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# New short-range weather forecast products improved by citizen observations

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# REFERENCES- REFERENCES- REFERENCES- REFERENCES- REFERENCES- REFERENCES- REFERENCES-REFERERE

Ensemble Statistical Interpolation (EnSI) that is an adaptation of Local Ensemble Transform Kalman Filter to spatial analysis

Quarterly Journal of the Royal Meteorological Society

RMetS

RESEARCH ARTICLE | Full Access

**Spatial interpolation of two-meter temperature over Norway based on the combination of numerical weather prediction ensembles and in-situ observations**

C. Lussana, I. A. Seierstad, T. N. Nipen, L. Cantarello

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Lussana, C. , Seierstad, I. A., Nipen, T. N. and Cantarello, L. (2019), Spatial interpolation of two-meter temperature over Norway based on the combination of numerical weather prediction ensembles and in-situ observations. Q J R Meteorol Soc. Accepted Author Manuscript. doi:10.1002/qj.3646

Also related:

Nipen, T. N., Seierstad, I. A., Lussana, C., Kristiansen, J. and Hov Ø. (2019), Adopting citizen observations in operational weather prediction. Bull. Amer. Meteor. Soc., currently under review

# MET Nordic dataset

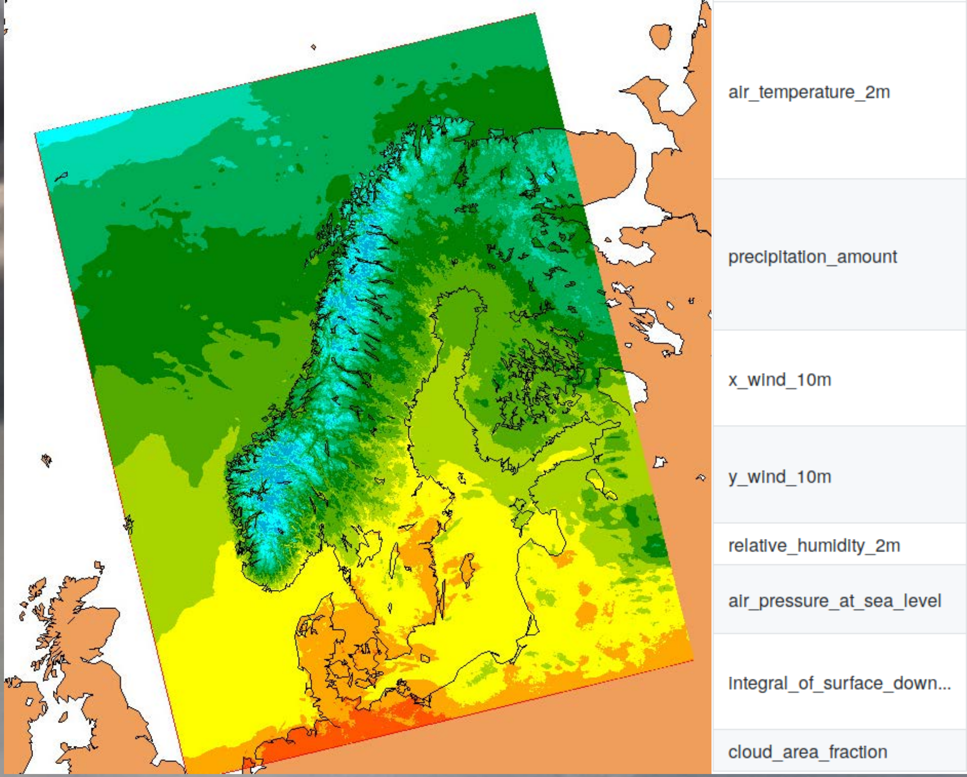
*not only rain…*

*1 km grid, Scandinavia*

*data since 2013*

*NWP post-processing*

*+ observations for precipitation and temperature*

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# Why do we need statistical post-processing for nowcasting of 1km-scale weather?

# Can’t we simply run the model more often?

# Why do we need statistical post-processing for nowcasting of 1km-scale weather?

## Can't we simply run the model more often?

## we would need to run it very-very often and with a massive amount of new 1km-scale observations

Three different ways to include new "local" observations in a cloud-resolving Local Atmospheric Model

