



# NATIONAL POSTER BELGIUM

## Modelling team

### Royal Meteorological Institute of Belgium



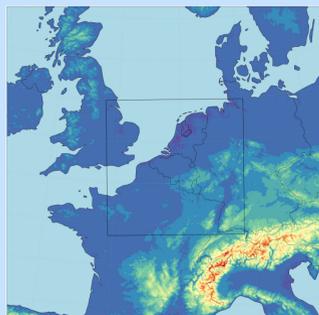
#### The operational ALADIN-Belgium models

##### 1. Operational runs at ECMWF:

- Running as TC-2 application
- NodeRunner scripting

##### 2. Model version: cy43t2

- 4 km resolution 432x432x87L to +60h hourly coupling to Arpège downscaling model
- 1.3 km resolution 600x600x87L to +48h hourly coupling to ECMWF Surface assimilation
  - Alaro (ISBA, NH)
  - Arome
- Model runs use 30+1 nodes.
- 3d-Var in preparation



##### 3. Local HPC runs

- The RMI SGI is now 9 years old and showing it.
- Problems with support
- Still running daily forecasts as backup, coupled to Arpège
- Possible "mini-EPS" with ECMWF runs (different coupling!)

#### Adaption of ACCORD codes to GPU's

Daan Degrauwe & Denis Haumont

- Following developments and strategy of ECMWF (IFS) and Meteo-France (ARPEGE) due to shared code.
- Activity within Destination Earth project DE330, targeting EuroHPC infrastructure (Lumi and Leonardo HPCs)
- Porting strategy is based on 3 pillars:
  - smart data structures (FieldAPI) to handle data flows and keep track of CPU-GPU synchronization
  - source-to-source translation tools to convert CPU-targeted code (coarsely granular parallelism, OpenMP) to GPU-targeted code (finely granular parallelism, OpenACC)
  - vendor-specific libraries for dedicated algorithms (FFT, BLAS)
- Current status:
  - bi-fourier spectral transforms have been ported to AMD and NVIDIA GPUs
  - radiation scheme has been ported
  - nonhydrostatic gridpoint dynamics have been ported
  - currently working on more parameterizations and spectral dynamics
- Sensible evaluation of performance is only possible when most/all of the code has been ported, but standalone tests on spectral transforms and radiation scheme are promising.

#### ML-efforts at RMI

Michiel Van Genderachter, Dieter Van den Bleeken

**Main objective: Use MLWF-techniques for lightweight EPS over Belgian domain.**

Current status: exploratory phase

##### 1. Anemoi framework (open-source [1]): First training runs

- ML-toolkit designed specifically for Weather Forecasting
  - based on PyTorch
  - developed by ECMWF
  - co-developed by MS in Machine Learning Pilot Project
- Training dataset: CERRA [2]
  - Copernicus European Regional ReAnalysis
  - ~ 30 year of 3-hourly analysis
  - 5.5 km resolution (1069 x 1069 grid, see Fig. 1)
- Graph(-Attention) Network

##### 2. Neural-LAM framework (open-source [3]): Data preparation

- ML-toolkit designed specifically for LAM Weather Forecasting
  - based on PyTorch
  - developed by Joel Oskarsson (Linköping University)
  - co-developed by ML-LAM community (DMI, SHMI, MeteoSwiss, Met Eirann,...)
- Training dataset: Archive of local ALARO analysis/forecasts
  - ALARO emulator
- Graph Neural Network

##### 3. In-depth validation of current MLWF-models

- Idealized out-of-sample tests (e.g. Matsuno-Gill response [4])
- Extremes and high Impact events



##### Hardware:

- 1 year project on LUMI EuroHPC through Belgian Allocation

##### Project involvement:

- ECMWF Machine Learning Pilot Project
- Destination Earth DE\_330: WP14

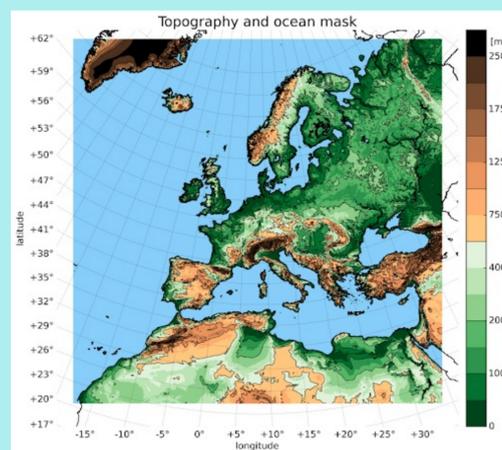


Fig. 1 Domain of the CERRA-dataset.

[1] [anemoi.ecmwf.int](http://anemoi.ecmwf.int)

[2] [climate.copernicus.eu/copernicus-regional-reanalysis-europe-cerra](https://climate.copernicus.eu/copernicus-regional-reanalysis-europe-cerra)

[3] [github.com/mlam/neural-lam](https://github.com/mlam/neural-lam)

[4] Hakim, G. J., and S. Masanam, 2024: Dynamical Tests of a Deep Learning Weather Prediction Model. *Artif. Intell. Earth Syst.*, 3, e230090, <https://doi.org/10.1175/AIES-D-23-0090.1>.