Regional Cooperation for
Limited Area Modeling in Central Europe

LACE
nwp central europe

ALARO experience in Czech Republic

CHMI NWP team

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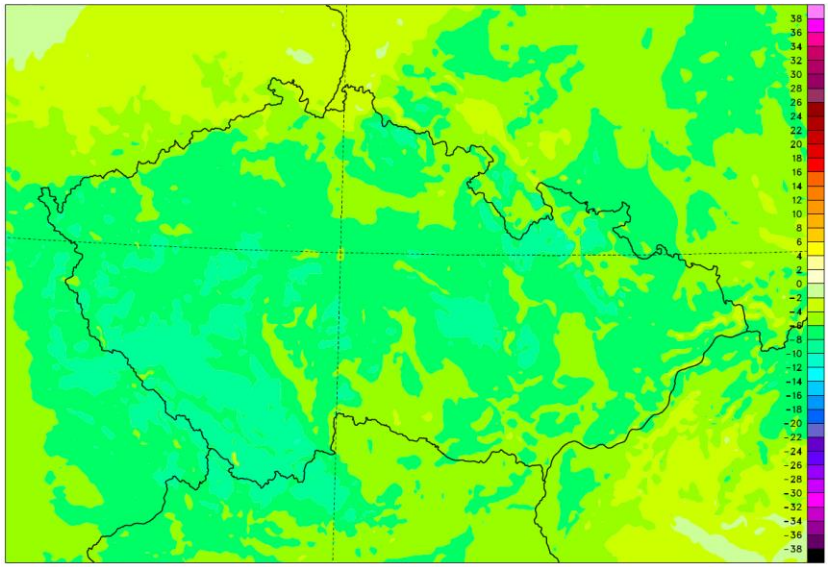
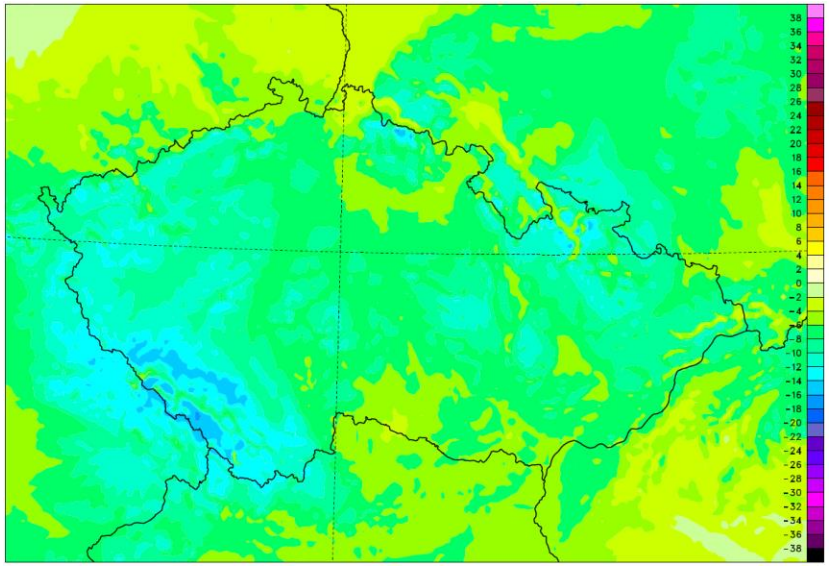
Temperature at 2m

- Known weaknesses:
  - Diurnal amplitude not strong enough with too warm summer minimal temperatures and too cold afternoon maximal temperatures;
  - Winter clear night conditions with snow – temperature does not drop enough because of a heat flux from soil.
- Remedies:
  - At the high-resolution e-suite we could reduce the error diurnal cycle thanks to the combination of: cloudiness retuning, roughness and less thermal capacity of vegetation.
  - Either we shall get better result with SURFEX (more sophisticated snow scheme) or before that one can try the existing parameterization to reduce the heat flux from soil in presence of snow.