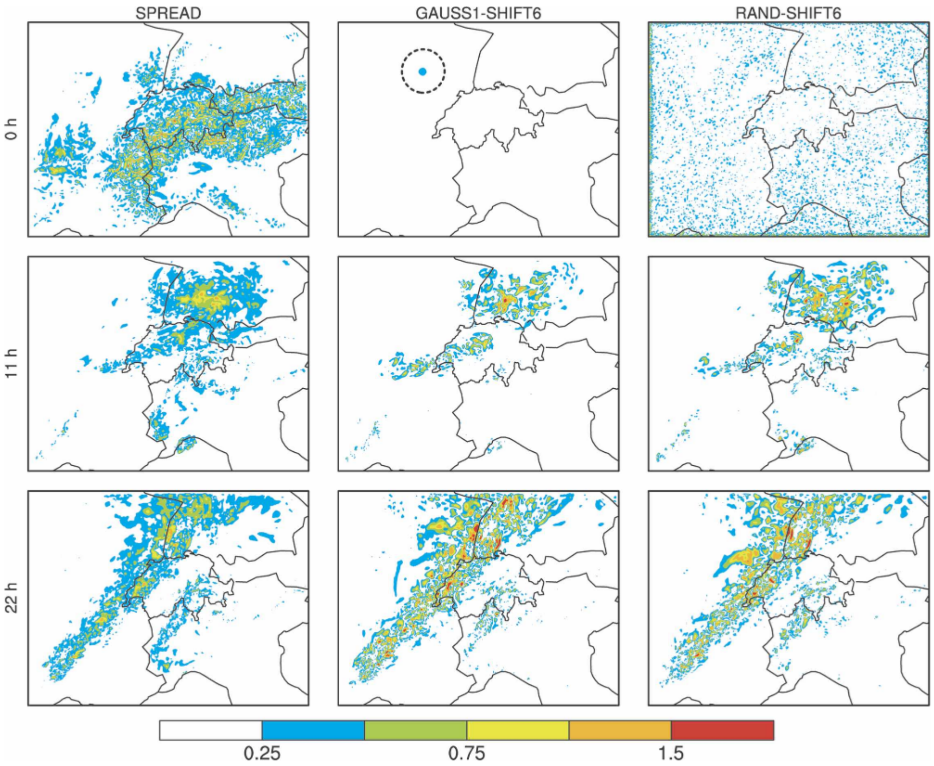


FIG. 2. Comparison of different perturbation methodologies, i.e., (left) shifting initialization, (center) Gaussian perturbation, and (right) random numbers valid after 0, 11, and 22 h of integration at 1-km height (K). The panels show temperature spread $\mathcal{S}$ (for the shifting initialization technique) and temperature difference $\mathcal{D}$ (for the other techniques). The dashed line indicates the footprint of the initial Gaussian perturbation associated with GAUSS1 in the lowermost model layer. The maps cover an area of approximately 882 km × 662 km (401 × 301 grid points).

Hohenegger, C. and C. Schär, 2007: Predictability and Error Growth Dynamics in Cloud-Resolving Models. J. Atmos. Sci., 64, 4467–4478, https://doi.org/10.1175/2007JAS2143.1

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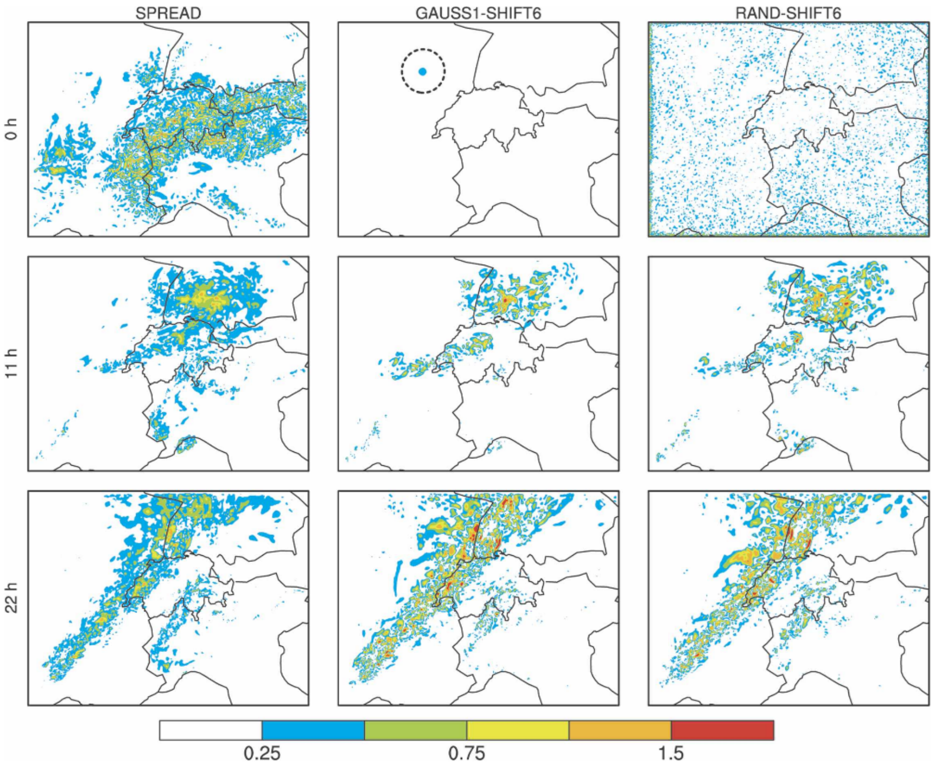


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High level of agreement between the three methodologies at forecast lead time +22 hours



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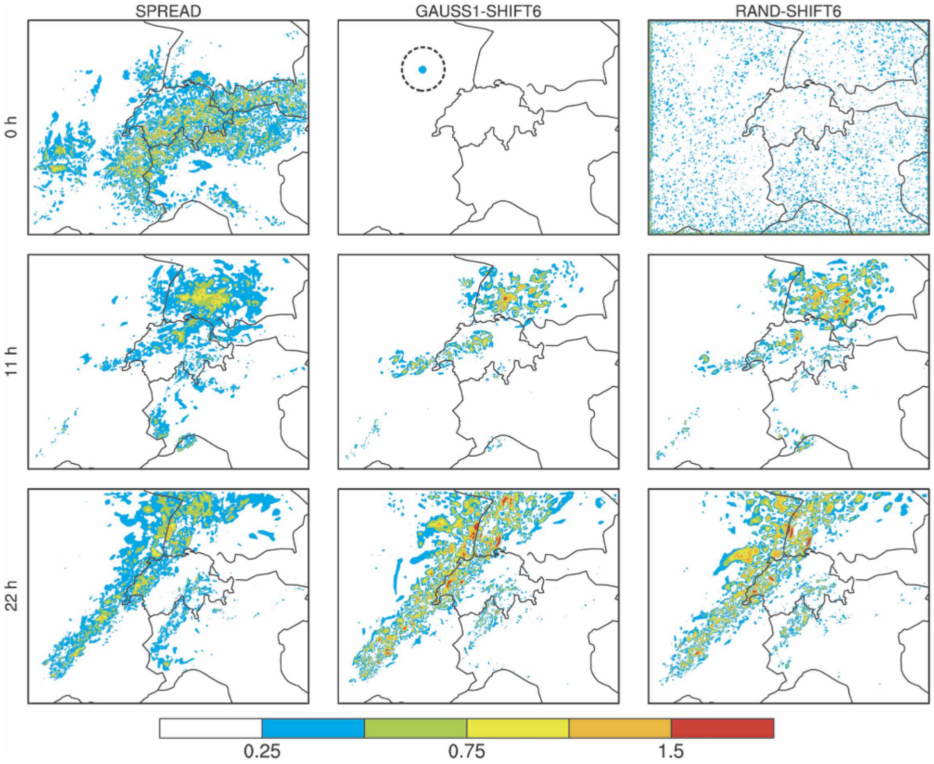


