Norwegian Meteorological Institute

Nye muligheter i modellering med “moderne” observasjoner, eksempel fra numerisk værvarsling.
[Emerging possibilities in NWP from novel observations]

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Numerisk værvarsling

- (Diagnosis) Calculate the weather now:

  Satellite, radar, weather stations, balloons, … , model estimate (short forecast)

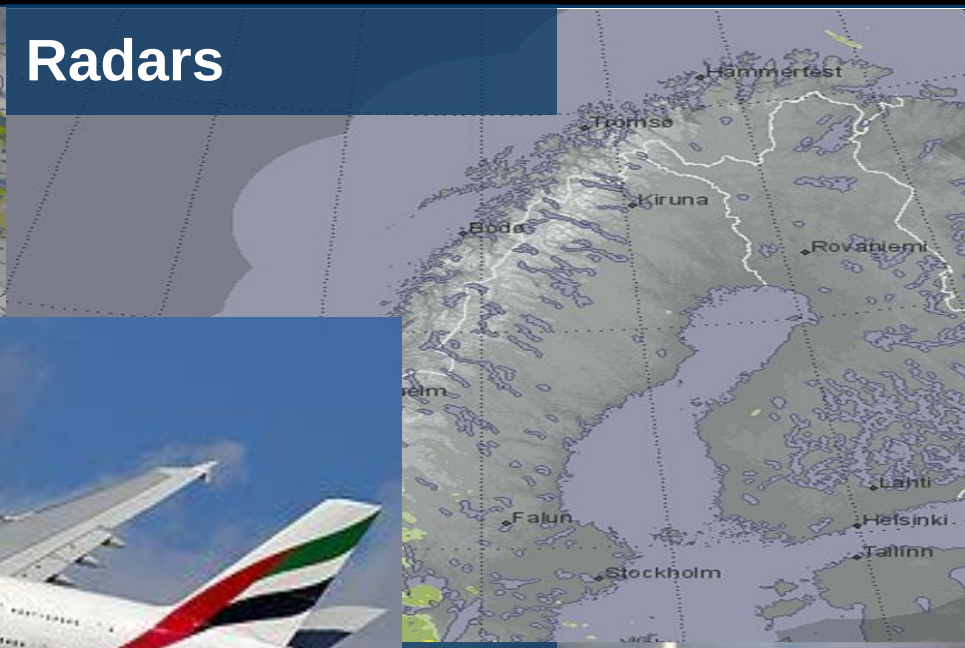
- (Prognosis) Run a weather model forward in time:

  Laws of physics and mechanics simulated on big computers (HPC)

Observing the atmosphere - conventional observations, structure functions, flow dependency, ...

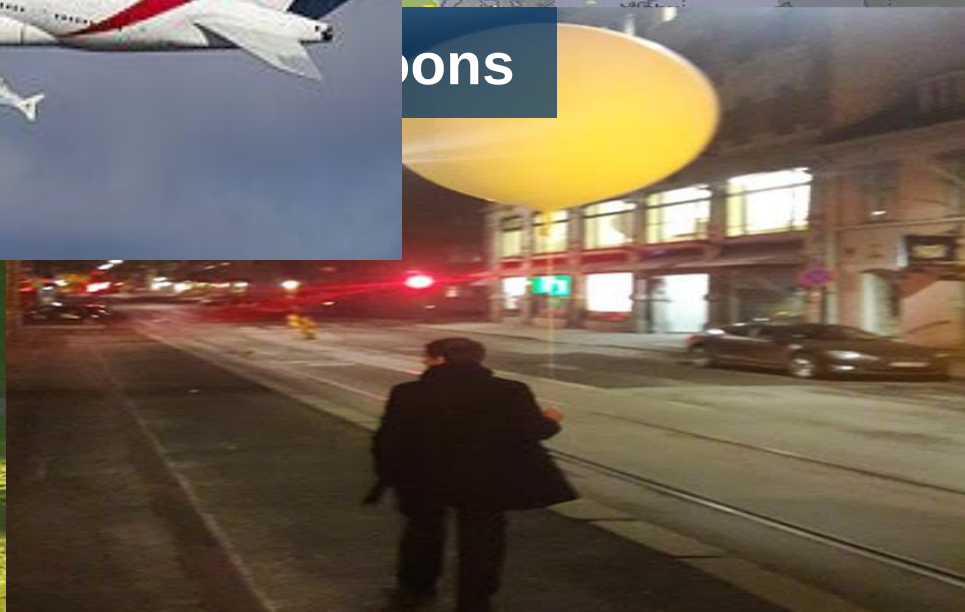
Satellites

Radars

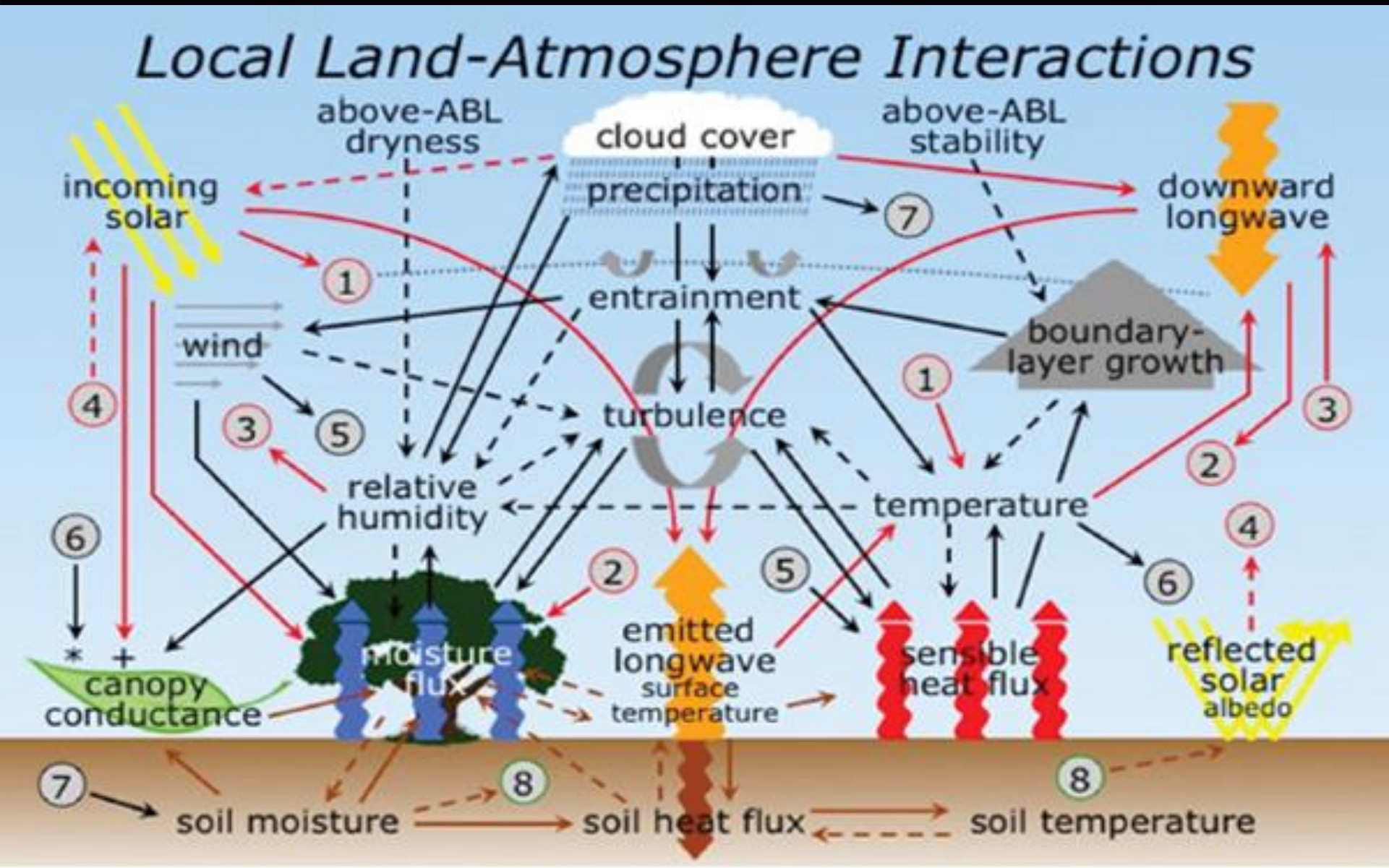


Weather stations

...ons

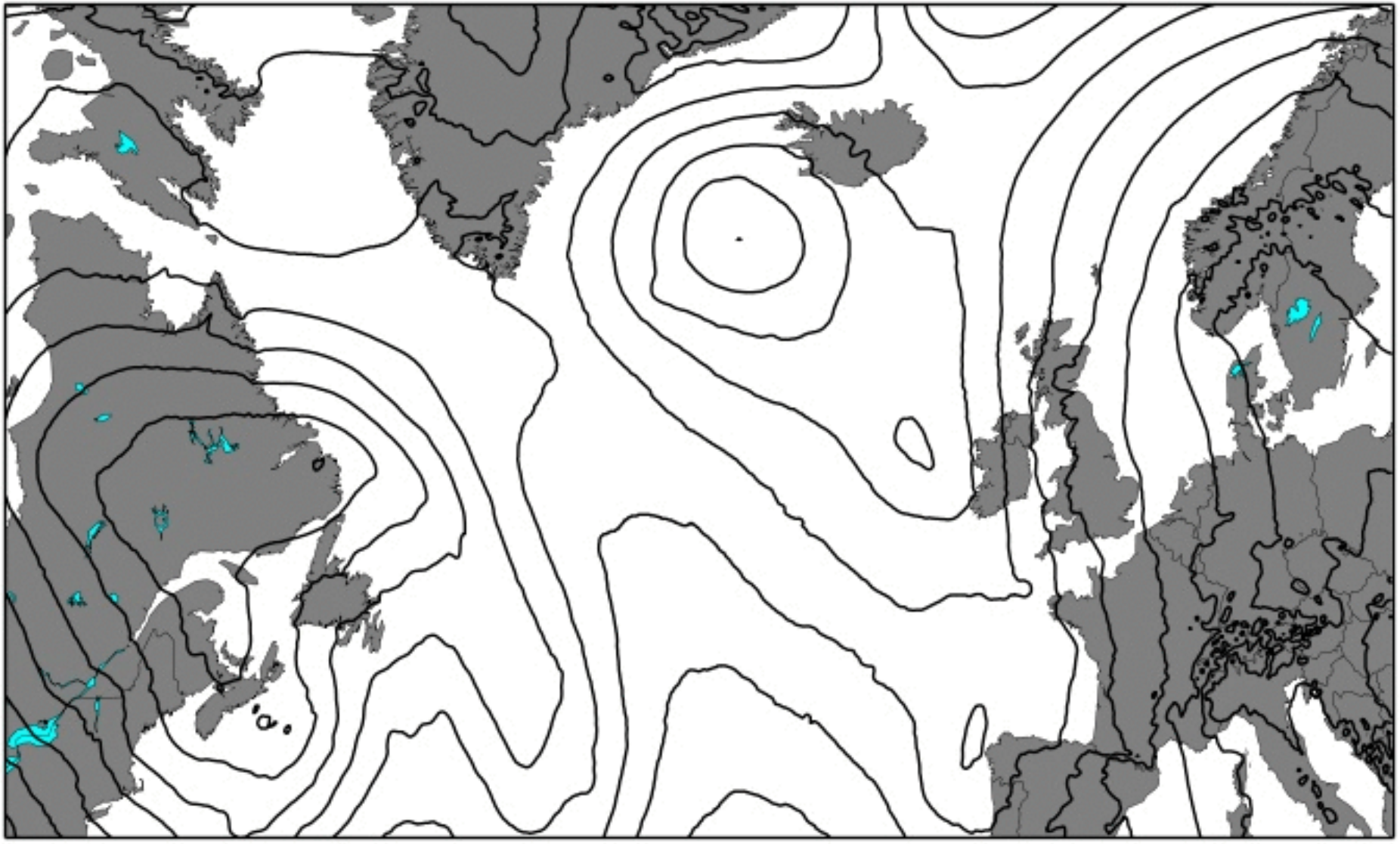


Sunshine (and more) inside a computer - process understanding, parameterizations, earth-system, ...

