

Dynamical downscaling of GFS ensemble forecasts for Iceland

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Overview of this talk

- Workplan – not just ensemble
- Ensemble what???
- What and who is to gain
- Examples of products
- Future work



Just what is it that we want to do?

- Real time weather forecasts
- Ensemble forecasts
- Case studies, research and development of NWP models
- Climatological studies
- Deliver high quality products based on these core competances
- ...and we're gonna have a good time

The main workhorse

- AR-WRF has been in use at IMR since 2007
 - Is currently used for daily forecasts for two main domains and two sub-domains
 - Greenland (12 km)
 - N-Atlantic (27 km), with Iceland (9 km) and Bergen area (3km)
 - The ensemble system will be built on top of the system developed for daily forecasts
 - Pre- and post-processing parts of the deterministic system will also be recycled for use in the ensemble system

Systems overview

- We are building a flexible system to work with weather and climate models and accompanying data
- The AR-WRF has been chosen as the main model, but we can handle other models as well (MM5, ...)

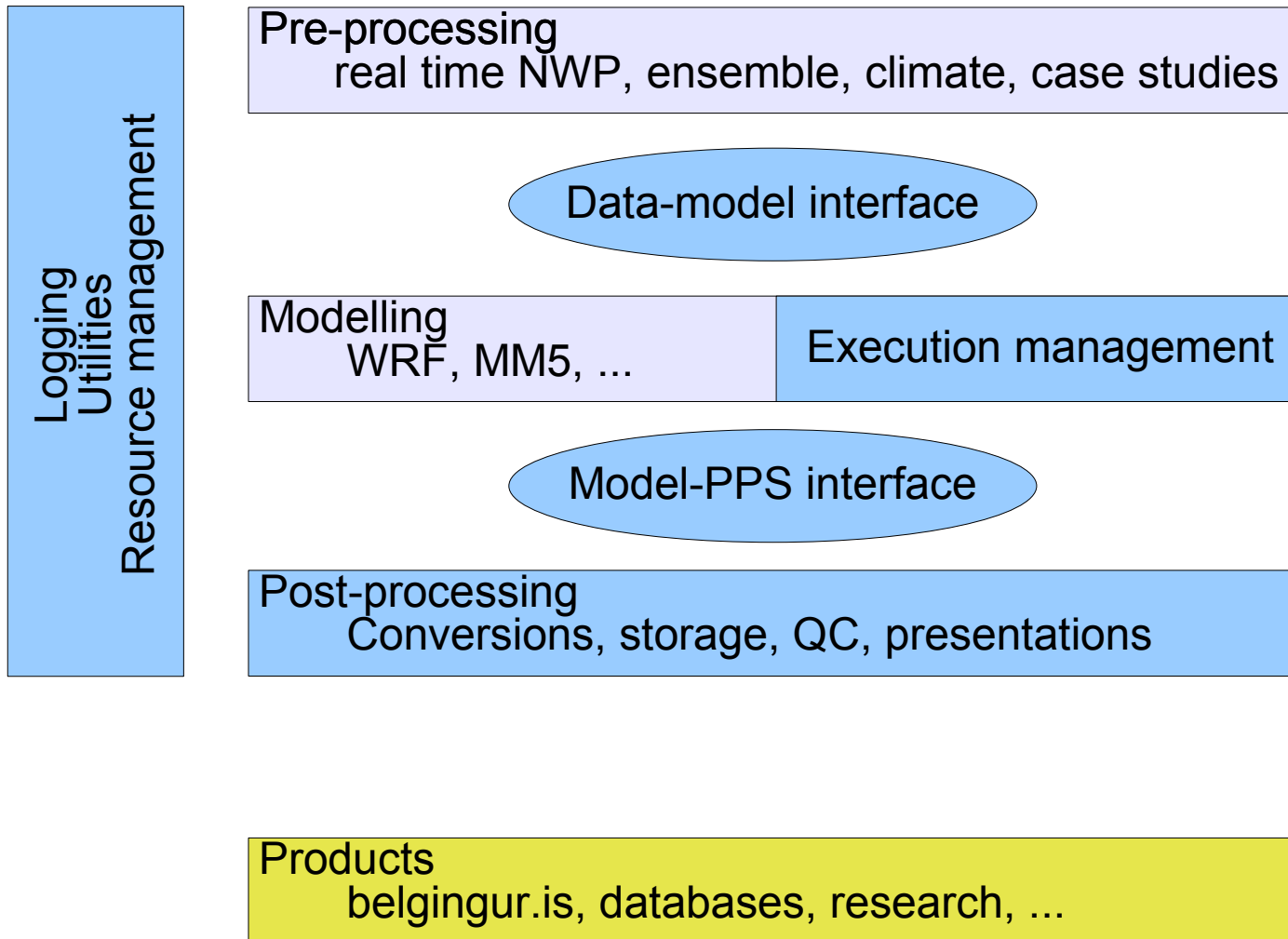


Systems - Dataflow

- Dataflow is simple:
 - Input data → Model → Output data → Product
- Data processing is overlaid on this dataflow, preserving as much of the simplicity as possible
 - Pre-processing (fetch input data, conversions, etc.)
 - Modelling (run model)
 - Post-processing (plots, extract/convert data, data storage, quality control, etc.)
 - Deliverable products (“packaging”)

Dataflow

GFS
ECMWF
etc.



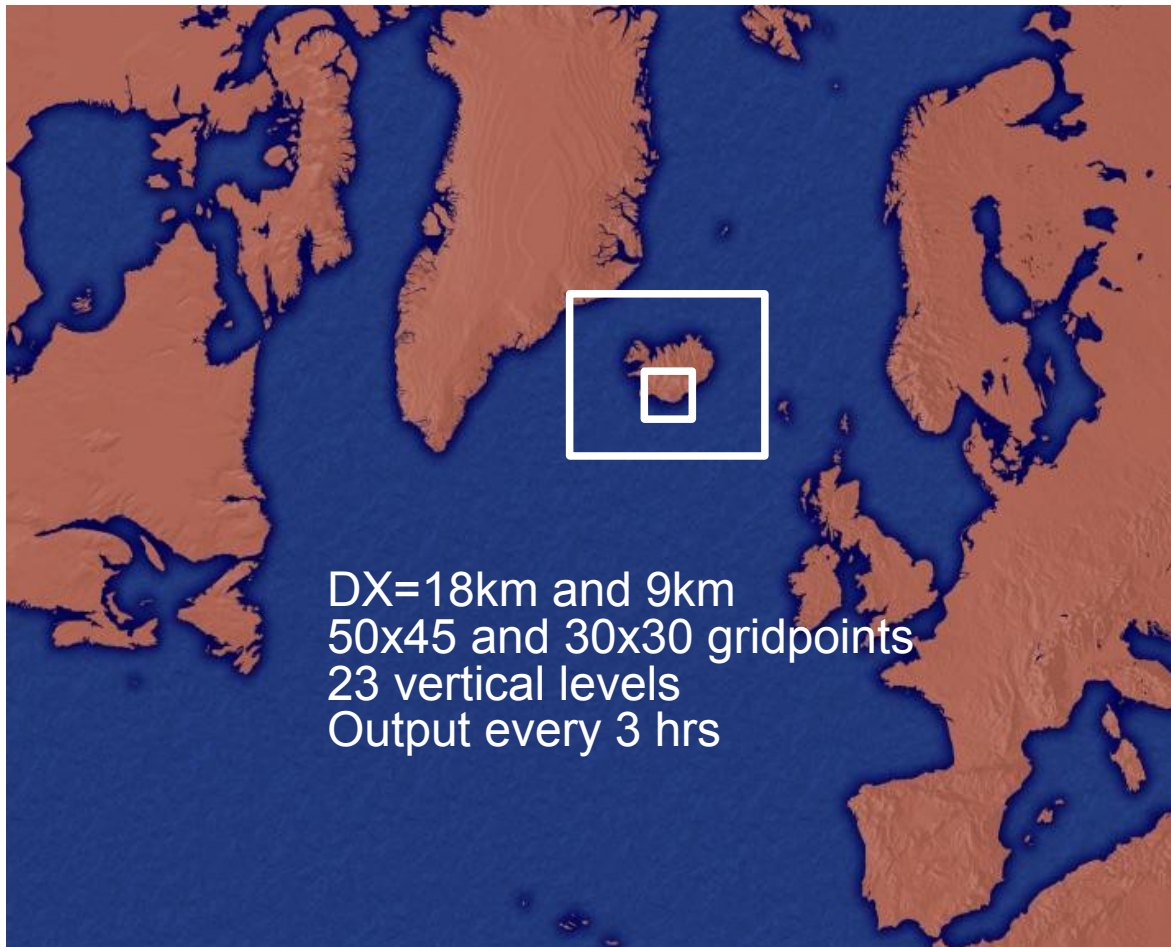
What is an ensemble forecast?

