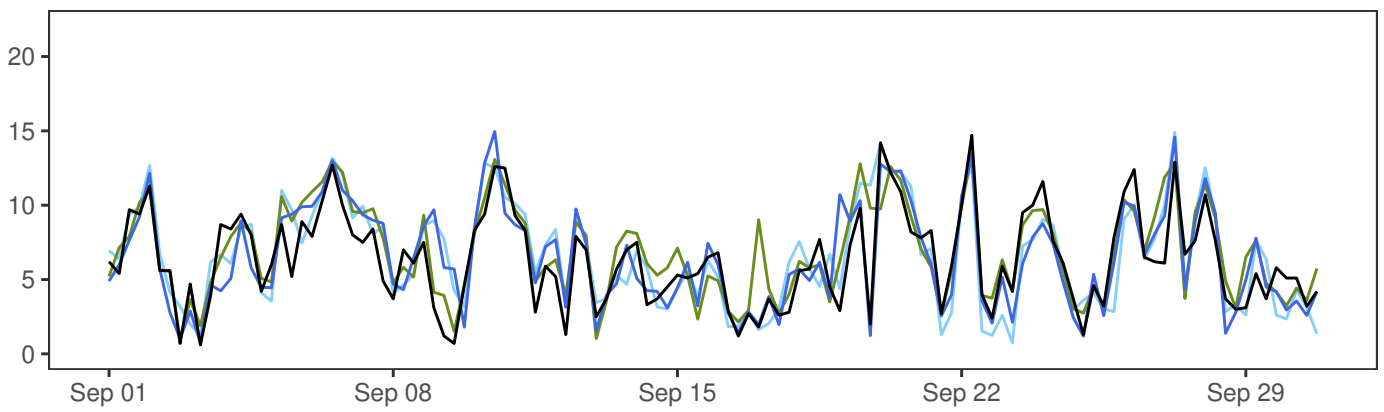
KAUTOKEINO



- synop: 00,06,12,18
- MEPSctrl: 12+18,+24,+30,+36
- AA25: 12+18,+24,+30,+36
- ECMWF: 12+18,+24,+30,+36



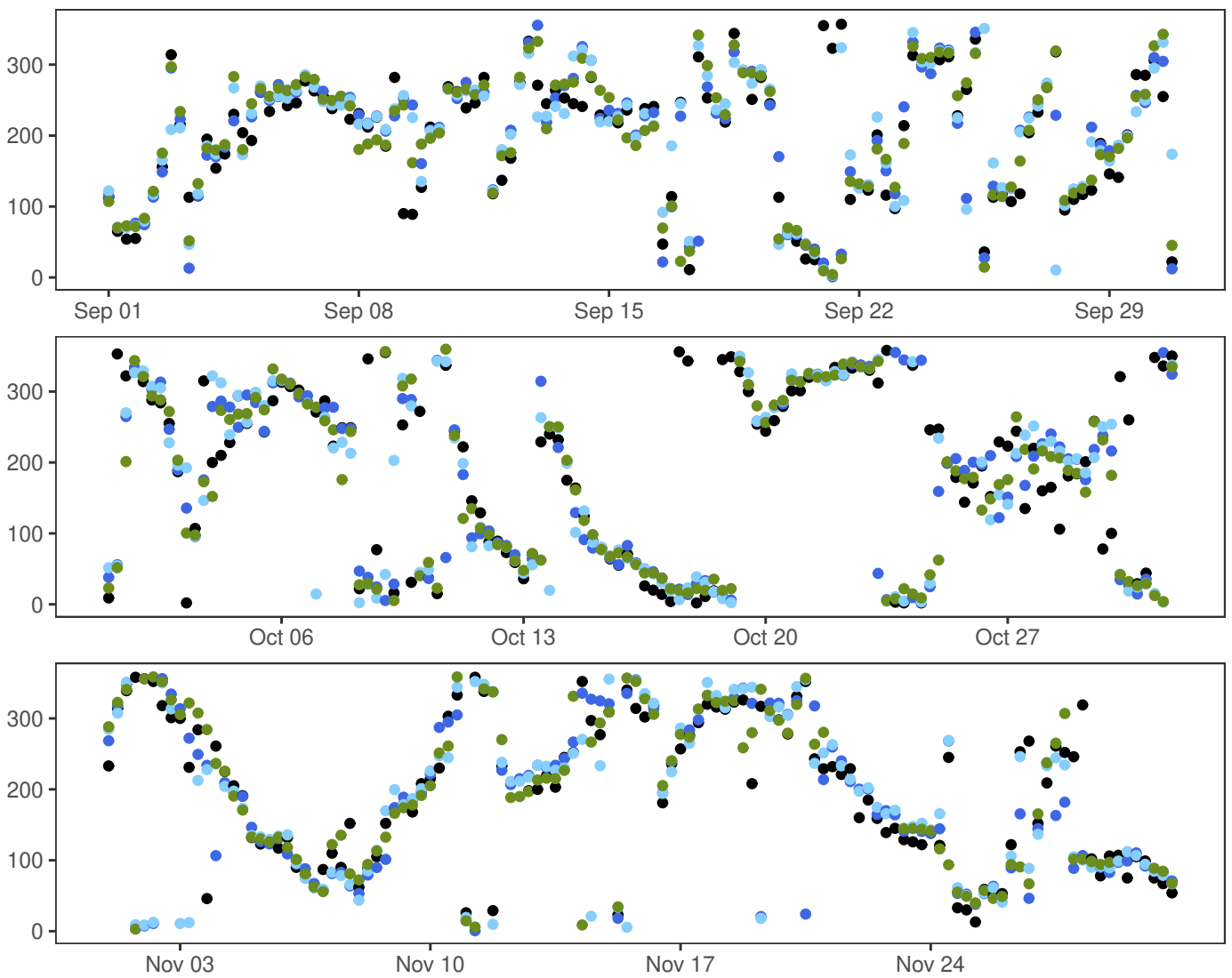
SLETTNES FYR



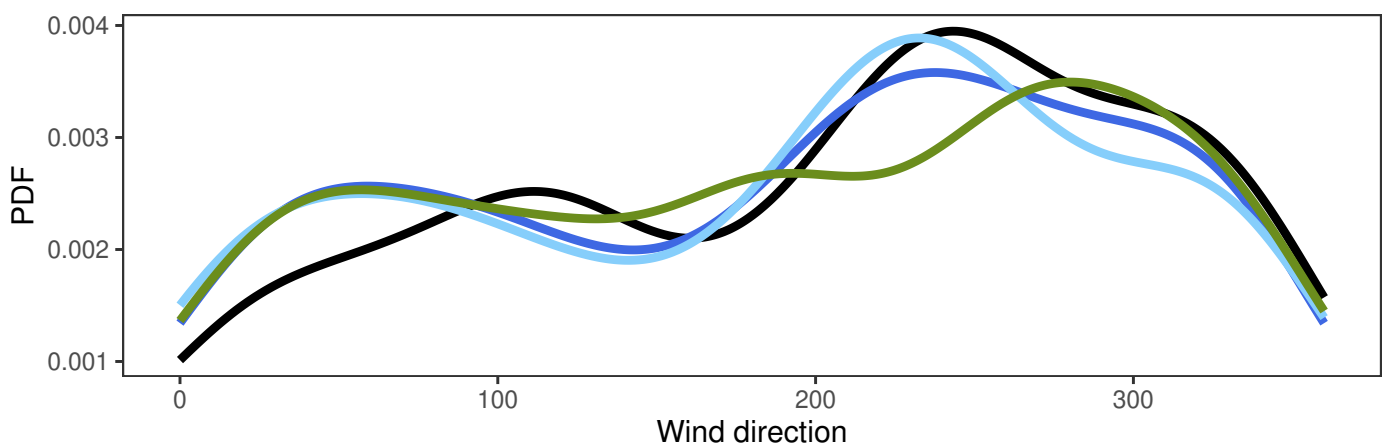
	Min	Mean	Max	Std	N
— synop: 00,06,12,18	0.3	7.1	22.0	3.7	364
— MEPSctrl: 12+18,+24,+30,+36	0.8	7.1	19.4	3.5	364
— AA25: 12+18,+24,+30,+36	0.7	7.1	18.9	3.5	360
— ECMWF: 12+18,+24,+30,+36	0.0	6.9	19.4	3.4	352

	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl-synop	-0.1	2.0	2.0	1.6	7.8	348
AA25-synop	-0.1	2.3	2.3	1.7	9.3	348
ECMWF-synop	-0.2	2.1	2.1	1.6	10.4	348

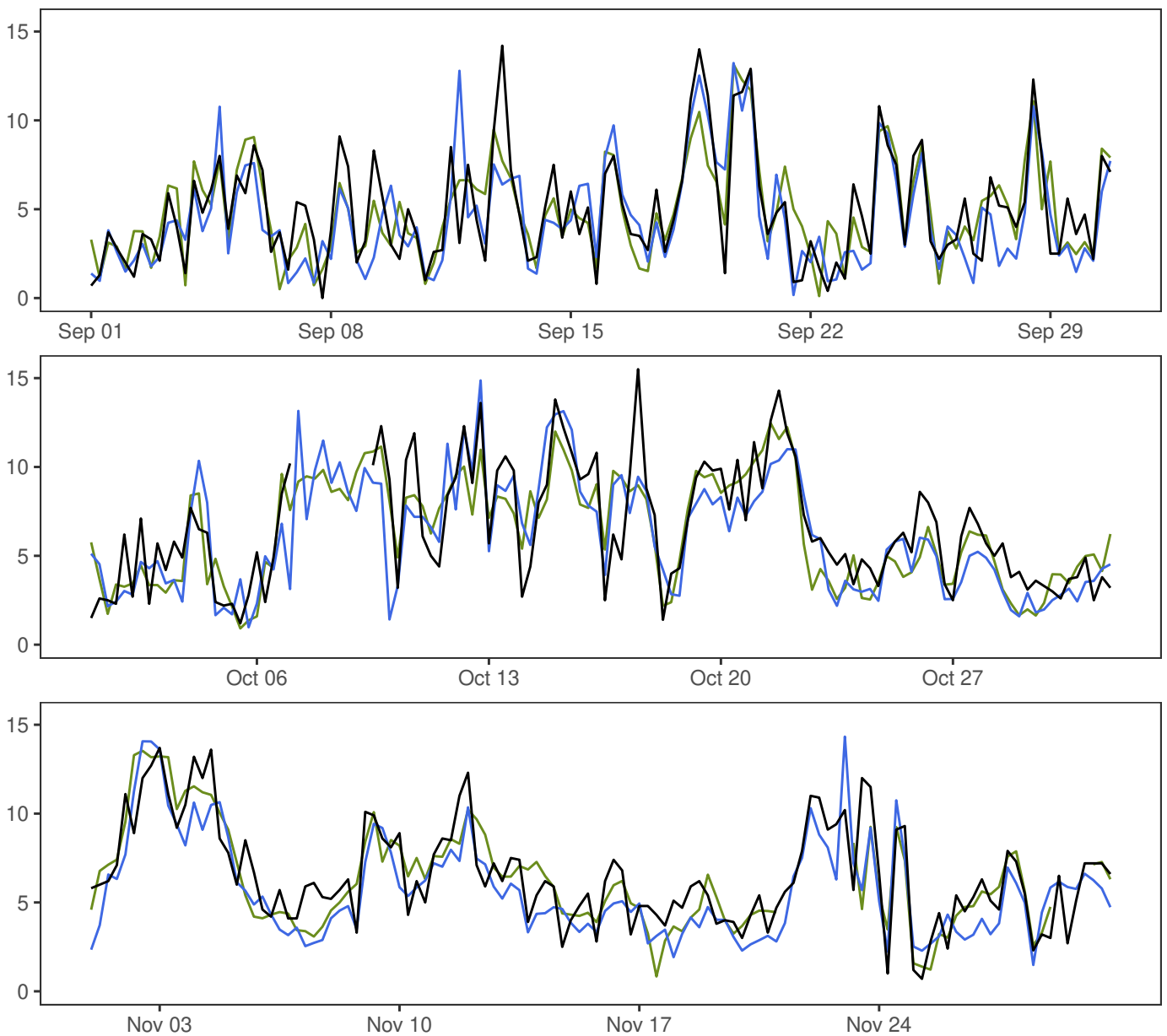
SLETTNES FYR



- synop: 00,06,12,18
- MEPSctrl: 12+18,+24,+30,+36
- AA25: 12+18,+24,+30,+36
- ECMWF: 12+18,+24,+30,+36



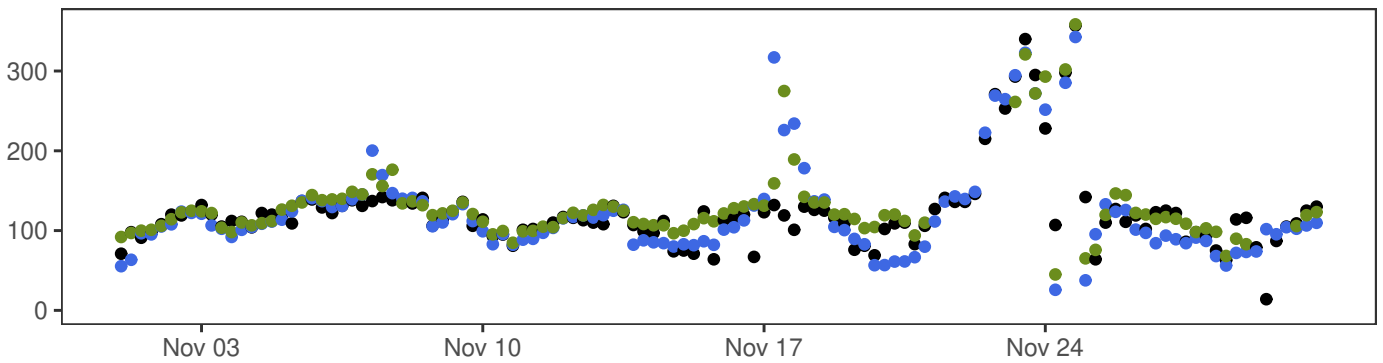
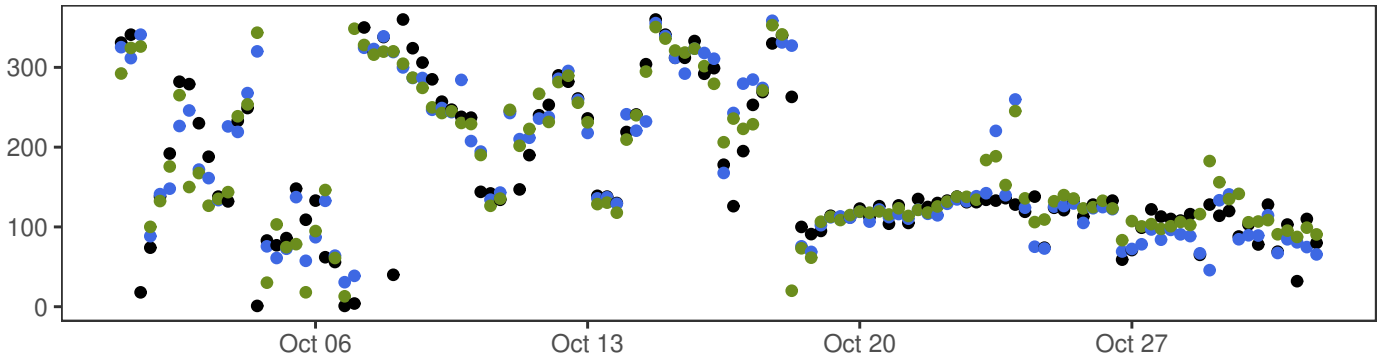
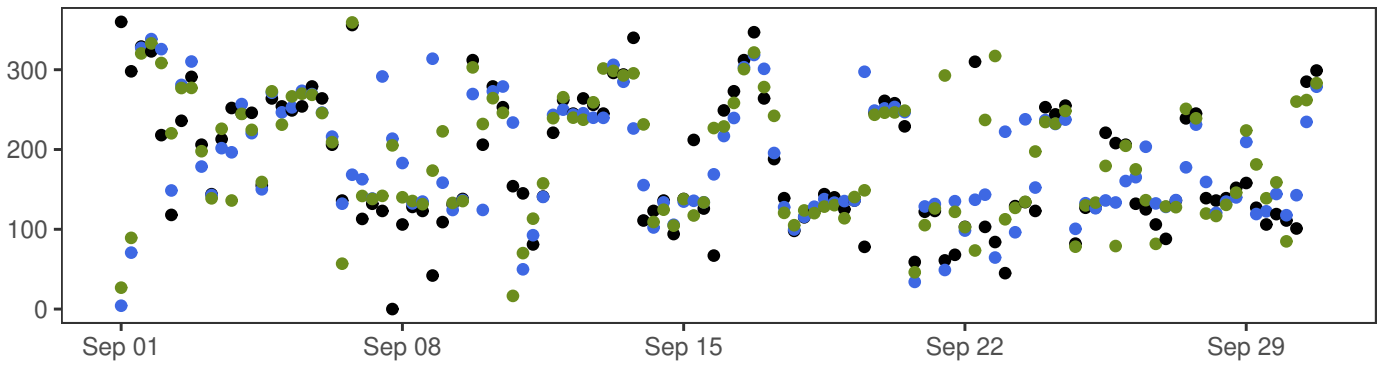
ØRLAND III



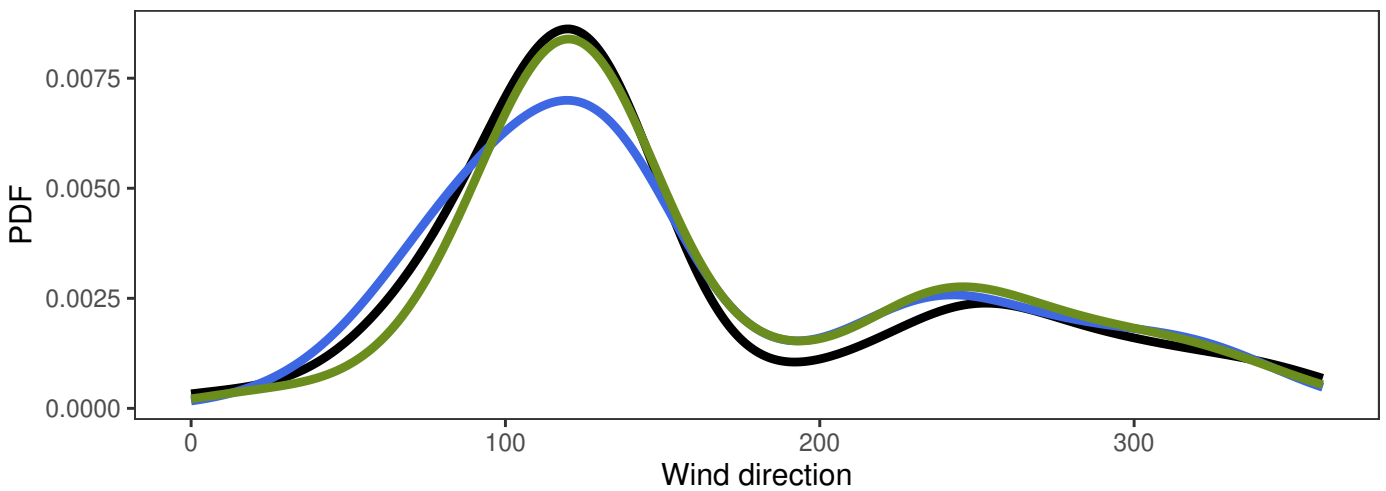
	Min	Mean	Max	Std	N
— synop: 00,06,12,18	0.0	6.0	15.5	3.2	355
— MEPSctrl: 12+18,+24,+30,+36	0.2	5.5	14.9	3.1	364
— ECMWF: 12+18,+24,+30,+36	0.1	5.8	13.5	2.9	352

	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl-synop	-0.7	1.9	2.1	1.6	9.7	343
ECMWF-synop	-0.2	1.8	1.8	1.4	7.4	343

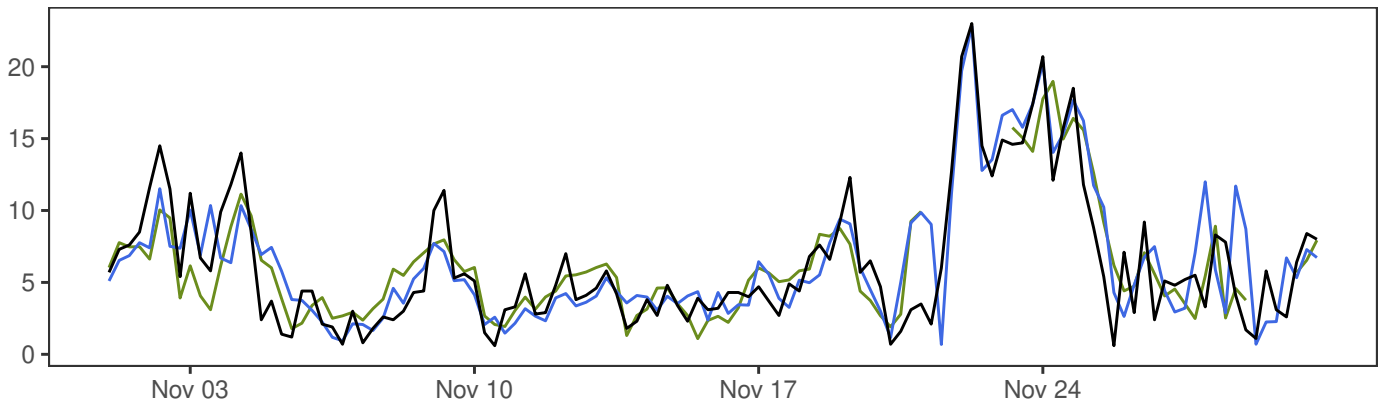
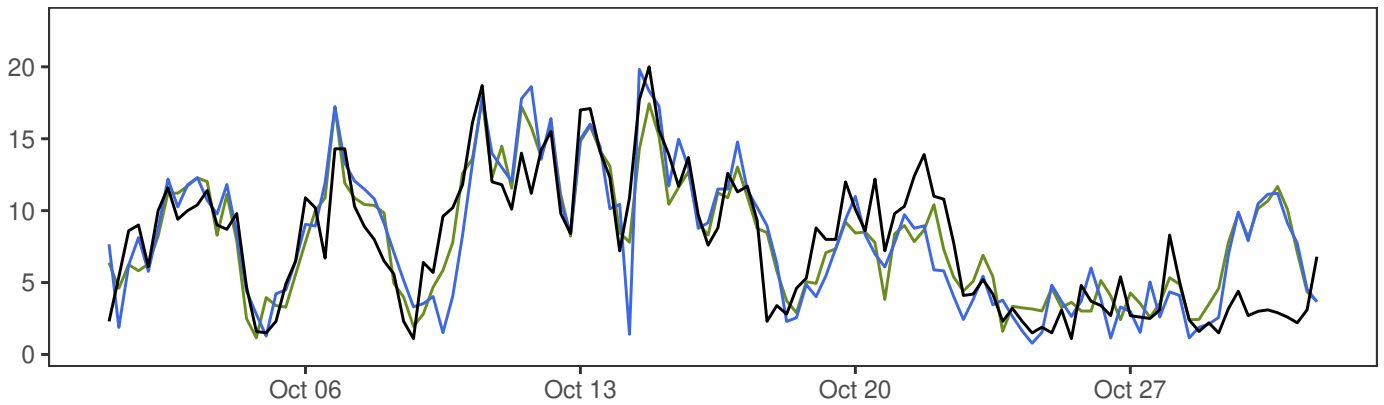
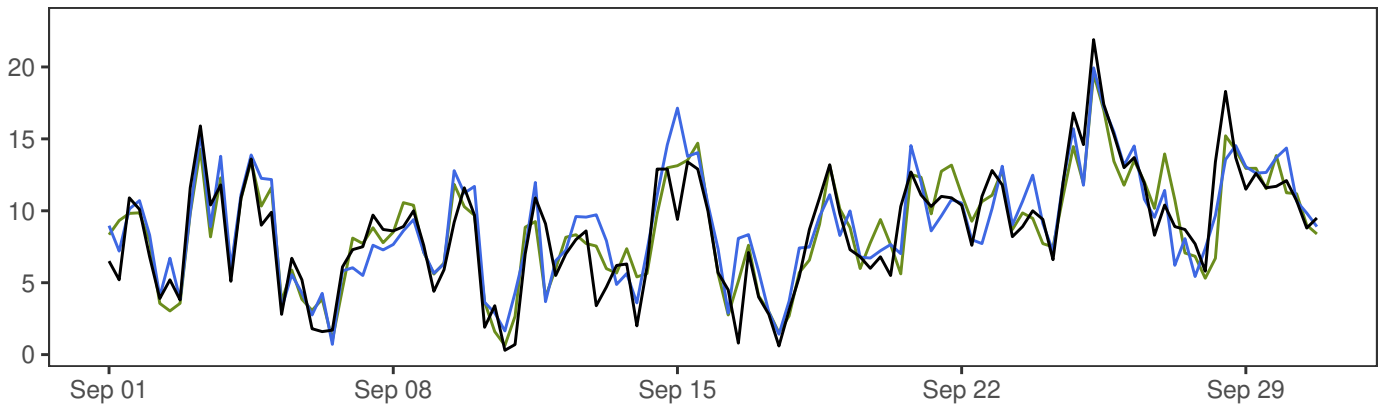
ØRLAND III