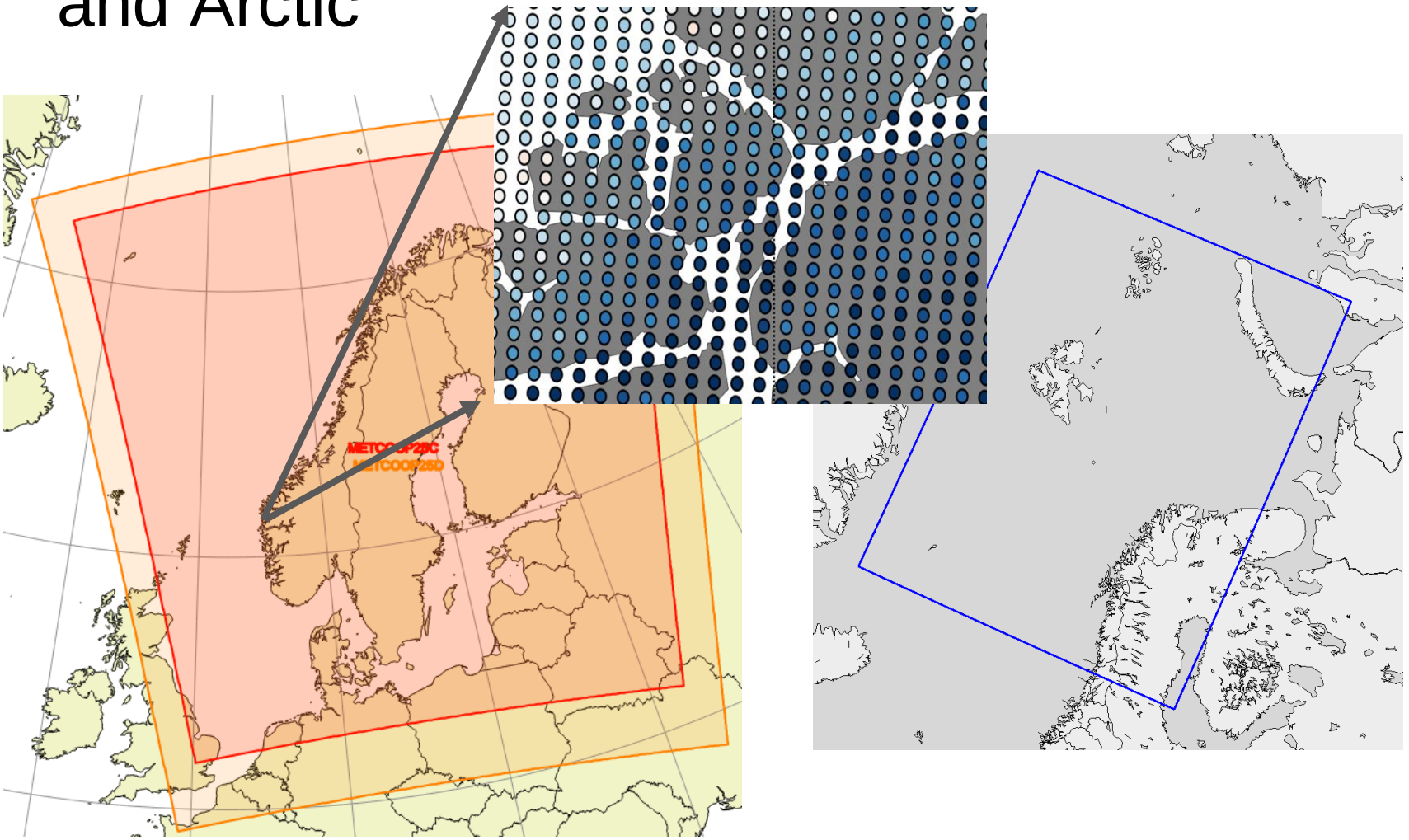


https://www.nap.edu/openbook/21873/xhtml/images/p183.jpg

Prognosis - global model



Our regional model domains - AROME MEPS and Arctic



In Autumn 2018, the HPC installations will consist of three completely redundant sites, with HPCs located at FMI, SMHI and the National Supercomputer Centre (NSC) in Linköping, Sweden.

The weather forecasts have been fully automated (since 2013)

… with a human touch

Search for a location...

Advanced search

My places

Front page › Norway › Oslo › Oslo › Oslo

Weather forecast for

Oslo

Updated at 7:34. **Next update around 23:00.**

Add to My places

Forecast as PDF

- Overview
- Hour by hour
- Long term
- Weather radar
- Statistics
- Maps
- Coastal forecast

RELEVANT PLACES

- Oslo
- Abu Dhabi
- Nice
- Skullerud
- Hakadal observation site
- Rotnes
- New Westminster
- Bjørnholt observation

Today, Thursday 09/02/2017

Time	Forecast	Temp.	Precipitation	Wind
23:00–00:00		-4°	0.2 – 0.3 mm	Moderate breeze, 6 m/s from northeast

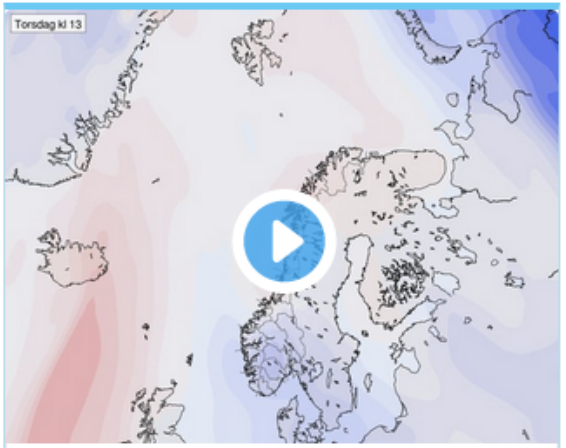
Tomorrow, Friday 10/02/2017

Time	Forecast	Temp.	Precipitation	Wind
00:00–06:00		-4°	1.0 – 1.5 mm	Moderate breeze, 6 m/s from northeast
06:00–12:00		-4°	0.6 – 1.0 mm	Gentle breeze, 5 m/s from northeast
12:00–18:00		-4°	0 – 0.5 mm	Moderate breeze, 6 m/s from northeast
18:00–00:00		-4°	0 – 0.2 mm	Gentle breeze, 5 m/s from northeast

Saturday, 11/02/2017

Time	Forecast	Temp.	Precipitation	Wind
00:00–06:00		-4°	0 mm	Gentle breeze, 5 m/s from northeast

The meteorologists on Twitter



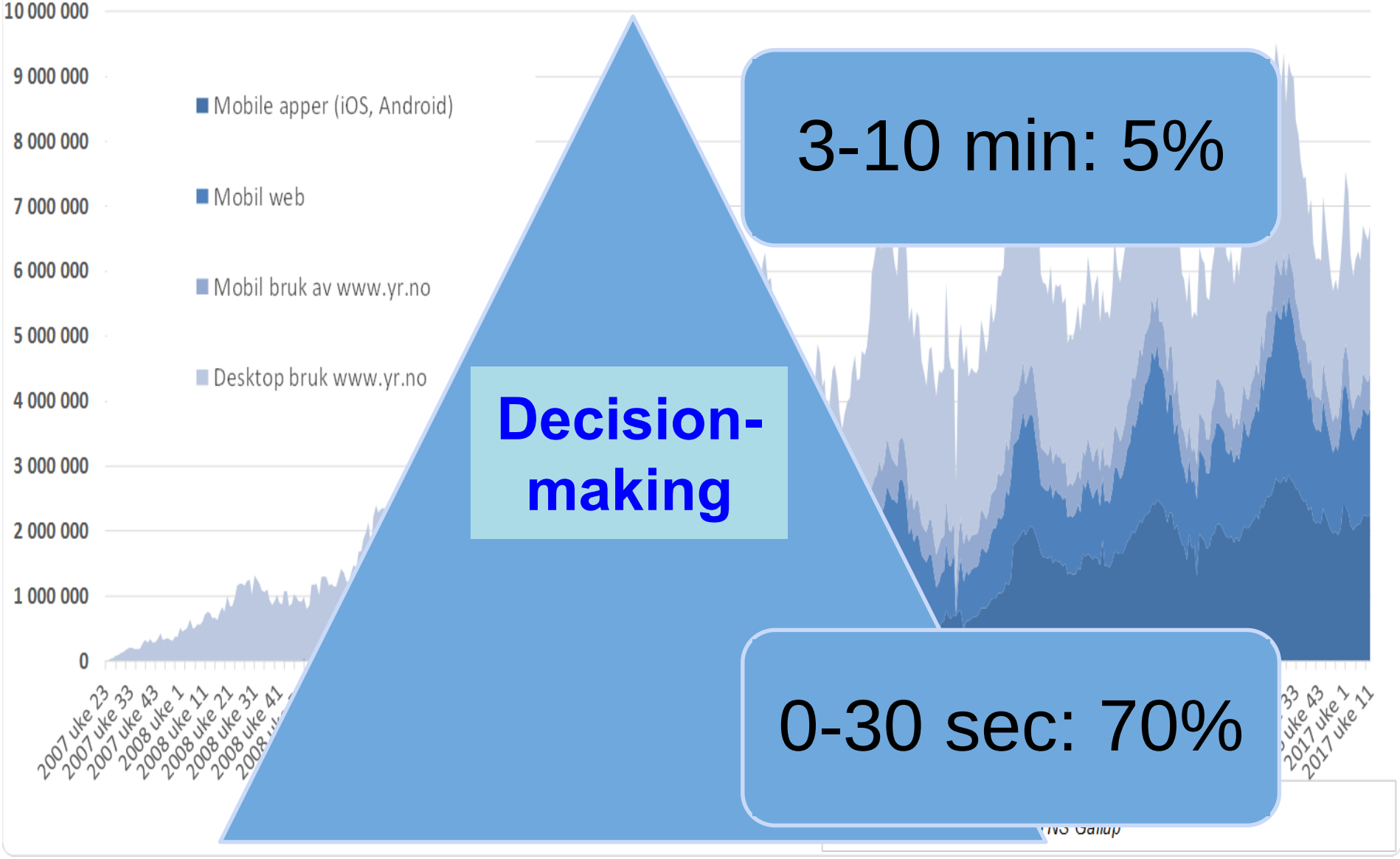
Meteorologene
@Meteorologene

Kaldlufta blir erstatta med mildare luft i #Norge til uka. Best vær i sør, fram med regnjakka og sydvest i Nord-Norge