- The traditional method of making a weather forecast is to take the best model available and run it until it loses its skill due to the growth of small errors in the initial conditions
- An alternate method that produces forecasts with skill up to 15 days after the initial forecast uses what is called “ensemble forecasting”
- Instead of using just one model run, many runs with slightly different initial conditions are made. An average, or “ensemble mean”, of the different forecasts is created

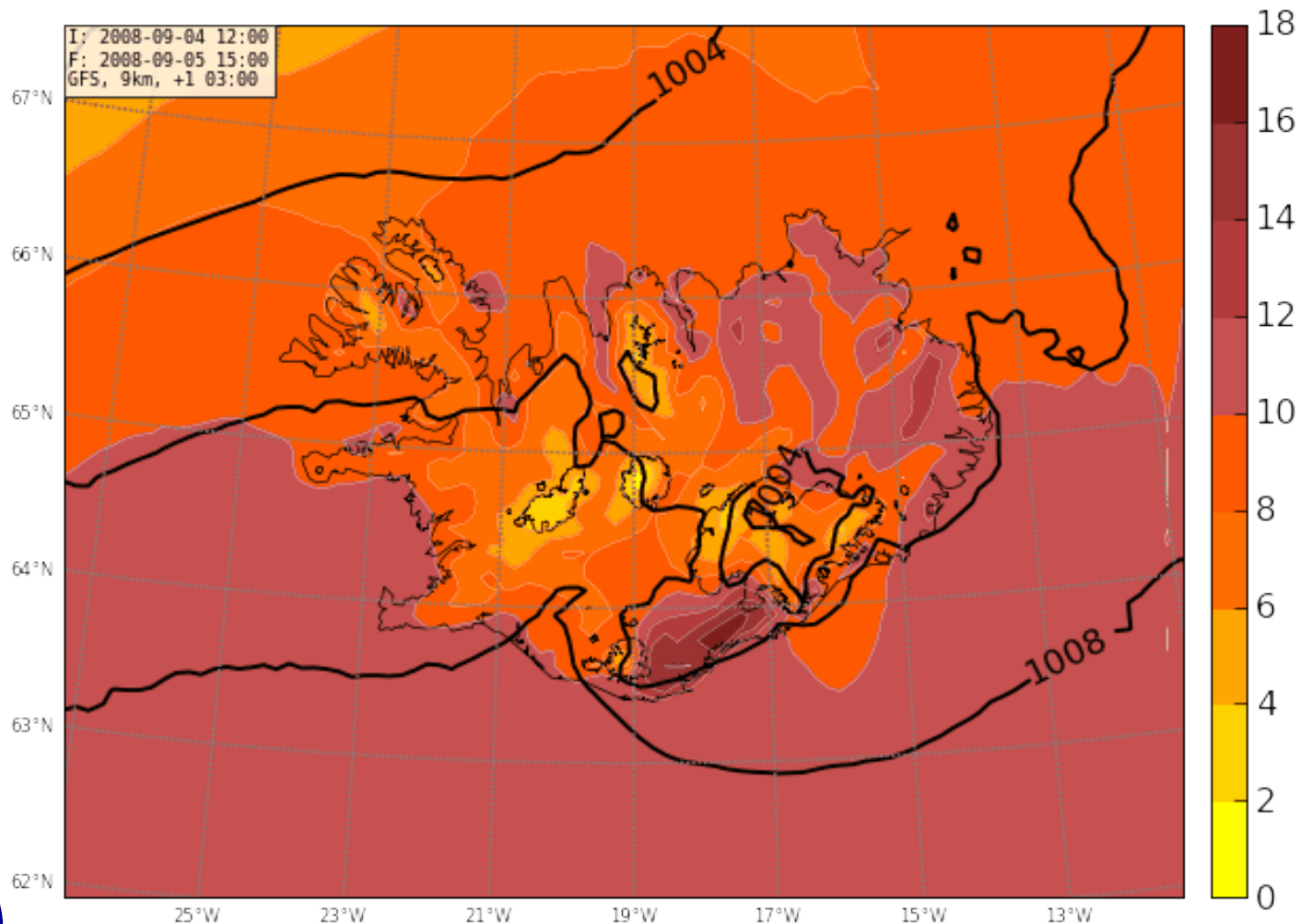
What is an ensemble forecast?