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Lost memory of the local information
The model evolution is forced by something else (boundary conditions … )

High level of agreement between the three methodologies at forecast lead time +22 hours

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# statistical post-processing for nowcasting


# remedy for short term memory loss in NWP

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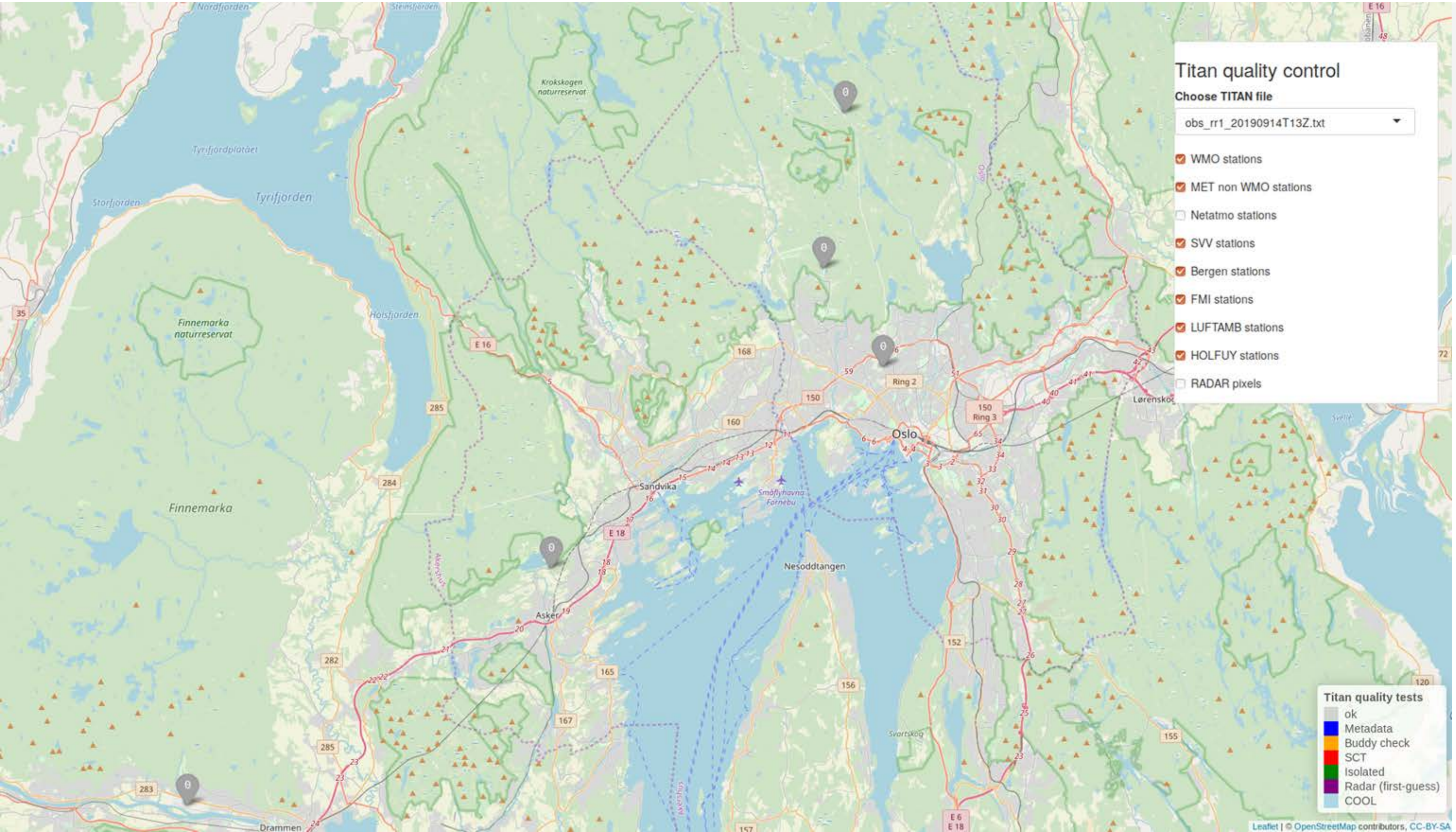
# Why use citizen observations?