- synop: 00,06,12,18
- MEPSctrl: 12+18,+24,+30,+36
- ECMWF: 12+18,+24,+30,+36



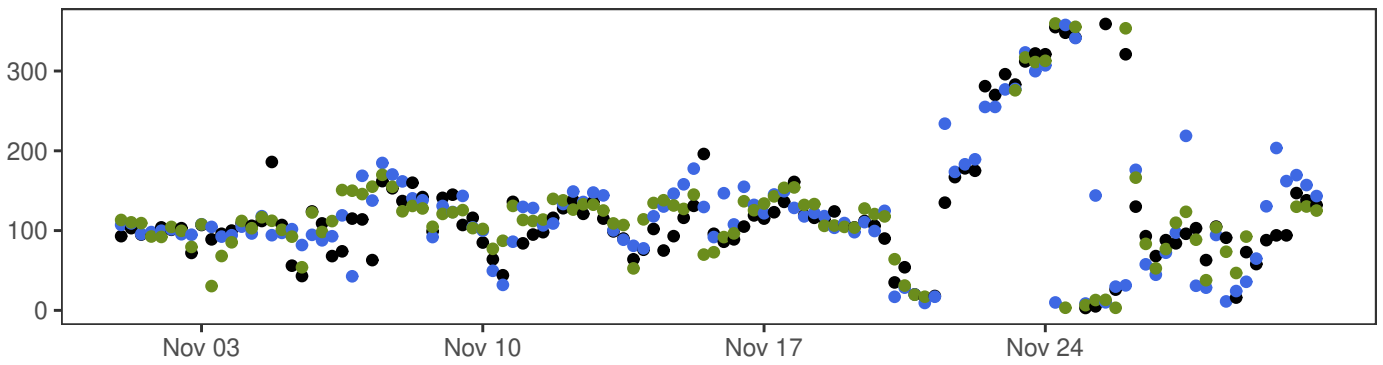
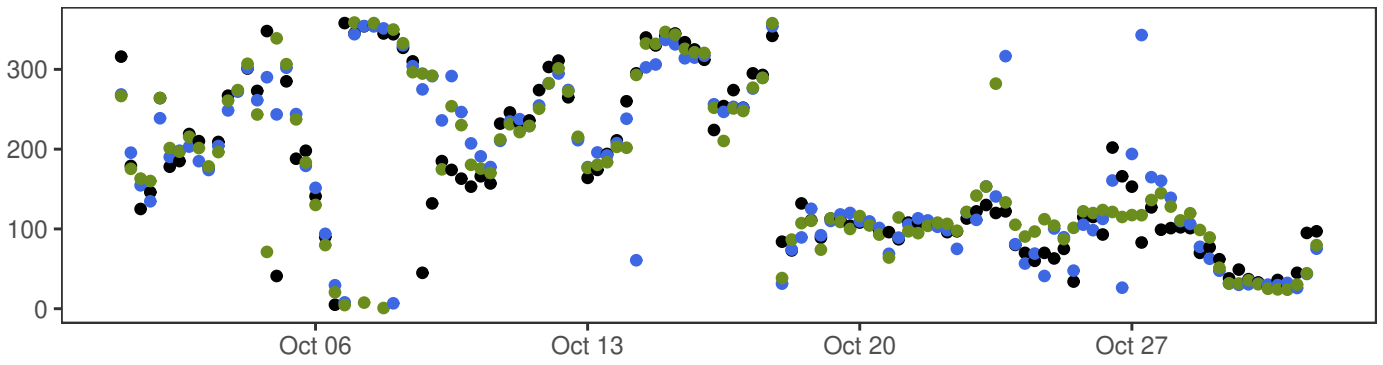
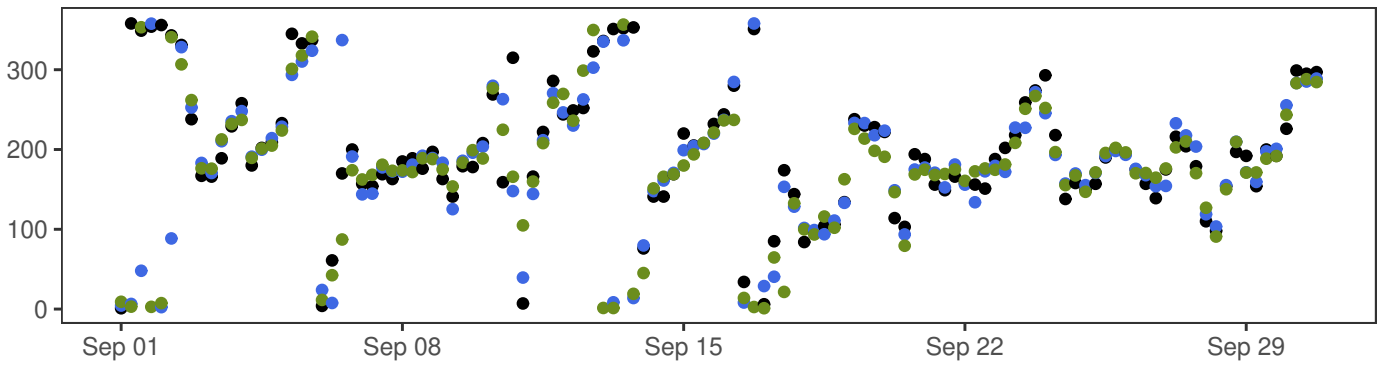
YTTERØYANE FYR



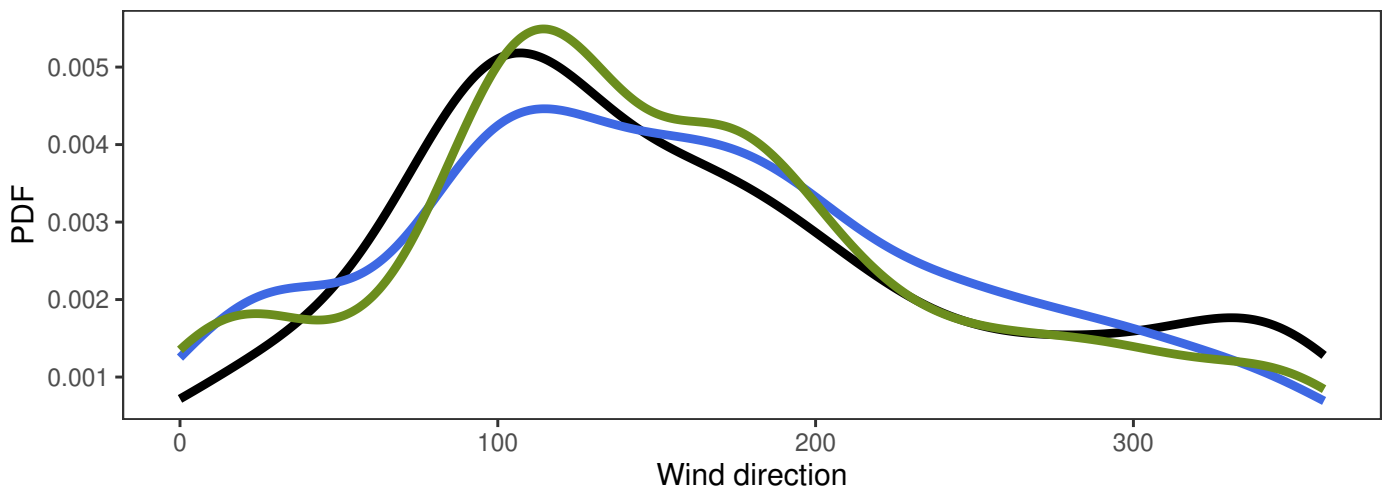
	Min	Mean	Max	Std	N
— synop: 00,06,12,18	0.3	7.6	23.0	4.5	364
— MEPSctrl: 12+18,+24,+30,+36	0.7	7.8	22.8	4.5	364
— ECMWF: 12+18,+24,+30,+36	0.6	7.7	19.5	4.0	352

	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl-synop	0.3	2.6	2.6	1.9	9.5	352
ECMWF-synop	0.2	2.3	2.3	1.8	8.8	352

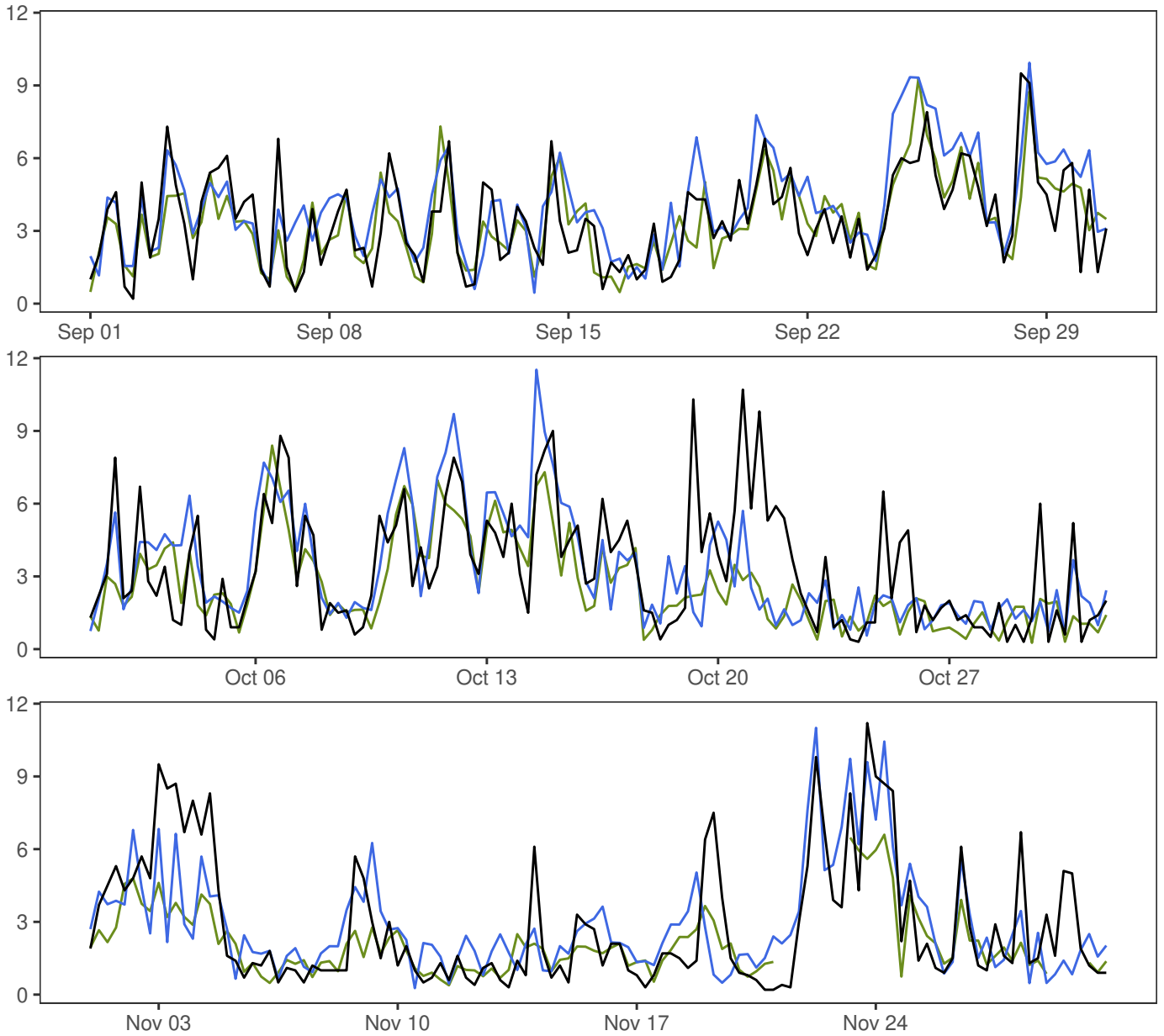
YTTERØYANE FYR



- synop: 00,06,12,18
- MEPSctrl: 12+18,+24,+30,+36
- ECMWF: 12+18,+24,+30,+36



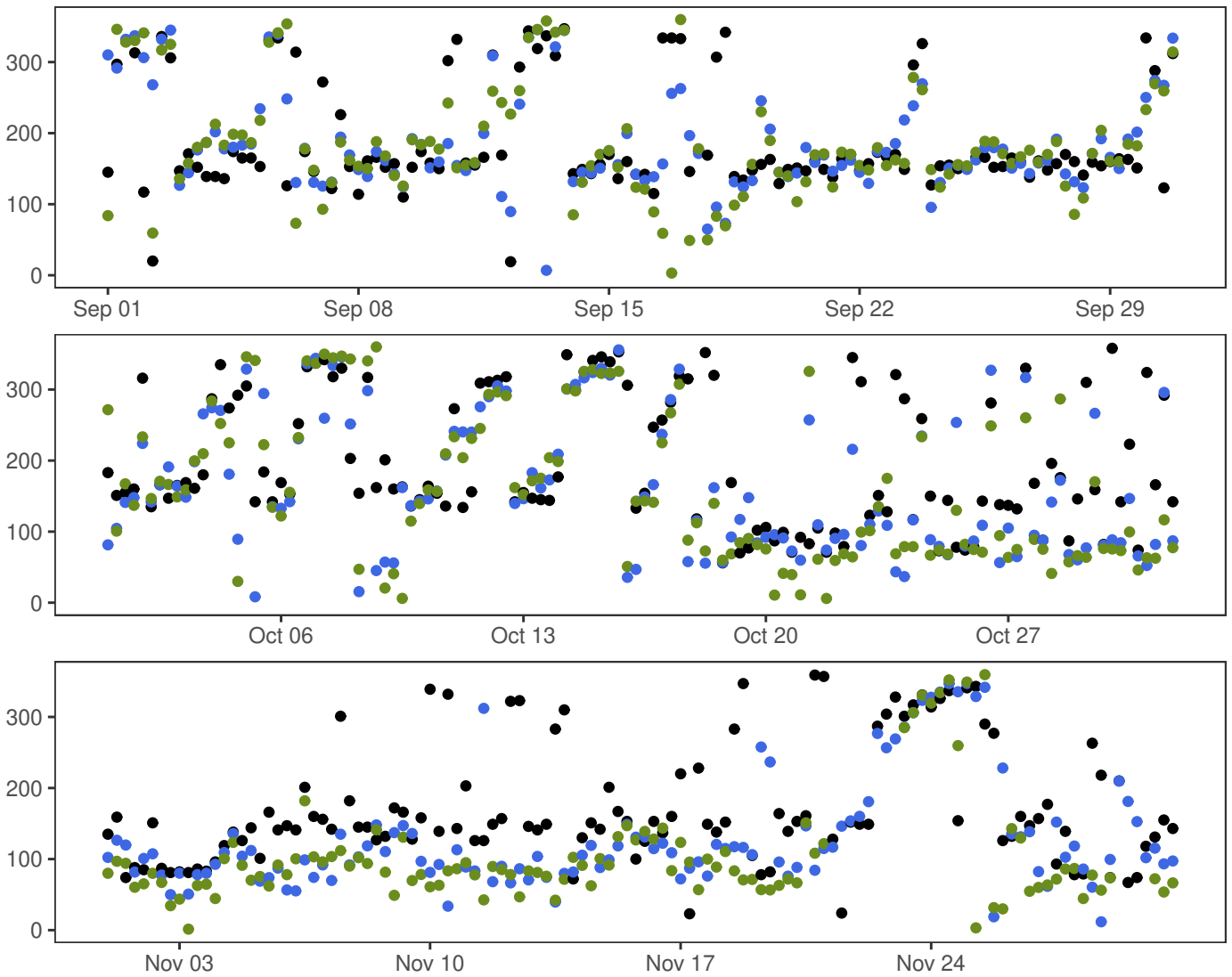
BERGEN – FLORIDA



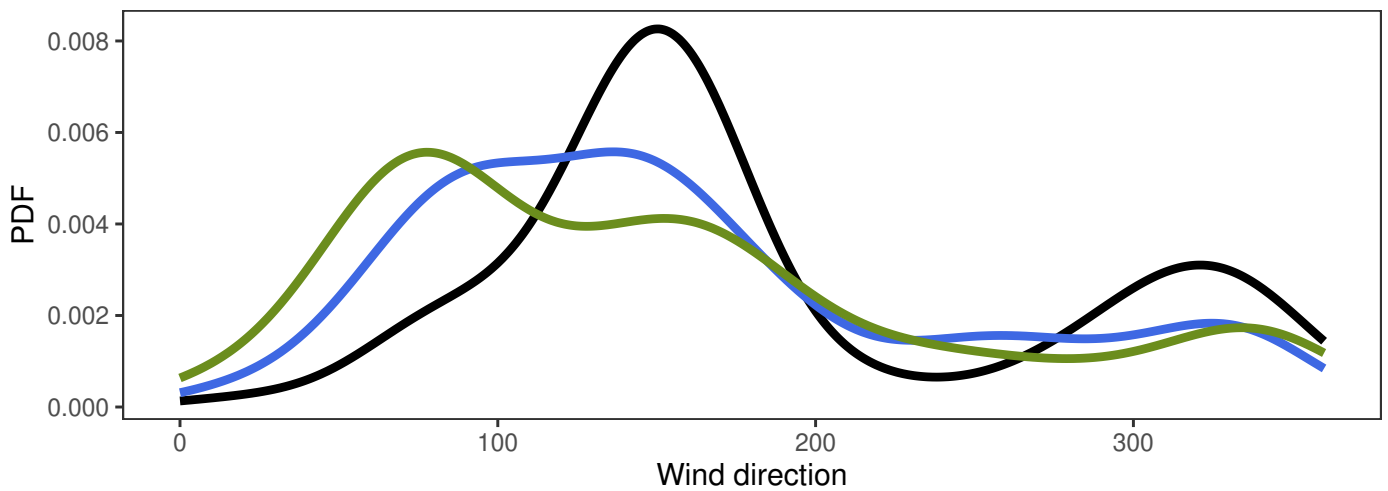
	Min	Mean	Max	Std	N
— synop: 00,06,12,18	0.2	3.2	11.2	2.4	364
— MEPSctrl: 12+18,+24,+30,+36	0.3	3.4	11.5	2.2	364
— ECMWF: 12+18,+24,+30,+36	0.3	2.7	9.3	1.7	352

	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl–synop	0.2	1.9	1.9	1.4	8.8	352
ECMWF–synop	-0.5	1.7	1.8	1.2	8.1	352

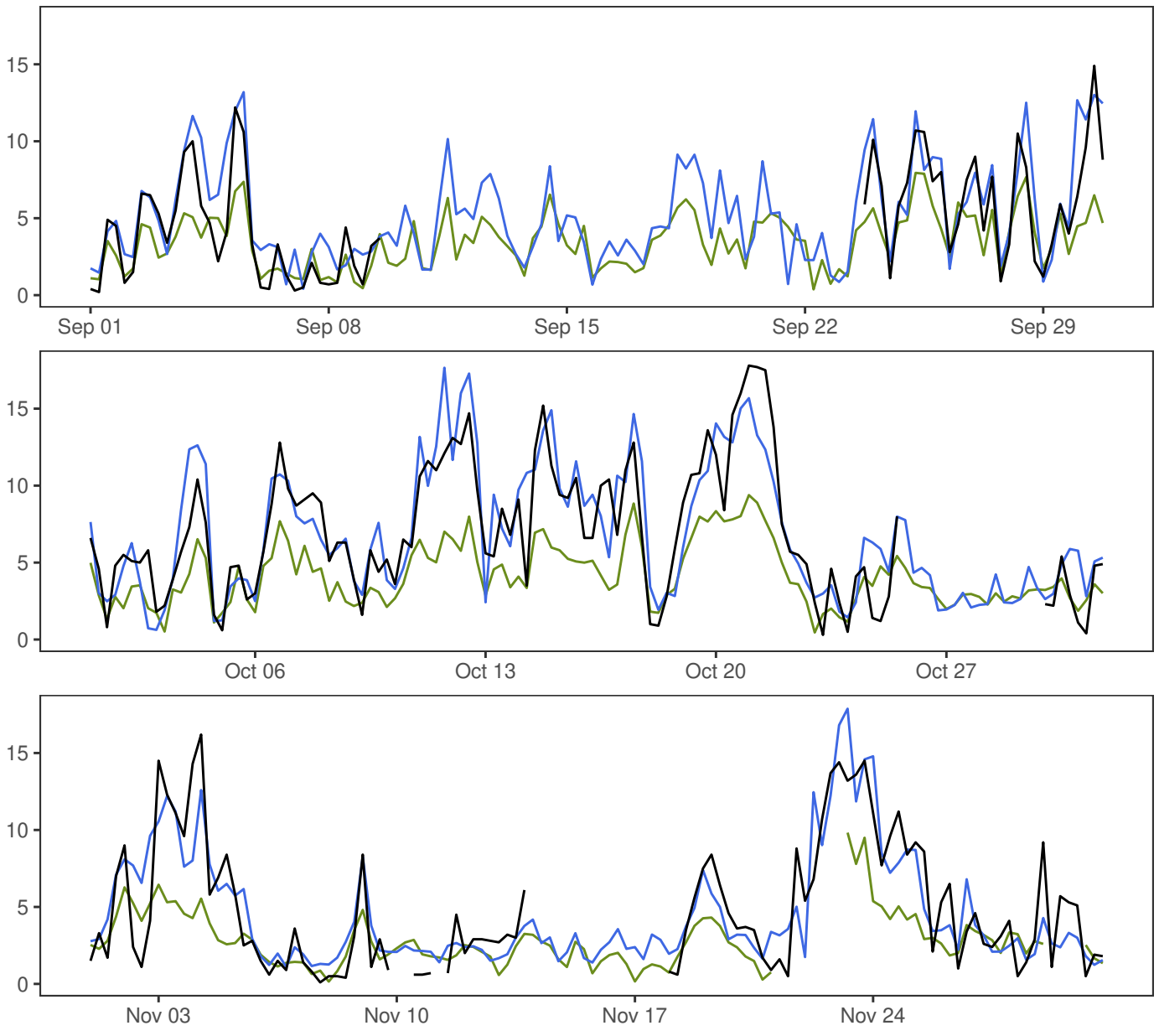
BERGEN – FLORIDA



- synop: 00,06,12,18
- MEPSctrl: 12+18,+24,+30,+36
- ECMWF: 12+18,+24,+30,+36



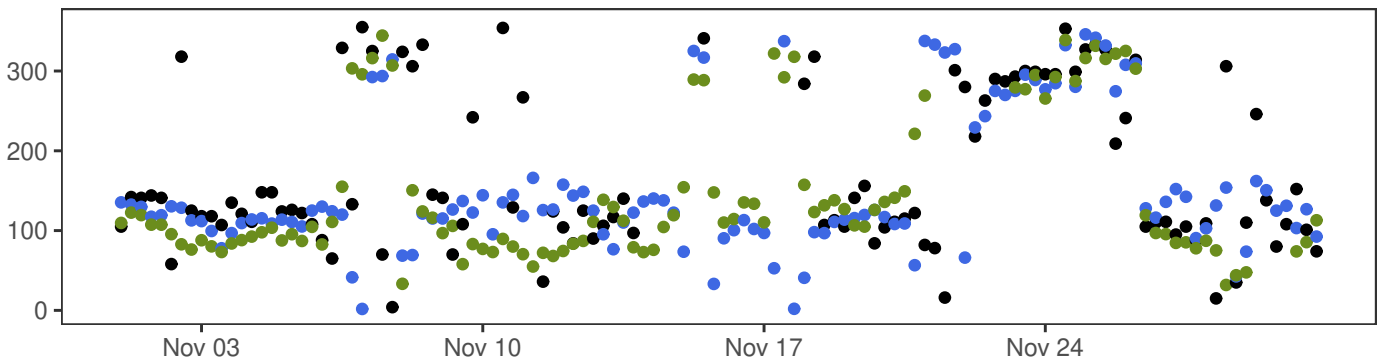
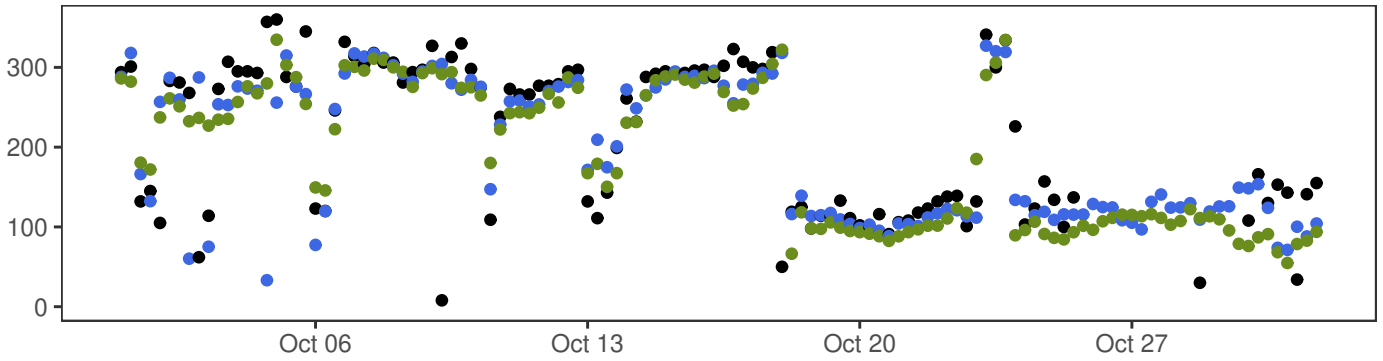
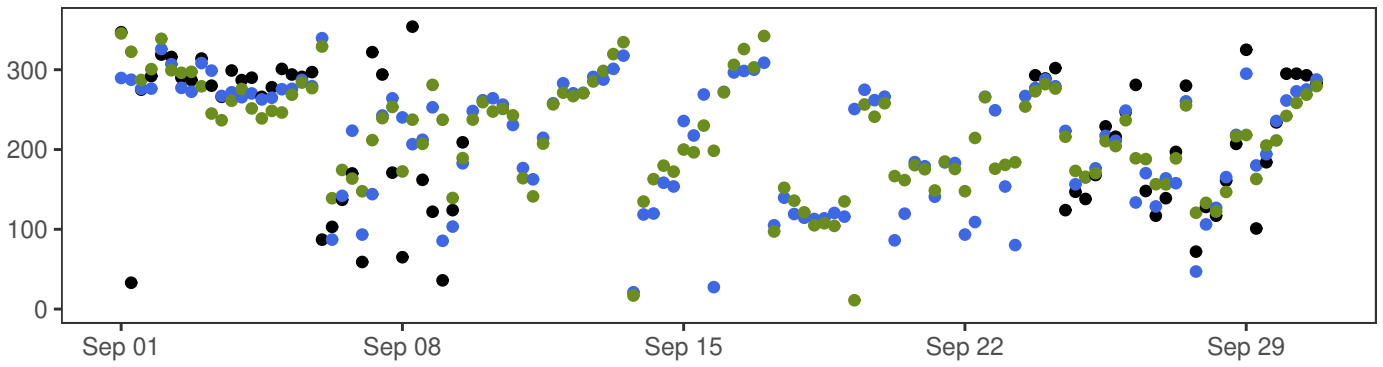
FINSEVATN



