



Norwegian
Meteorological
Institute

NWP in Hydropower: Research for Operations at MET Norway

Roohollah Azad, Thomas Nipen, Eivind Støylen

36Th EWGLAM and 21th SRNWP Meeting

30.09.14

Outlines

- MET Norway
- MetCoOp
- RADARIII
- MIST2
- NVE-flom

MET Norway

- Meteorological service for The Military, the Civil Services and the public
- To protect life, property and the environment, and to provide the meteorological services required by society.

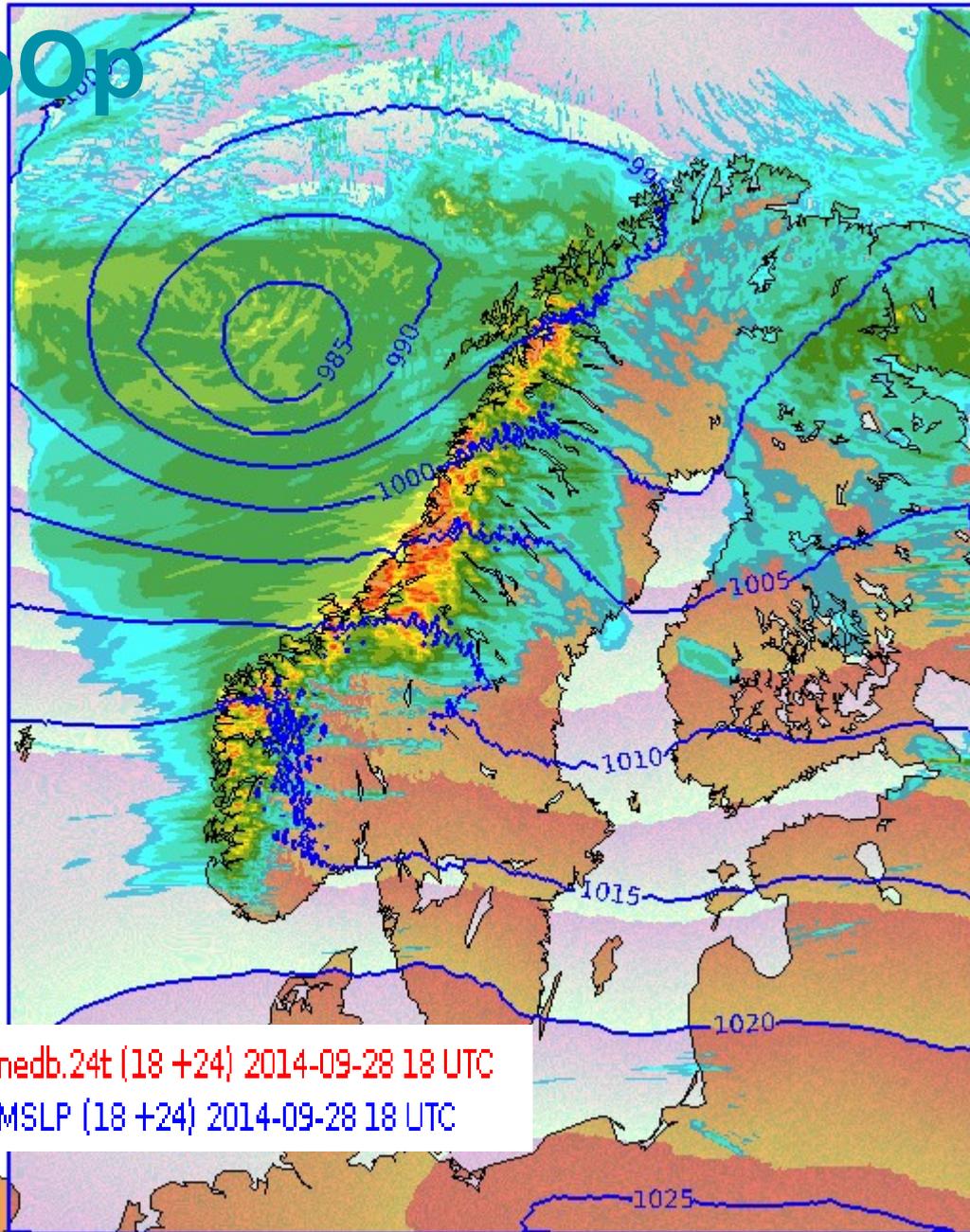
- R & D activities
 - EU Framework Program,
 - Research Council of Norway (NFR)
 - Private Companies: dealing with environment, energy, offshore activity and information technology.

 - National supercomputer at NTNU in Trondheim, Vilje
 - ECMWF facilities.

