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New operational nowcasting system at Finnish Meteorological Institute

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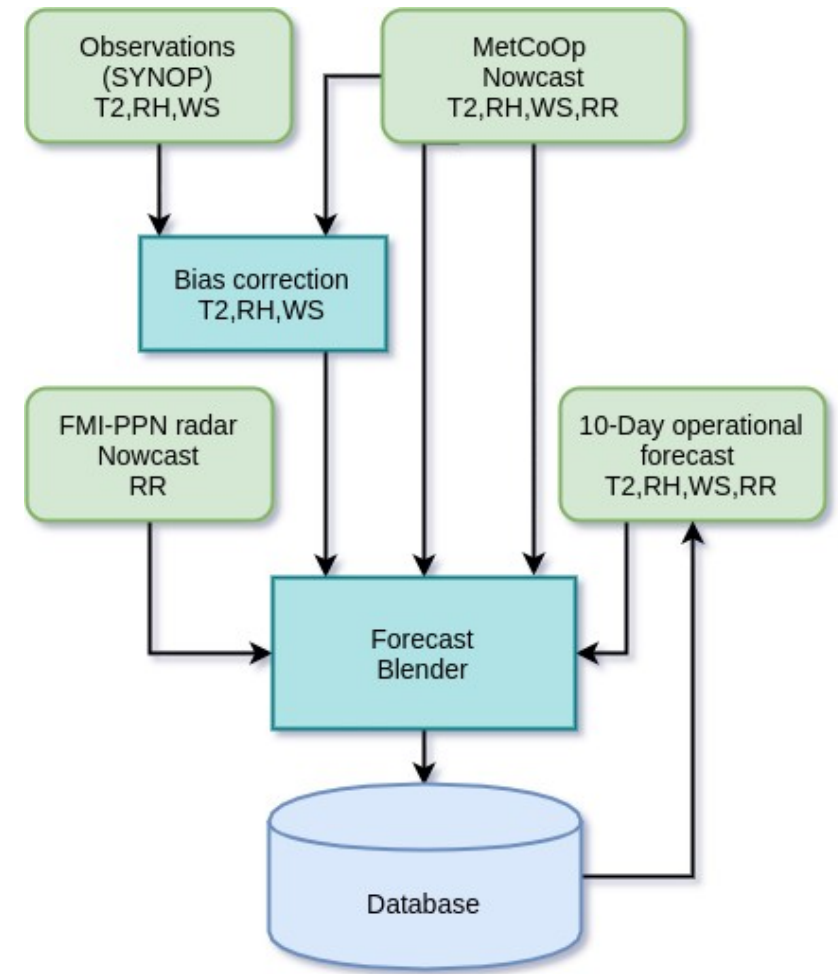


Motivation

- To create a method to produce accurate and timely short range forecasts and blend the information seamlessly to the 10-day operational forecast → *Smartmet nowcast*-system
- The Smartmet Nowcast is reducing the delay in production and improving the accuracy of the short range forecasts at Finnish Meteorological Institute
- The method will be automated in our operational forecast production during this year.
- *Smartmet Nowcast* data is hourly updating, available 25min past the observation hour and the horizontal resolution is currently ~2.5km (used to be 7.5km due to the former limitations in operational production)