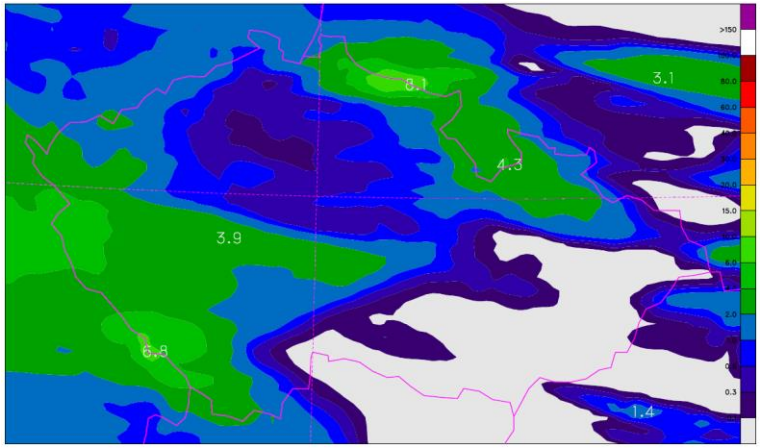


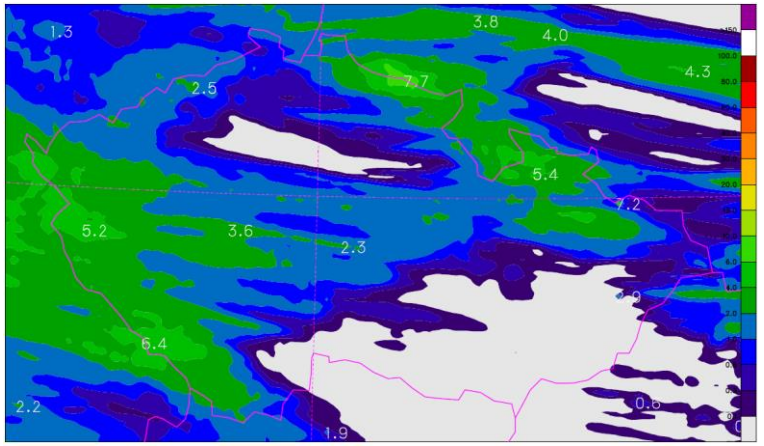
- Forecasted morning temperatures at +30h valid on 05 February 2019.
  - Left: e-suite reference;
  - Right: experiment with NCHSP=2.
- The minima in the experiment dropped to measured values around -15°C, but overall scores got worse, likely due to localization.
- The result is valuable for the warning but not for point-wise scores.

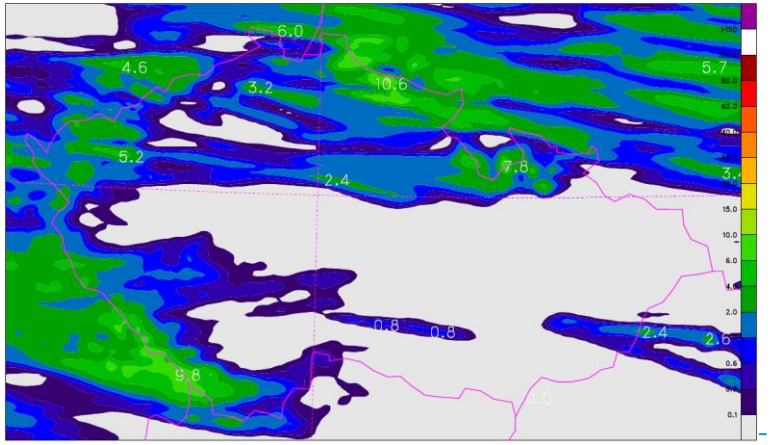
Wind at 10m

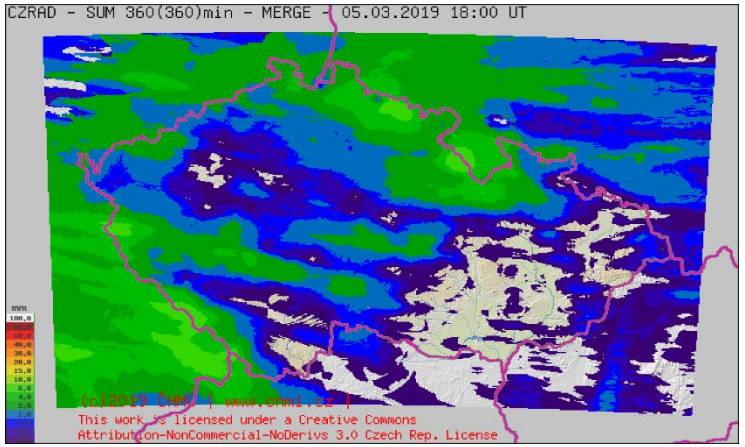
- Obviously, surface drag plays here a crucial role:
  - Resolved orography – model dynamics;
  - Unresolved orography – when changing the horizontal resolution the limit between resolved and unresolved orography changes and has the impact on the "gravity wave drag" family of parameterizations;
  - Local obstacles: roughness length – parameterization of turbulence;
  - Vertical penetrability of the atmosphere – stability conditions (BVF in parameterizations)
- ALARO at higher resolution nicely improves the V10m scores.
- There is still a room for improvements via better database of sub-grid-scale orography