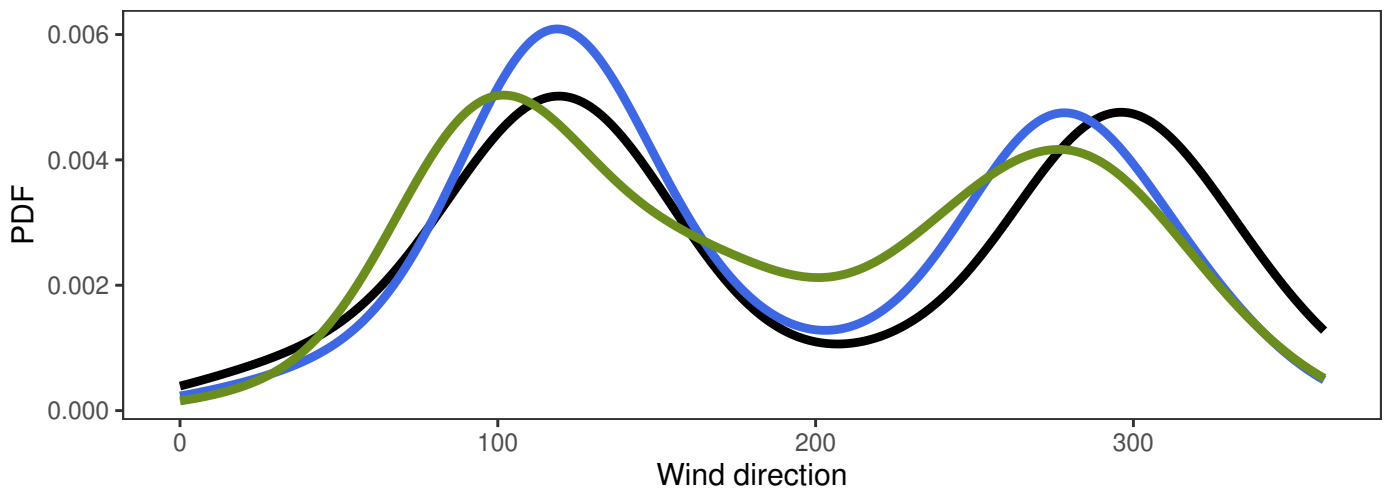
	Min	Mean	Max	Std	N
— synop: 00,06,12,18	0.1	5.7	17.8	4.2	274
— MEPSctrl: 12+18,+24,+30,+36	0.4	5.5	17.9	3.8	364
— ECMWF: 12+18,+24,+30,+36	0.1	3.5	9.8	1.9	352

	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl-synop	0.4	2.2	2.2	1.7	7.3	262
ECMWF-synop	-1.9	2.6	3.3	2.5	10.7	262

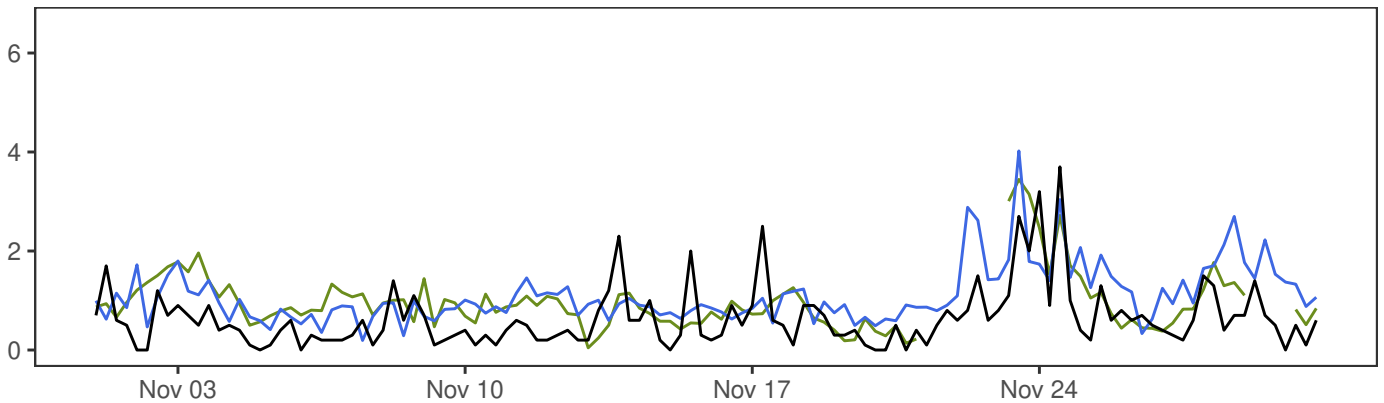
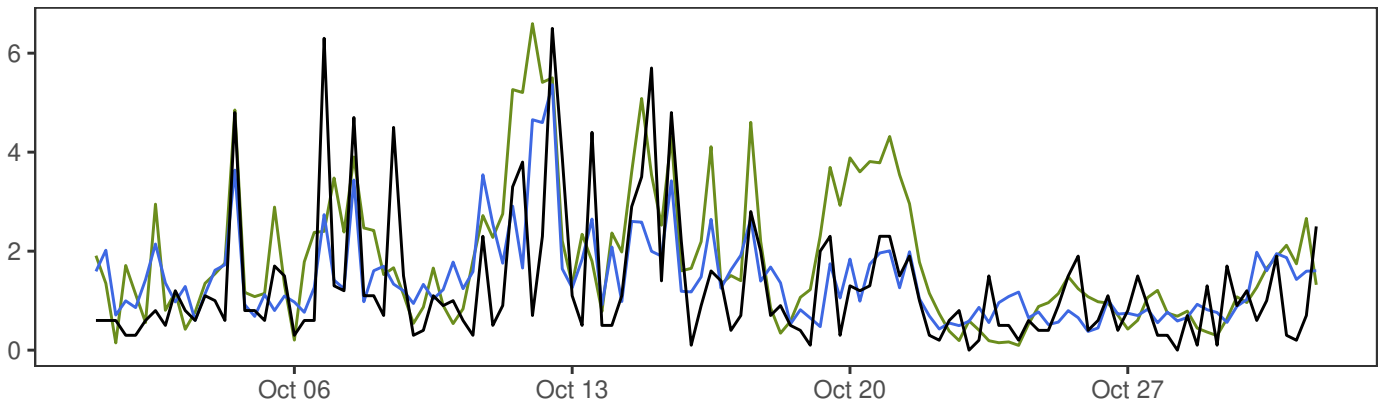
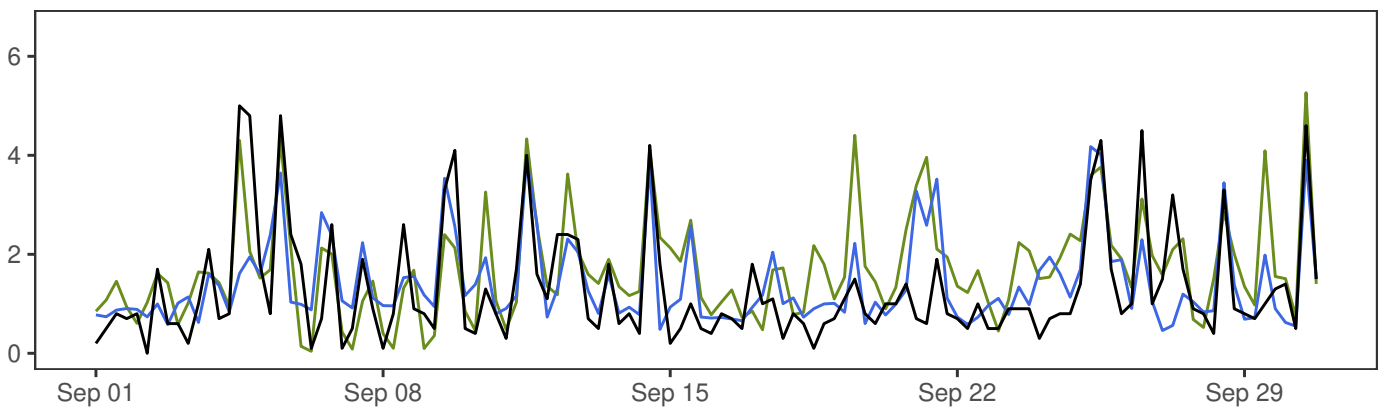
FINSEVATN



- synop: 00,06,12,18
- MEPSctrl: 12+18,+24,+30,+36
- ECMWF: 12+18,+24,+30,+36



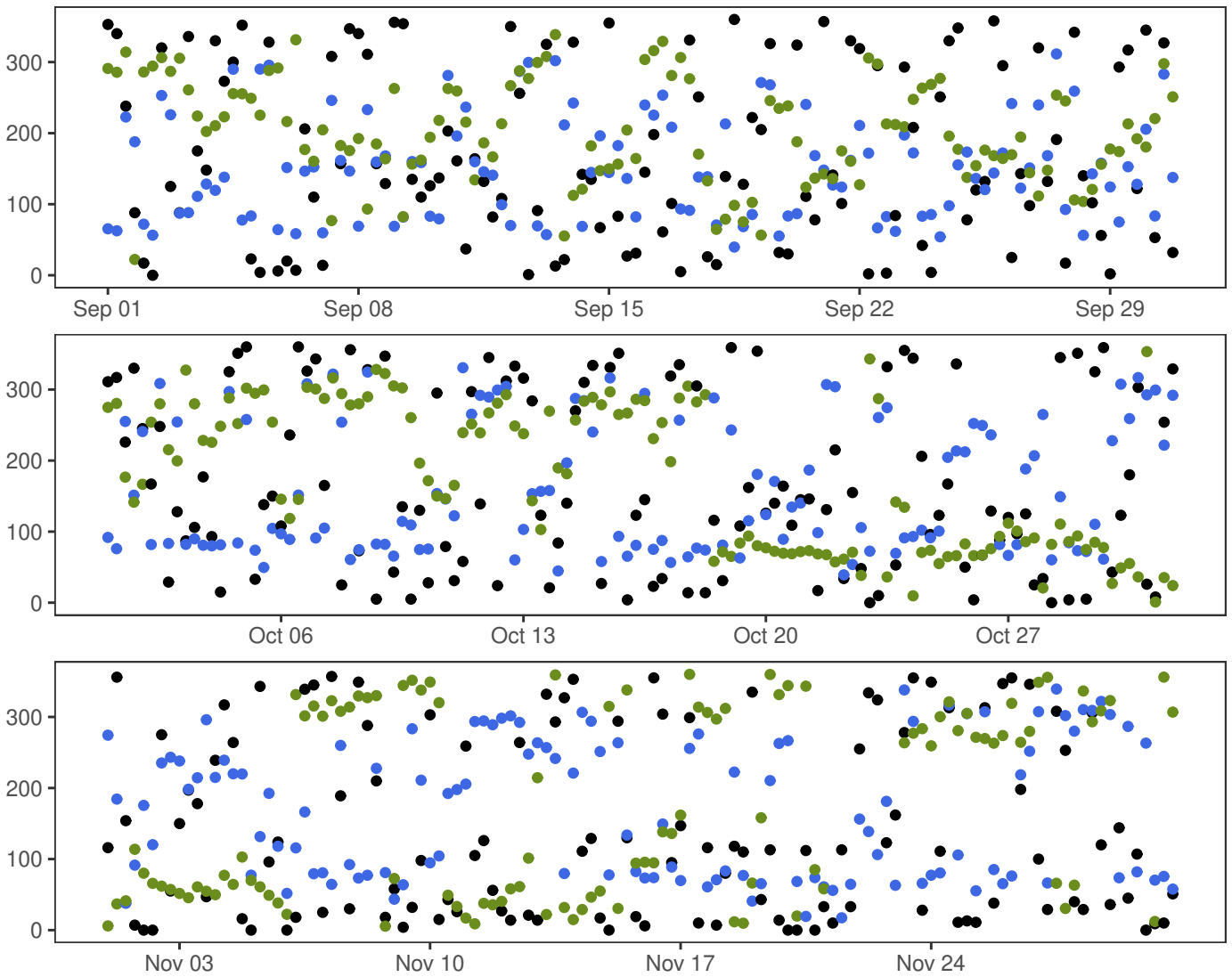
NESBYEN – TODOKK



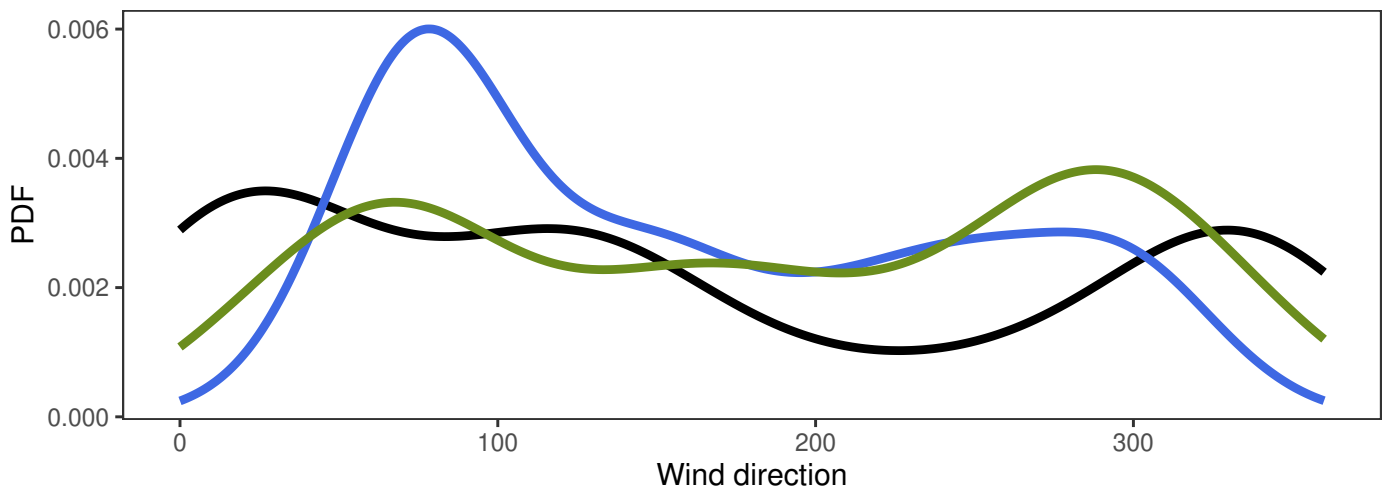
	Min	Mean	Max	Std	N
— synop: 00,06,12,18	0.0	1.1	6.5	1.1	364
— MEPSctrl: 12+18,+24,+30,+36	0.2	1.3	5.4	0.8	364
— ECMWF: 12+18,+24,+30,+36	0.0	1.5	6.6	1.1	352

	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl–synop	0.2	0.9	0.9	0.7	4.0	352
ECMWF–synop	0.4	1.0	1.1	0.8	5.9	352

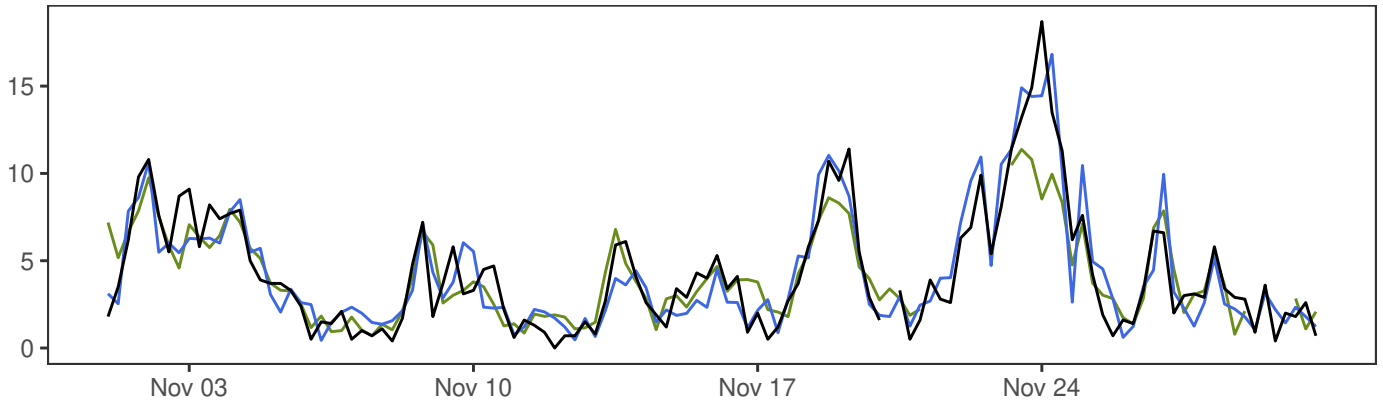
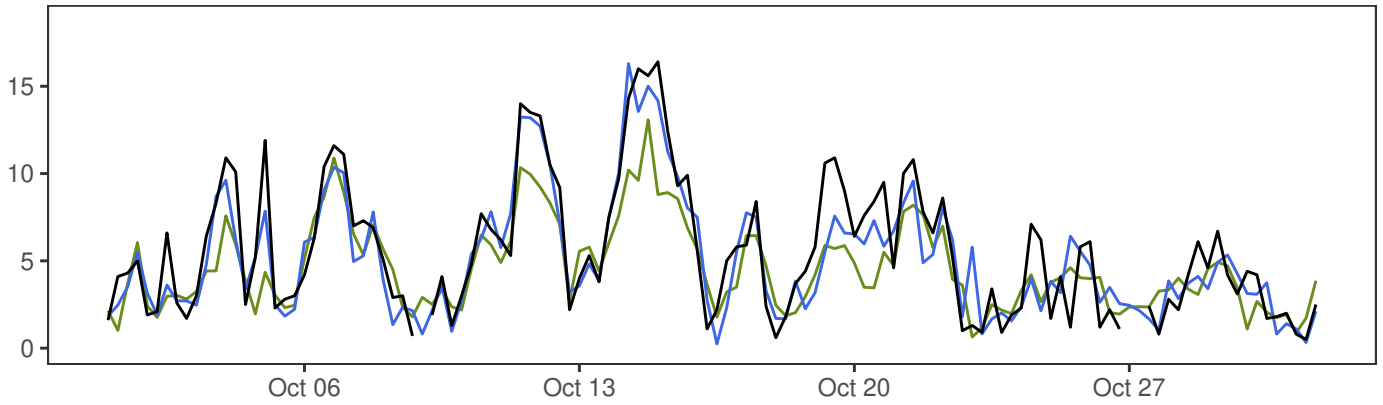
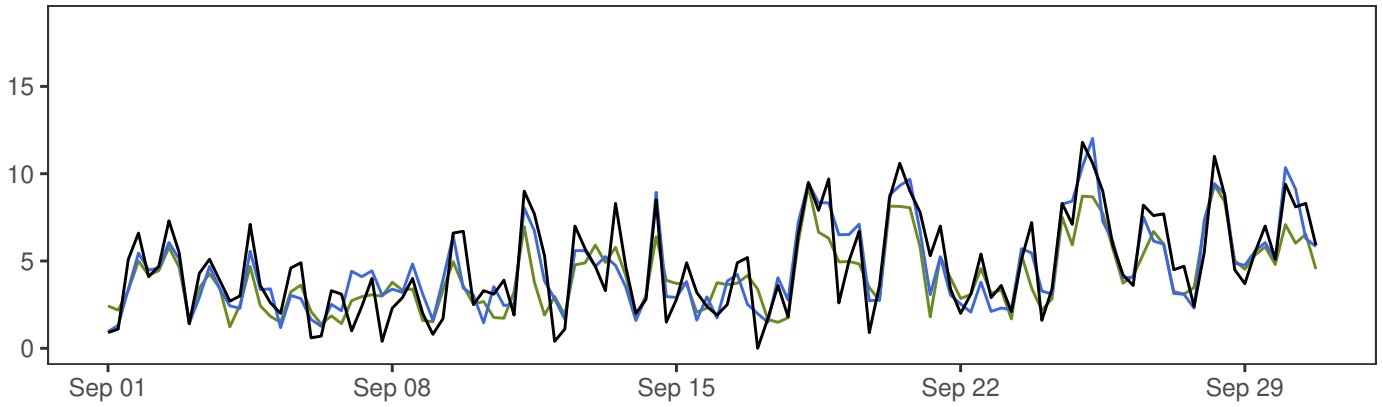
NESBYEN – TODOKK