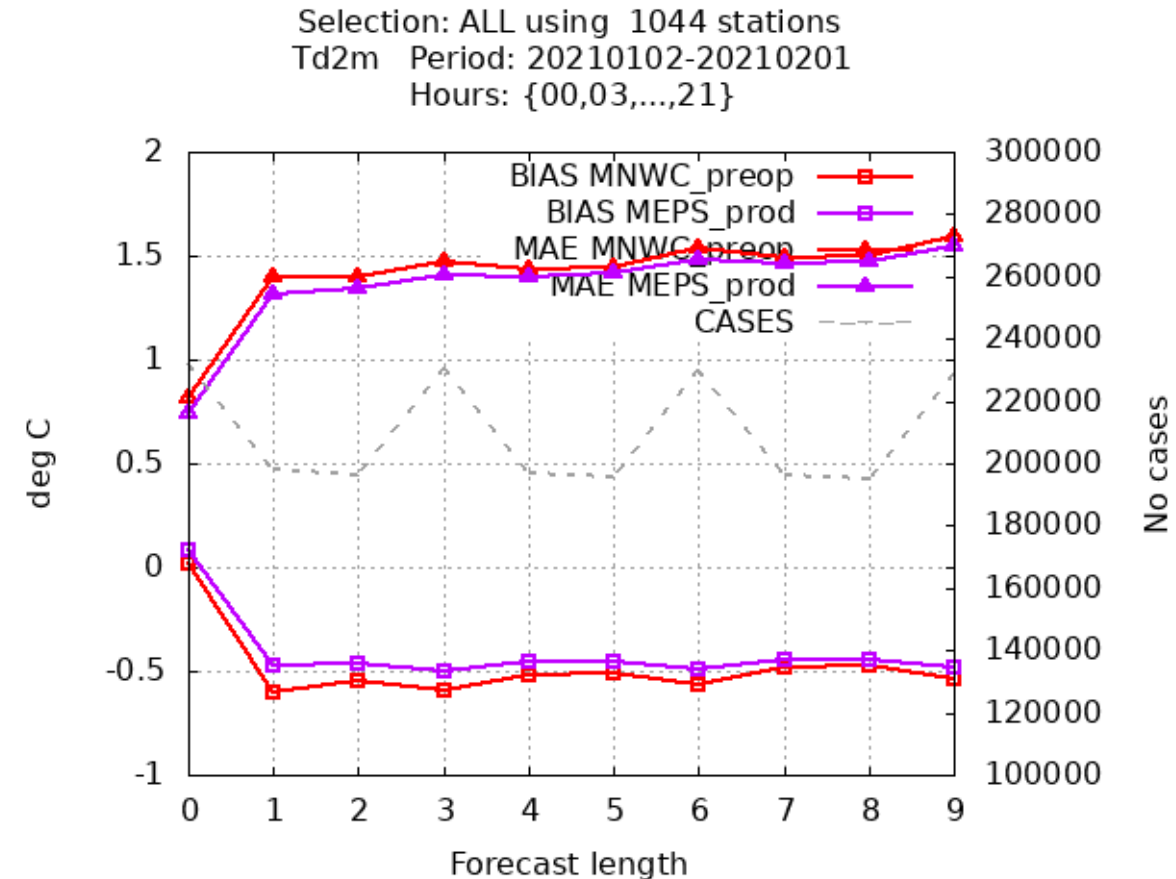
Smartmet nowcast, SNWC

- Combines recent observations, nowcast information derived from observations (radar nowcast) and NWP model data and seamlessly blends the short forecast information with the operational 10-day forecast
- Currently produced for parameters T2m, RH, 1h precipitation accumulation, Wind speed, Cloud cover
- Is based on pre-operational MetCoOp nowcast model (MNWC)
 - hourly updating, resolution ~2.5km, forecast length 9h)
 - MEPS control run used as back-up data



Bias correction: T2m, RH and WS

- Bias correction is done to parameters: T2m, RH and WS
- Assimilated observations do not have as strong impact on NWP model forecast as should
- With bias correction the short range forecasts of the NWP model can be improved
- The bias correction is based on the most recent forecast minus observation information, this error information is gridded and used to correct the leadtimes 0-4h using error weights