MetCoOp

- Meteorological Co-operation on operational NWP
- The co-operation is between the Norwegian Meteorological Institute (MET Norway) and Swedish Meteorological and Hydrological Institute (SMHI)
- The goal is to produce and deliver the best short range numerical weather forecasts for a common domain.
- The non-hydrostatic HARMONIE model with high resolution (2.5 km) and with AROME physics

MetCoOp



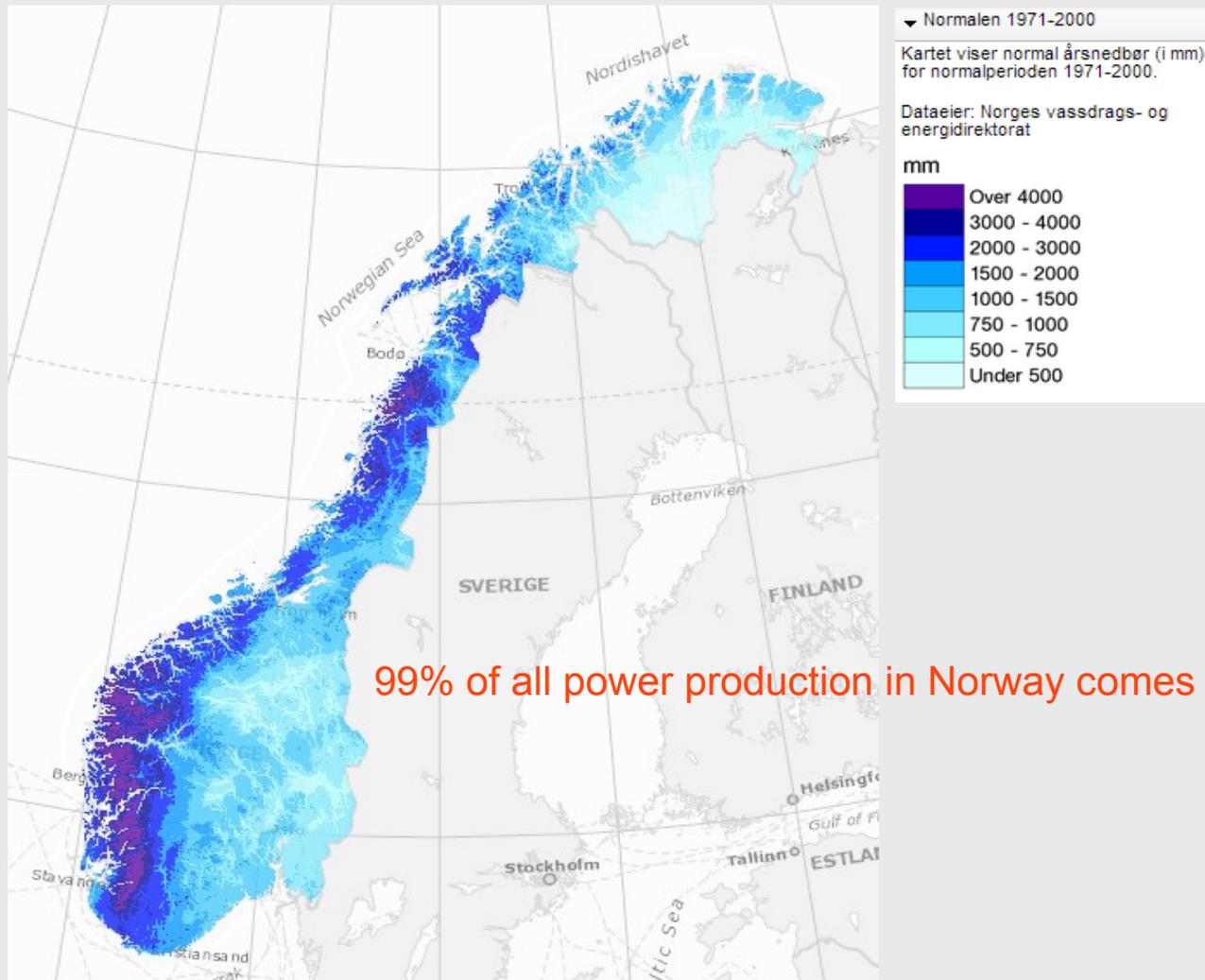
AROME-MetCoOp.2.5KM nedb.24t (18 +24) 2014-09-28 18 UTC