2019-09-14 13:00 UTC

Oslo

**1-hour precipitation tot**

*most likely, no rain over most part of the region*

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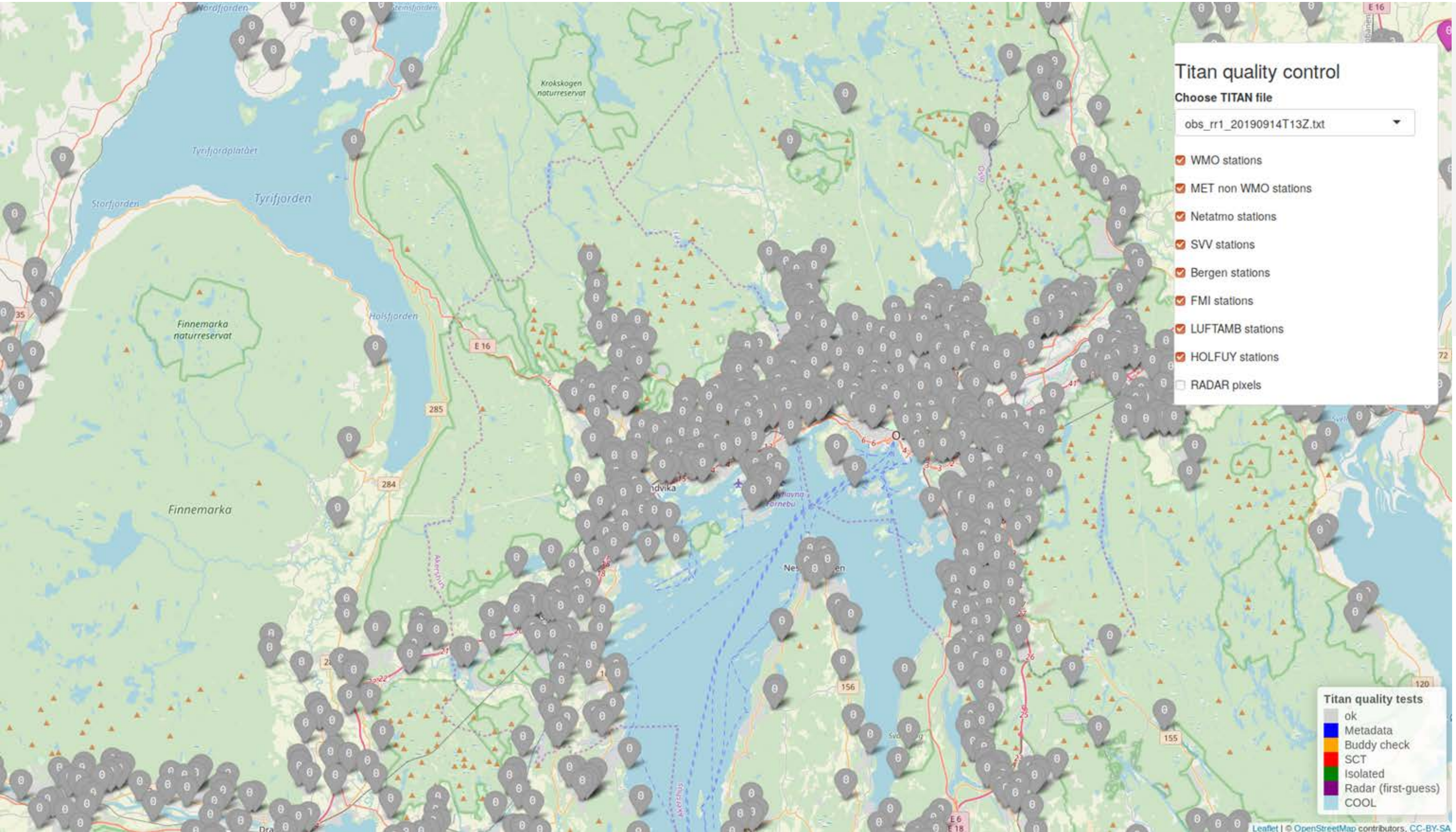
DATA - DATA - DATA - DATA - DATA - DATA - DATA - DATA - DATA - DATA - DATA - DATA - DATA - DATA - DATA -

# to gain confidence in our predictions




2019-09-14 13:00 UTC

Oslo

1-hour precipitation tot

**citizen observations**

*no rain over Oslo, Drammen and the coast of the Oslo fjord. Most likely, no rain in the forests*

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# ...even better if we have multiple sources


2019-09-14 13:00 UTC

Oslo

1-hour precipitation tot

citizen observations

**radar estimates**

*no rain.*

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...citizen observations turn out to be useful even when it is raining...