- synop: 00,06,12,18
- MEPSctrl: 12+18,+24,+30,+36
- ECMWF: 12+18,+24,+30,+36



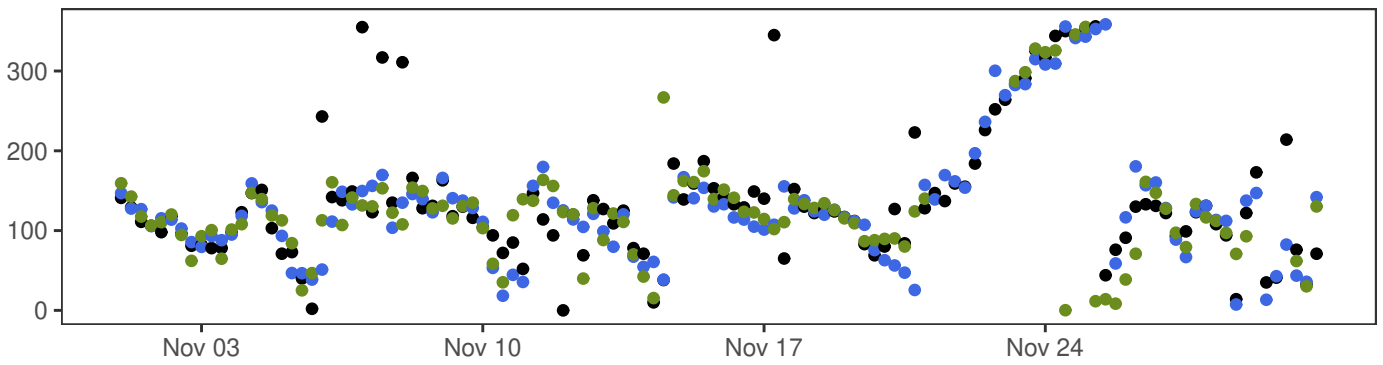
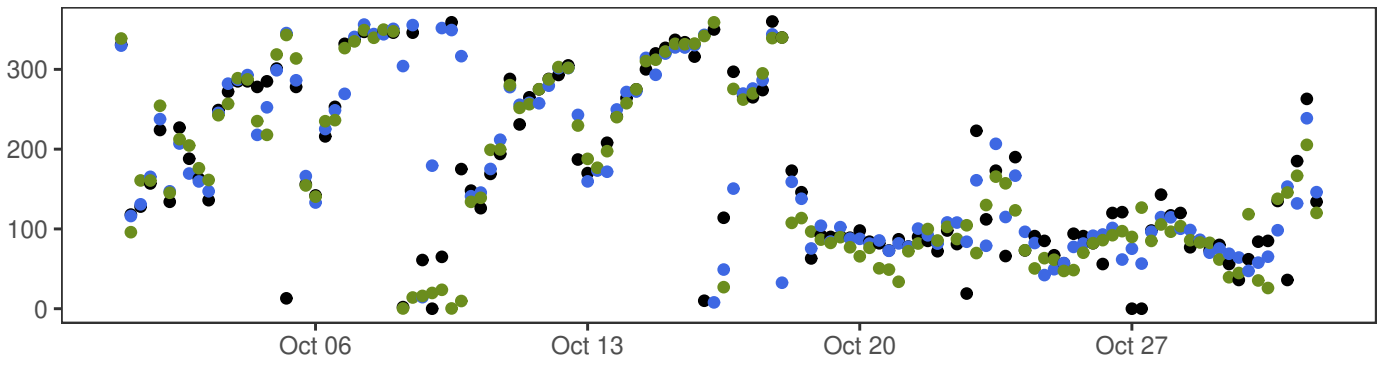
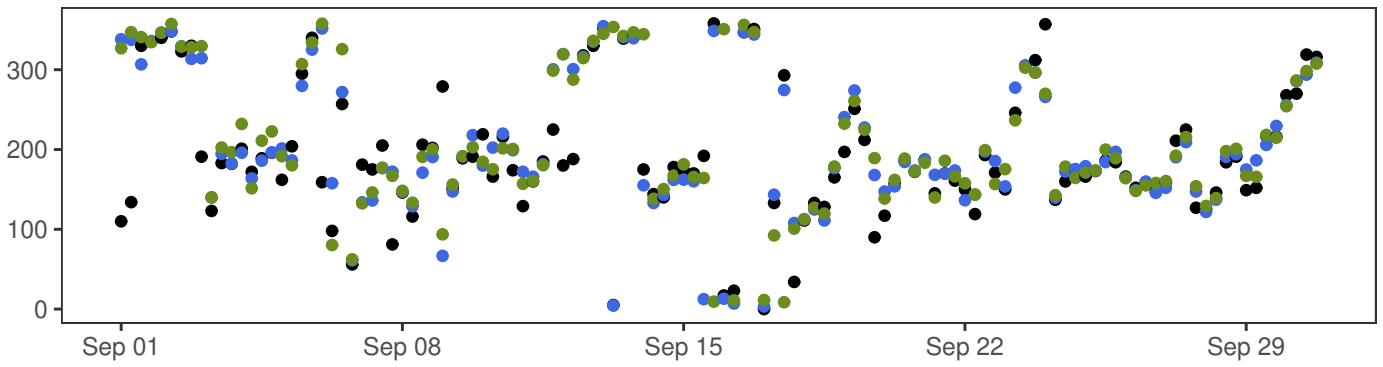
SOLA



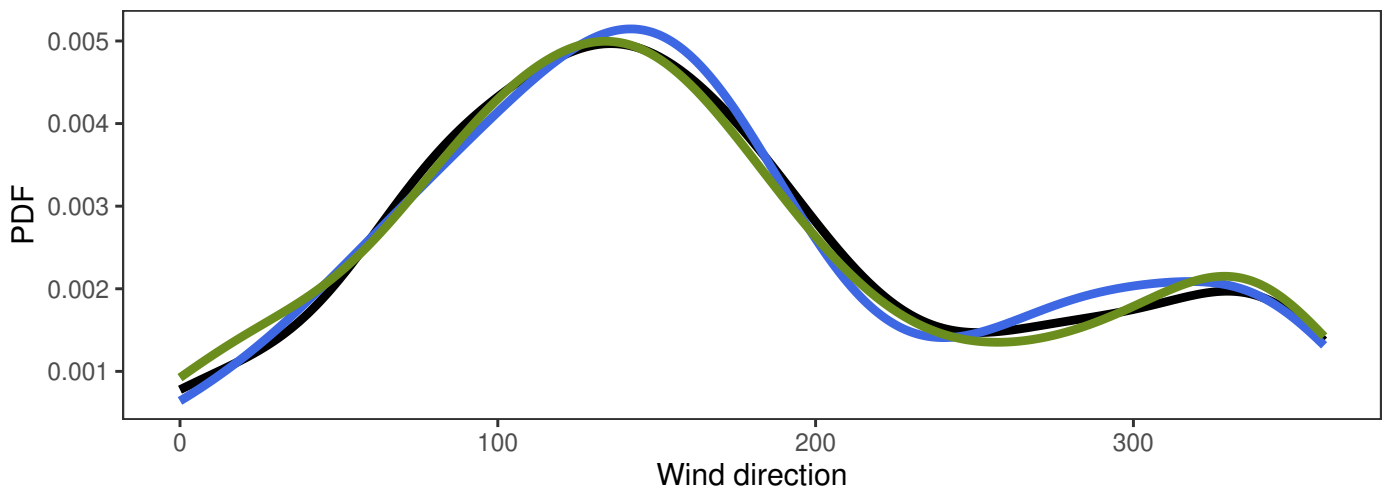
	Min	Mean	Max	Std	N
— synop: 00,06,12,18	0.0	4.9	18.7	3.4	360
— MEPSctrl: 12+18,+24,+30,+36	0.2	4.6	16.8	3.1	364
— ECMWF: 12+18,+24,+30,+36	0.6	4.3	13.1	2.4	352

	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl-synop	-0.2	1.5	1.5	1.2	5.2	348
ECMWF-synop	-0.6	1.8	1.9	1.4	10.2	348

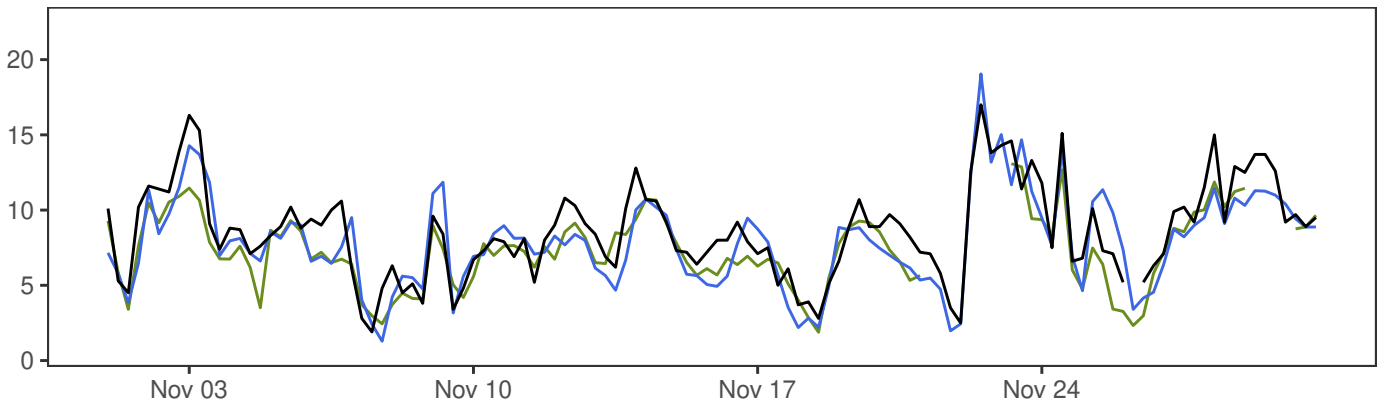
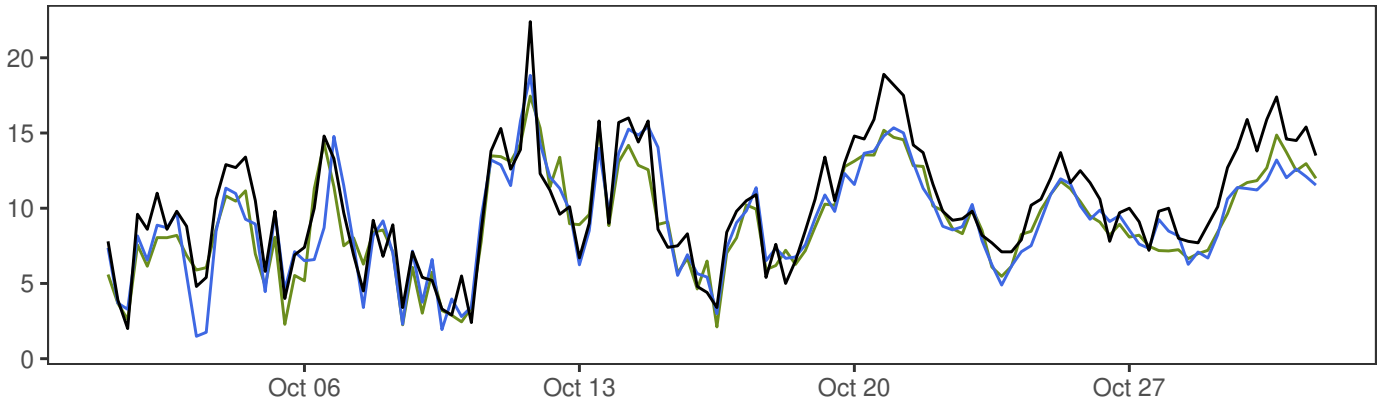
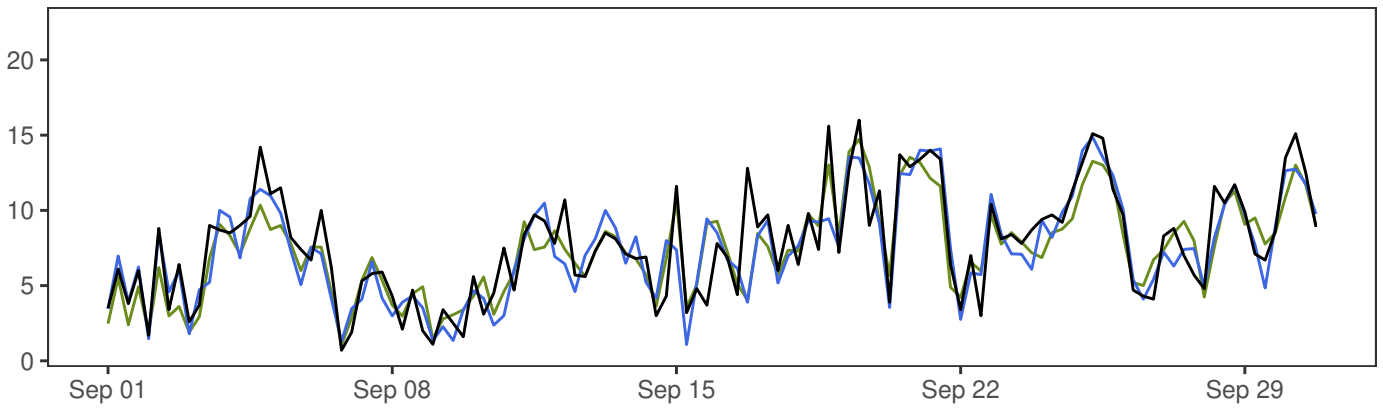
SOLA



- synop: 00,06,12,18
- MEPSctrl: 12+18,+24,+30,+36
- ECMWF: 12+18,+24,+30,+36



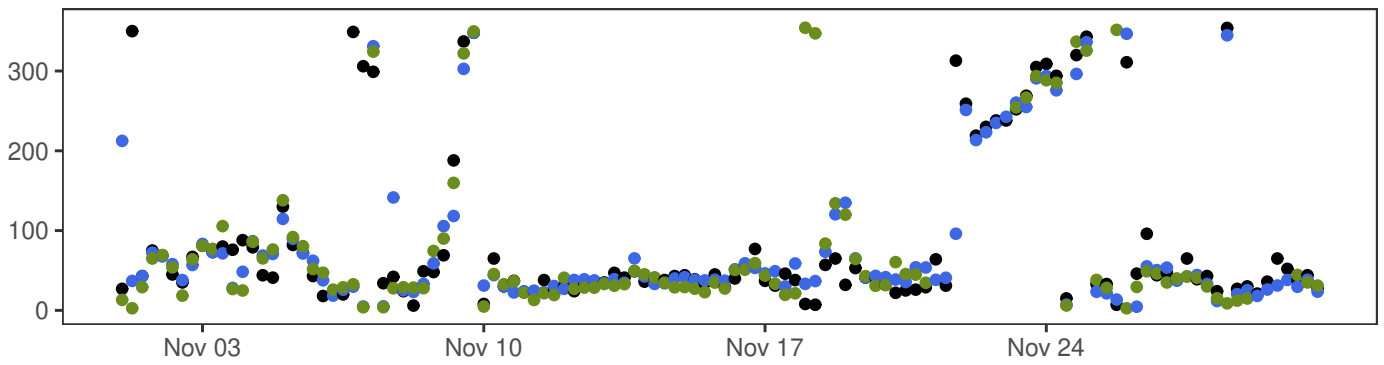
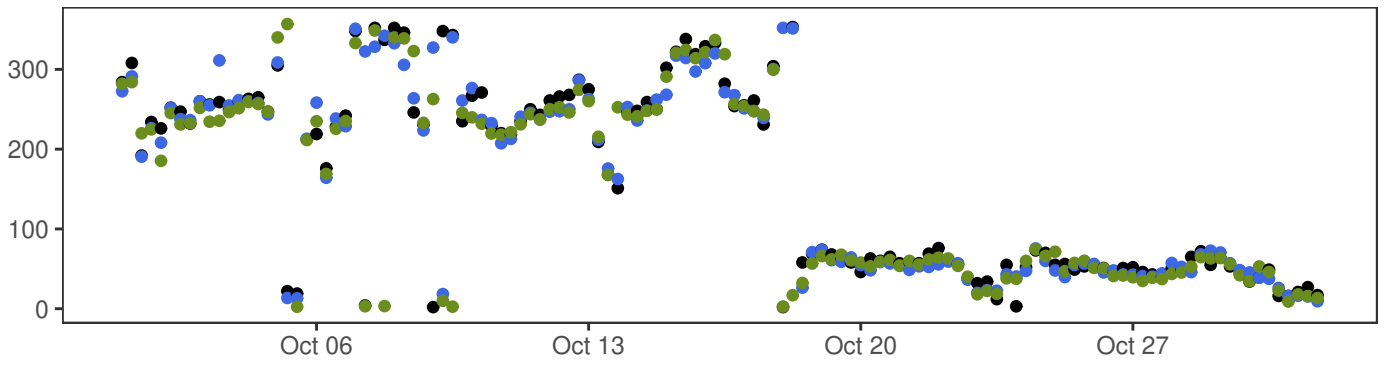
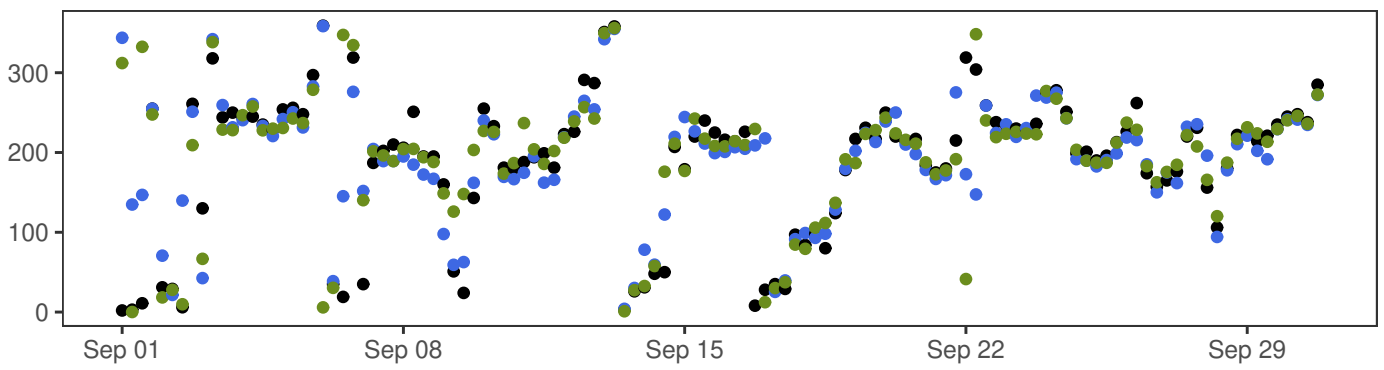
FÆRDER FYR



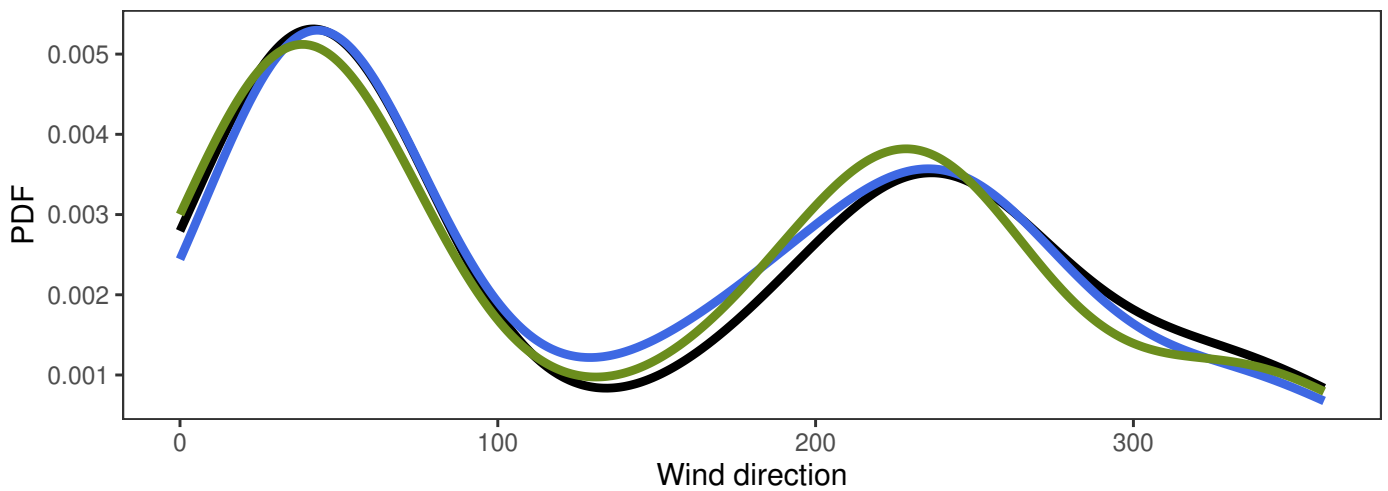
	Min	Mean	Max	Std	N
— synop: 00,06,12,18	0.7	8.8	22.4	3.7	363
— MEPSctrl: 12+18,+24,+30,+36	1.1	8.1	19.1	3.4	364
— ECMWF: 12+18,+24,+30,+36	1.1	7.9	17.5	3.1	352

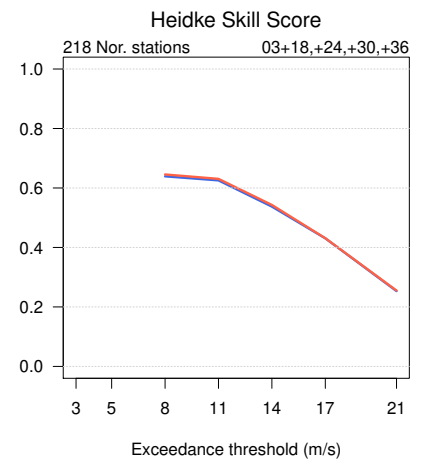
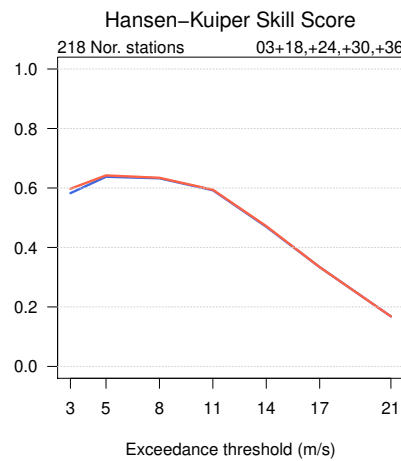
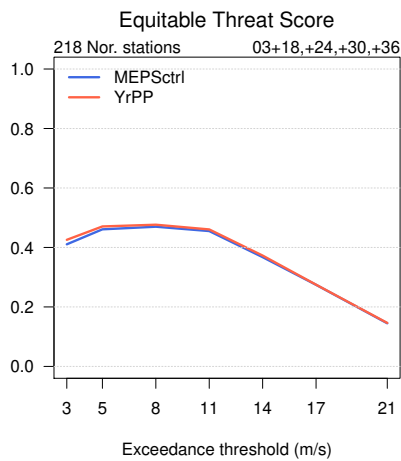
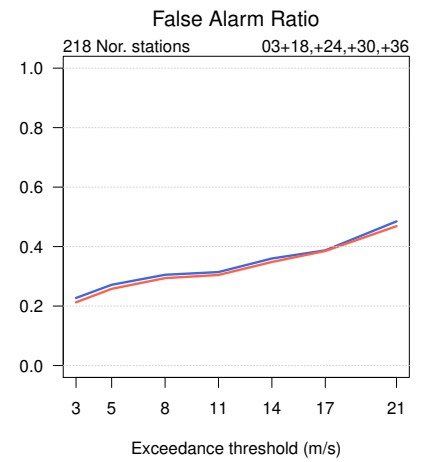
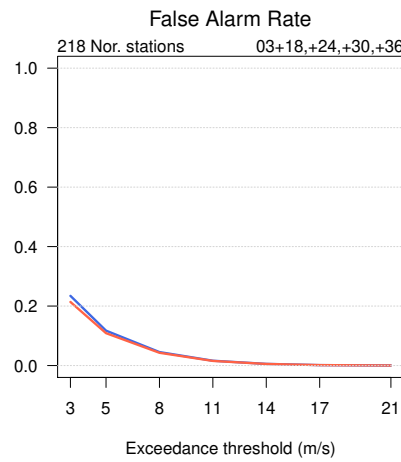
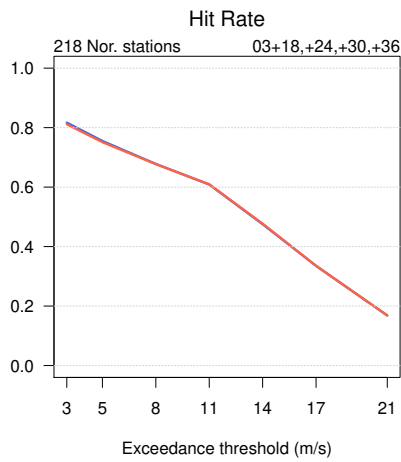
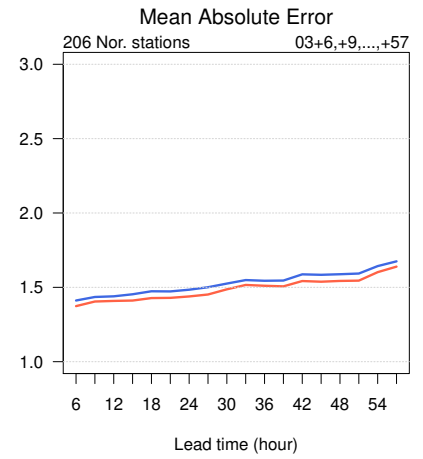
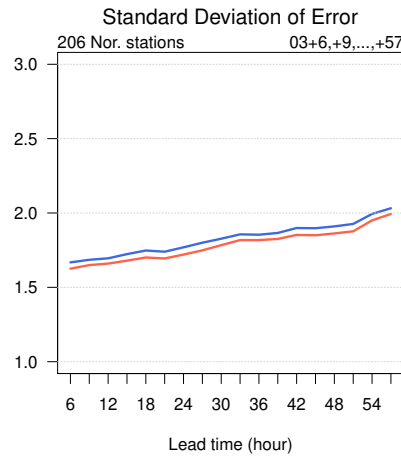
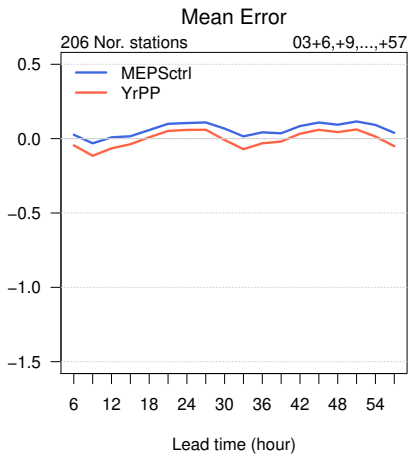
	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl-synop	-0.7	1.8	1.9	1.5	8.9	351
ECMWF-synop	-0.8	1.6	1.8	1.4	8.8	351