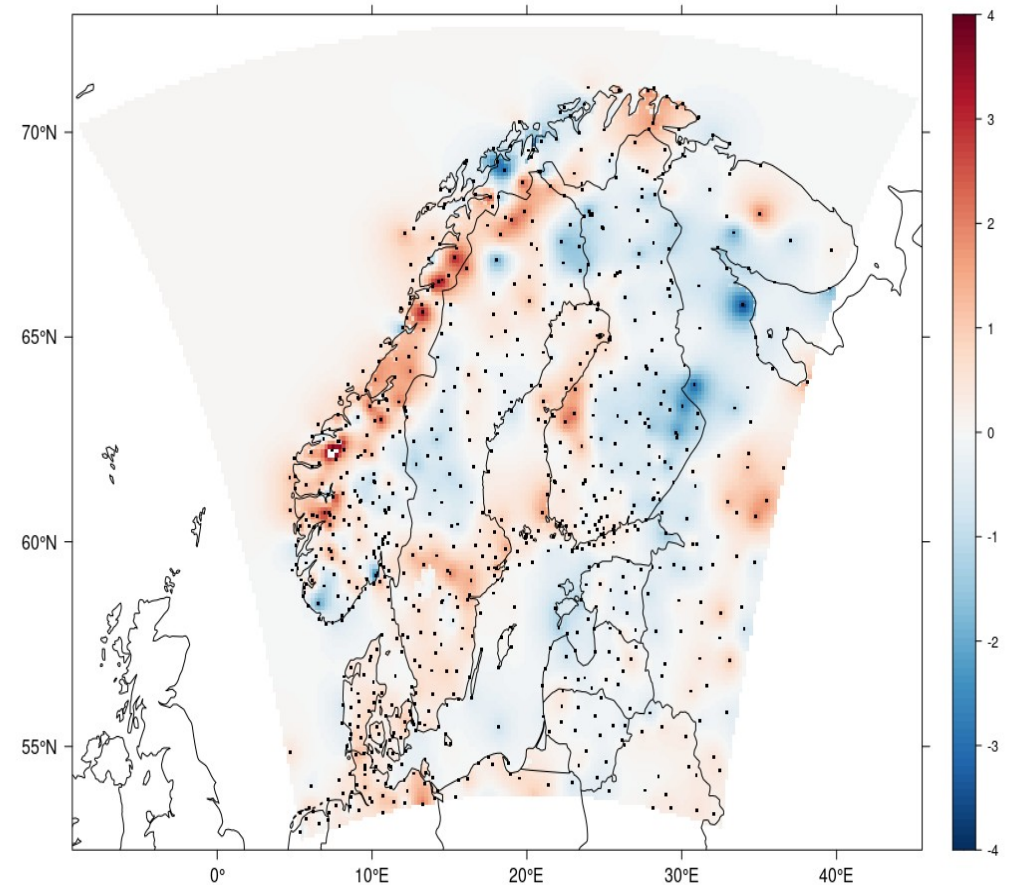
Verification results for NWP model shows that assimilated observations have impact mostly only on analysis time

Bias correction: T2m, RH and WS

- Error weights used to correct the lead times 1-4h were determined using ~1 year of forecast-observation error information and finding the weight that produced minimum in RMSE over the stations
- → NetAtmo QC corrected temperature observations will be added to the correction in near future

Table 1: Weights used in bias correction for different parameters and forecast lead times.