AROME-MetCoOp.2.5KM MSLP (18 +24) 2014-09-28 18 UTC

MetCoOp

- Experimental runs since December 2013
- Operational from 18 March 2014
- Arome physical parametrization
- 2.5 km / 65 levels / 10 hpa
- Hourly boundaries from ECMWF
- Surface assimilation
- Forecast length 66 hours
- 3DVAR upper-air assimilation
- 3-hourly cycling
- Harmonie cycle 38h1.1

Annual Precipitation in Norway



Hydropower related projects

● RADAR III :

- EnergiNorge: non-profit industry organization
- NFR Innovation project in the business sector – ENERGIX
- Statkraft, Lyse, TrønderEnergi, GLB, Hydro og E-CO

● MIST 2 :

- Statkraft

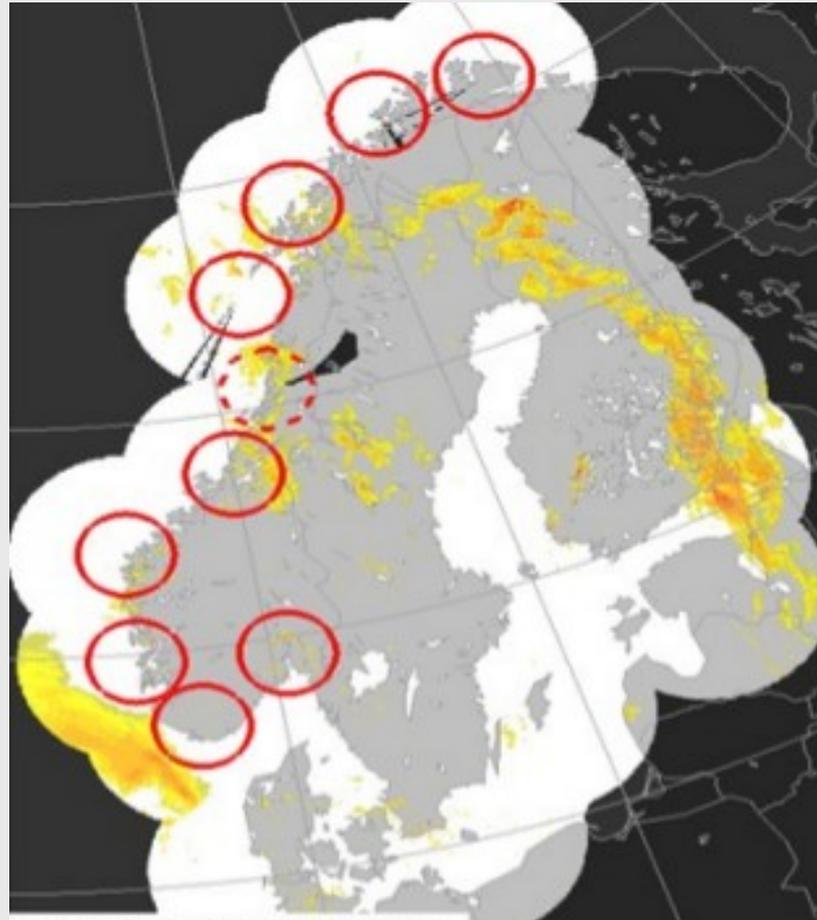
● NVE-flom :

