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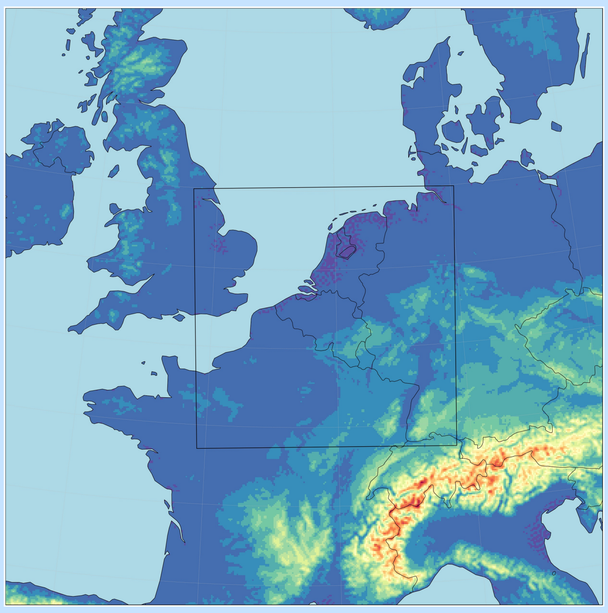
The operational ALADIN-Belgium model

1. The computer system

- SGI Rackable cluster
- 2x56 compute nodes with each 2 Xeon E5-2680V3 processors.
- 24 cores per node, 2x1344 cores in total



2. Model versions

- 4 km resolution 432x432x87L to +60h 3-hourly coupling to Arpège cy43t2 + ALARO-1 + non-saturated downdraft + TOUCANS + ACRANEB2
- 1.3 km resolution 600x600x87L to +36h hourly coupling to 4km run cy43t2 + ALARO-1, non-hydrostatic
- model runs use 720 cores.

3. Experimental versions

- 1.3km Arome (cy43t2) with surface assimilation

Road Weather Modelling at the RMI

Road Weather Models (RWM) make use of meteorological forcing from weather models, and 1D heat balance balance equations at the road surface.

The RMI has collaborated with KNMI (Netherlands) to adapt their RWM (Karsisto, Tijm, and Nurmi, 2017) for Belgium. The system is operational since winter 2018 – 2019.

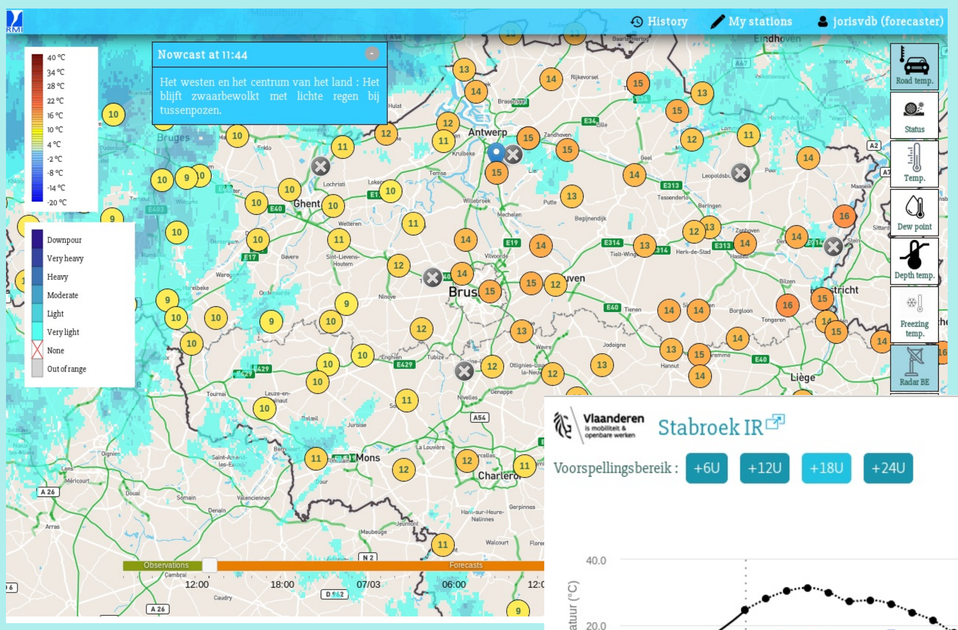
After retuning of heating/cooling rates we get satisfactory results for for Belgian highways