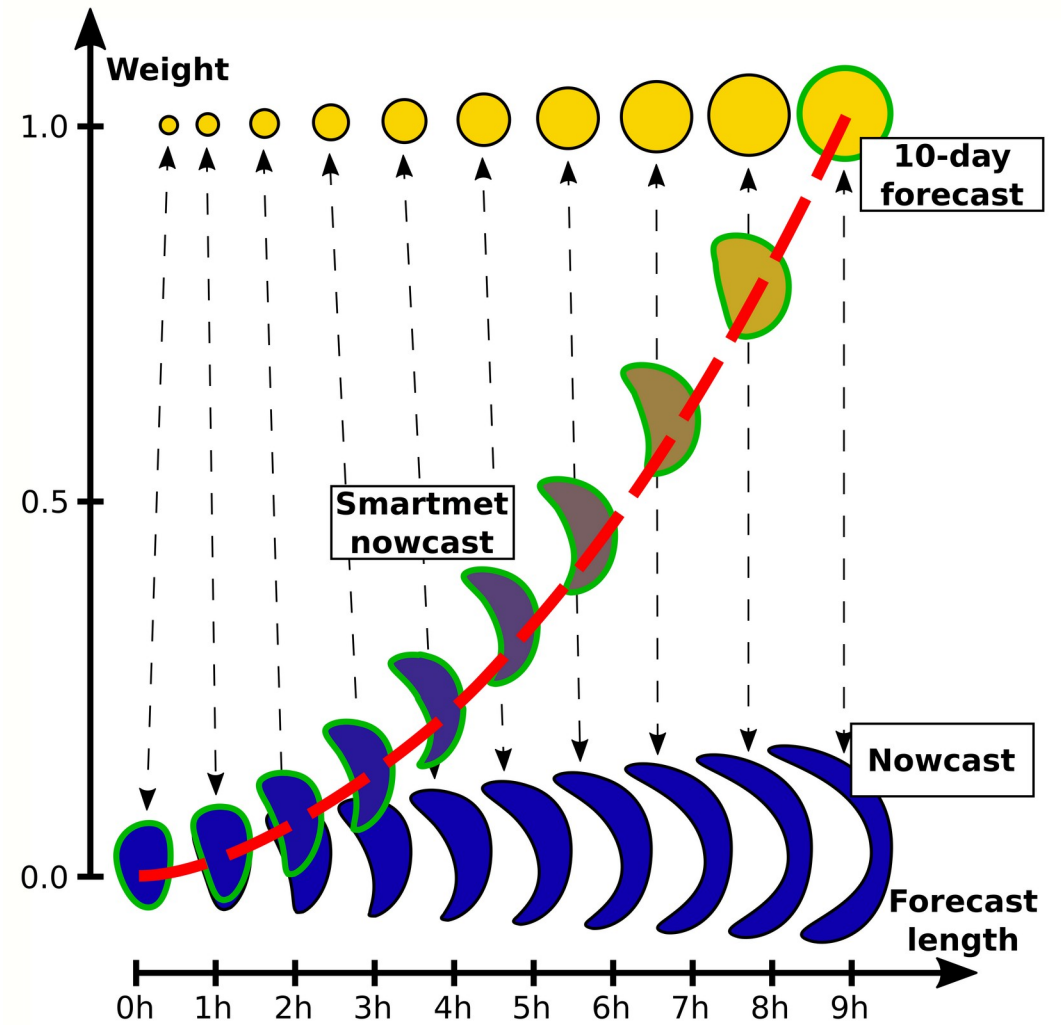
Lead time	Temperature	Wind speed	Relative humidity
0 h	1.0	1.0	1.0
1 h	0.9	0.9	0.8
2 h	0.9	0.8	0.7
3 h	0.8	0.7	0.6
4 h	0.7	0.7	0.6