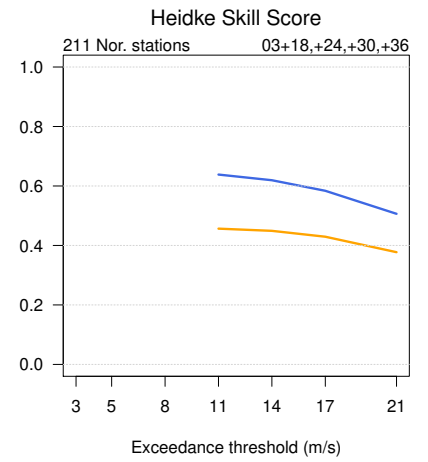
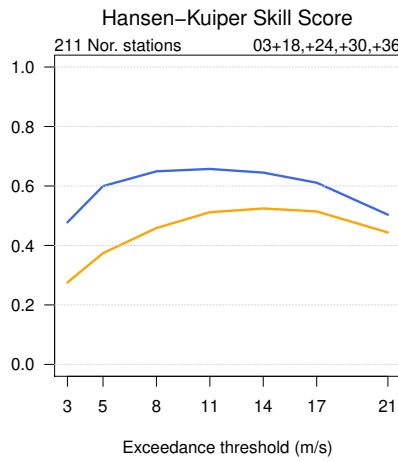
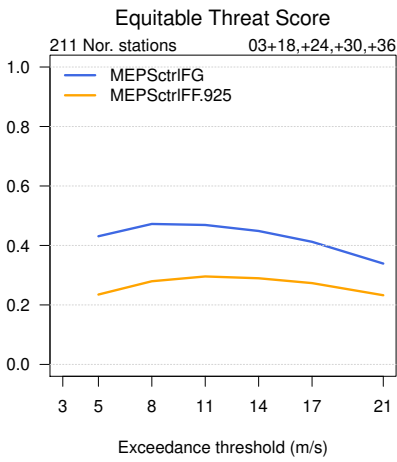
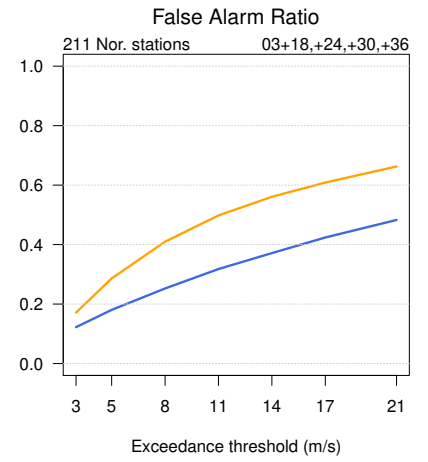
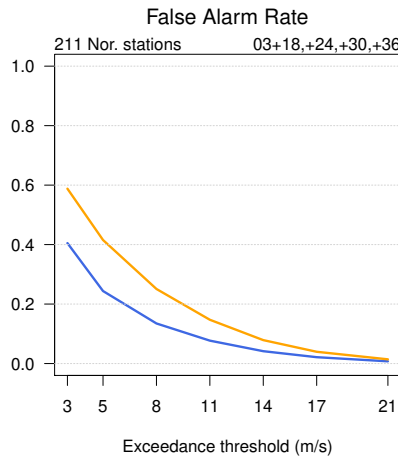
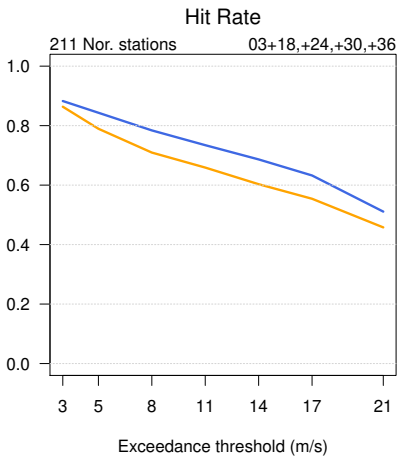
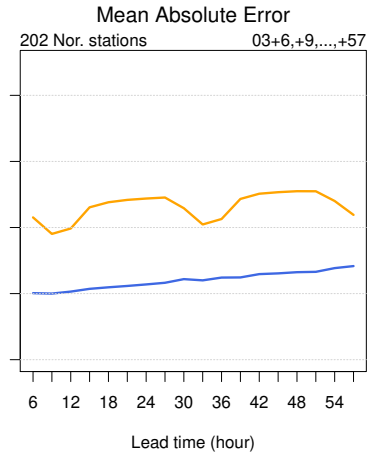
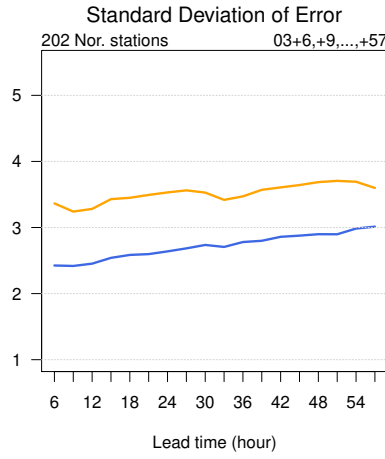
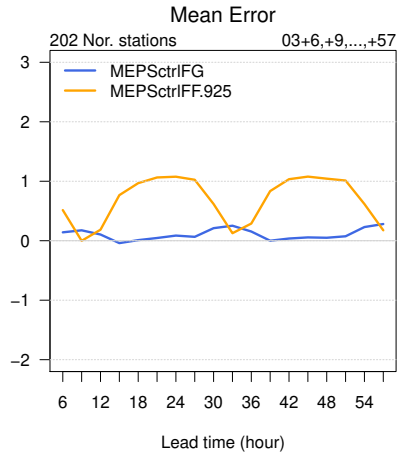
FÆRDER FYR

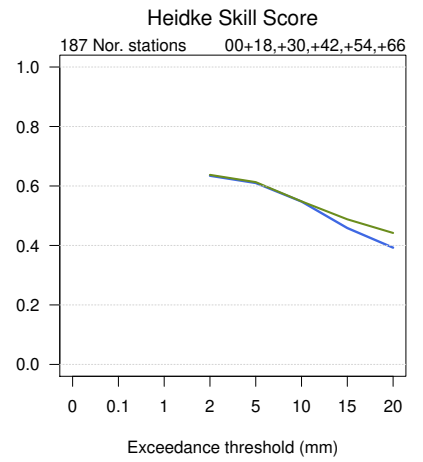
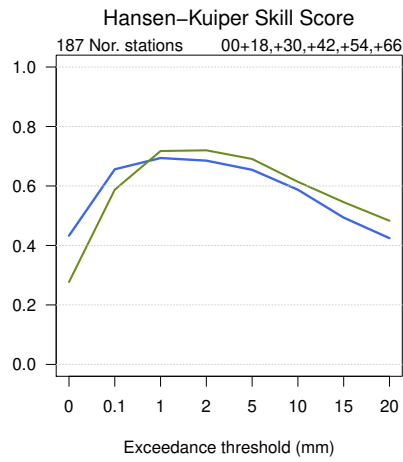
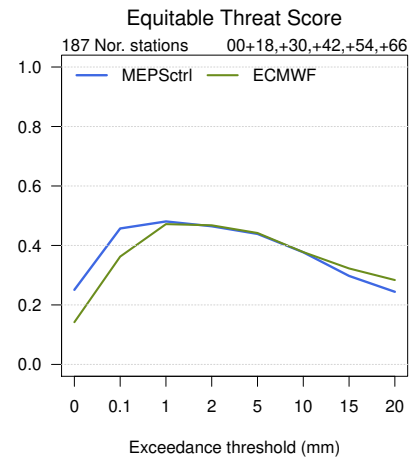
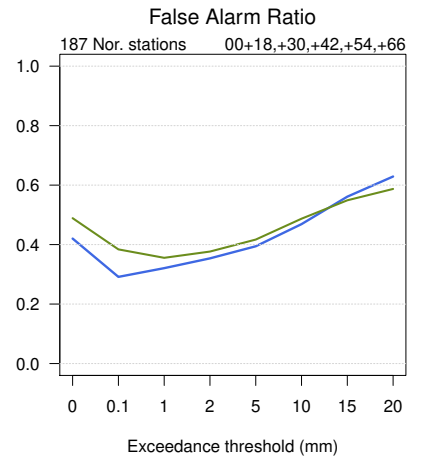
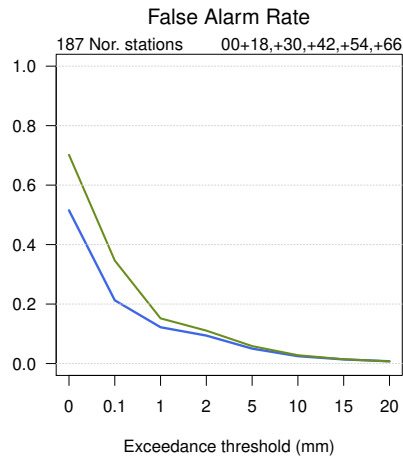
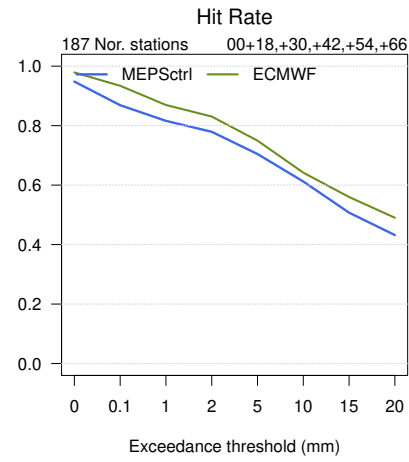
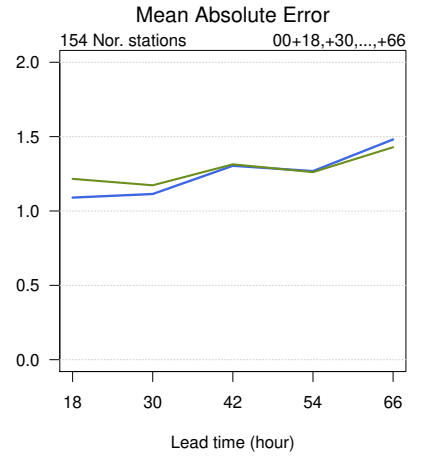
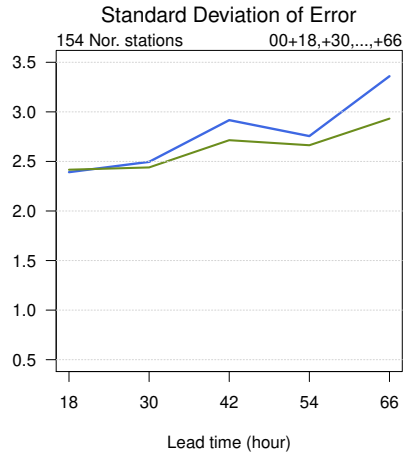
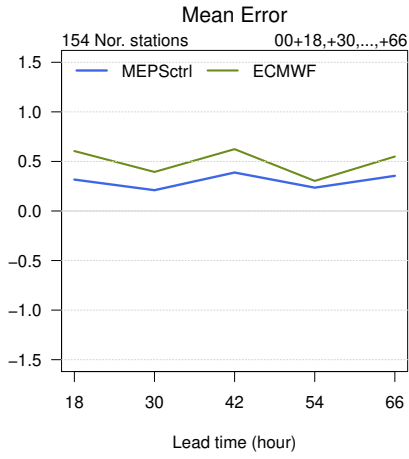


- synop: 00,06,12,18
- MEPSctrl: 12+18,+24,+30,+36
- ECMWF: 12+18,+24,+30,+36

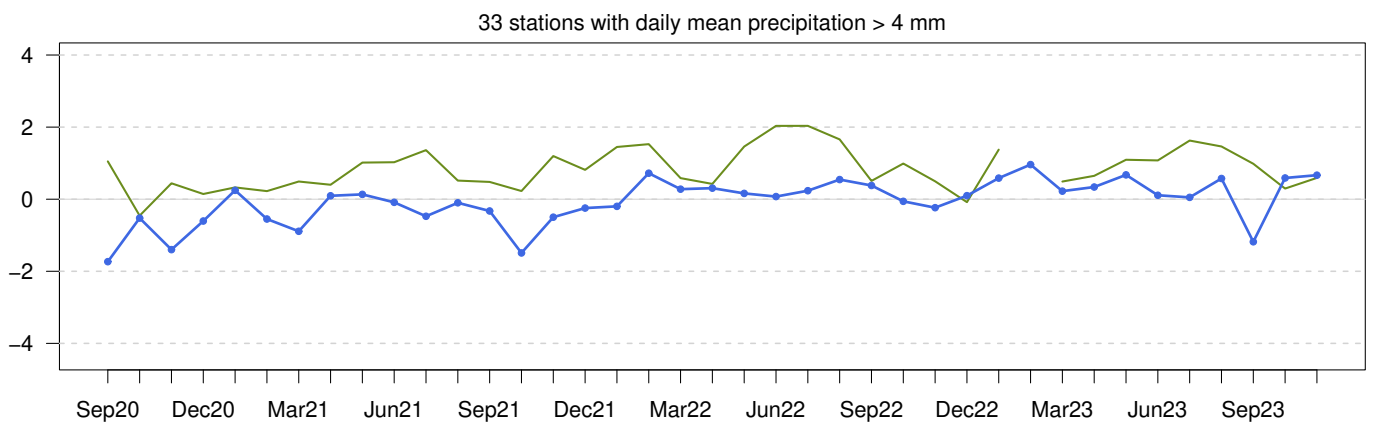
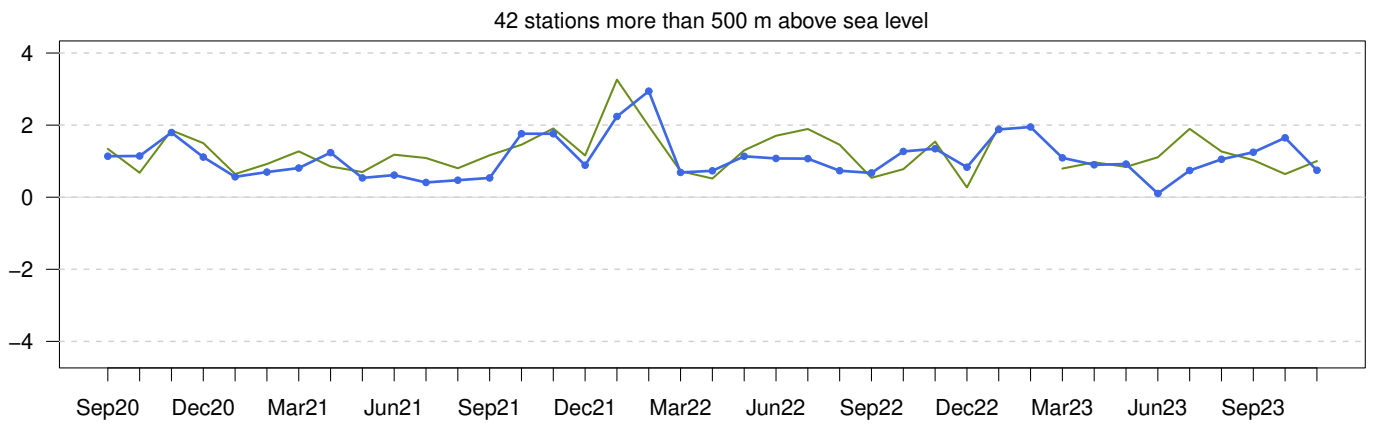
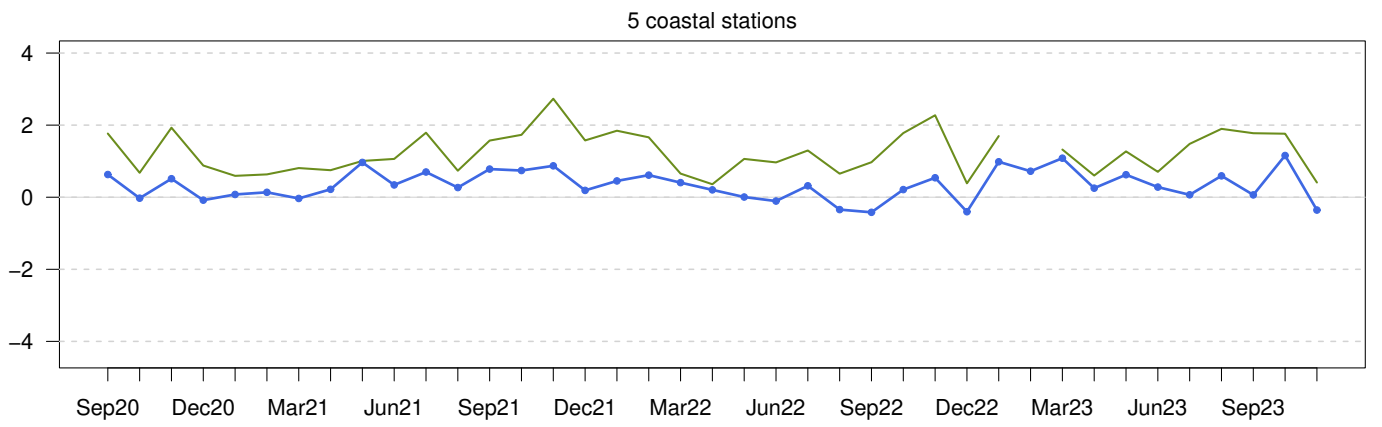
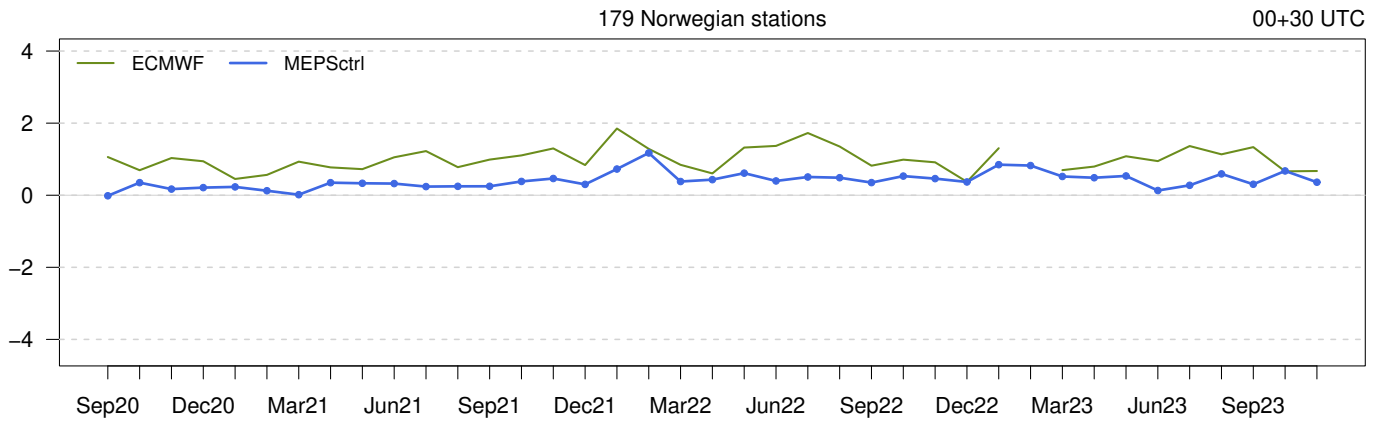




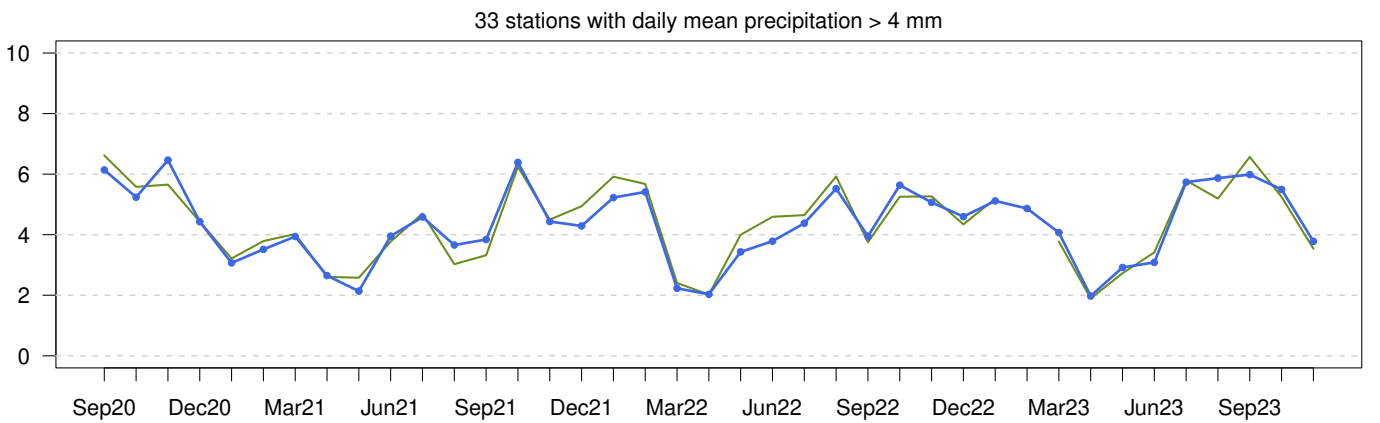
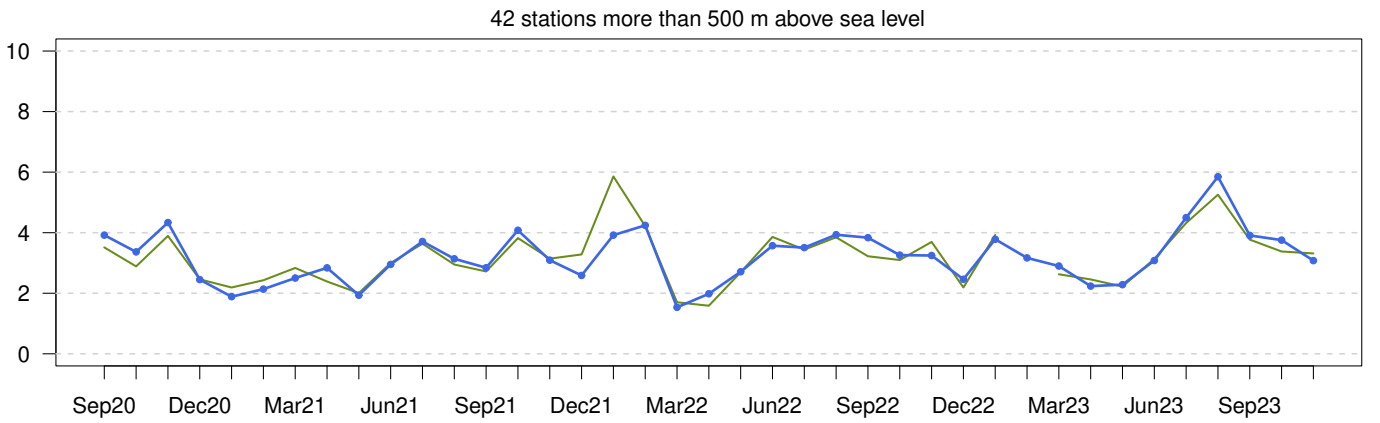
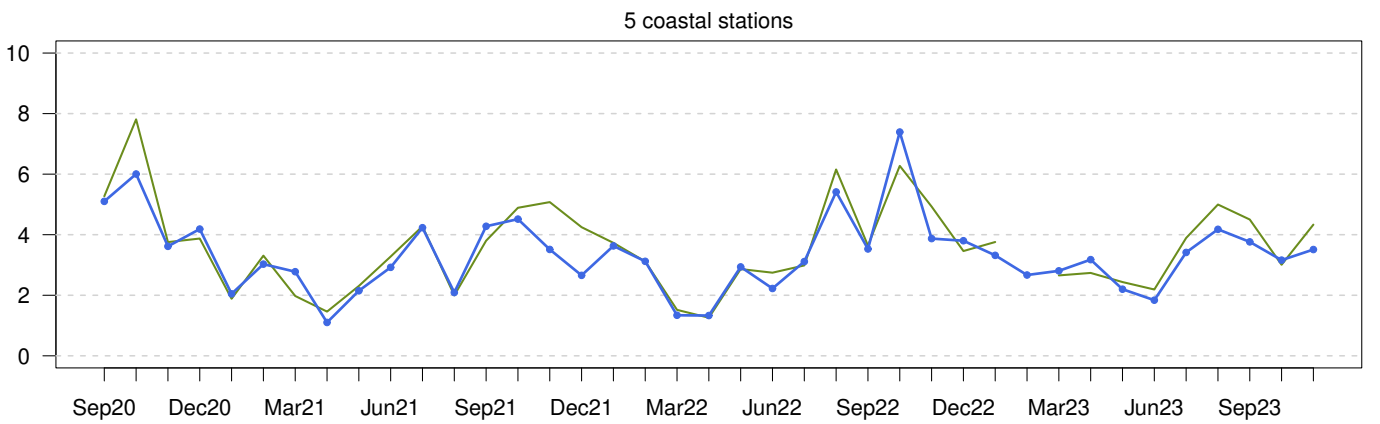
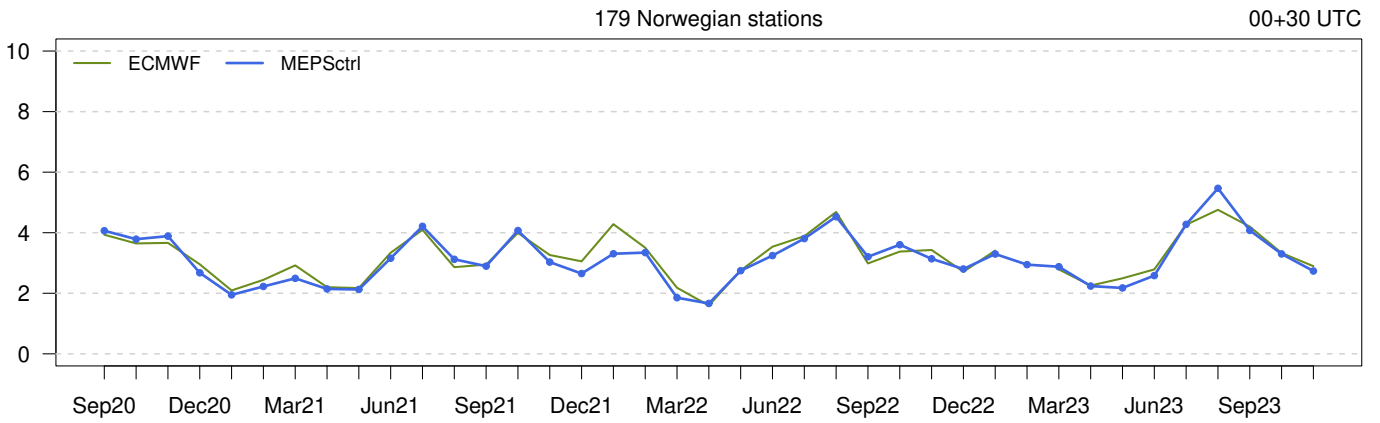