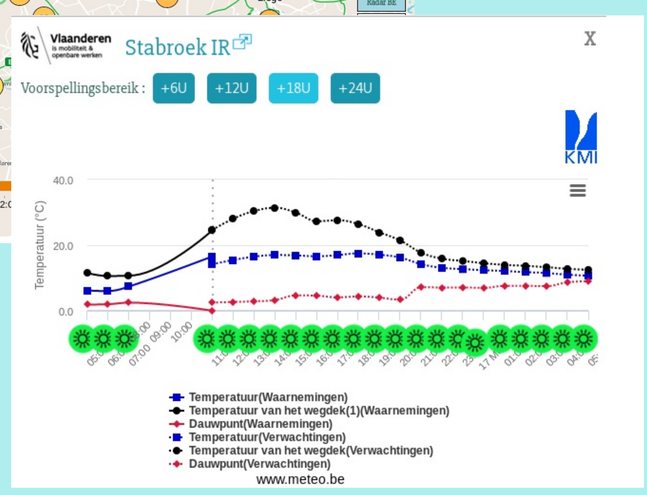
Input

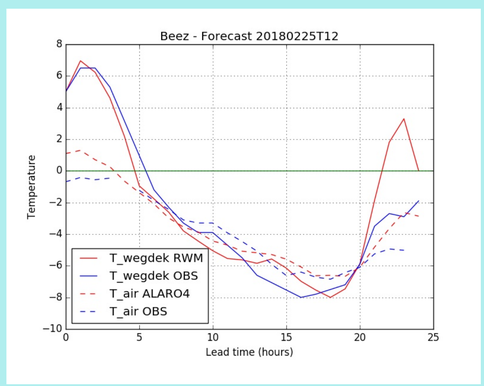
- Air temperature
- Relative humidity
- Rain, Snow, Graupel
- Wind speed
- Solar & thermal radiation

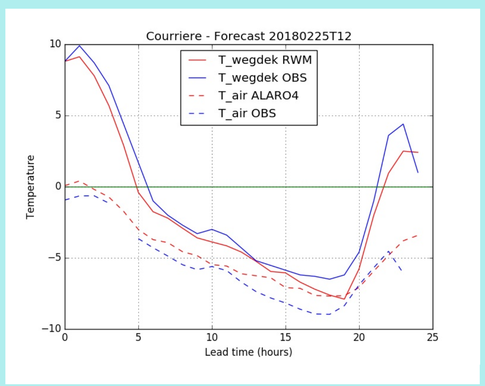
Output

- Road surface temperature
- Road surface condition: Dry, wet, snow, ice, melting snow, …