SYNOP station locations and gridded error field for t2m

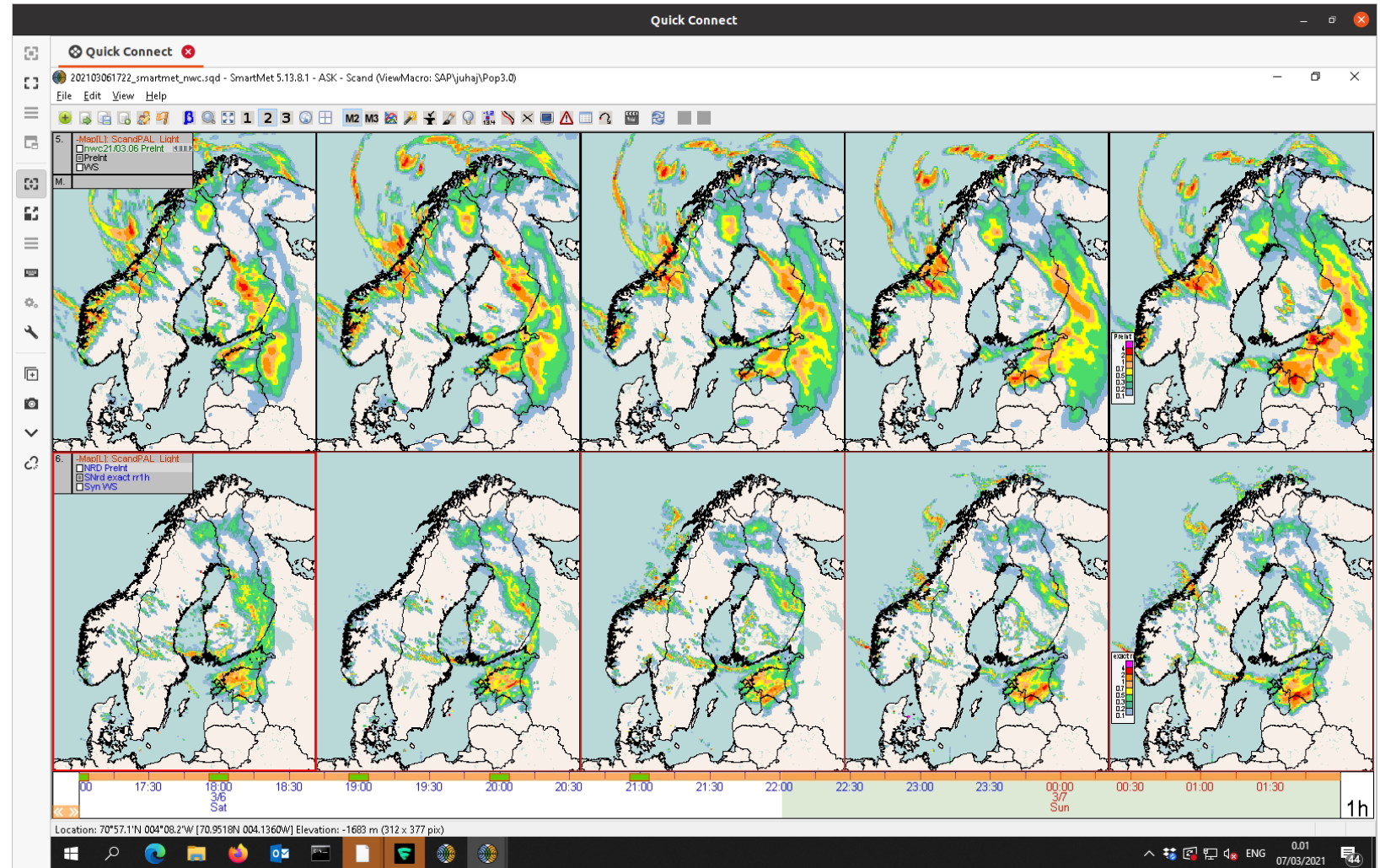
Forecast blender

- Forecast blender takes in all the various information sources and makes a seamless forecast out of them
- Combined data sources provide alternatives for each forecast length
- From these two forecast sources, a blended forecast is produced through mutual weighting
- OpenCV¹ interpolation is used where similar features between consecutive images are used to derive a motion vector field



Precipitation nowcast (1h accumulation)

- RR nowcasts produced by blending radar nowcast with MNWC
- An example of the smartmet nowcast RR (top panel) and the radar observed RR (bottom panel)
- SNWC is capturing well the movement of large scale precipitation, but is unable to capture well the convection



Validation: T2m, WS, RH

- Data used from September-November 2020
- Y-axis reversed RMSE x-axis forecast lead time
- The point-wise "optimal" bias correction (red), Smartmet nowcast (violet), forecaster (green) and MetCoOp nowcast (blue)
- The point-wise bias correction and Smartmet nowcast (red, violet) improves the forecasts for all the parameters and leadtimes, but the gridding and interpolation to coarser resolution (2.5km → 7.5km) reduces the results of the Smartmet nowcast