# Extreme local precipitation in Oslo

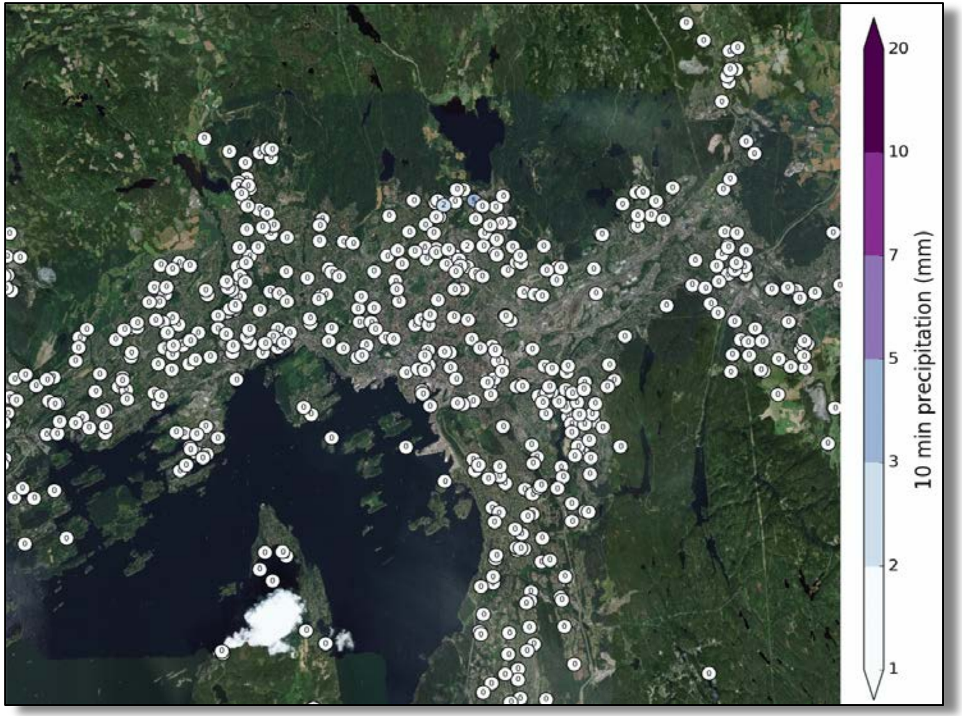


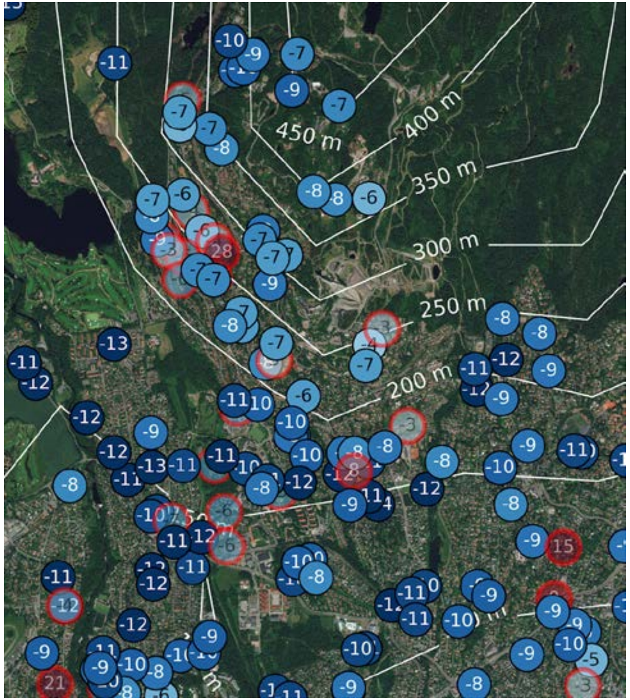


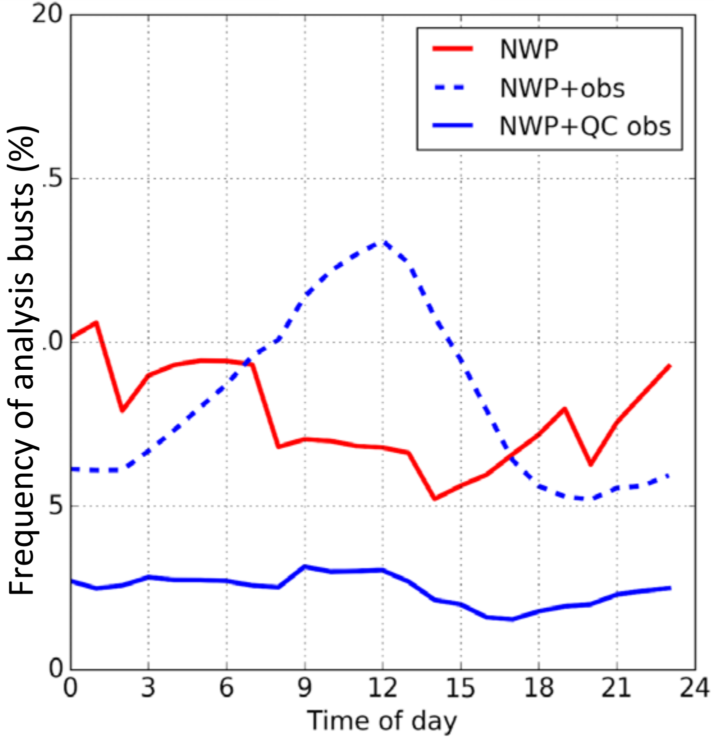
Photo:
Audun Braastad / NTB Scanpix

# Quality control is essential to get value!

Network should be treated as a whole, not as individual stations

