Operational Forecasts

ALARO-v1B NH (CY43T2)

- E440 domain: 4.0 km horizontal resolution, 798x799 grid points; 70 vertical model levels on a Lambert projection with 3h coupling frequency and 1h output, coupling zone with 8 points; Runs 4 times per day (00,06,12 and 18) with 72 hours forecast range; LBC from ARPEGE with 9.4 km horizontal resolution; Time step 150 s.

- PO2 domain: 2.0 km horizontal resolution, 799x799 grid points, 70 vertical model levels on a Lambert projection with 1h coupling frequency and 1 hour output. 4 runs per day (00,06,12 and 18) with 30 hours forecast range; LBC from ALARO 4.0 km; Time step 5s.

Operational machine characteristics

Cluster of HP BL460c; GENI servers connected with Infiband network; OS Scientific Linux 6; Intel Xeon ES-2680 processors – with maximum 1552 cores (97 nodes with 16 cores each), each core RAM 128 GB, disc array – 64 TB.

Impact of Meteorological Conditions on the Dynamics of the COVID-19 Pandemic in Poland

Data on a daily number of laboratory-confirmed COVID-19 cases and the number of COVID-19-related deaths were gathered from the official governmental website. Meteorological observations from 55 synoptic stations in Poland were used. Moreover, reports on the movement of people across different categories of places were collected. A cross-correlation function, principal component analysis and random forest were applied.

The results show that the maximum value of correlation was obtained with a sunshine duration equal to −0.45 with time lag of −10 days, daily temperature range (0.43) with a similar time lag, maximum daily temperature (−0.4). A high positive correlation (0.41) and time lag equal to −14 days indicate that an increase in mobility causes an increase in the number of infections.

To determine whether weather conditions affect mobility and mobility affects COVID-19, or whether weather has a direct impact on the pandemic dynamics, we calculated CCF between new COVID-19 cases/new deaths and mobility. Our study showed that, although meteorological parameters were correlated with mobility, their correlation with the dynamics of COVID-19 pandemic was stronger than mobility data. Therefore, we can state that meteorological parameters such as sunshine duration and relative humidity had a direct impact on the dynamics of COVID-19 pandemic in Poland.

Machine-learning-based post-processing of 2-m air temperature model output – a multi-model approach

In the experiment forecasted 2m temperatures from three operational models (ALARO 4km, AROME 2km and COSMO 7km) were compared with observed 2m temperature SYNOP values. A machine learning algorithm Random Forest Approach was applied (package randomForest in R), which uses a collection of decision trees (random forest) with increased performance and can use both classification and regression techniques depending upon the user and target or categories needed. In our case each decision tree, based on the respective predictor variables, was trained on different model and finally Random Forest took the average of the results from all the decision trees.

For building a random forest all models datasets were used with the same specification:

- sampling frequency:3h with leadtime: 3-30h;
- predictors comprise also month, day of the year, hour and leadtime;
- training was conducted on the two years period (2018-2019), which gave around 6800 cases,

Conclusions:

- RMSE reduction occurred at every station, with an average of 16%;
- The biggest improvement occurred for mountain-top stations (12510,12650), probably because models were strongly biased there;
- Training error (on the right) is slightly higher in highlands (from 12500 on) than in lowlands;
- The biggest training errors are noticeable for stations 12500 and 12625, which lays in a bottoms of valleys at the mountains;
- Some predictors with information about topography and cloudiness/insolation should be added to training data;
- Although random forest performs better than the best of three models only in 30-40% of forecasts, its impact is the most visible when considering big errors (over 5°C) – e.g. for Cracow (12566) random forest made such an error only 4 times, while COSMO 20 times, ALARO – 21 and AROME – 23.