6:56 PM - 9 Feb 2017

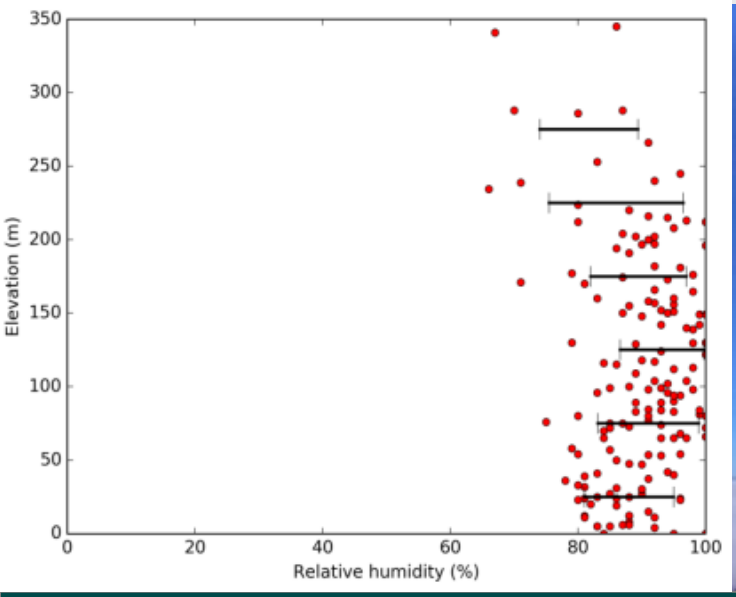
2

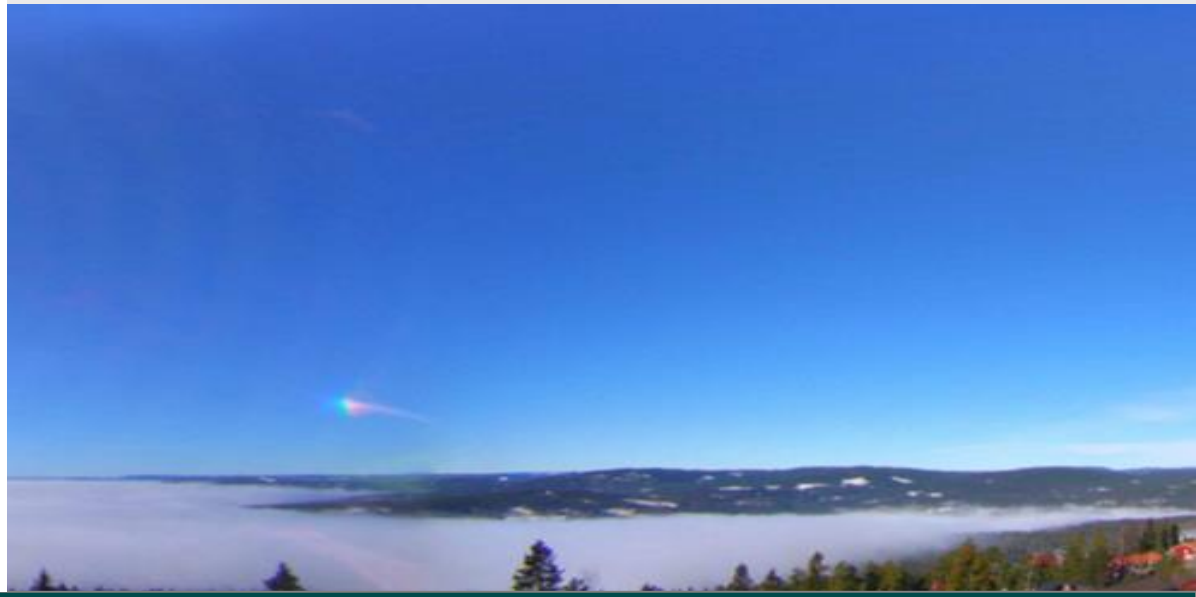
Number of weekly unique users on Yr



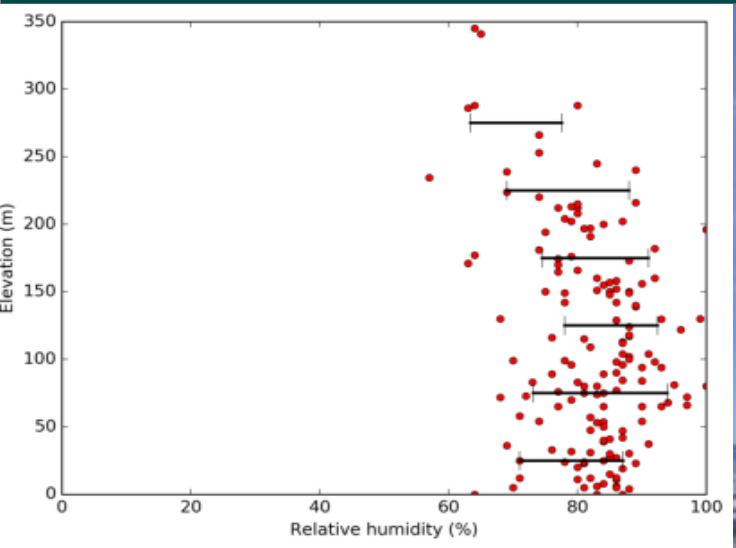
Local weather forecasts for local weather conditions

Detecting fog using private observations

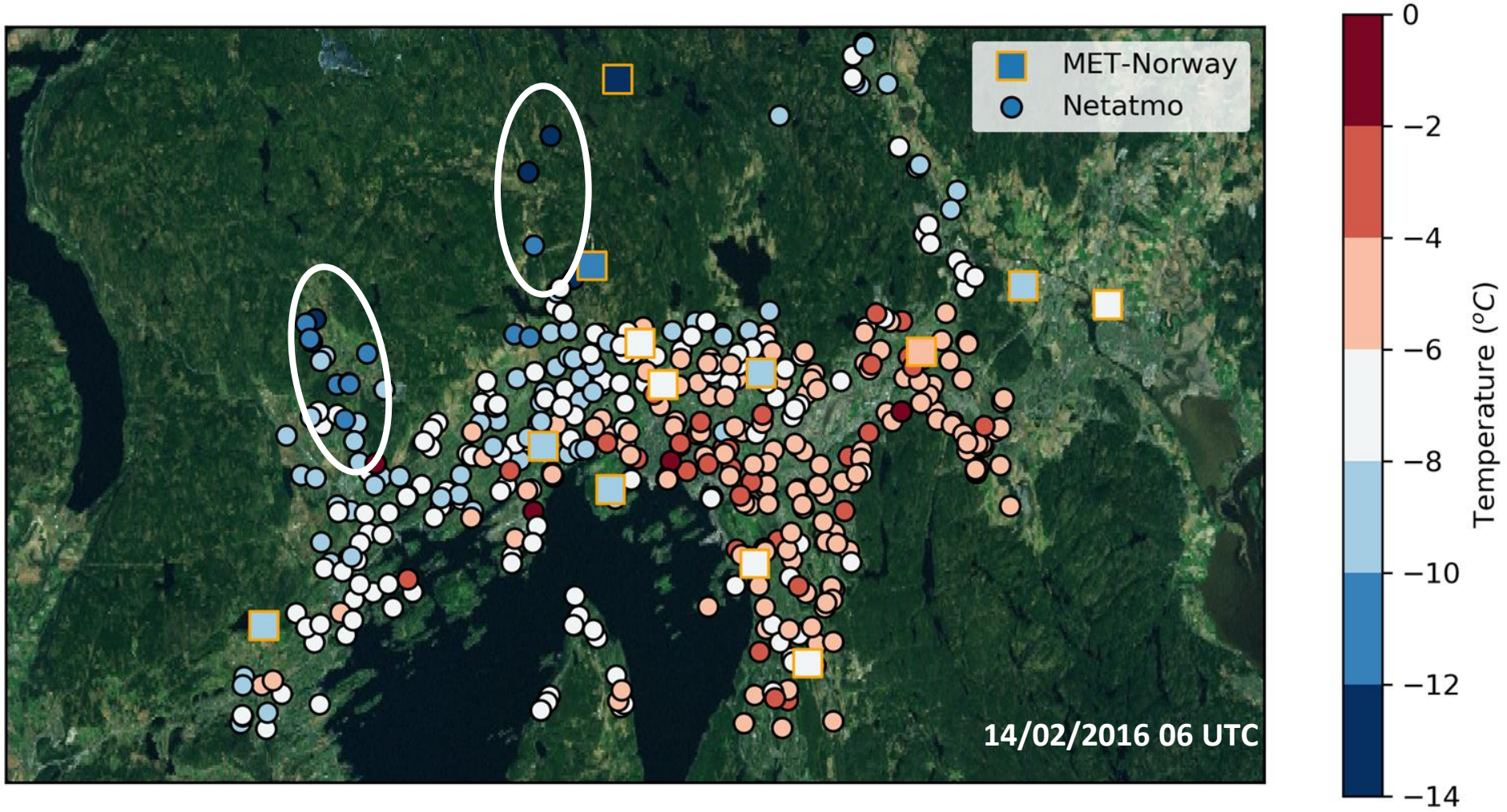




Oslo (17 March 2016) noon (top); noon + 3 h (bottom)

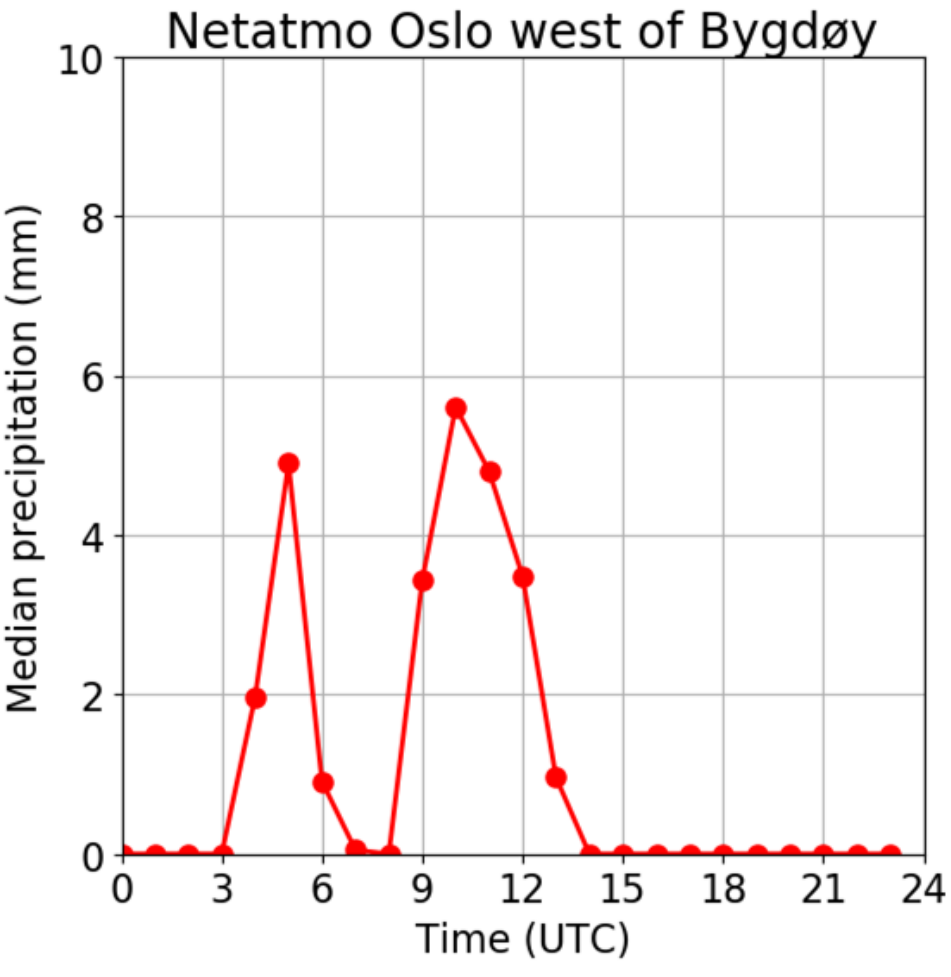


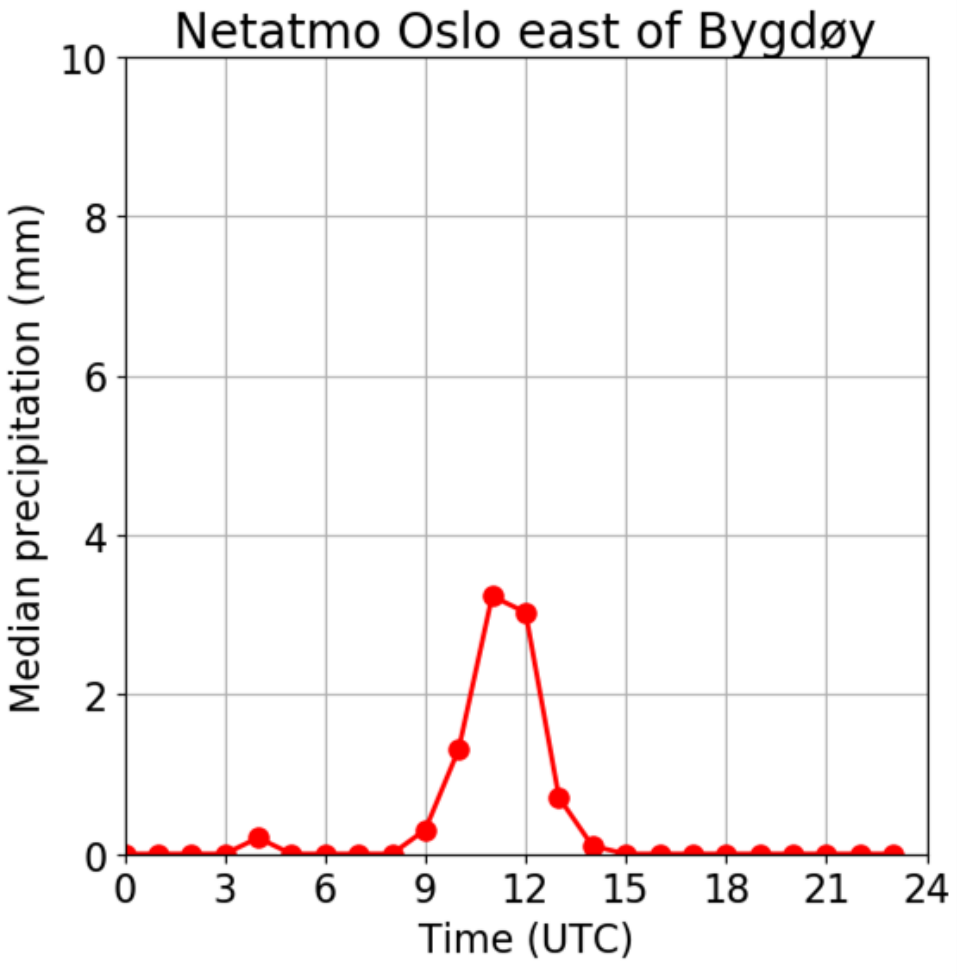
Citizen observations: Detection of cold pools in valleys