Only 20% are removed in our conservative QC



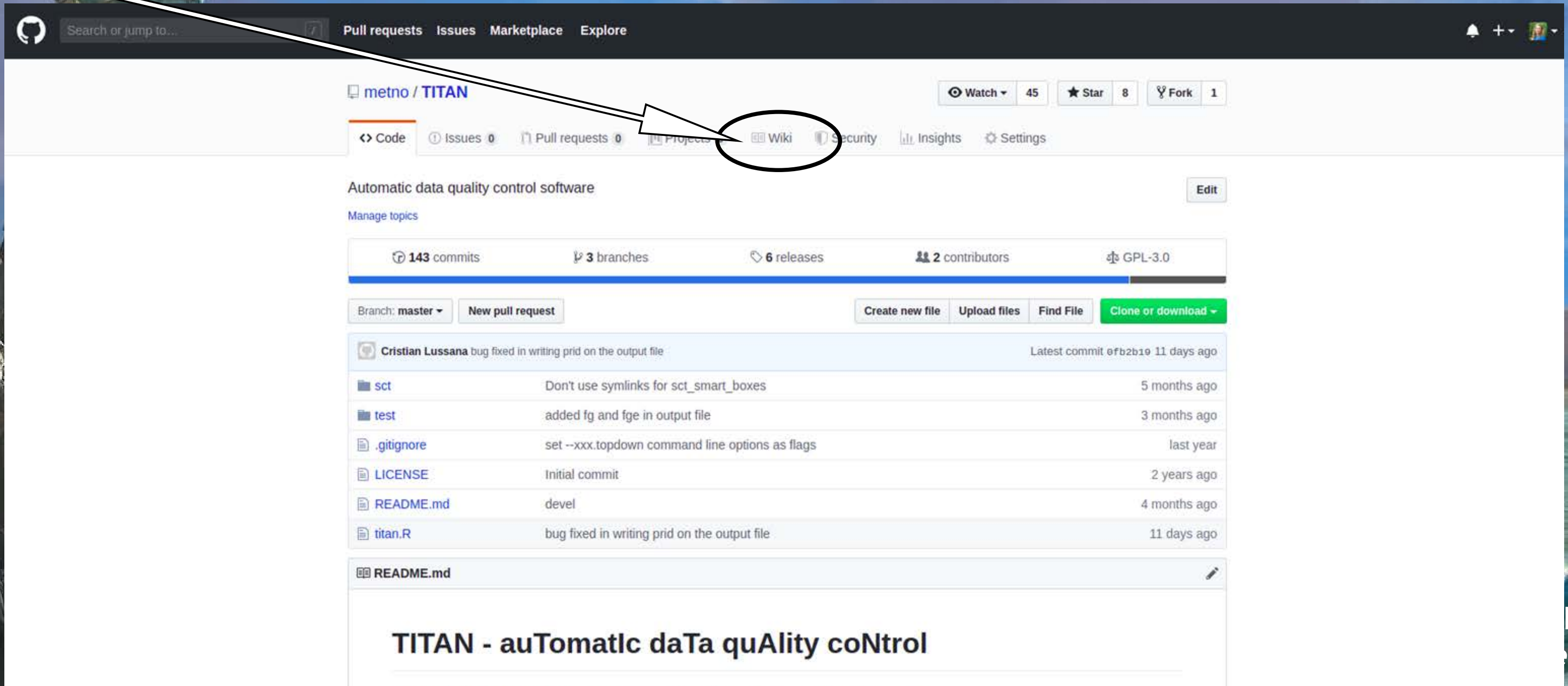



# TITAN

## automatic data quality control software

https://github.com/metno/TITAN

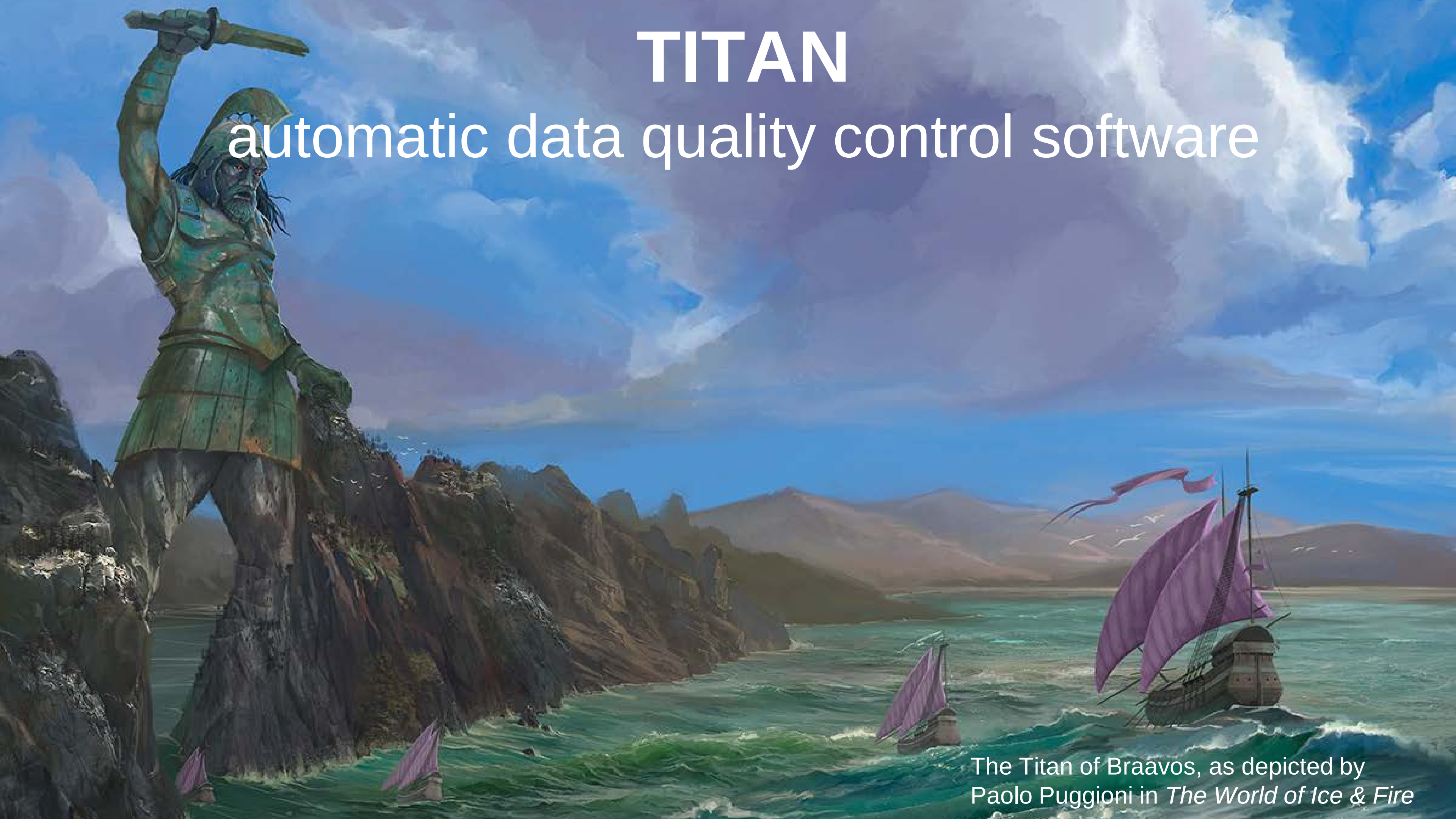
check out the wiki !