- This ensemble mean will likely have more skill because it averages over the many possible initial states and essentially smoothes the chaotic nature of climate
- It is possible to forecast probabilities of different conditions because of the large ensemble of forecasts available
- In addition, data can be used to force hydrological models to create an ensemble of run-off scenarios

Dynamical downscaling using AR-WRF forced with GFS data



Domain will be similar in size as the current 9km domain for Iceland

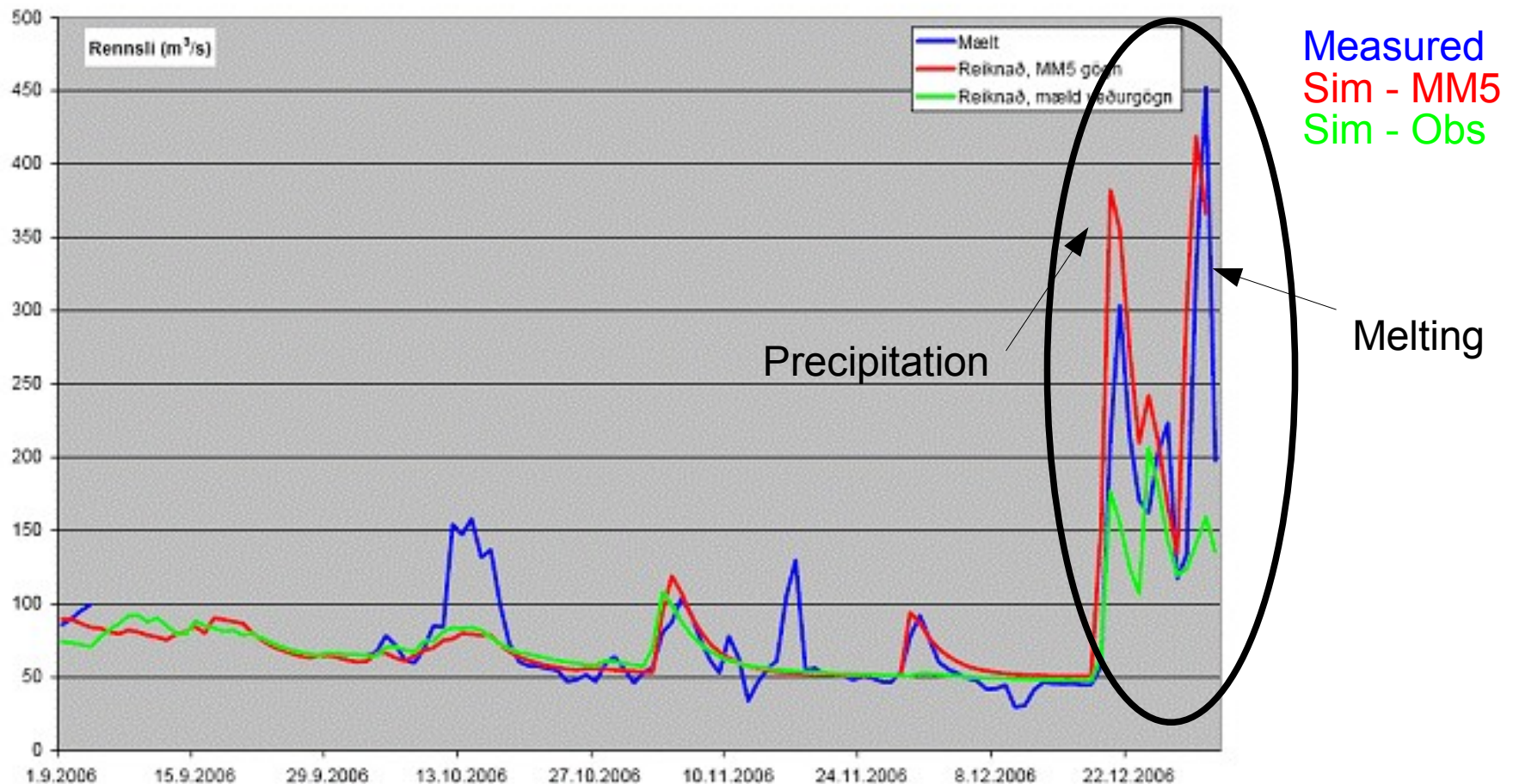


Who is to gain

- Severe floods in December 2006 caused structural damages at a number of reservoirs of Landsvirkjun. This in turn resulted in loss of water from the reservoirs (and hence financial loss) in addition to the structural damage
- The event was successfully simulated using a new version of the run-off model, forced with atmospheric data from the MM5 model
- The run-off model is now being improved and will be forced with forecasts from AR-WRF