Tidsutvikling - intens byge 6. august 2016

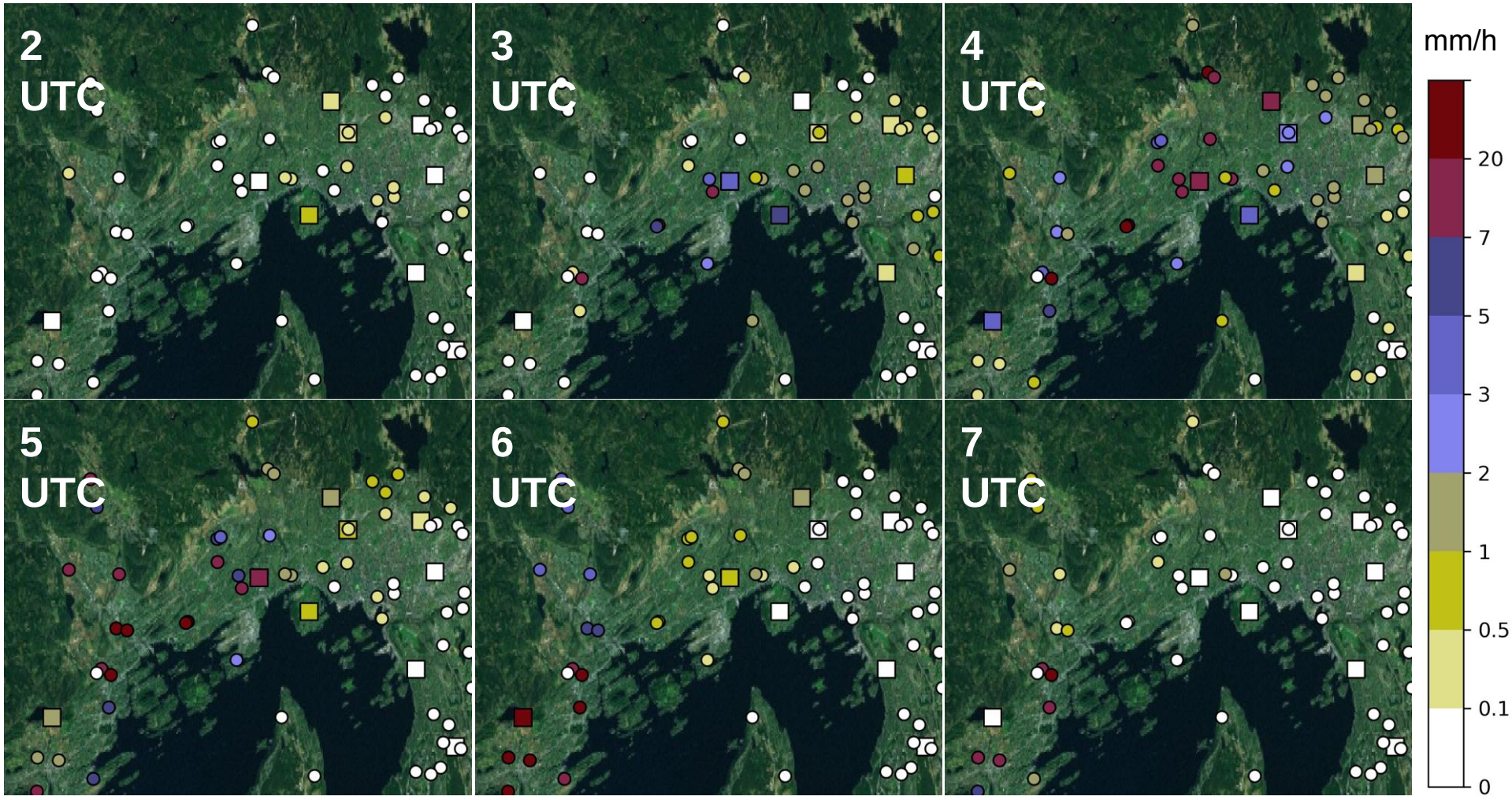
Ulik utvikling vest og øst for Bygdøy: To bygesystemer vest for Bygdøy og én øst for Bygdøy. Grafene viser medianen av alle Netatmo-stasjoner.





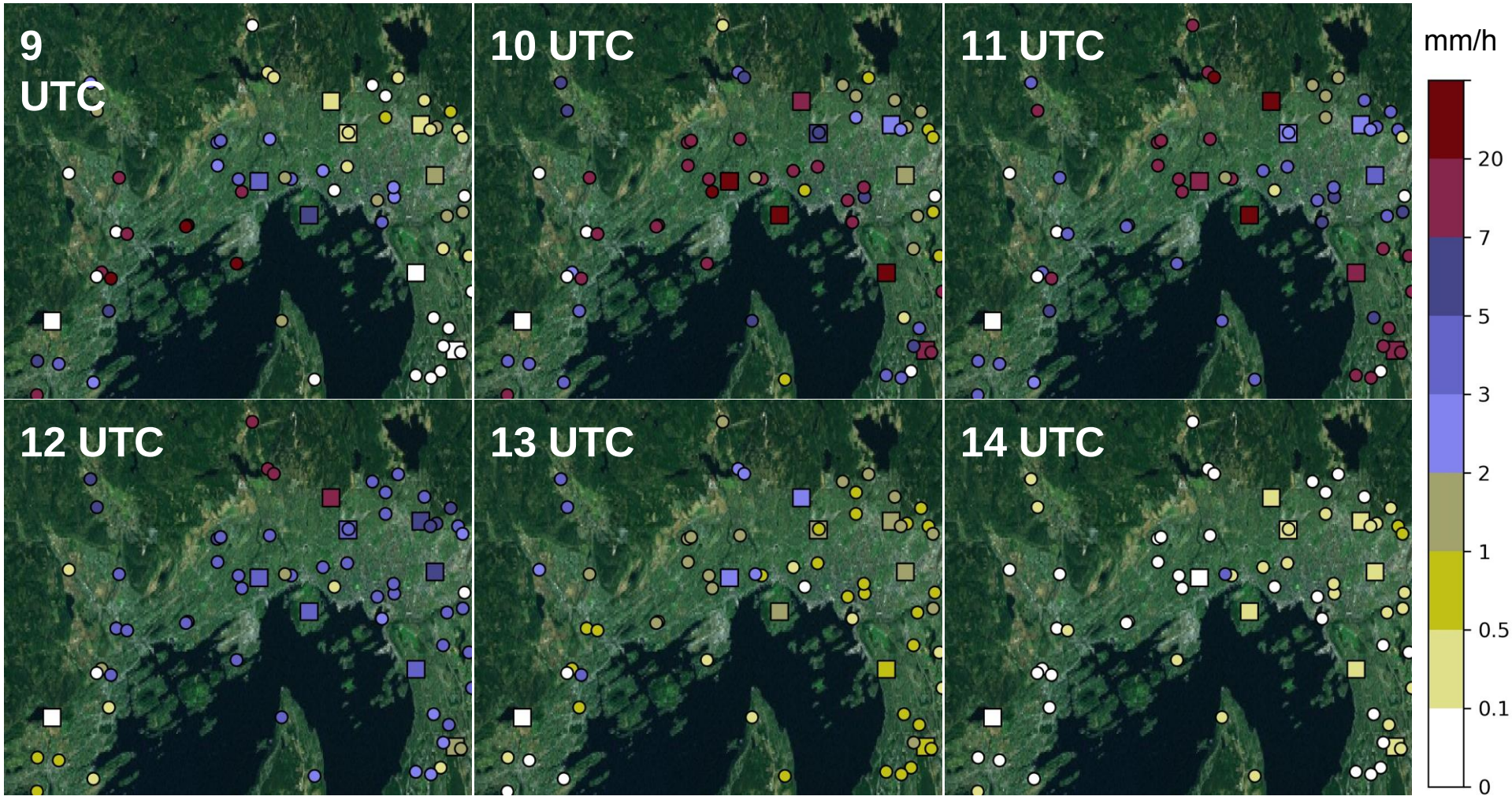
Tidsutvikling første byge

Starter ca. rundt Bygdøy og beveger seg mot sørvest



Tidsutvikling andre byge

Kommer fra vest og beveger seg mot øst



RadPrO

Radar for Improving Precipitation Estimates and Optimization of Hydropower Energy Production
ENERGIX programme

Forskningsrådet

Norwegian Meteorological Institute

- Improve **analysis and forecasts of precipitation** by combining information **from radar reflectivity, output from NWP model, and in-situ precipitation observations.**
- **Deliver estimate of precipitation, temperature, and wind in time (1 hour) and space (1km)** for hydrological models **to forecast inflow at catchment scale**.

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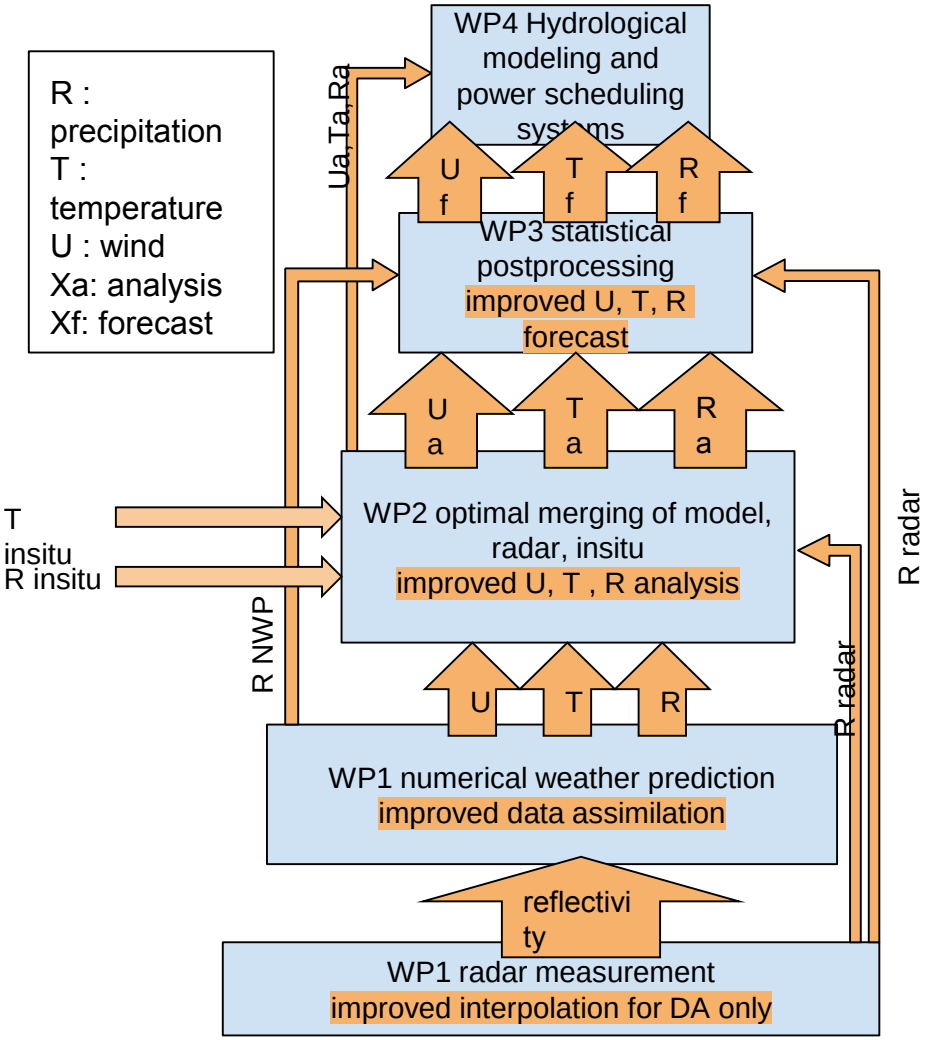