- Norwegian Water Resources and Energy Directorate

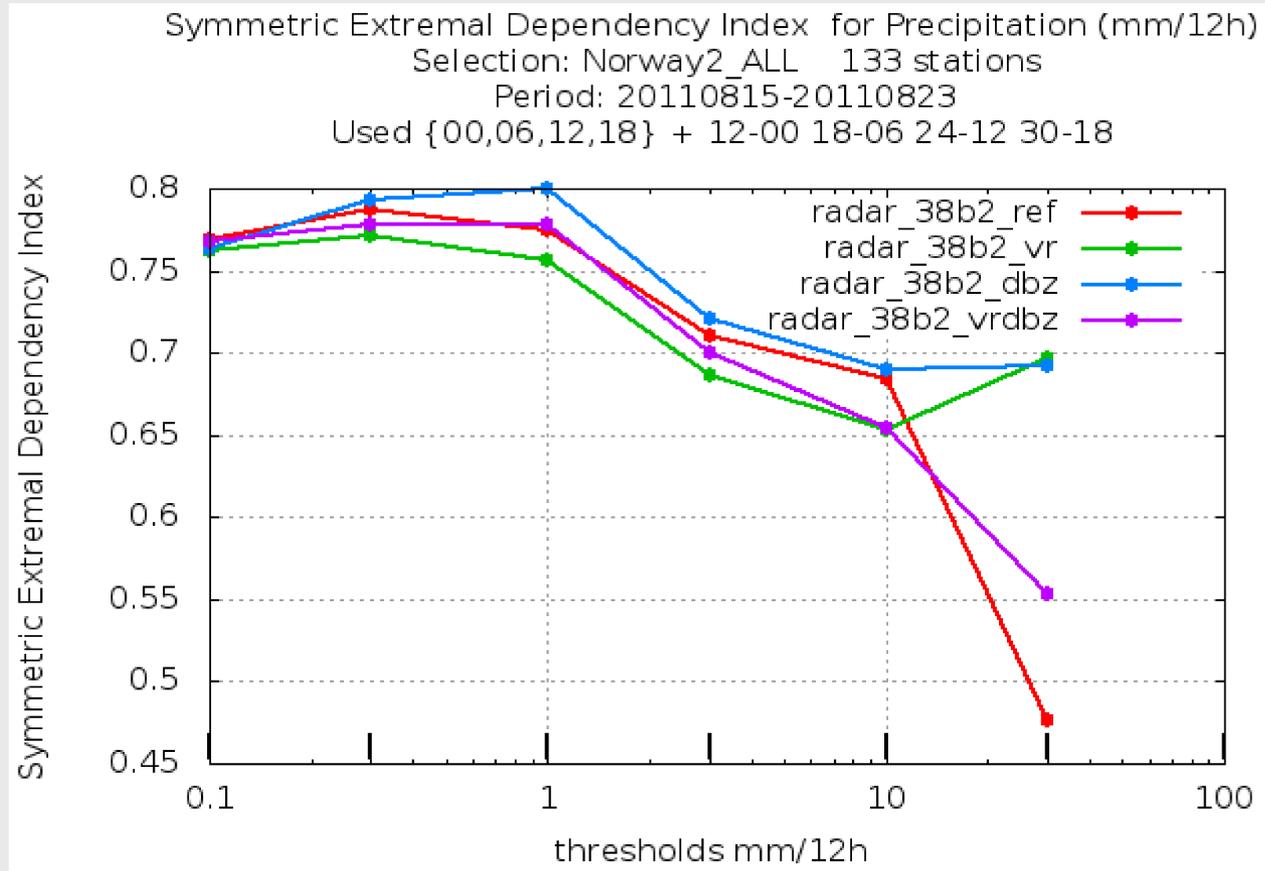
RADAR III

- The **primary objective** of the project is to use radar to improve and further develop the observation-based ground **precipitation products** and **precipitation forecast** used by the hydropower companies as input to their hydrological forecasting systems and thereby contribute to better inflow forecasts. The new products will use radar data both for **assimilation** into a numerical weather prediction model and for **estimating** ground precipitation.
- As model resolution increases the demand for **high resolution observations** increases. In order to deliver “the best **short range** numerical weather forecasts” it is necessary to include high resolution observations such as **radar data**.