Flooding event in December 2006

Mælt og reiknað rennsli í Tungnaá við Vatnaöldu

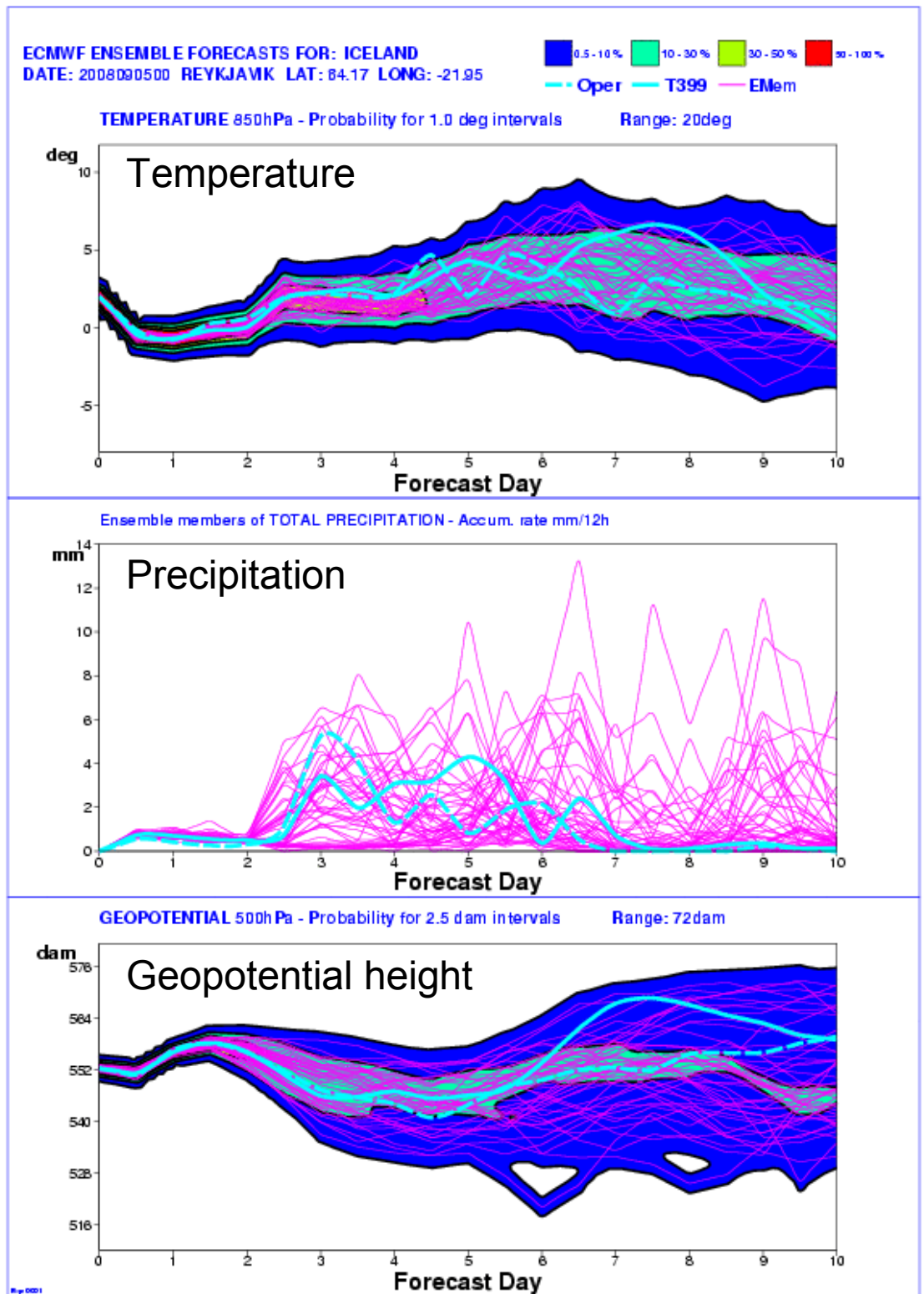


Curtesy of Vatnaskil

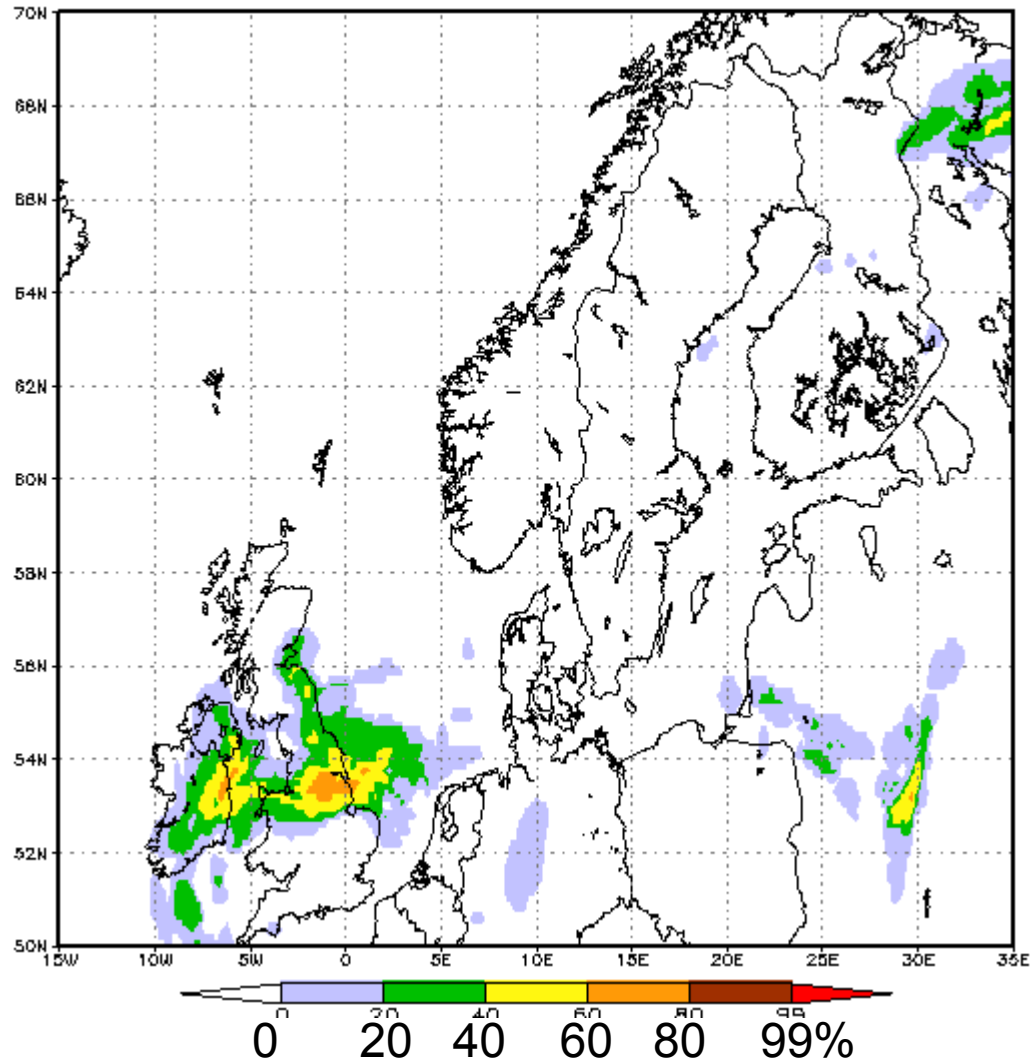
Examples of ensemble products

- Plume diagrams
- Ensemble mean and standard deviation
- Forecast probabilities
- Extreme forecast index
- Clusters