by
& Fire

# TITAN

## automatic data quality control software

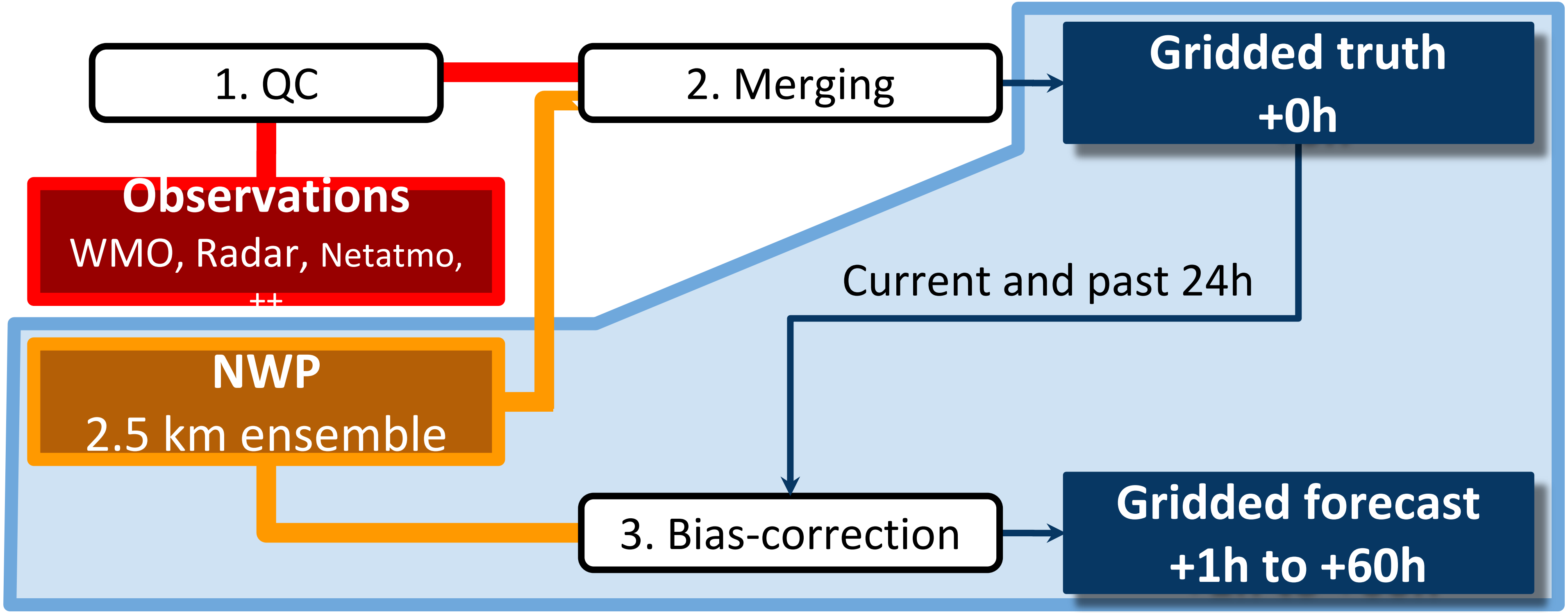


The Titan of Braavos, as depicted by
Paolo Puggioni in *The World of Ice & Fire*

# MET Nordic Forecast

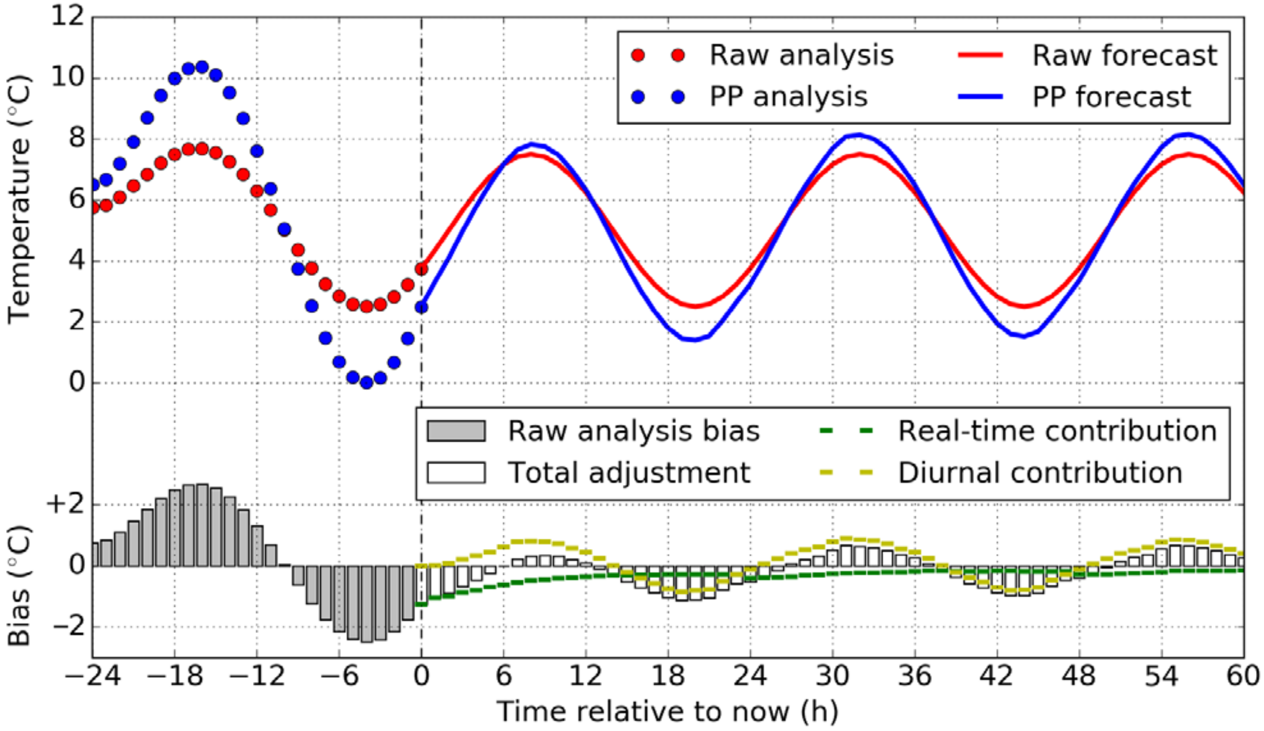


- Used in post-processing of temperature & precip  from NWP
- System is run every hour
- Seamless transition from +0h to +1h