<u>People involved from MET Norway:</u>

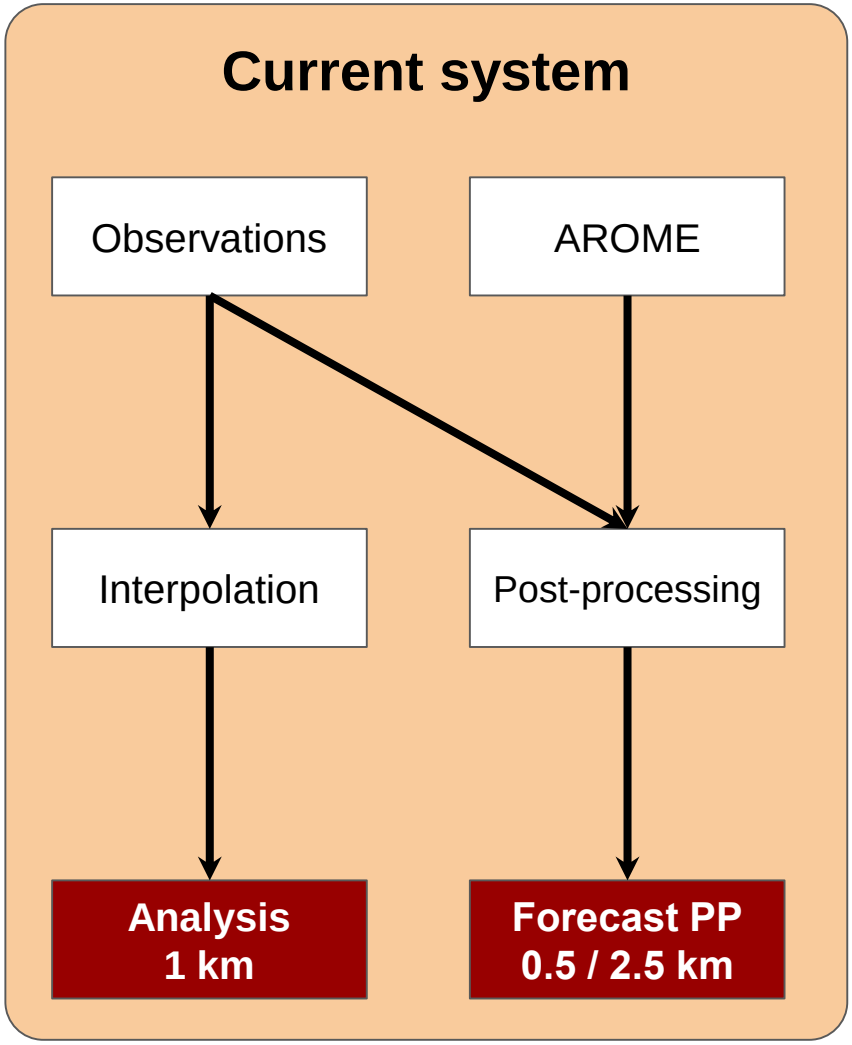
Roger Randriamampianina (project leader), Roohollah Azad, Thomas Nipen, Cristian Lussana, Christoffer Elo, Jørn Kristiansen

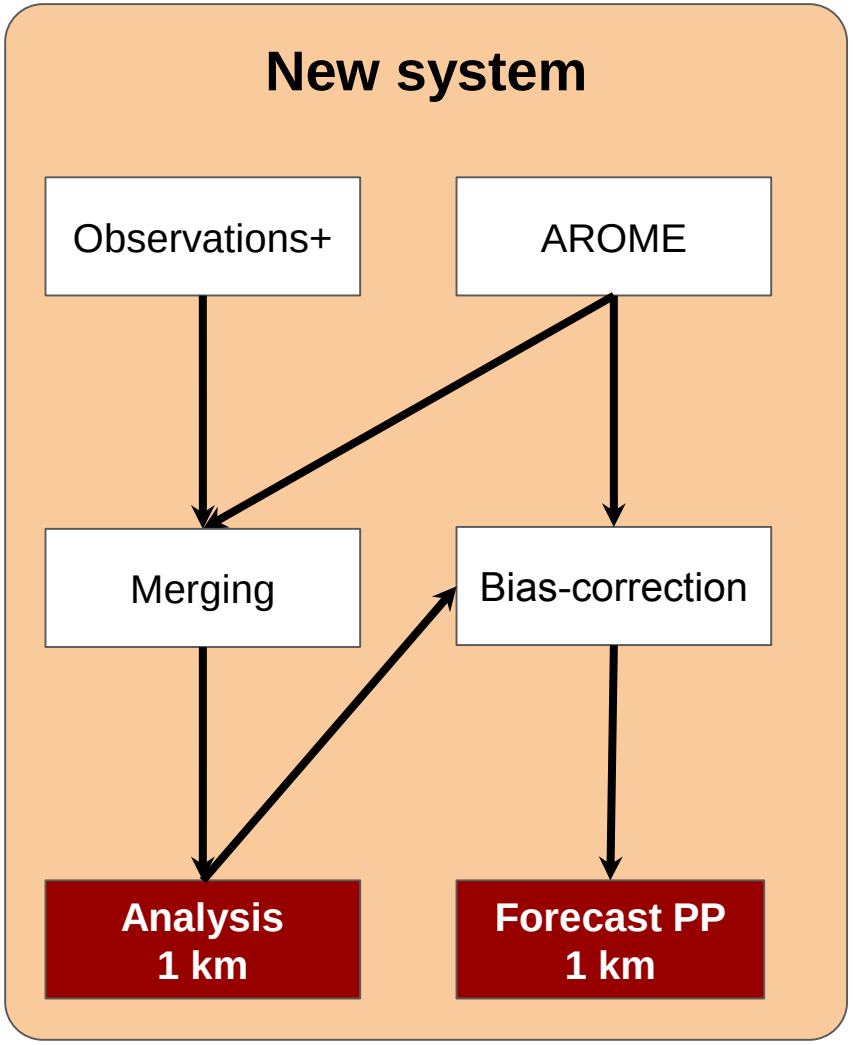
<u>Partners:</u>

Statkraft, Agder Energi, Lyse, Energi Norge, Glitre Energi, Hydro Energi, GLB, E-CO, NVE

.

Analysis/forecast co-production (RadPro)





Varslene fra Yr oppdateres nå mye oftere, og blir mer treffsikre

Yr får fra i dag av tilgang til data fra et stort antall private værstasjoner over hele landet.

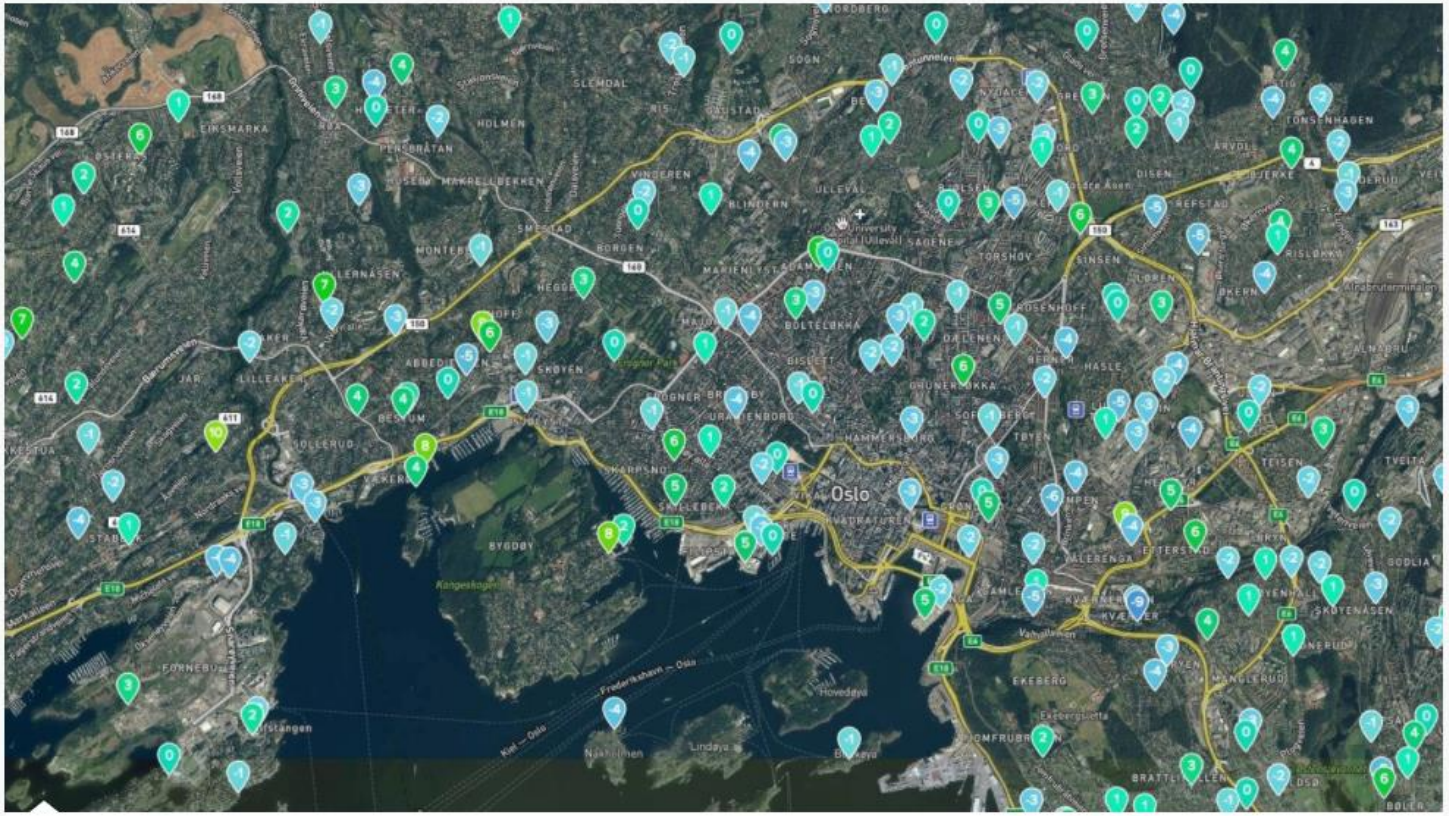
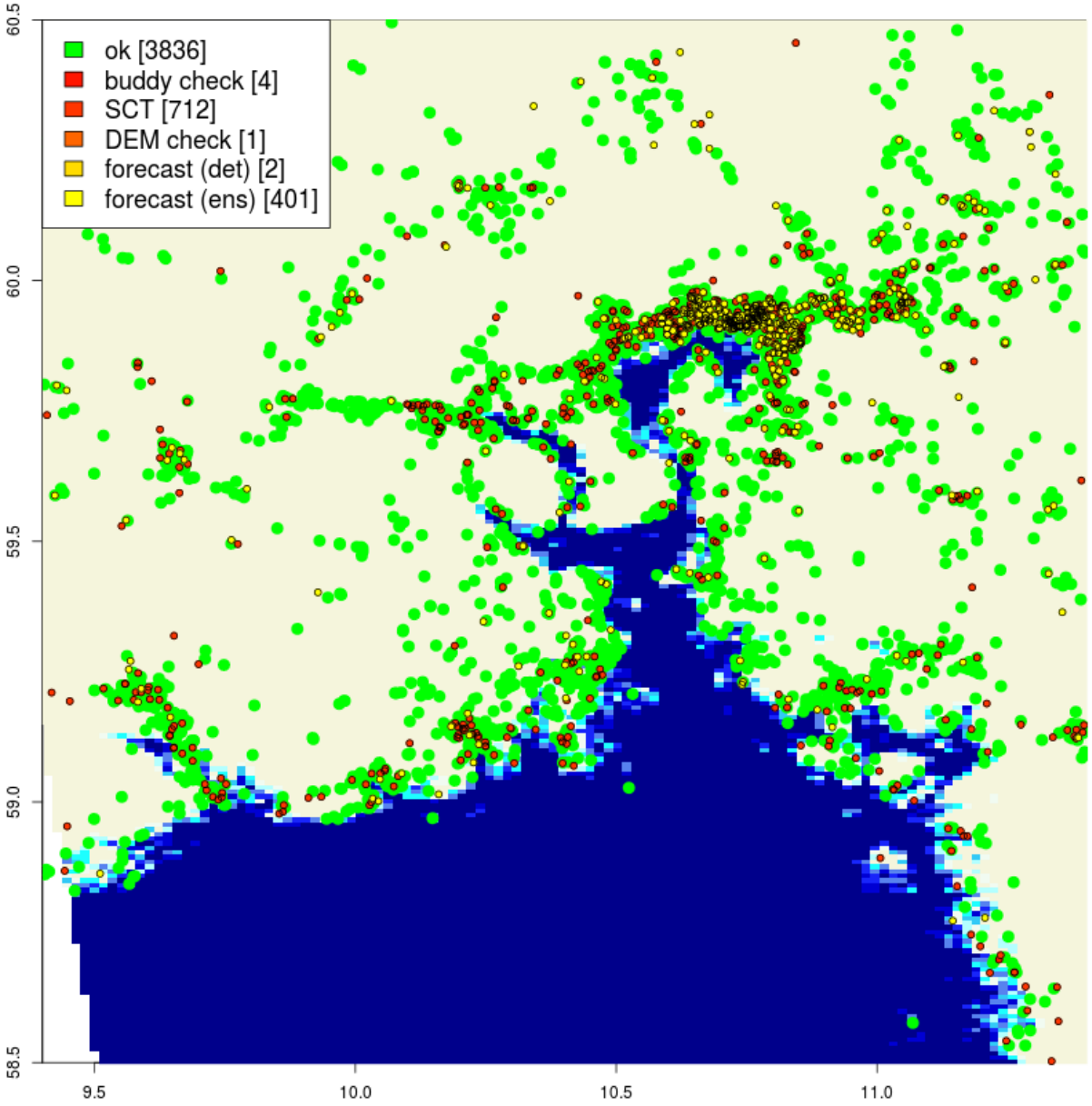


FOTO: Skjermdump/Netatmo

Værstasjonskartet til Netatmo viser at et stort antall privatpersoner deler værdata i Norge. Her fra Oslo.