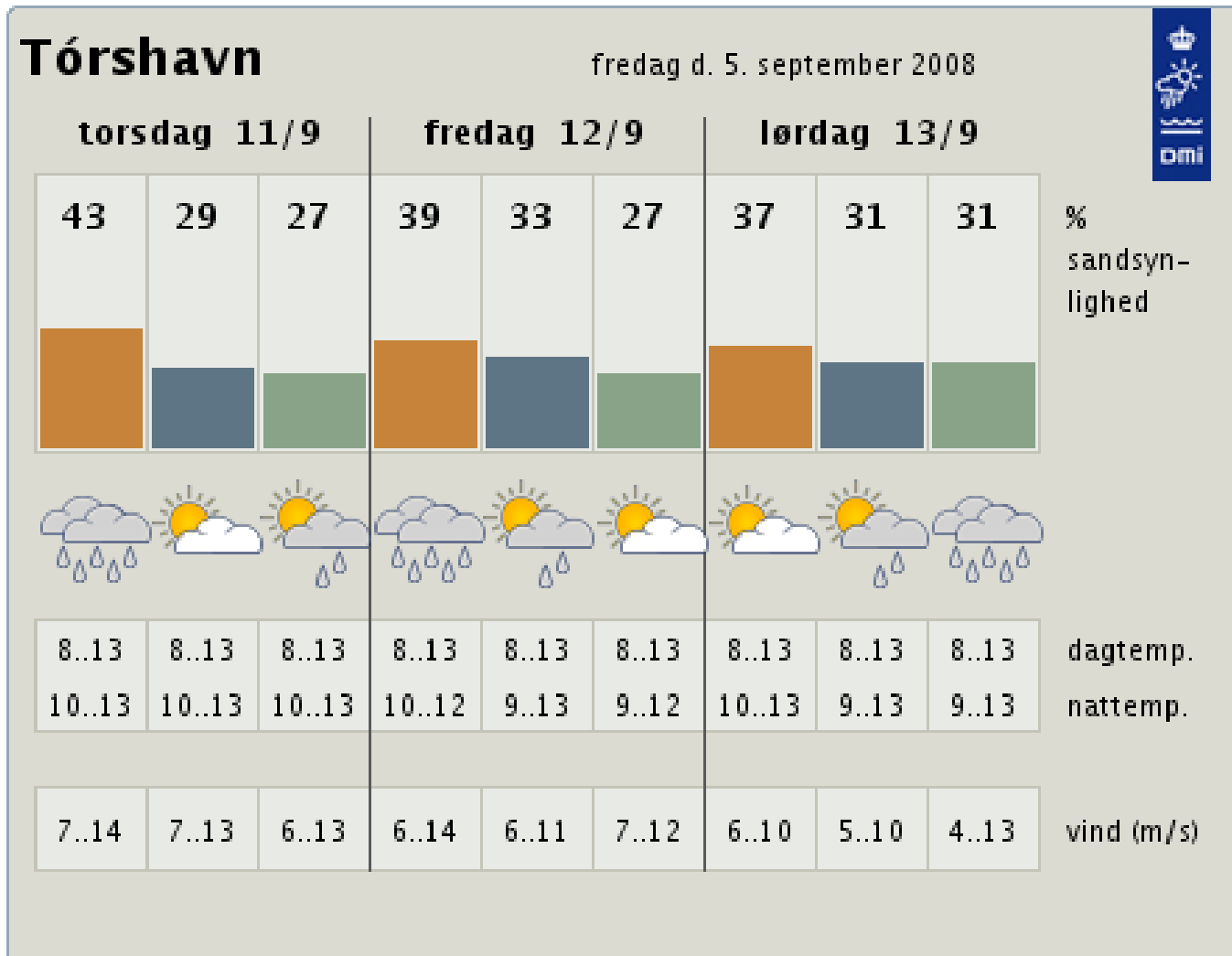
Plume diagrams



Forecast probabilities Precipitation



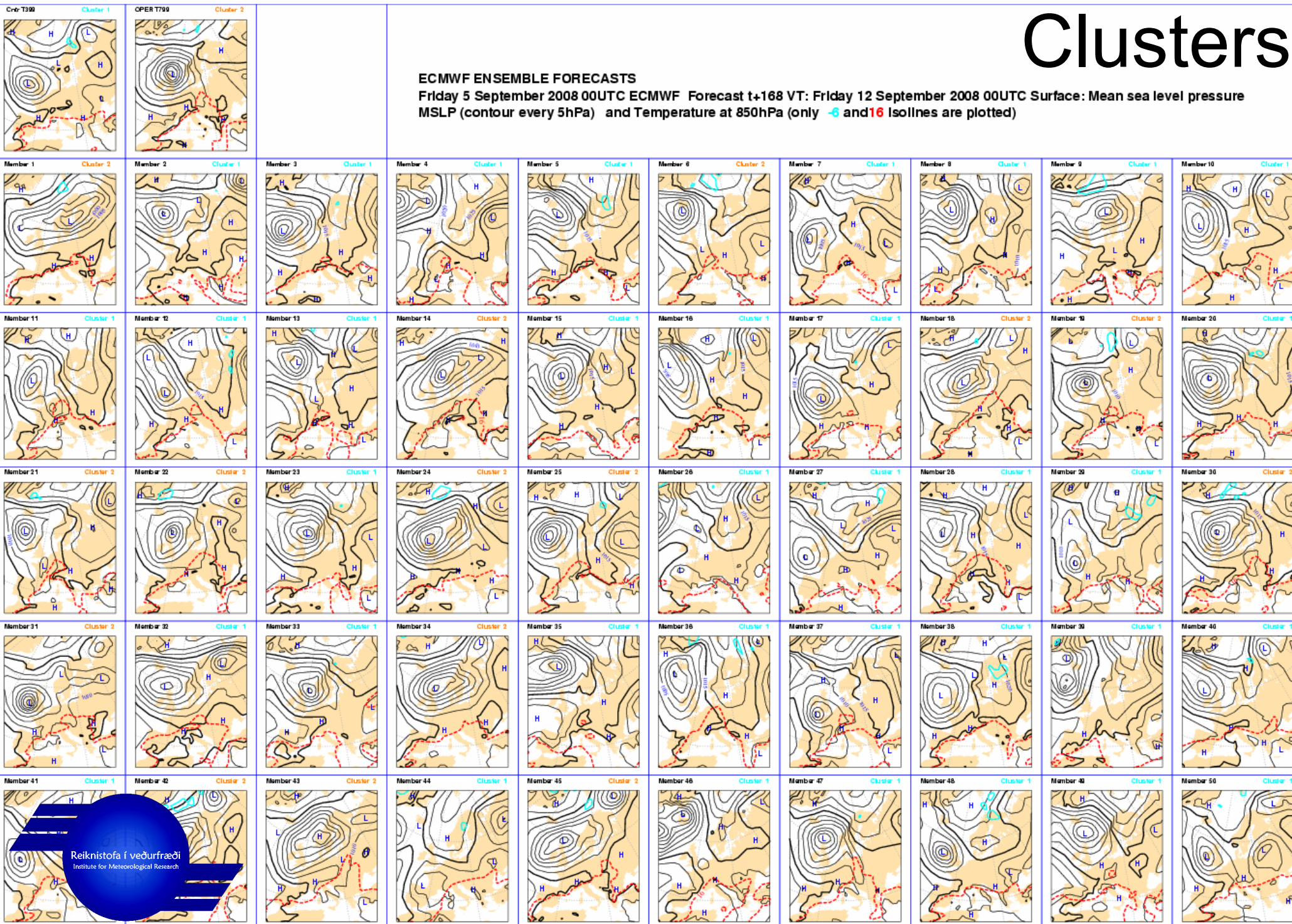
Forecast probabilities Meteograms - Þórshöfn



Clusters

ECMWF ENSEMBLE FORECASTS

Friday 5 September 2008 00UTC ECMWF Forecast t+168 VT: Friday 12 September 2008 00UTC Surface: Mean sea level pressure
MSLP (contour every 5hPa) and Temperature at 850hPa (only -6 and 16 Isohnes are plotted)



Future work

- Create short-range (1-3 days) ensemble at a higher resolution
 - There is a problem with ensemble forecasts regarding the lack of variability during the first two days
 - The variability is less for singular vector (ECMWF) methods than it is for breeding vector (GFS) methods
 - Can use mixture of models (AR-WRF/MM5) as well as different setups of the model physics and/or configurations to increase variability