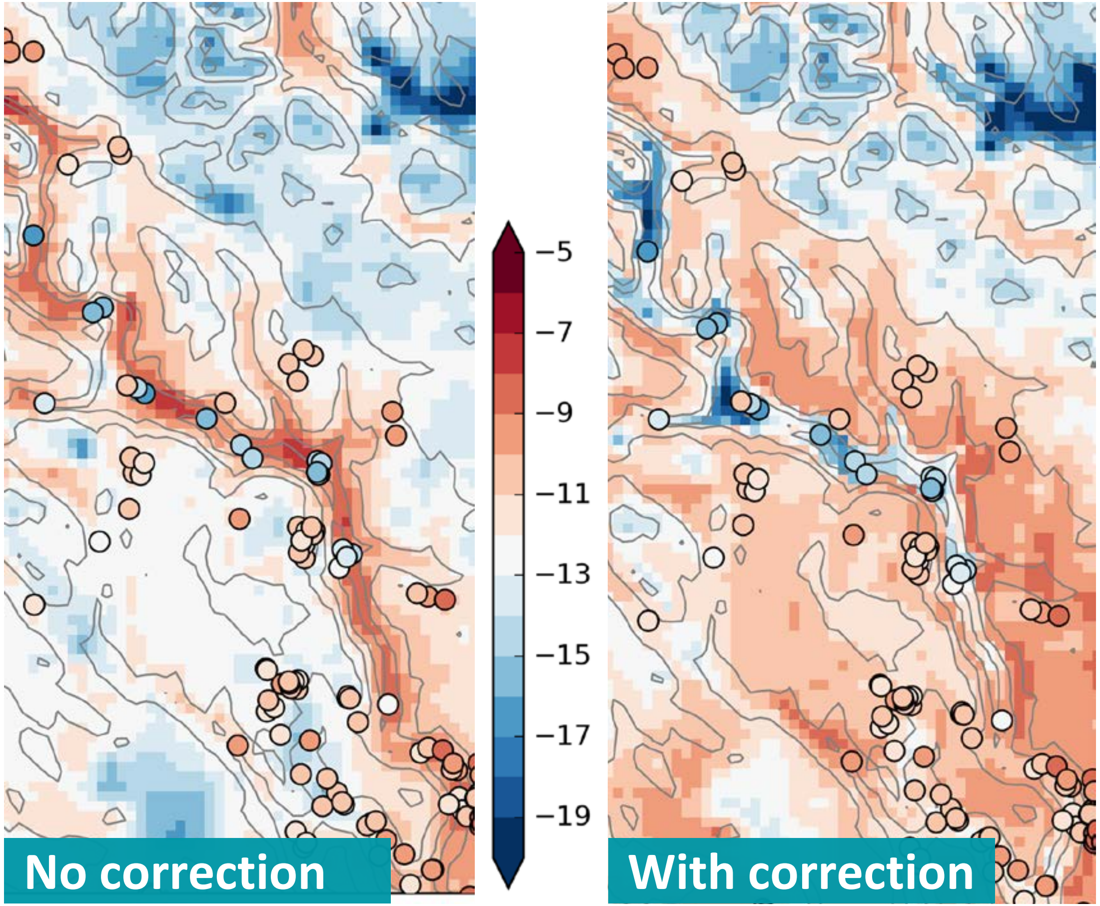


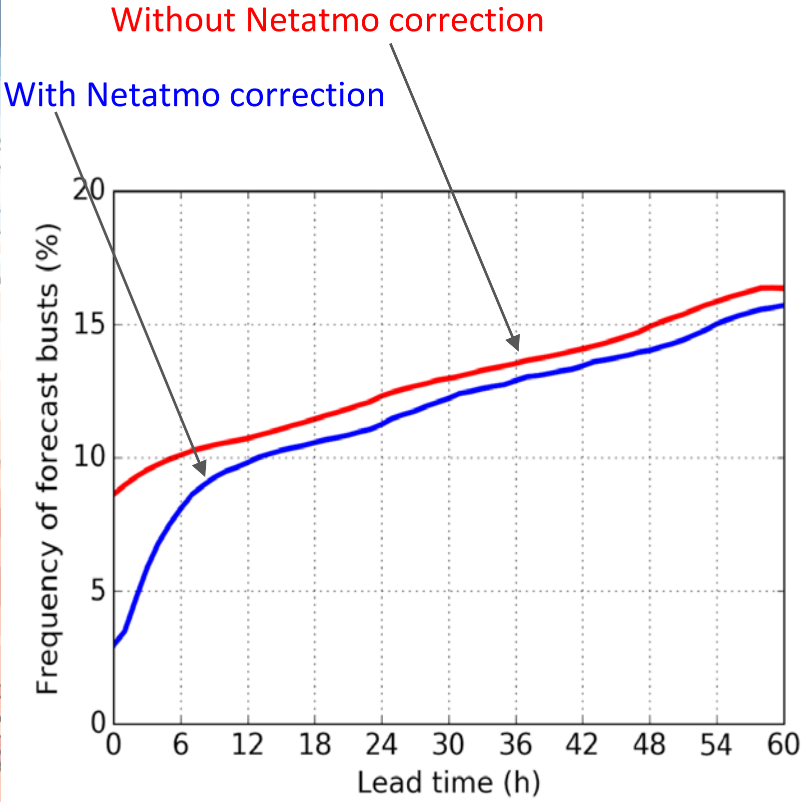
# 3. Bias-correction

- Gridpoint by gridpoint correction
- Seamless transition from gridded truth to gridded forecast
- Diurnally varying bias based on last 24 hours

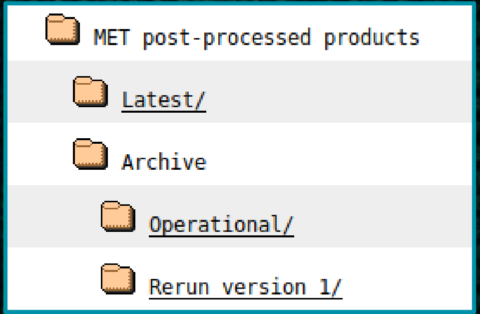


# Impact on operational forecasts



# MET Nordic Analysis and Forecasts




Production strategy:

- Hourly updates
- Reruns when significant improvements on
  - observational data
  - data quality control methods
  - statistical post-processing methods
- OpenData access on thredds.met.no
- Wiki https://github.com/metno/NWPdocs/wiki/Post-processed-products

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# Supplementary Material

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