Hourly quality control of temperature observationsExample from Molde on a sunny day

Example Mar 26, 2018 08:00 UTC



Temperature

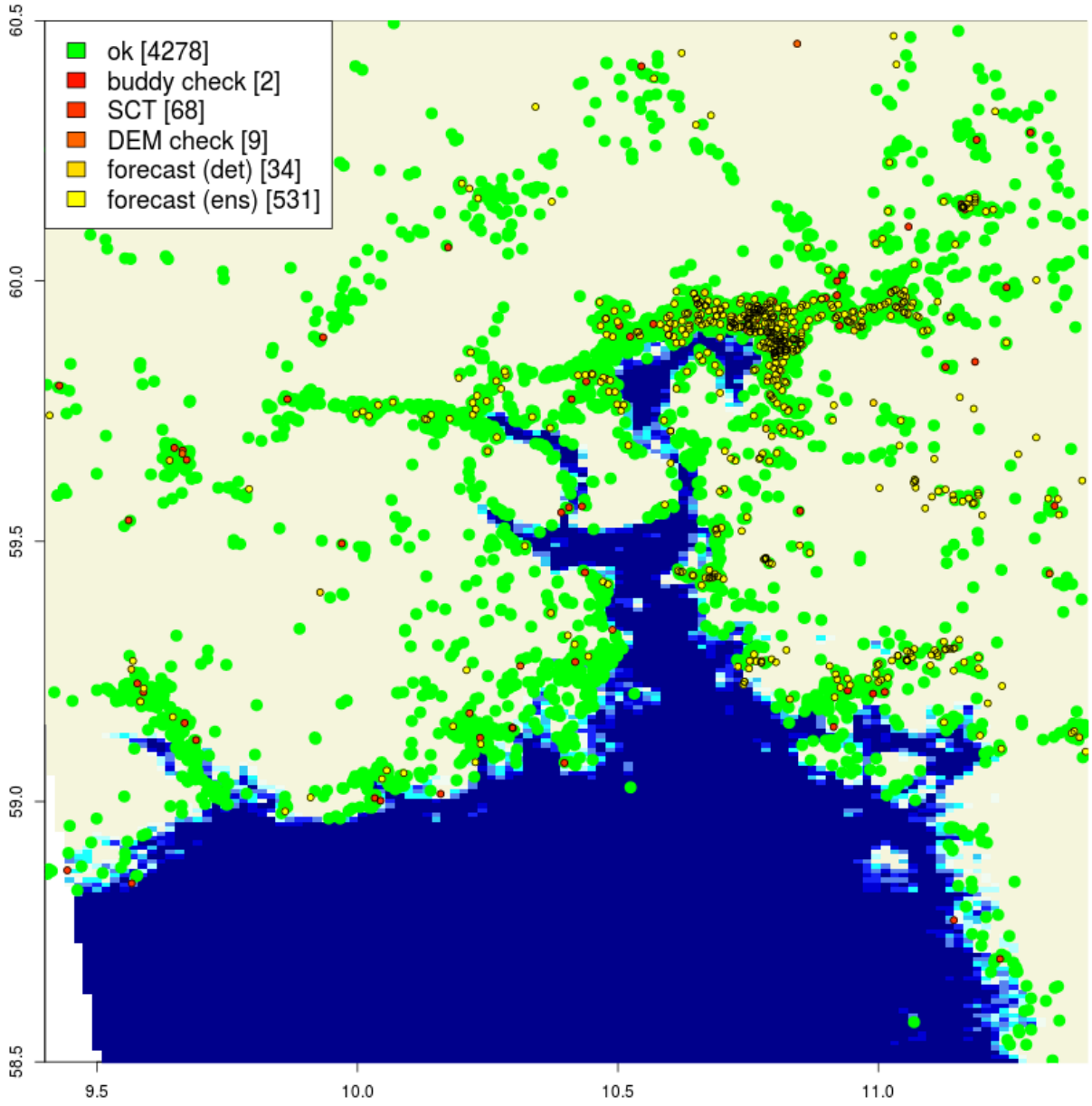
Thousand of observations used over relatively small but densely populated area

SCT, spatial consistency test

DEM, digital elevation model

forecast test. The observations are compared against the NWP model fields. It is possible to consider deterministic and ensemble NWP outcomes.

Example Mar 26, 2018 08:00 UTC

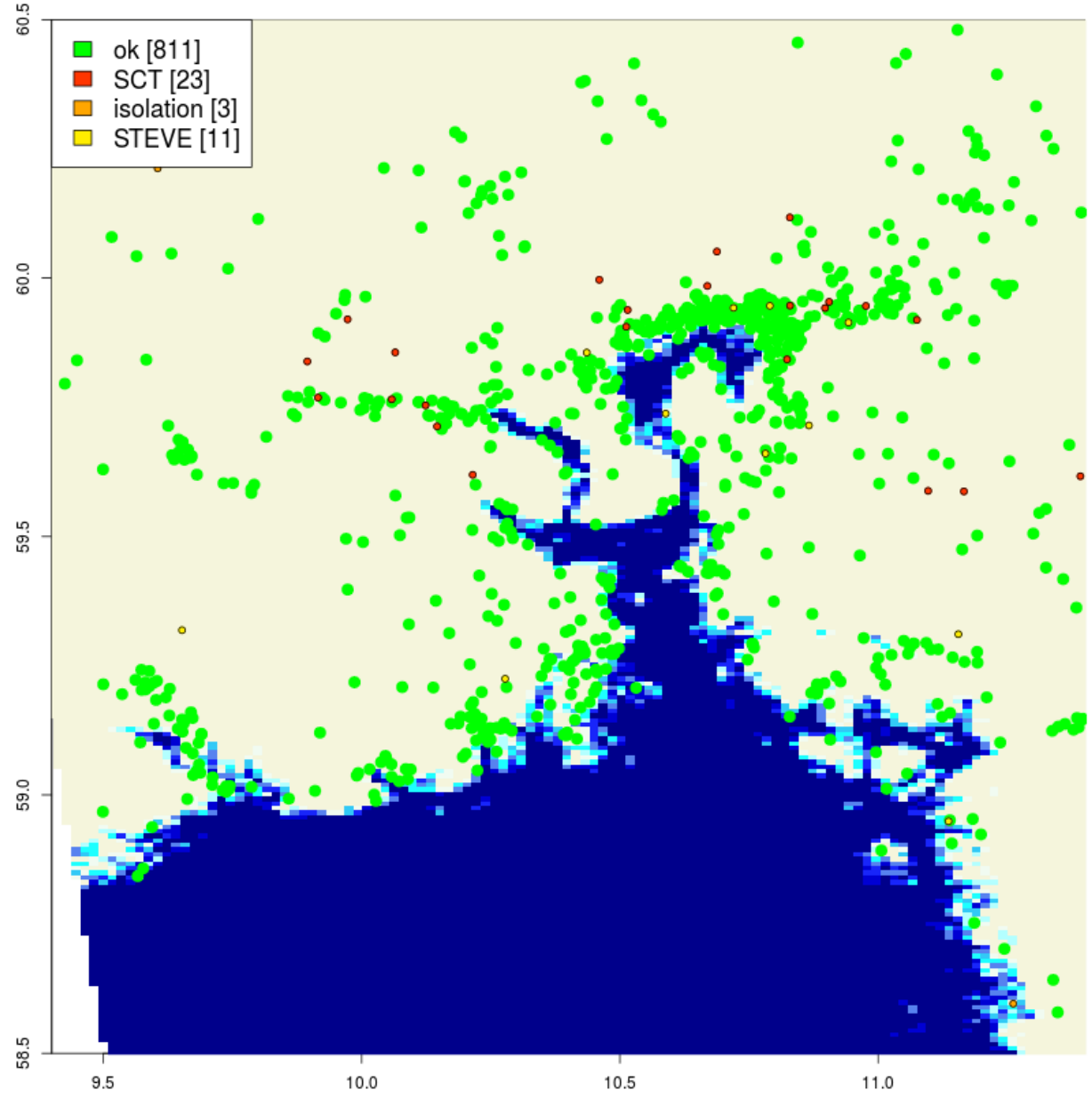


Relative humidity

Dense network, comparable to temperature.

Important variable for the closure of the water balance.