RADAR III: distribution of radars in Norway

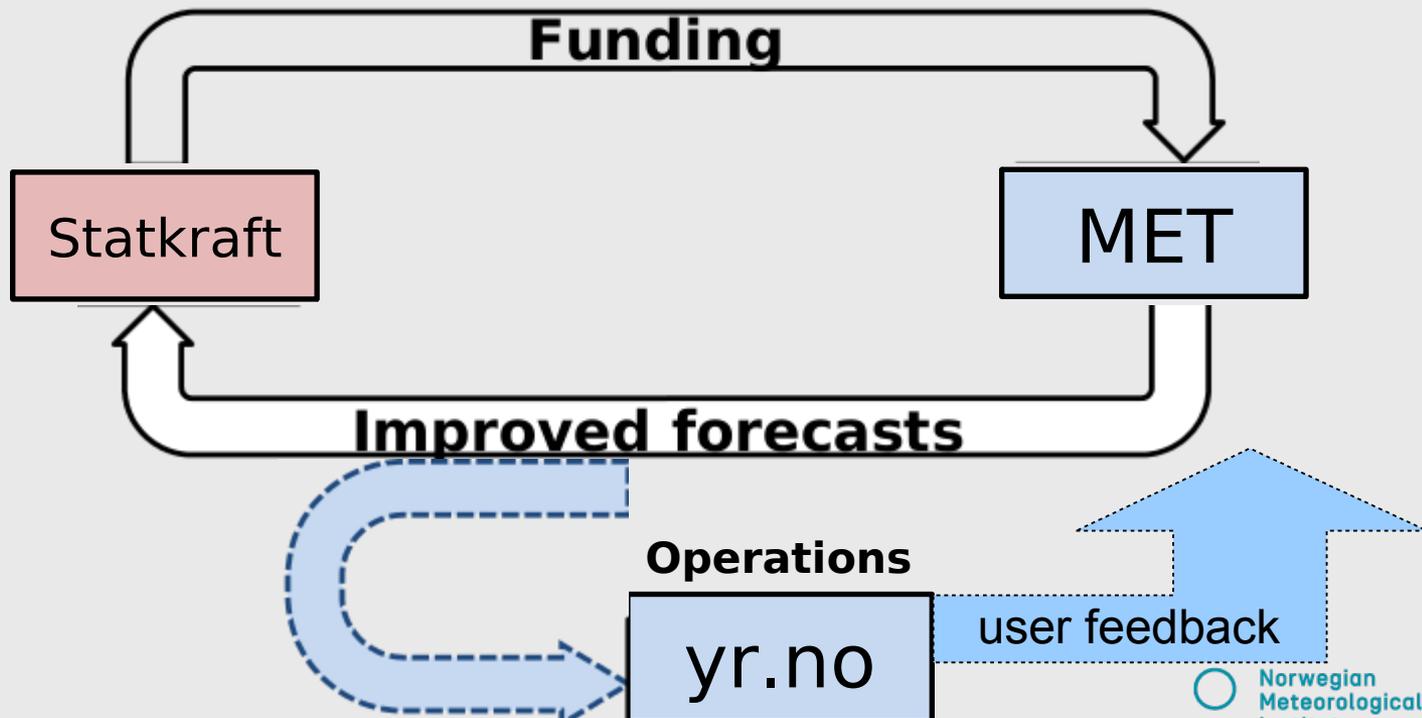


RADAR III



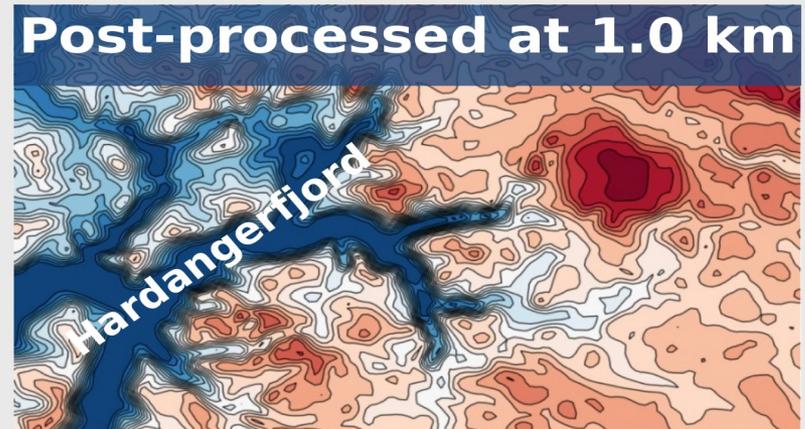
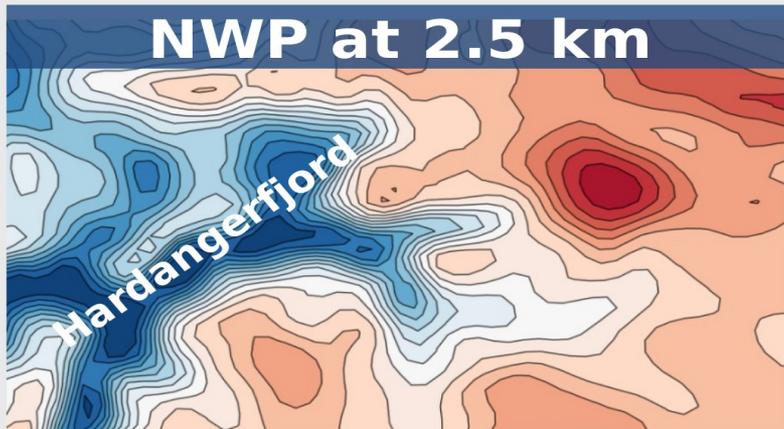
MIST 2

- Industry partner Statkraft
 - Hydroelectric energy producer in Norway
 - We deliver high resolution NWP, as input to their hydrologic models.
 - Identifying research that benefits Statkraft and our operations



MIST 2

- Needs: hourly high-resolution gridded forecasts



- Intricate topography, more detail available at the higher resolution
- To better represent large local variability in weather
- Statkraft operates on many small watersheds

MIST 2: parameters of interest

Parameter

Uses/challenges

2-m temperature

- Important for snow melting / run-off in the watersheds
- Elevation gradient / part of watershed undergoing melting