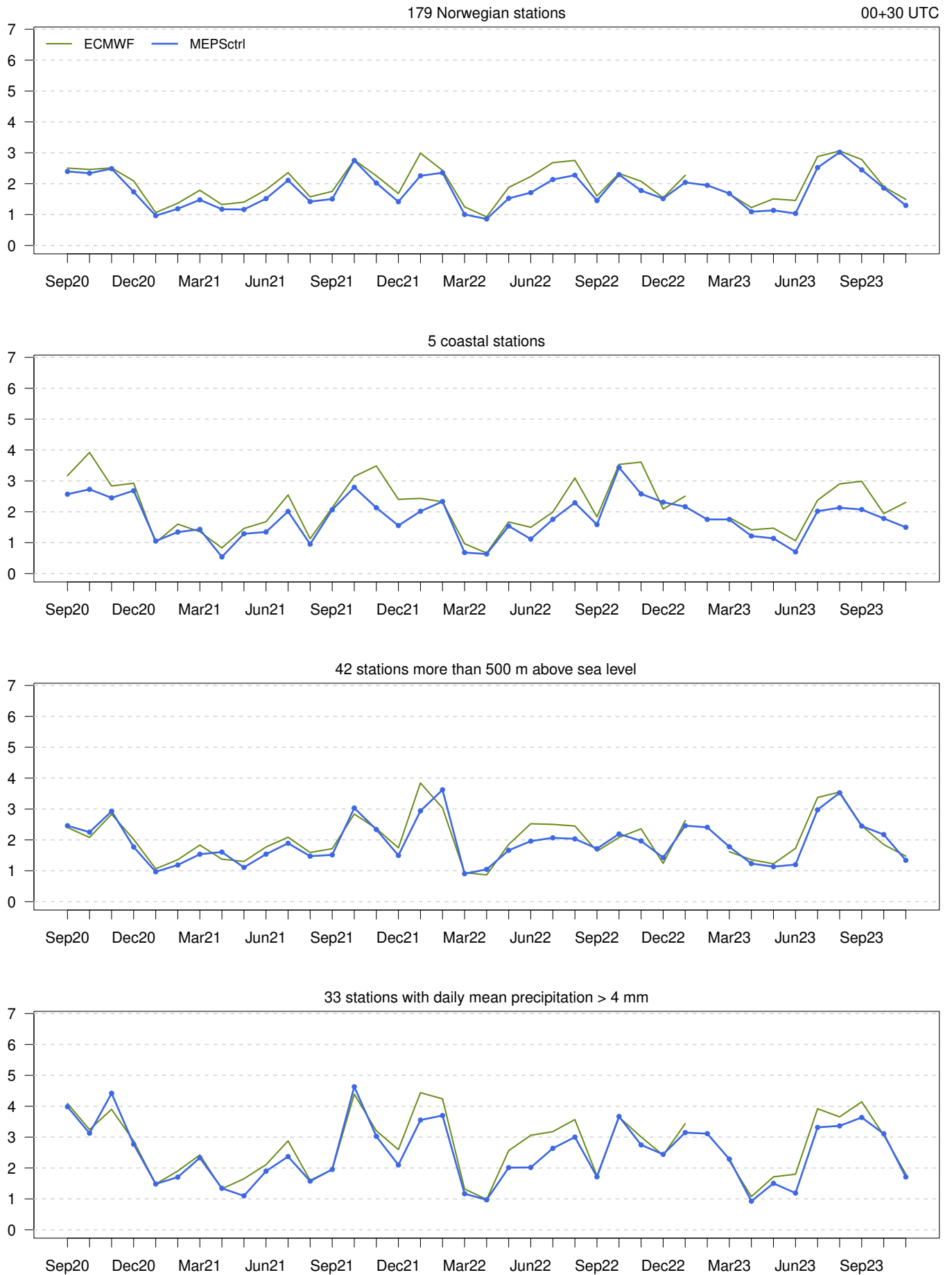
Mean Error



Standard Deviation of Error

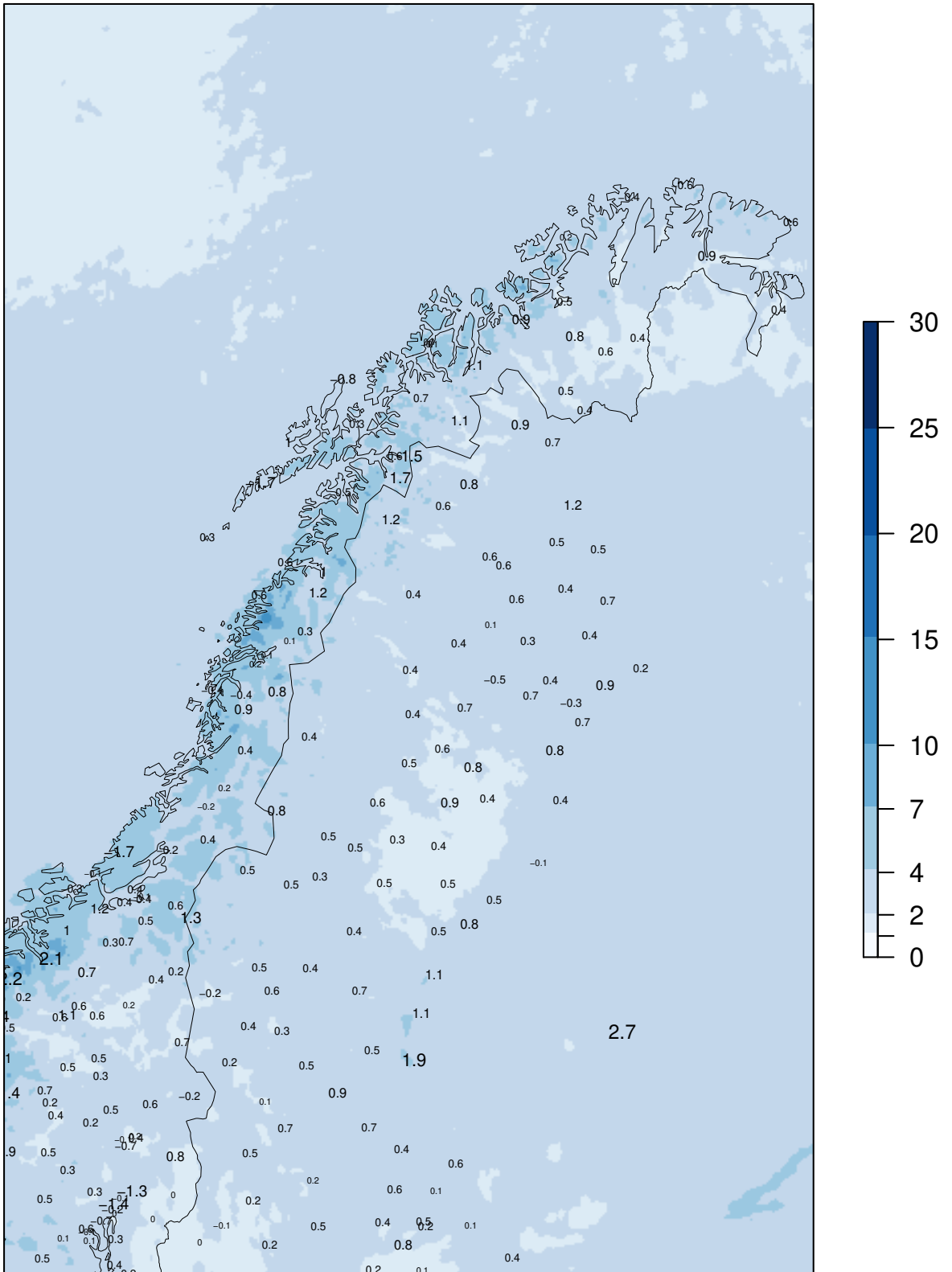


Mean Absolute Error



MEPSctrl 00+30

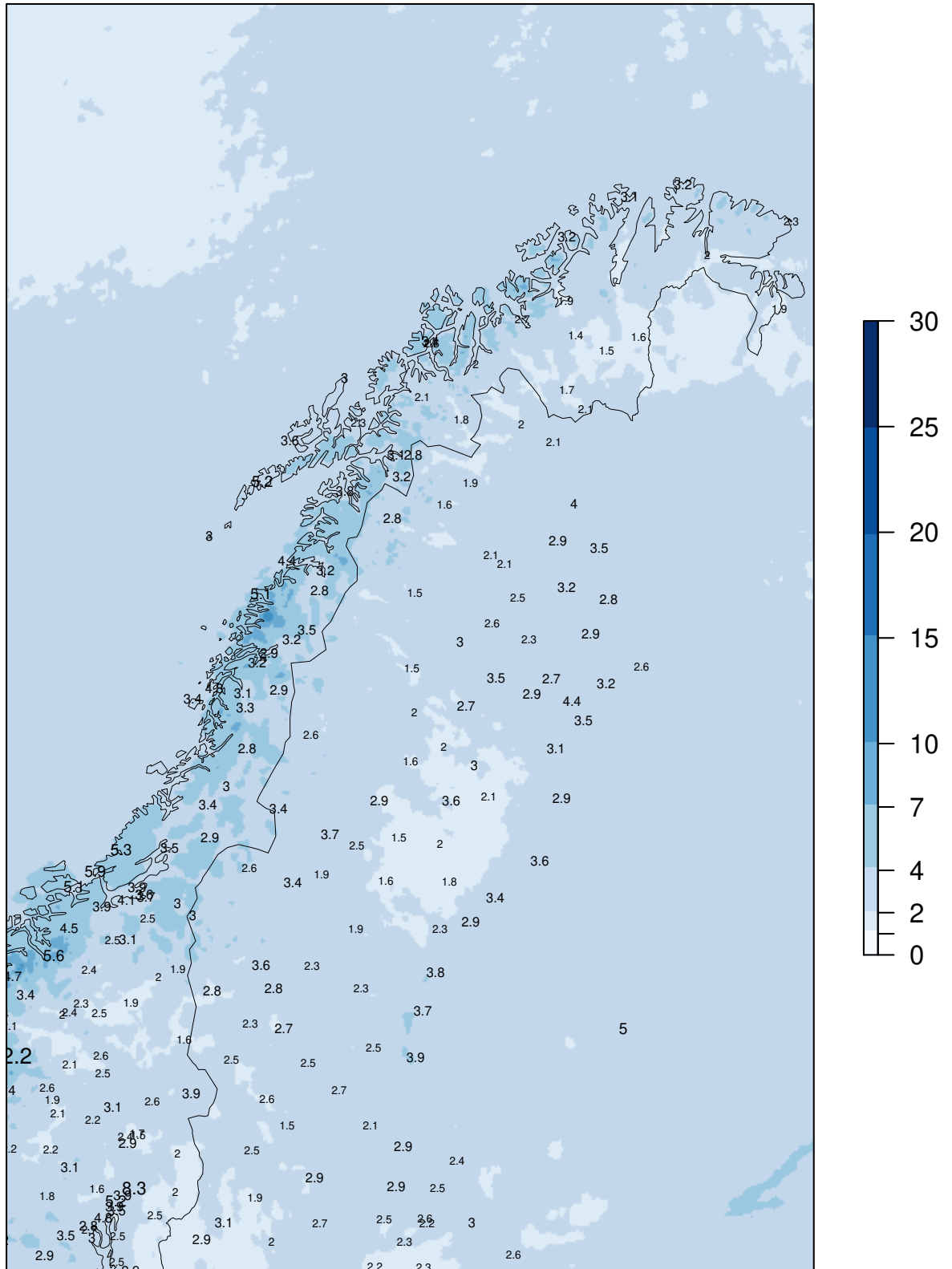
ME at observing sites
(numbers in black)



Model "climatology" 01.09.2023 – 30.11.2023

MEPSctrl 00+30

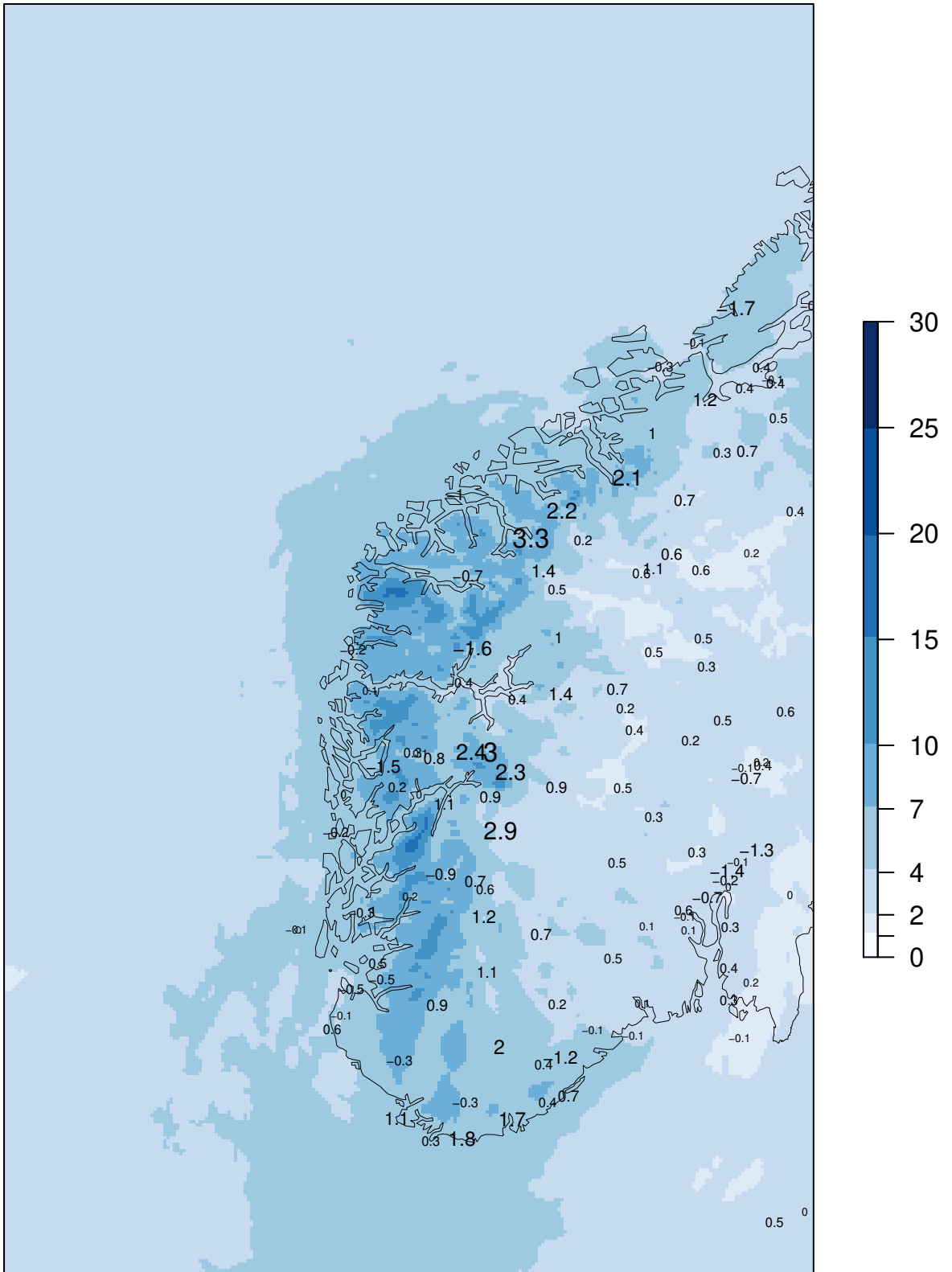
SDE at observing sites
(numbers in black)



Model "climatology" 01.09.2023 - 30.11.2023

MEPSctrl 00+30

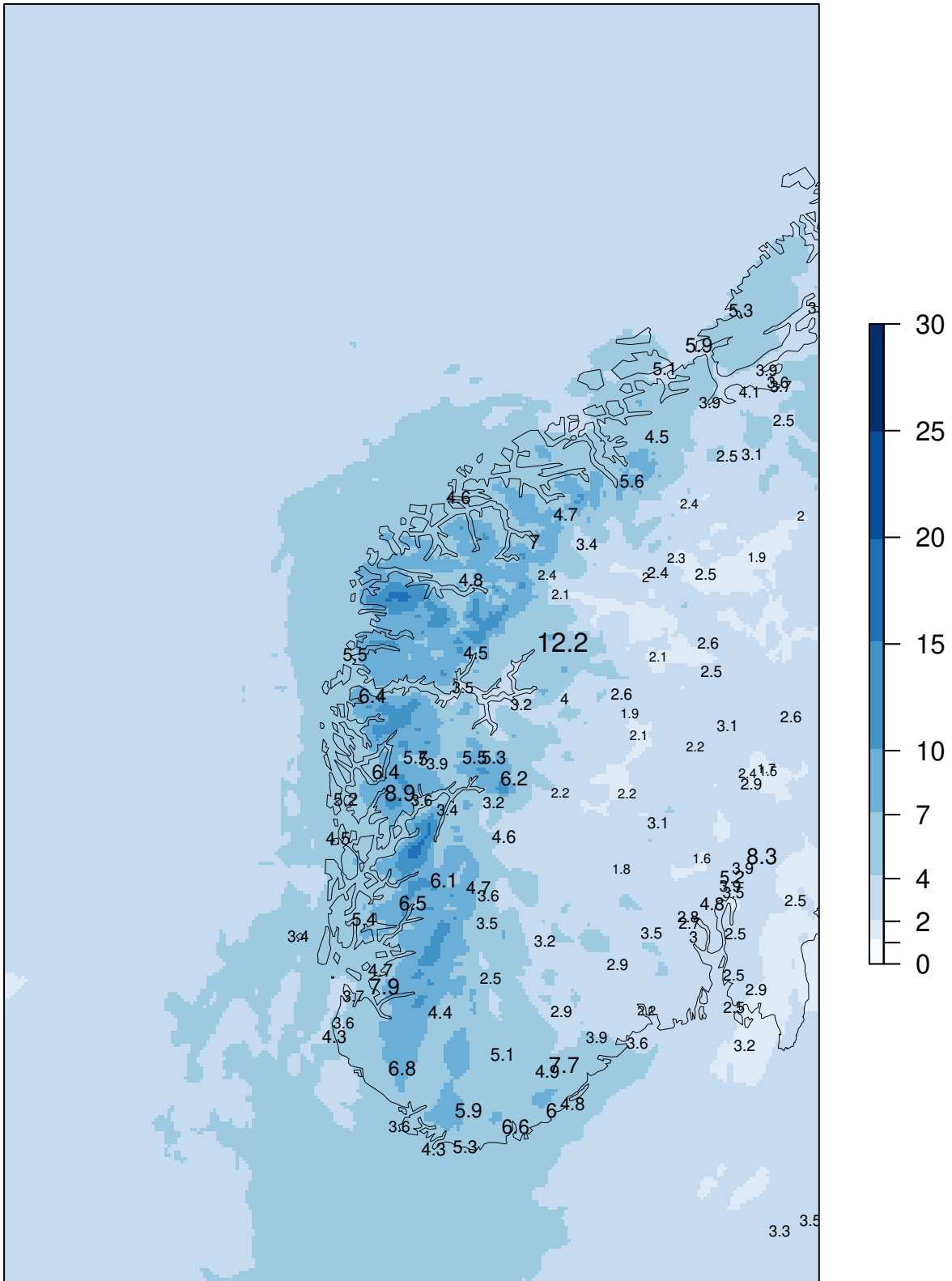
ME at observing sites
(numbers in black)



Model "climatology" 01.09.2023 – 30.11.2023

MEPSctrl 00+30

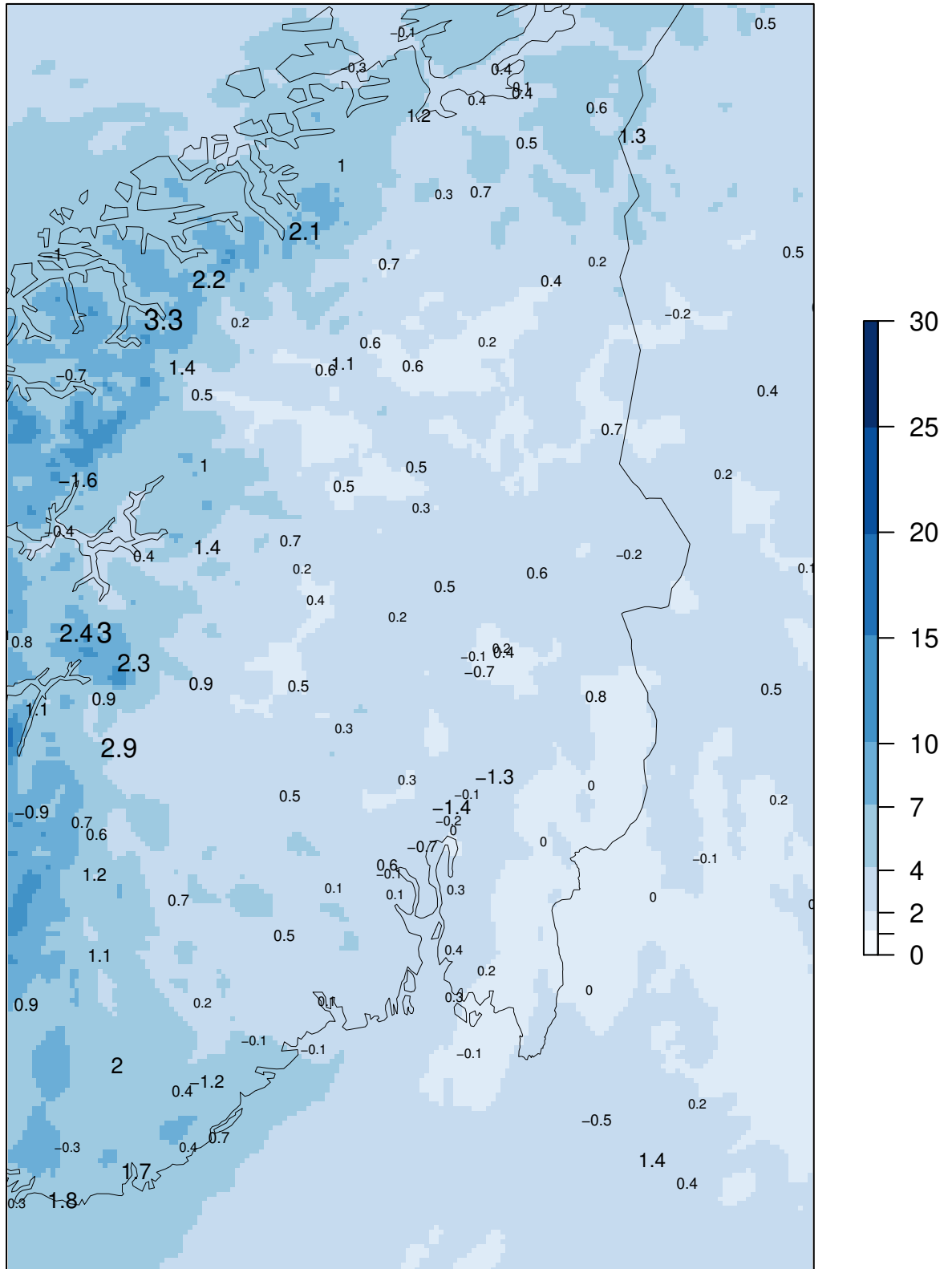
SDE at observing sites
(numbers in black)