Example Mar 26, 2018 08:00 UTC



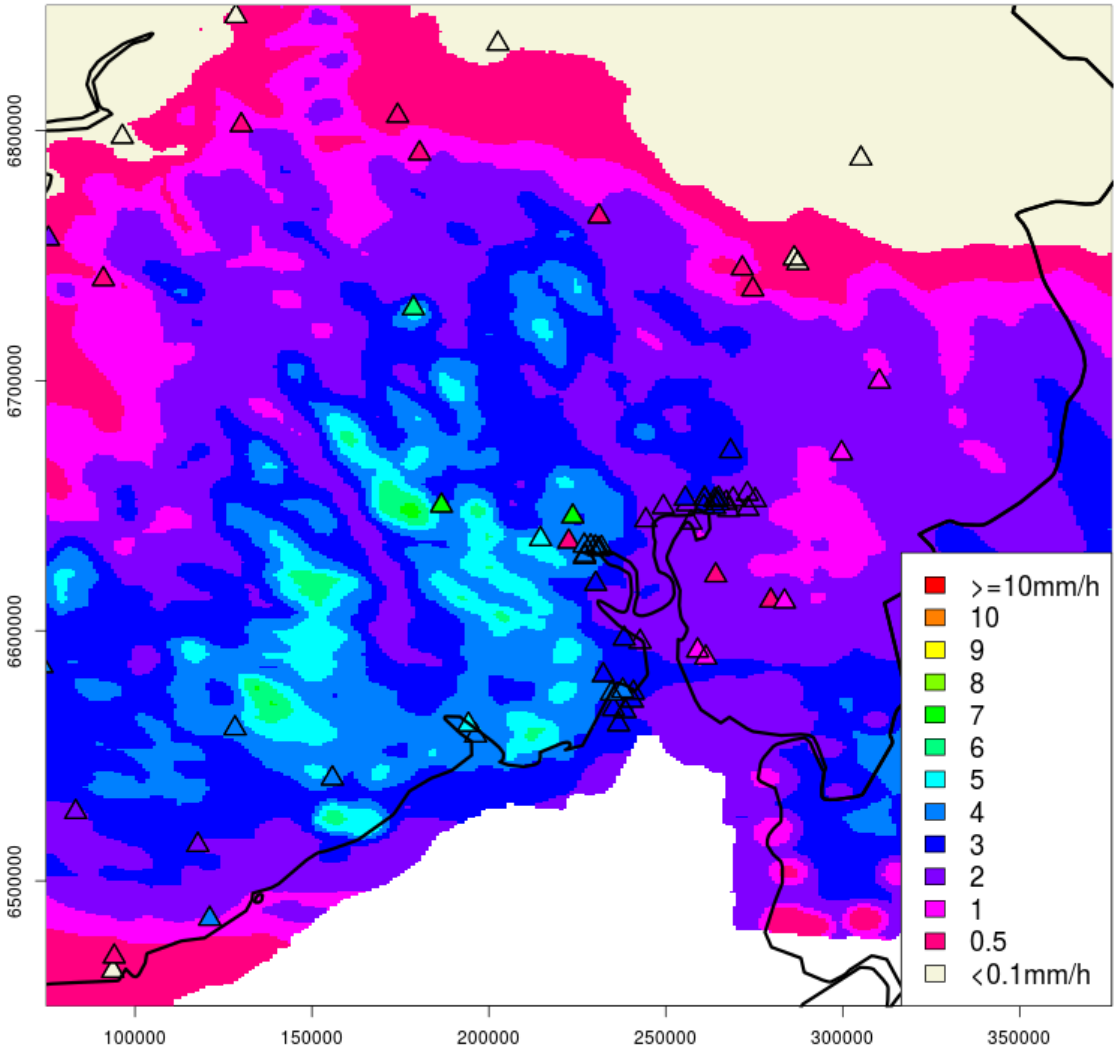
Precipitation

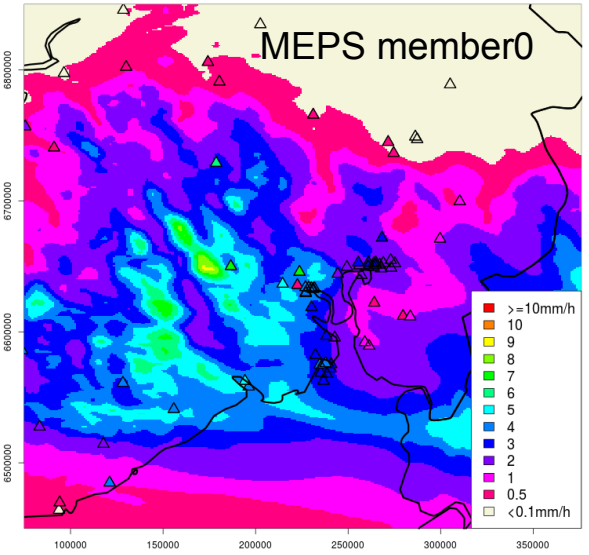
If compared to temperature, less observations are available.

STEVE, isolated event test, such as an observation not measuring precipitation surrounded only by observations that measure precipitation (or vice versa).

Combination MEPS-Radar-Gauge

Ex. Jun 07, 2017 12:00 UTC



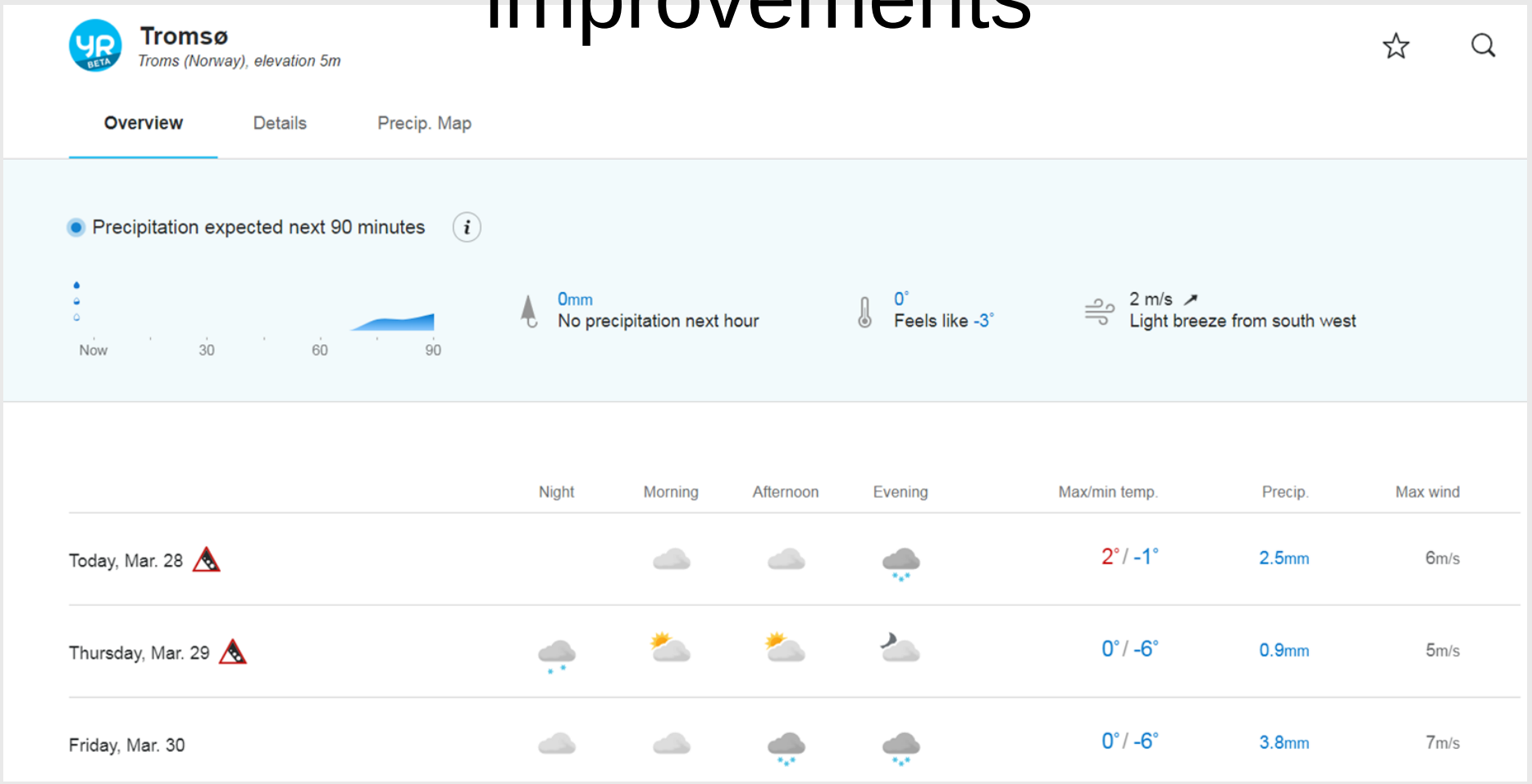


Independent observations are shown (triangles), they have not been used in the analysis procedure

Combined product based on Ensemble Optimal Interpolation (EnsOI).
Features:

- preserves the MEPS fine-scale precipitation pattern
- improves prediction accuracy (better ETS over 100 cases of intense precipitation)

Nowcasting of rain - further improvements

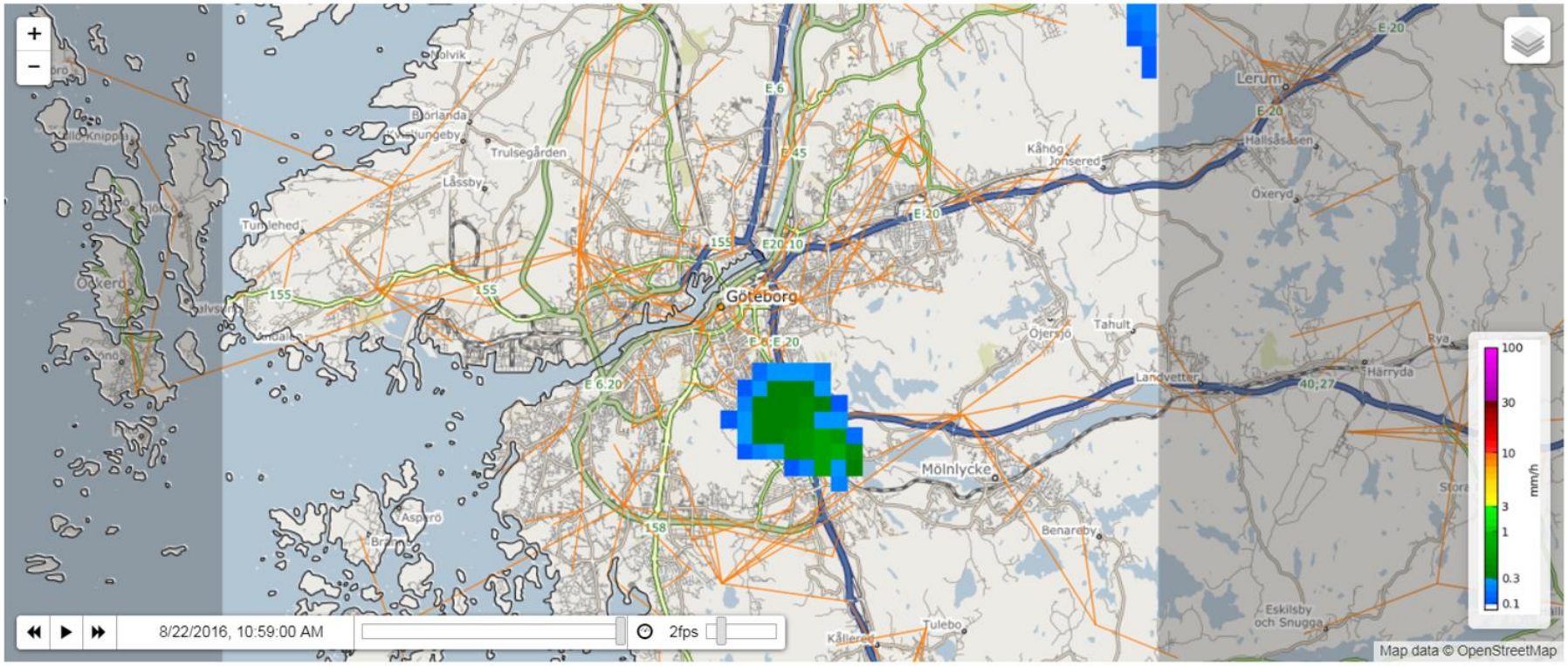


Nowcasting of cloud cover by weather cameras - under development

Postdoc UiB

UiB og MET med støtte fra SMHI og KNMI

MicroWeather - Exempeldata



Last but not least: Seamless long-term forecasts (2018)

51 members

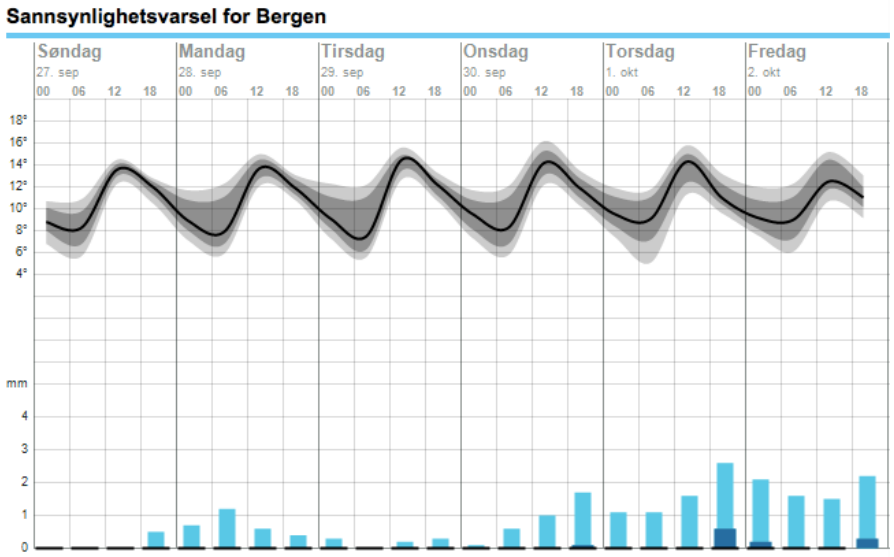
Raw ECMWF

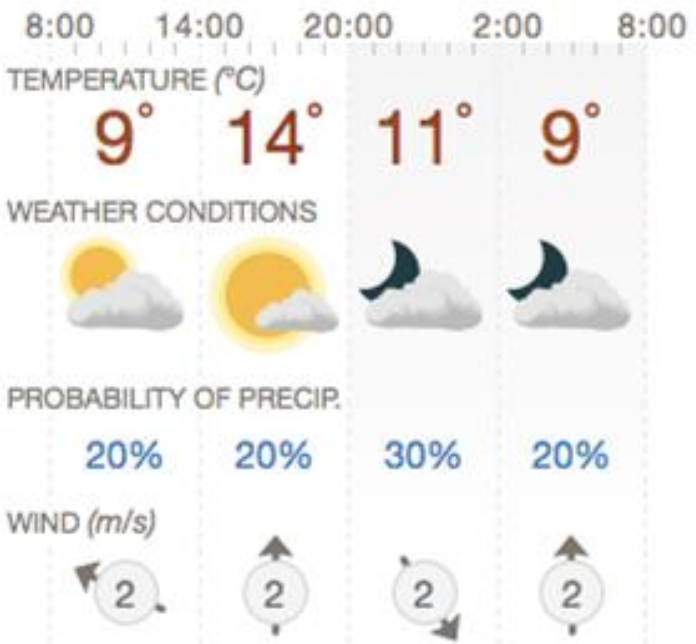
Precipitation Post-processing

51 members

Calibrated ECMWF

Precipitation probabilities on Yr.no





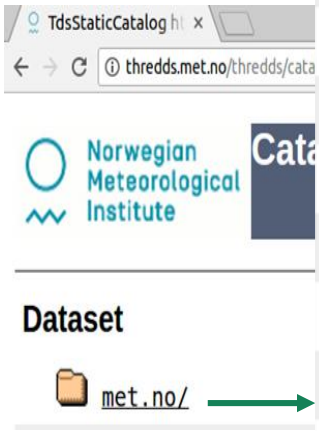
Thank you for your attention!