Precipitation amount

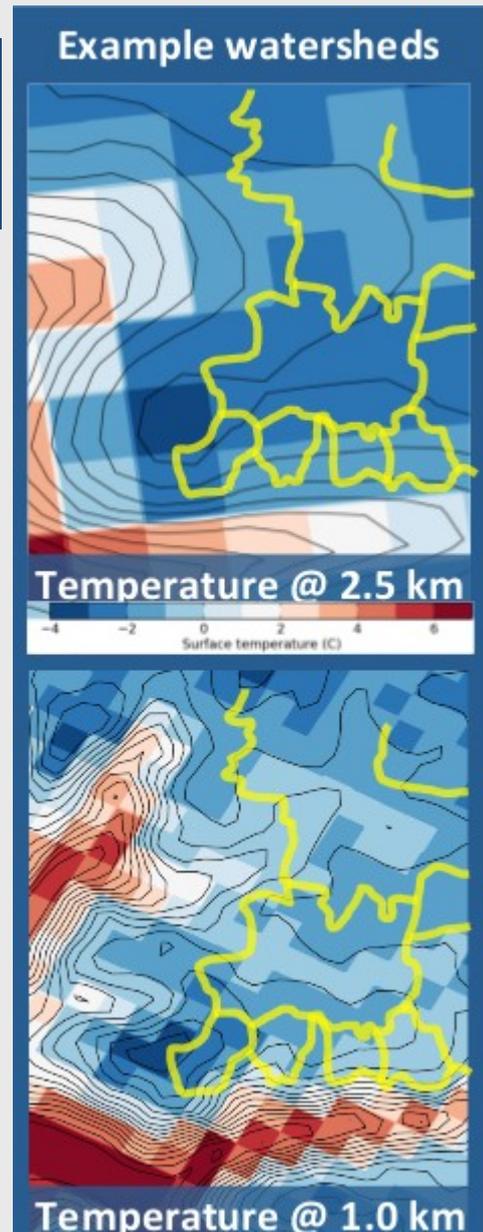
- Placement of rain band is a challenge

Precipitation phase

- Affects run-off differently

¹⁴ 10-m wind speed

- Adjust winter precipitation observations(?)