Model "climatology" 01.09.2023 – 30.11.2023

MEPSctrl 00+30

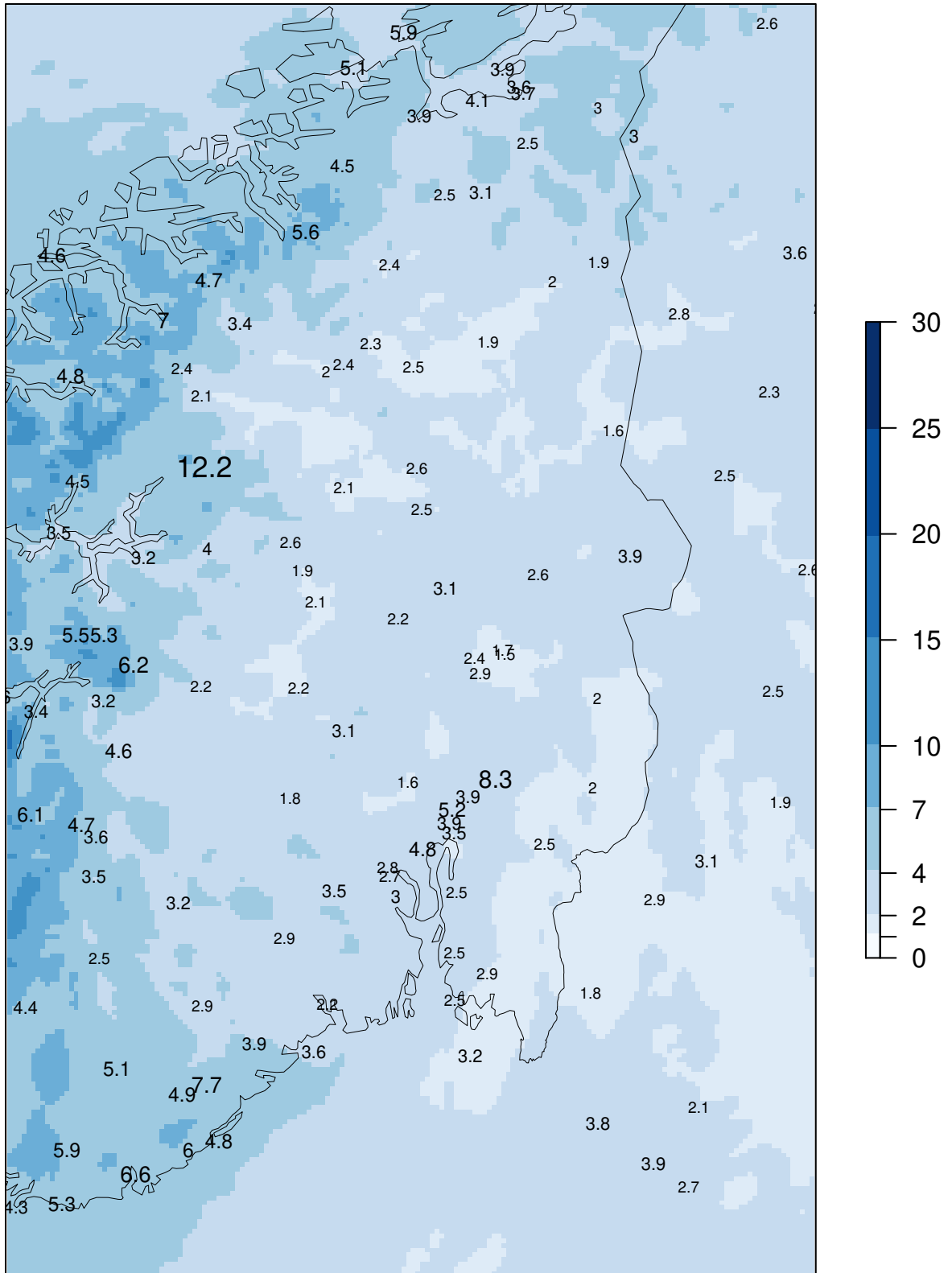
ME at observing sites
(numbers in black)



Model "climatology" 01.09.2023 – 30.11.2023

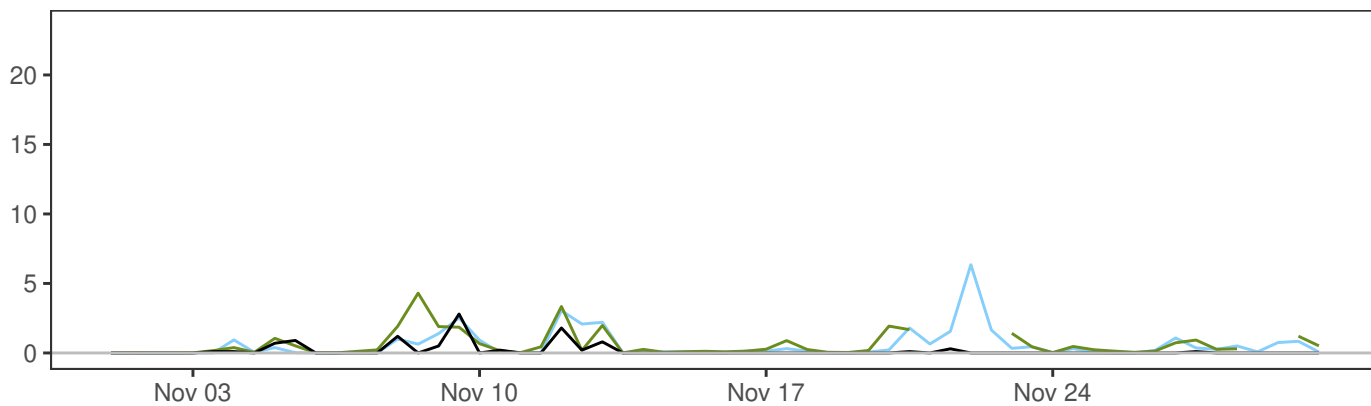
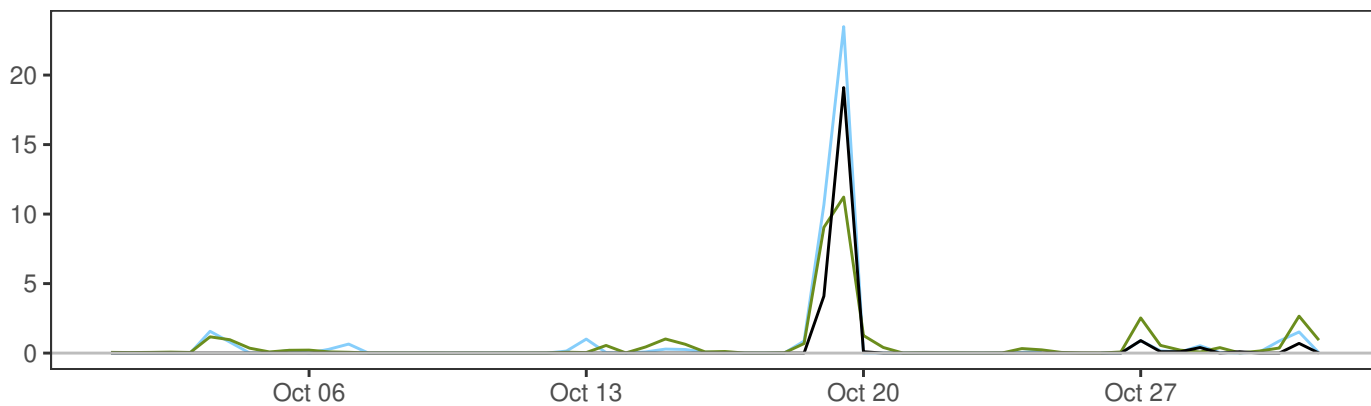
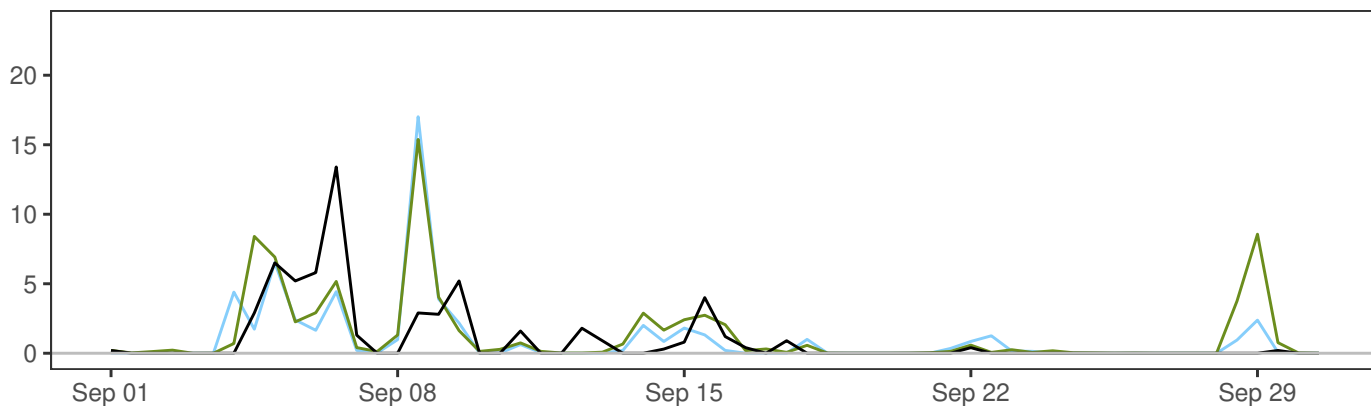
MEPSctrl 00+30

SDE at observing sites
(numbers in black)



Model "climatology" 01.09.2023 – 30.11.2023

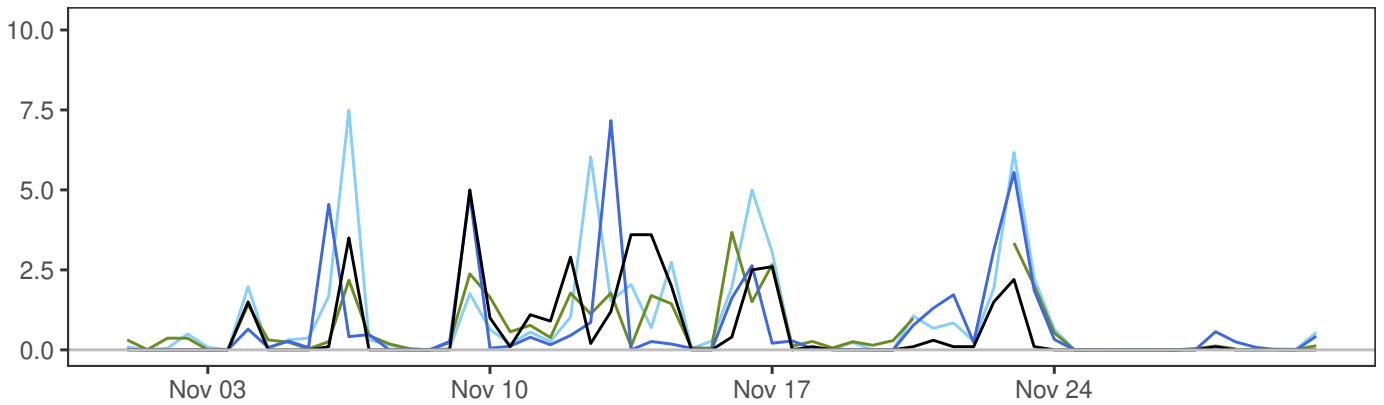
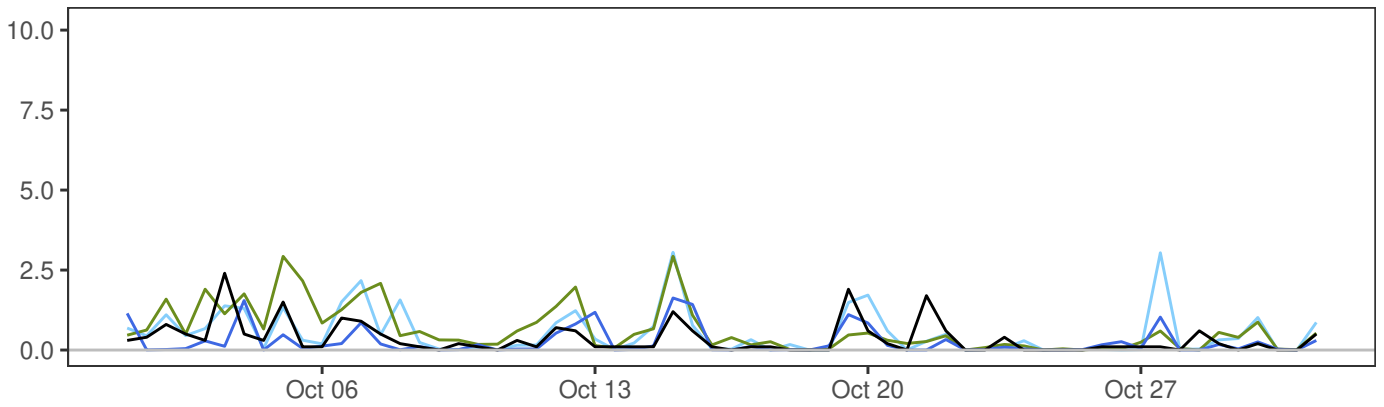
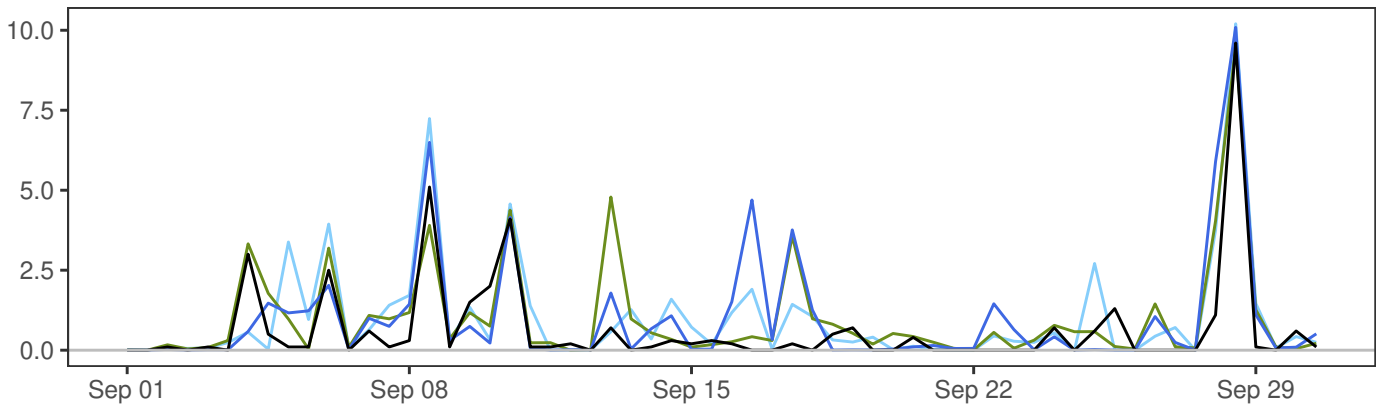
SVALBARD LUFTHAVN



	Min	Mean	Max	Std	N
— synop: 06,18	0.0	0.5	19.1	2.0	182
— AA25: 12+18,+30	0.0	0.8	23.5	2.5	180
— ECMWF: 12+18,+30	0.0	0.8	15.4	2.0	176

	ME	SDE	RMSE	MAE	Max.abs.err.	N
AA25–synop	0.2	1.6	1.6	0.6	14.1	174
ECMWF–synop	0.3	1.7	1.8	0.7	12.5	174

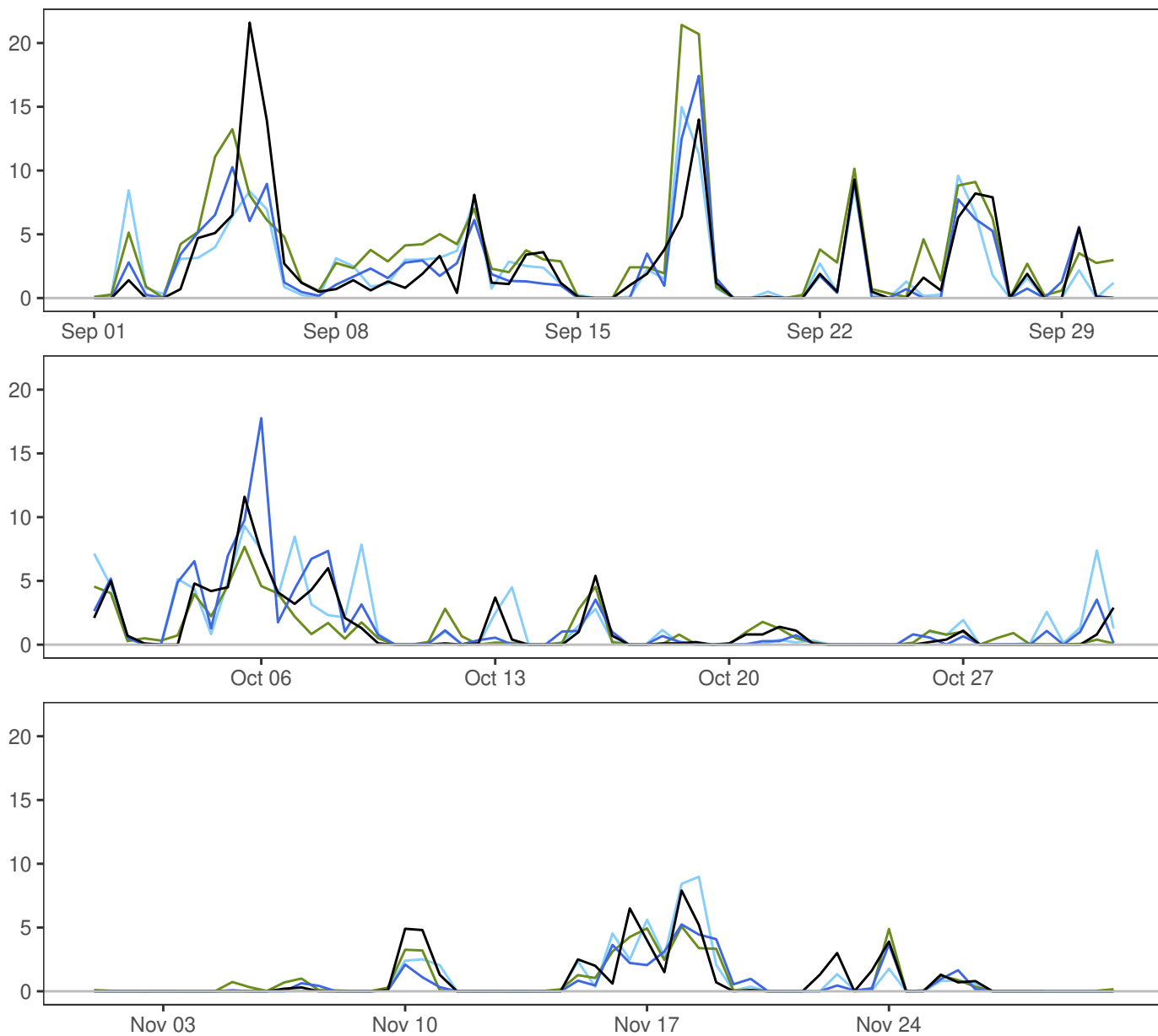
BJØRNØYA



	Min	Mean	Max	Std	N
— synop: 06,18	0.0	0.5	9.6	1.1	182
— MEPSctrl: 12+18,+30	0.0	0.6	10.1	1.4	182
— AA25: 12+18,+30	0.0	0.8	10.2	1.5	180
— ECMWF: 12+18,+30	0.0	0.8	9.5	1.2	176

	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl-synop	0.1	1.1	1.2	0.6	6.0	174
AA25-synop	0.3	1.0	1.1	0.6	5.8	174
ECMWF-synop	0.2	0.8	0.9	0.5	4.1	174

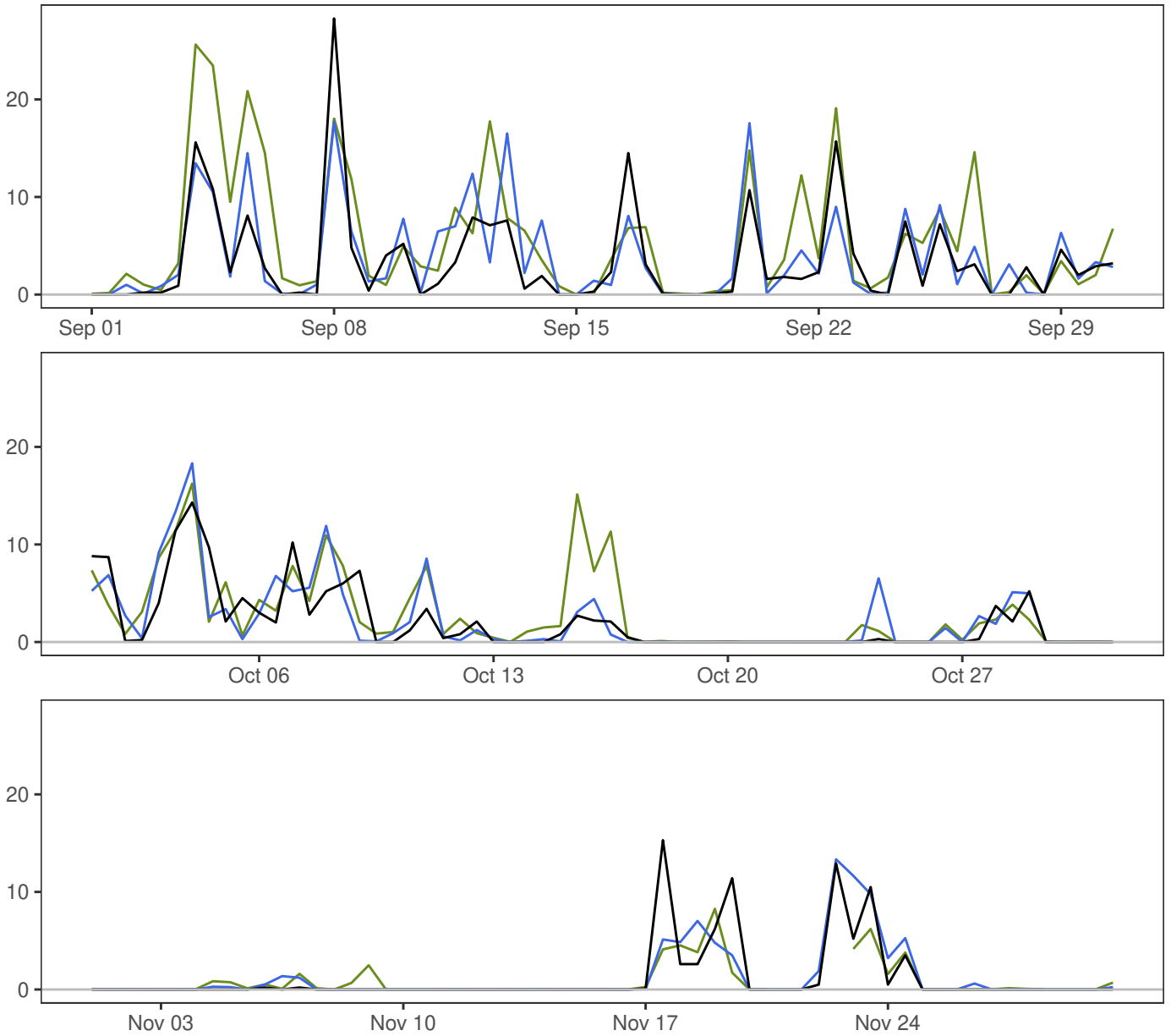
TROMSØ



	Min	Mean	Max	Std	N
— synop: 06,18	0.0	1.6	21.6	3.0	182
— MEPSctrl: 12+18,+30	0.0	1.6	17.8	2.9	182
— AA25: 12+18,+30	0.0	1.7	15.0	2.7	180
— ECMWF: 12+18,+30	0.0	1.9	21.4	3.2	176

	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl-synop	0.0	2.0	2.0	1.0	15.6	174
AA25-synop	0.1	2.1	2.1	1.1	13.2	174
ECMWF-synop	0.2	2.3	2.3	1.1	15.0	174