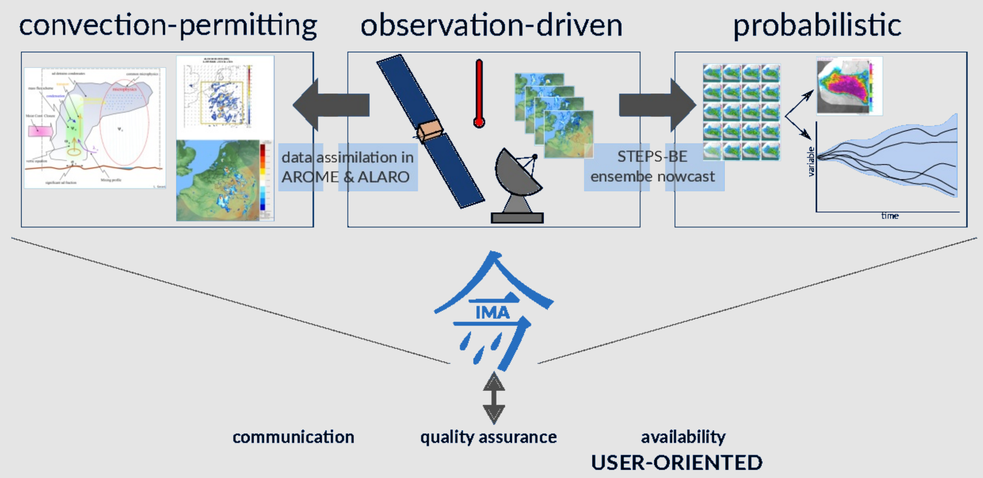




Project IMA: Seamless short-term ensemble prediction at the RMI

With project IMA (Japanese for "soon" or "now"), the RMI aims to combine data-driven probabilistic short-term predictions with convection-permitting NWP models. The goal is to have a seamless high-resolution probabilistic short-term forecast (24 hours). An effective transfer from research to operations is prepared by involving end users early, quality assurance through probabilistic verification (based on HARP), and the robustness of the operational system (based on EcFlow).

- A first building block of IMA is the short-term ensemble prediction system for Belgium: **STEPS-BE**. It generates probabilistic precipitation forecasts and will feature an adaptive skill-dependent blending with high-frequency (5 minute) precipitation output from a Mini-EPS of NWP models.
- **INCA-BE** will also be combined with the members of the Mini-EPS in order to generate a probabilistic forecast for all variables.



The basic building blocks such as nowcasting systems and convection-permitting NWP are present at RMI but an integrated, seamless product is lacking.

- The multimodel Mini-EPS will consist of an **ALARO-AROME 2+2**(lagged)-member ensemble running at 1.3km resolution, with a 3-hourly data assimilation cycle. This will also be our first trial of an ALARO-AROME ensemble running at a spatial resolution of 1.3km.

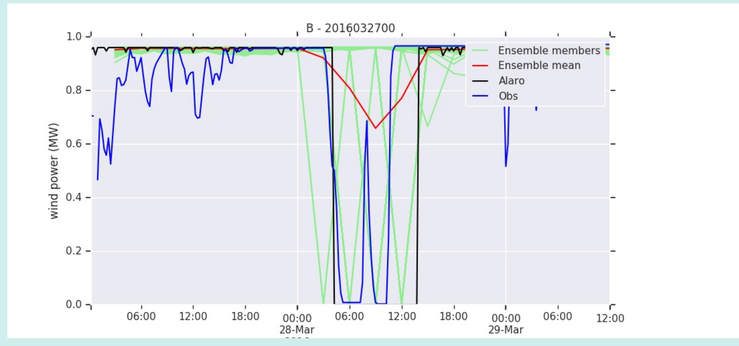
Probabilistic storm forecasts for wind farms in the North Sea

During major storms, the wind can reach speeds well above the characteristic cut-out speed of most wind turbines, resulting in shut down of the turbines as a protection measure. Since many wind farms in the North Sea are situated relatively close together, major storms can impact these wind farms at roughly the same time, thereby leading to large imbalance risks in the electricity grid. In order to better predict such cut-out events, and being able to take timely mitigating actions, the RMI is developing a dedicated storm forecast tool for Elia, the Belgian transmission system operator for high-voltage electricity.

We make use of our operational deterministic ALARO model (4 km resolution) combined with the ENS ensemble forecasts (~18 km resolution) of the European Centre for Medium Range Weather Forecasting (ECMWF). For the ALARO model, wind speed forecasts are calculated at turbine height from the model levels at 15 minute intervals, while for ENS we use the 1-hourly 100m wind speed field. The wind speed forecasts are then used to calculate an ensemble forecast of the wind power in each wind farm.

A typical cut-event is shown below. On 28 March 2016, all wind farms consisting of wind turbines with a 25 m/s cut-out speed experienced a cut-out event, which was well forecasted by both ALARO and ENS.

Ensemble wind speed forecasts from 27/03/2016 (00h UTC) for wind farm B.



Ensemble wind power forecasts from 27/03/2016 (00h UTC) for wind farm B.