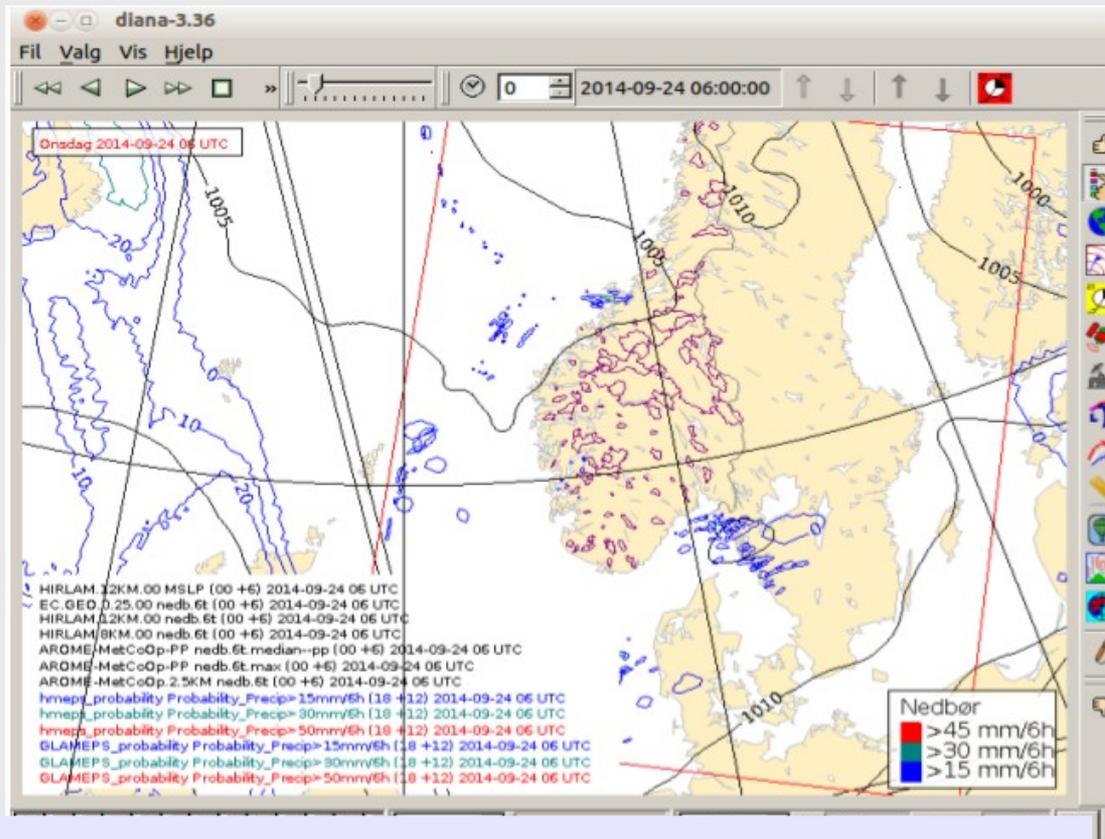
NVE-flom

- Cooperating toward better flood and land slide warnings



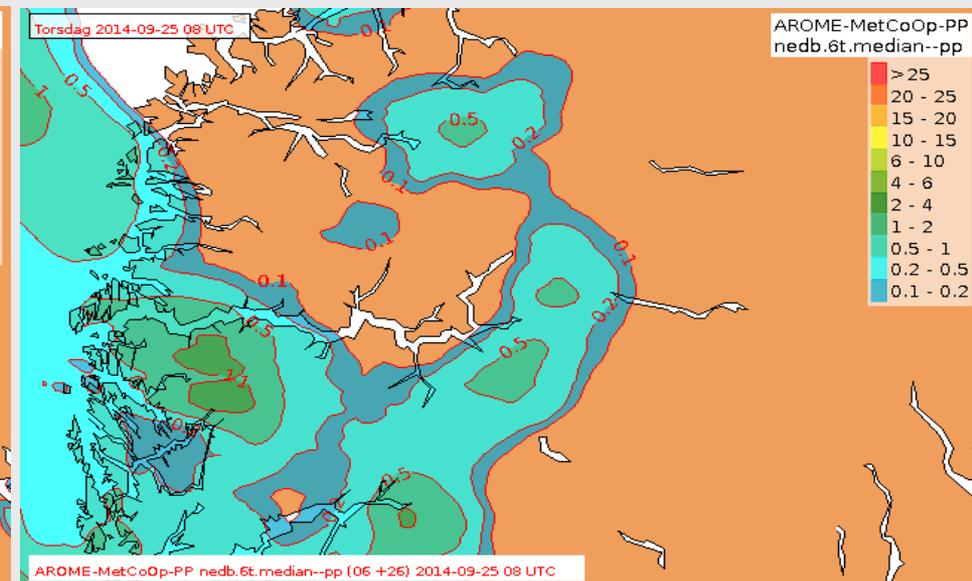
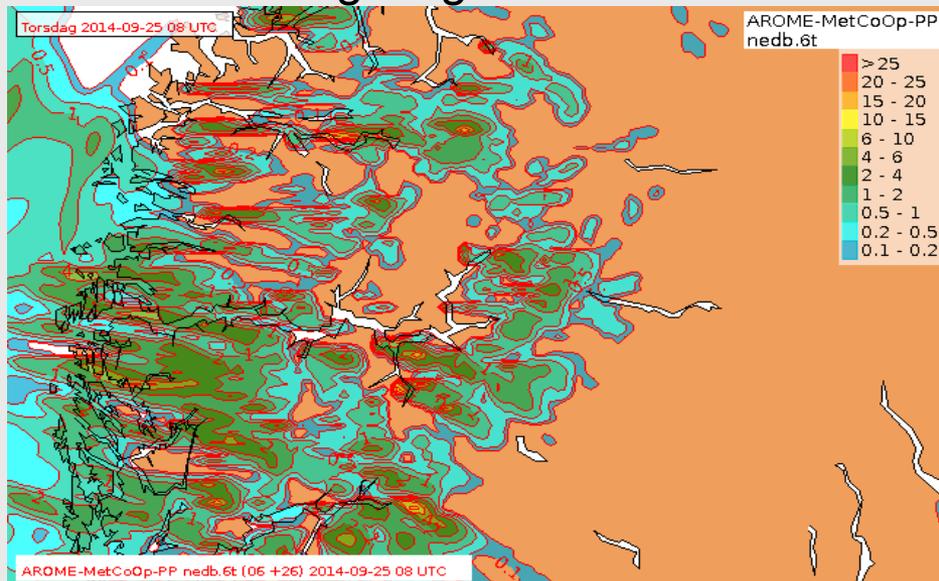
NVE-flom: daily briefing with meteorologists

- A shared screen between the NVE office and MET
- The differences between the models / the quality of actual forecast
- Forecaster at NVE to provide feedback and ask questions, in particular in potentially hazardous situations.