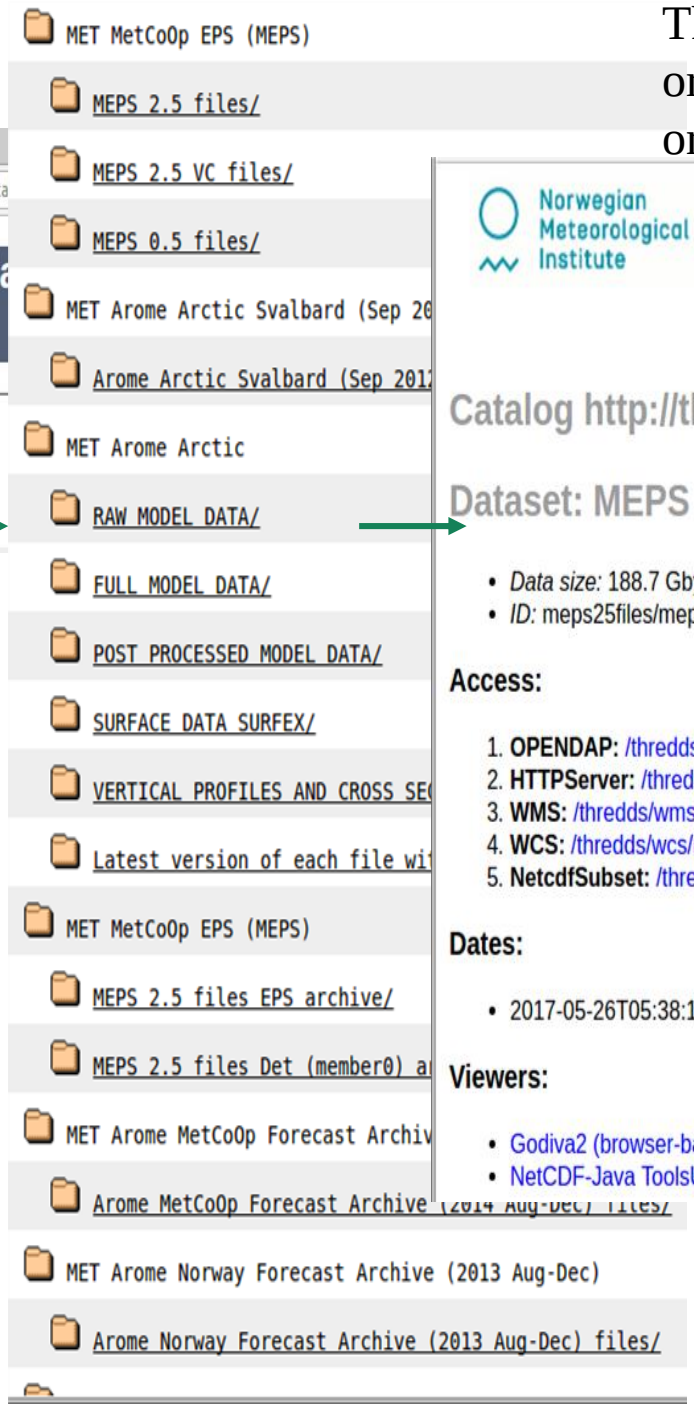
jornk@met.no

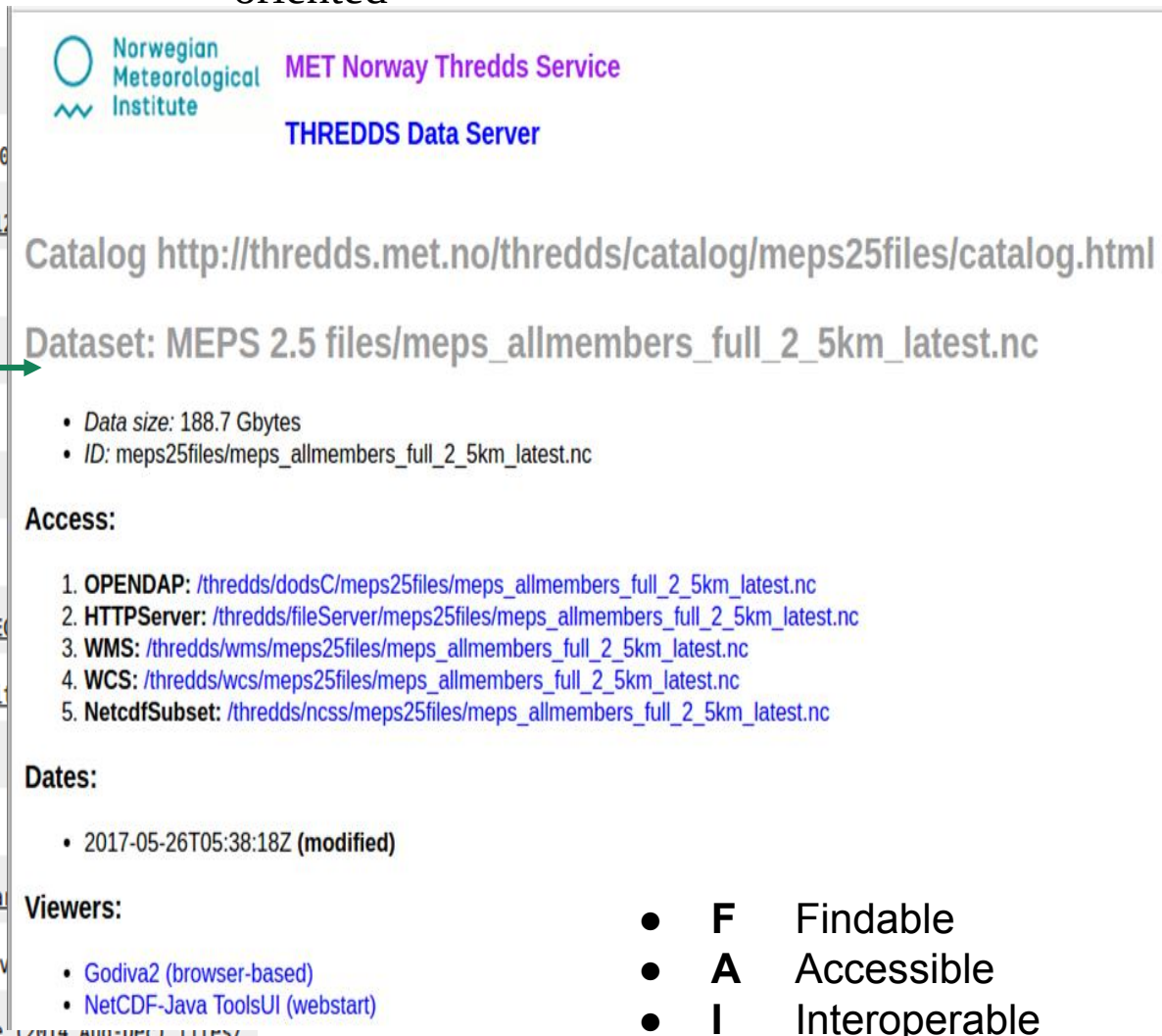
Visit api.met.no and thredds.met.no for open data free of charge.

Norwegian Meteorological Institute

The decision on an open data policy is not user-oriented -> How you make data available is user-oriented







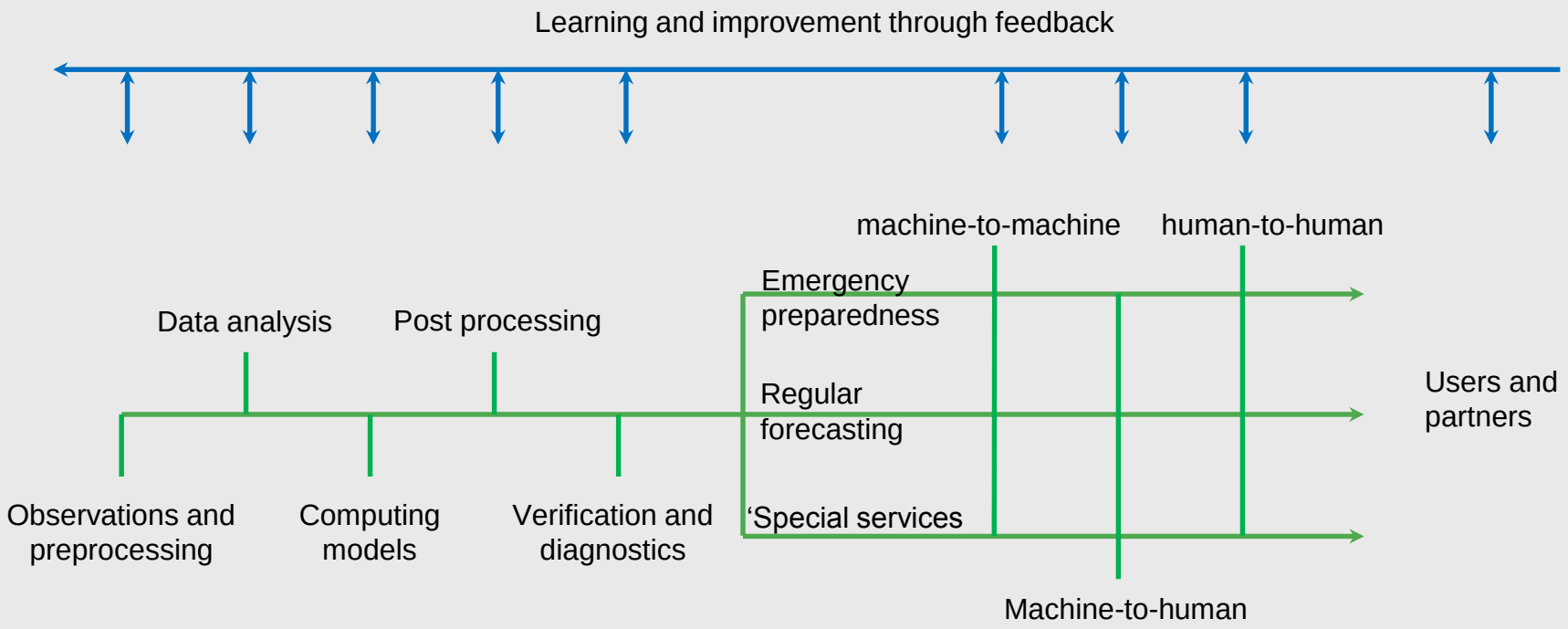
- **F** Findable
- **A** Accessible
- **I** Interoperable
- **R** Re-useable

Future opportunities

OECD: 10 disruptive technologies for the (near) future

- Internet of Things
- Big data analytics
- Artificial intelligence
- Neurotechnologies
- Nano/microsatellites
- Nanomaterials
- Additive manufacturing
- Advanced energy storage technologies
- Synthetic biology
- Blockchain

Evolution: MET Value chain



R & D & I with a short path to operational use

Collaboration internally - nationally - internationally

Infrastructure and policies

Meteorologisk institutt