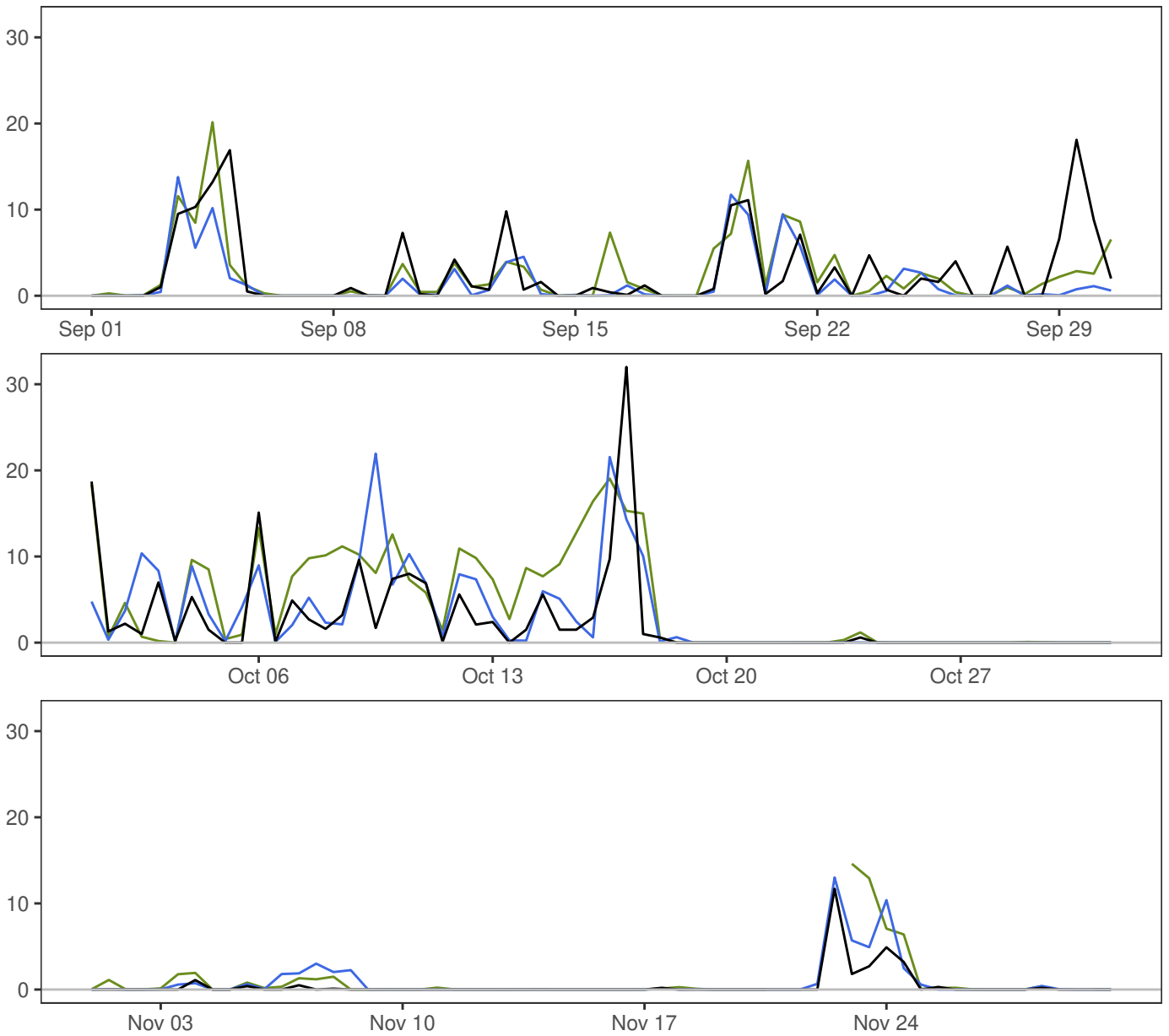
REIPÅ



	Min	Mean	Max	Std	N
— synop: 06,18	0.0	2.2	28.3	4.1	182
— MEPSctrl: 12+18,+30	0.0	2.5	18.3	4.0	182
— ECMWF: 12+18,+30	0.0	3.1	25.6	4.9	176

	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl-synop	0.2	2.6	2.6	1.4	10.6	176
ECMWF-synop	0.9	3.4	3.5	1.9	12.7	176

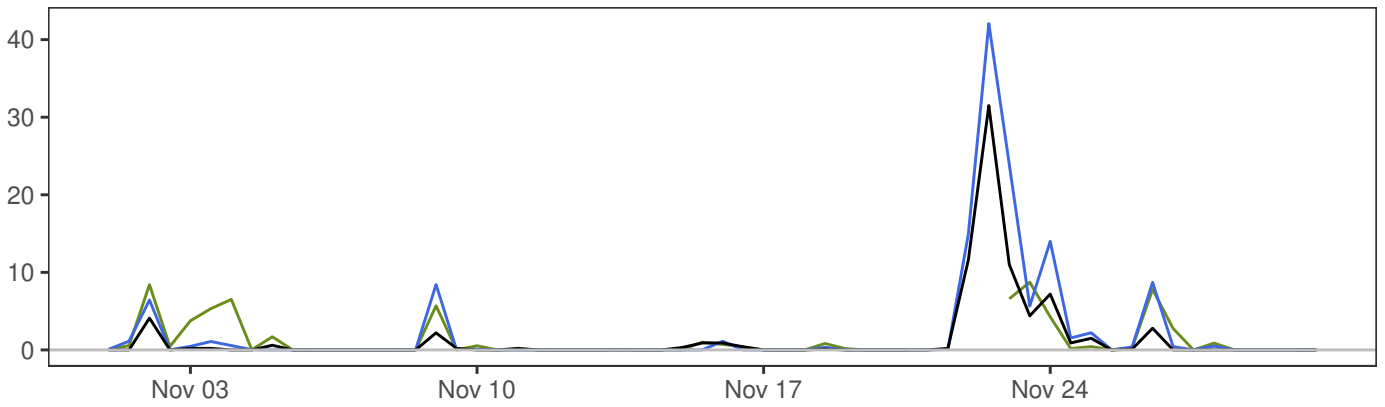
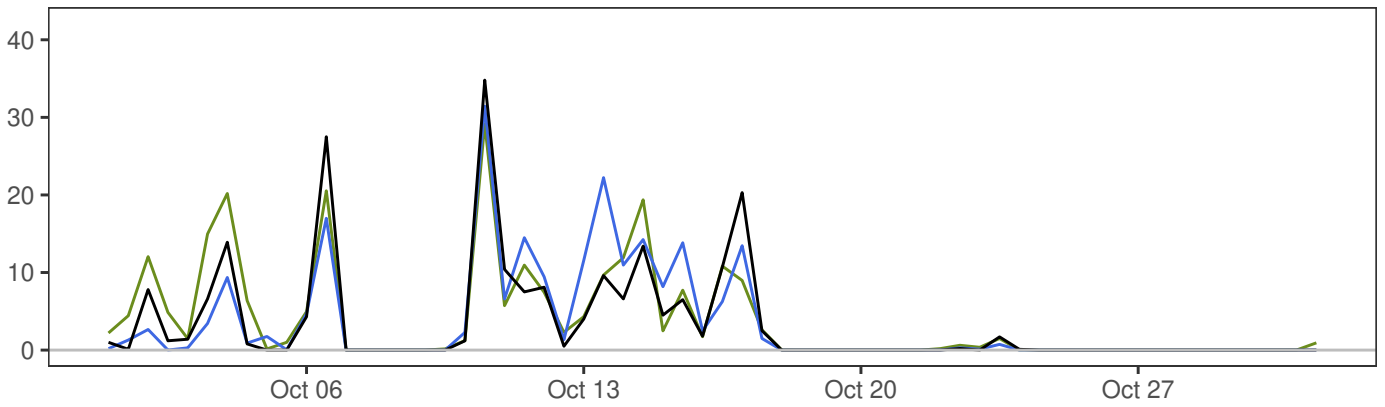
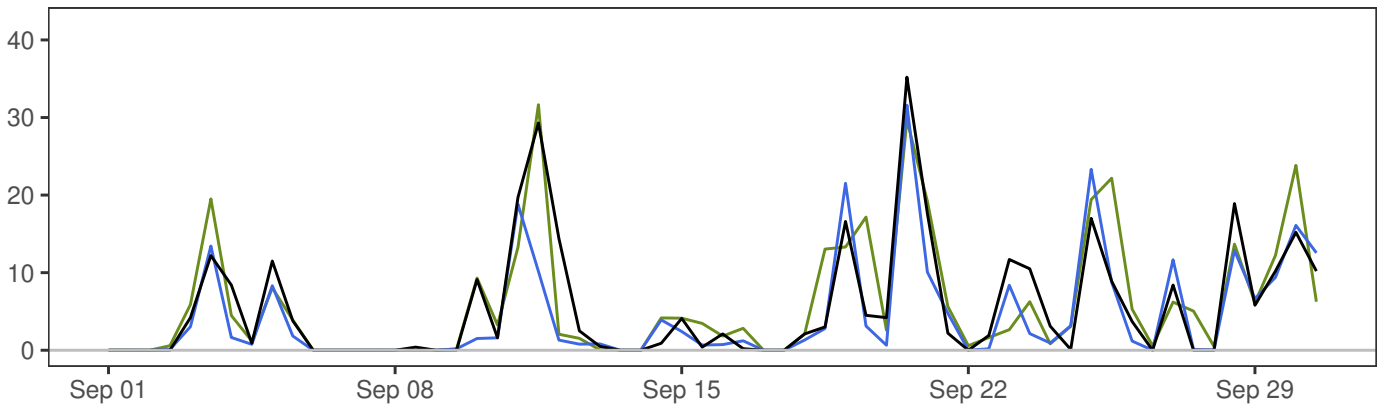
ØRLAND III



	Min	Mean	Max	Std	N
— synop: 06,18	0.0	2.0	32.0	4.3	182
— MEPSctrl: 12+18,+30	0.0	1.9	21.9	3.8	182
— ECMWF: 12+18,+30	0.0	2.8	20.1	4.6	176

	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl-synop	-0.1	3.7	3.7	1.6	20.2	176
ECMWF-synop	0.8	3.8	3.9	1.9	16.7	176

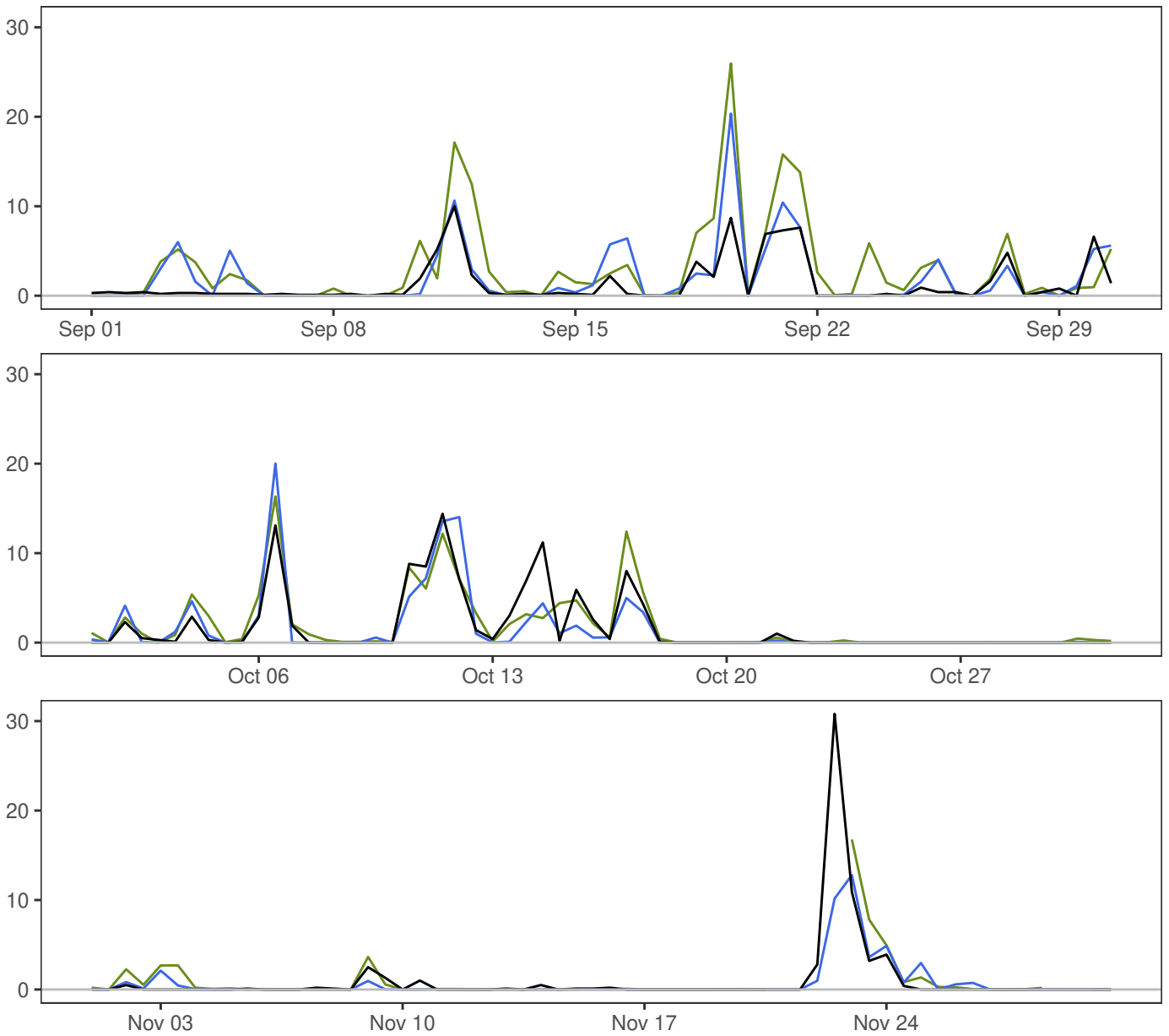
BERGEN – FLORIDA



	Min	Mean	Max	Std	N
— synop: 06,18	0.0	3.4	35.2	6.7	182
— MEPSctrl: 12+18,+30	0.0	3.4	42.1	6.7	182
— ECMWF: 12+18,+30	0.0	3.8	31.6	6.3	176

	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl–synop	-0.2	3.3	3.3	1.6	19.1	176
ECMWF–synop	0.4	3.2	3.2	1.7	13.3	176

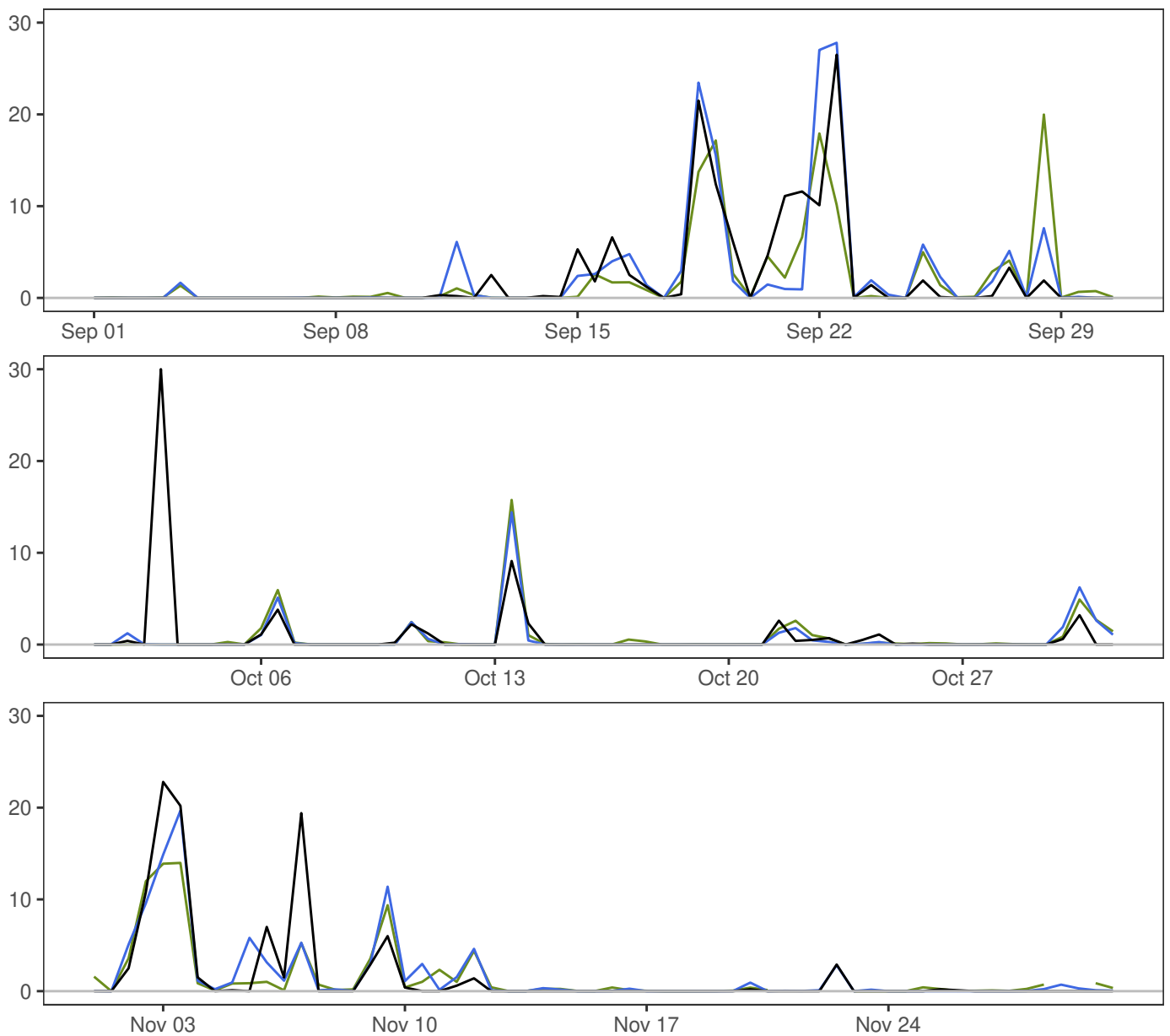
LÆRDAL IV



	Min	Mean	Max	Std	N
— synop: 06,18	0.0	1.4	30.8	3.5	182
— MEPSctrl: 12+18,+30	0.0	1.4	20.3	3.3	182
— ECMWF: 12+18,+30	0.0	2.0	26.0	3.9	176

	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl-synop	0.2	1.8	1.8	0.8	11.6	176
ECMWF-synop	0.8	2.4	2.5	1.2	17.3	176

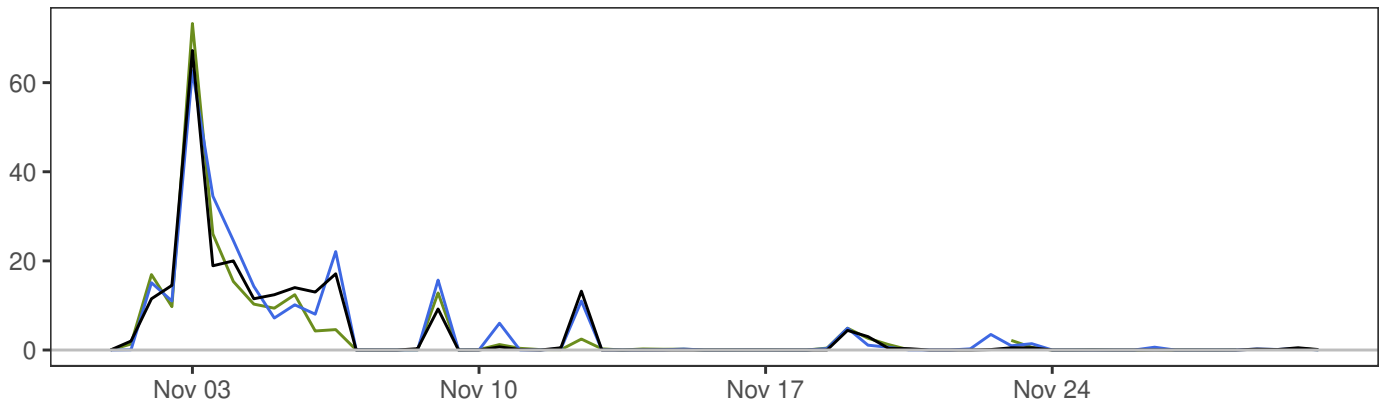
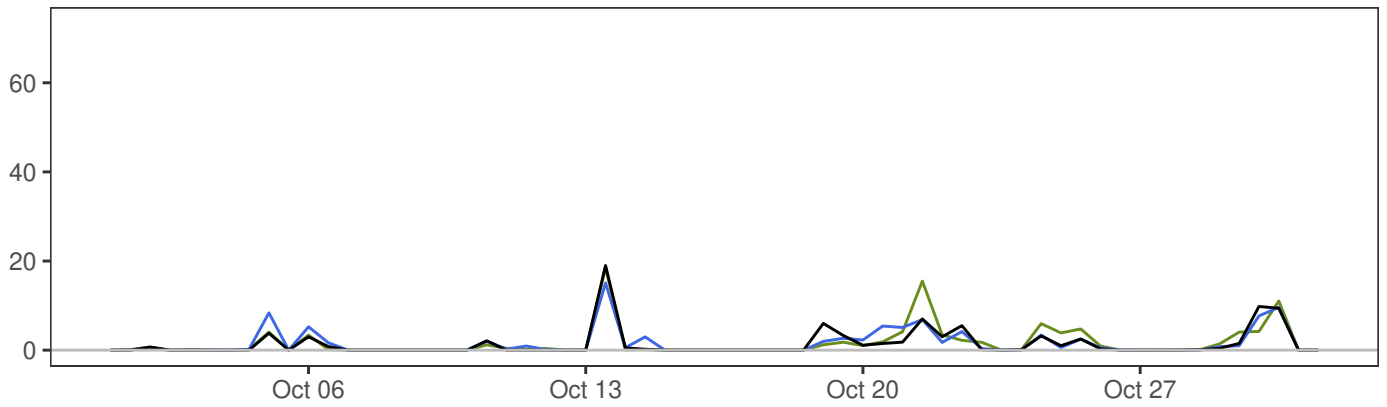
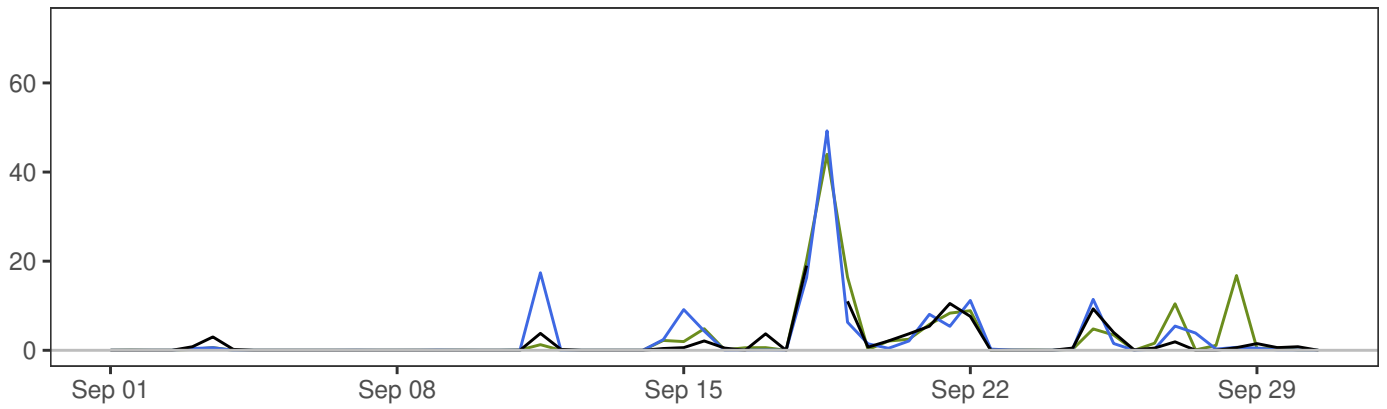
GARDERMOEN



	Min	Mean	Max	Std	N
— synop: 06,18	0.0	1.6	30.0	4.7	182
— MEPSctrl: 12+18,+30	0.0	1.6	27.8	4.3	182
— ECMWF: 12+18,+30	0.0	1.4	20.0	3.5	176

	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl-synop	0.0	3.4	3.4	1.1	30.0	176
ECMWF-synop	-0.2	3.6	3.6	1.2	30.0	176

NELAUG



	Min	Mean	Max	Std	N
— synop: 06,18	0.0	2.3	67.2	6.4	181
— MEPSctrl: 12+18,+30	0.0	2.8	62.7	7.5	182
— ECMWF: 12+18,+30	0.0	2.7	73.3	7.6	176

	ME	SDE	RMSE	MAE	Max.abs.err.	N
MEPSctrl-synop	0.2	2.4	2.4	1.1	15.6	175
ECMWF-synop	0.1	2.6	2.6	1.1	16.2	175