NVE-flom

- Model data from MET forecast as input to NVE's hydrological models
- Running dialogue and post-processed access
- Summer precipitation / accurately determine the position and timing / using neighbourhood methods.



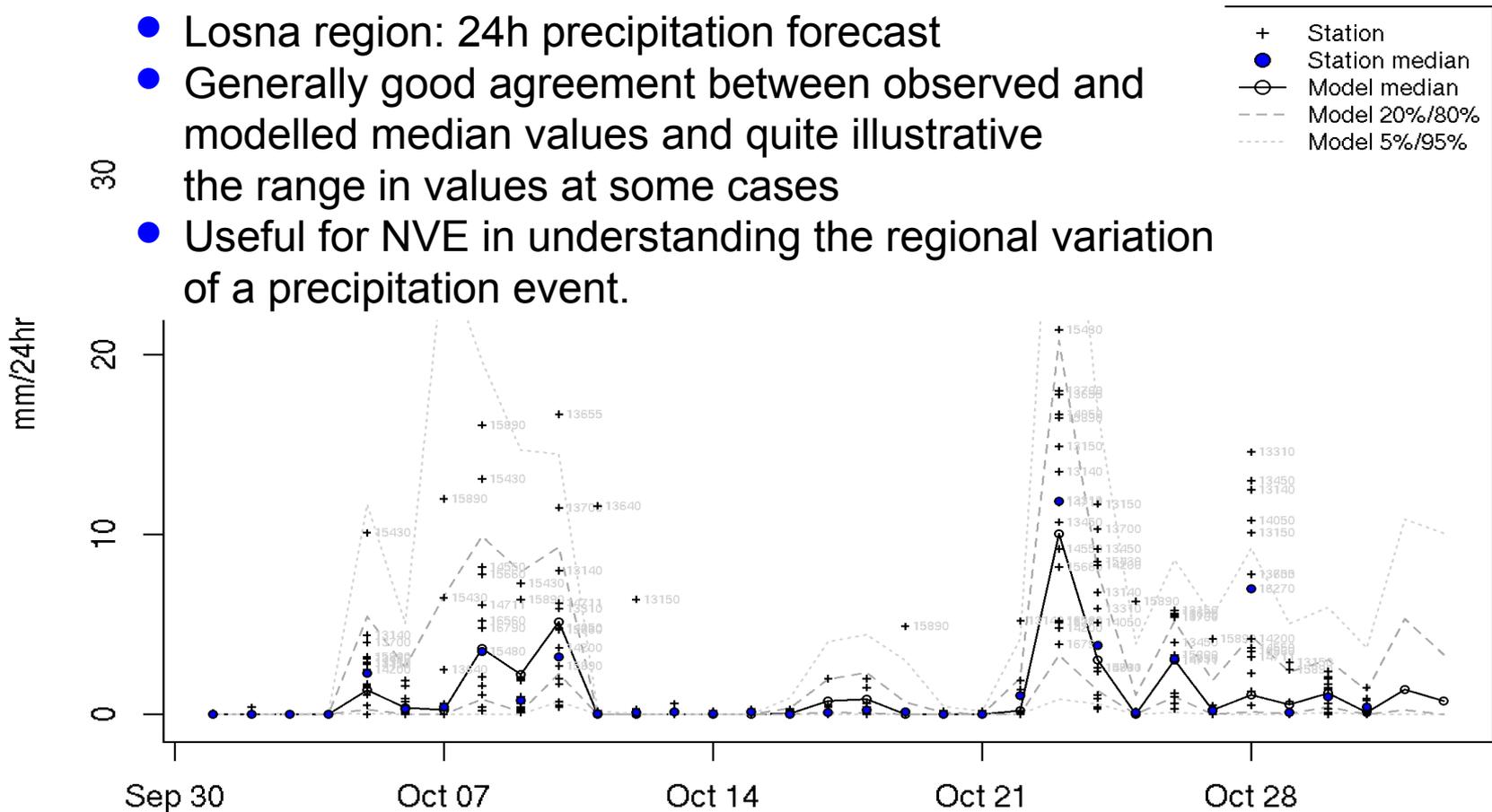
“raw data” the precipitation is intensified in small pockets, some regions no forecast precipitation at all.

“post-processed” the intensified precipitation is damped.

NVE-flom

RR24 for Losna, -30 til +2 dager

- Losna region: 24h precipitation forecast
- Generally good agreement between observed and modelled median values and quite illustrative the range in values at some cases
- Useful for NVE in understanding the regional variation of a precipitation event.



Thank you for your attention



Norwegian
Meteorological
Institute