Precipitation





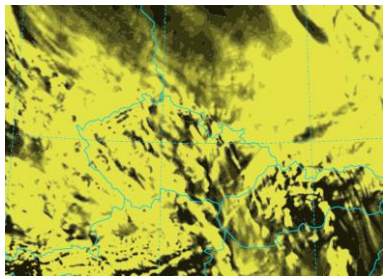


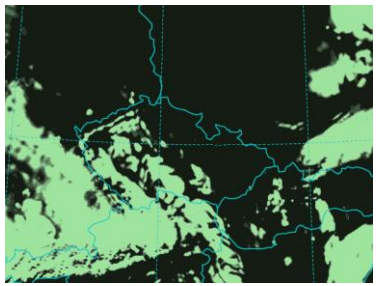


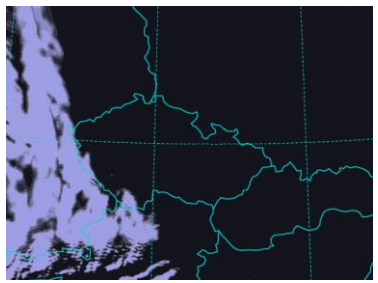
- At the horizontal resolution of 2.3 km we still get better results by keeping 3MT on.
- Here are precipitation 6h-sums, forecast base 05/03/2019 at 0h UTC, range +18h: ALARO at 4.7 km, at 2.3 km and below AROME at 2.3 km and merged radar-gauge measurements.

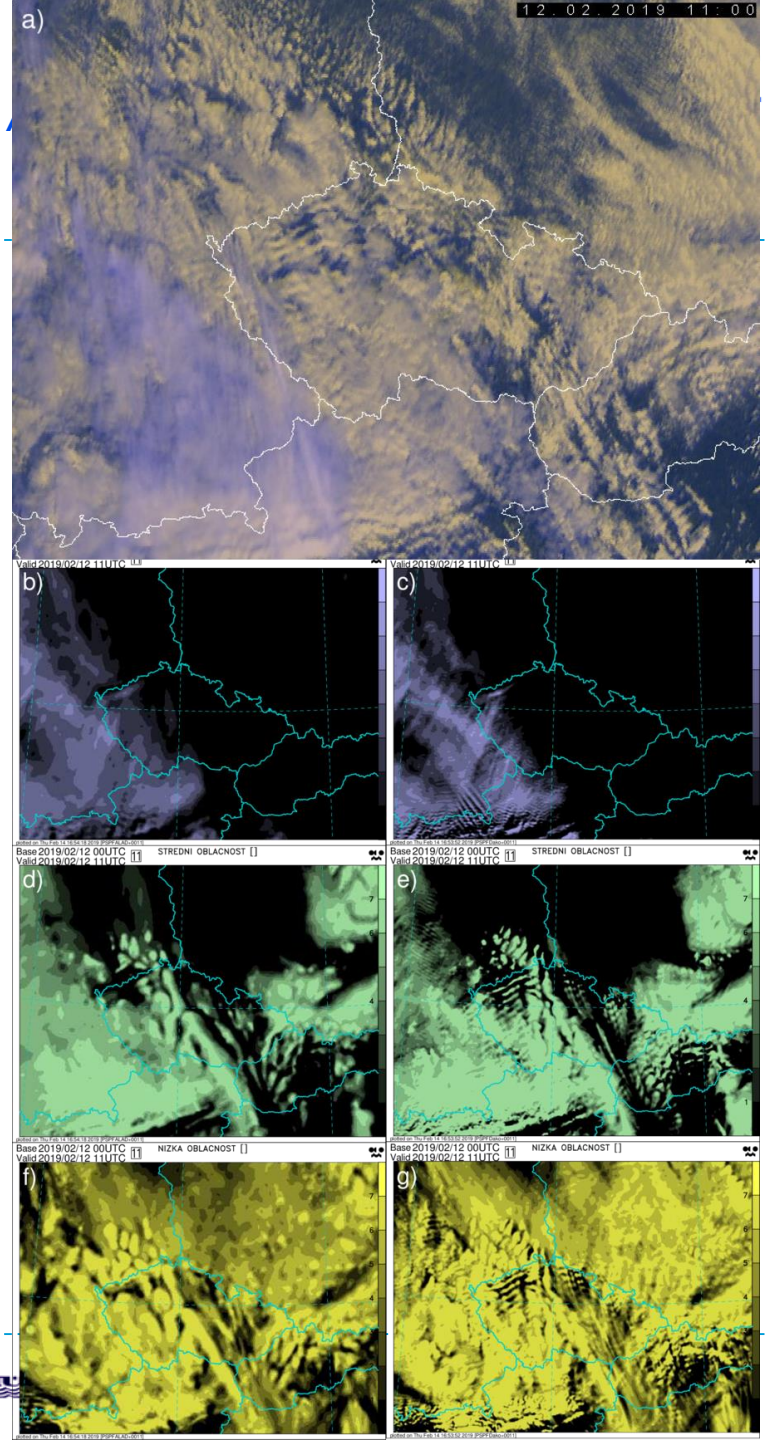
Cloudiness

- In the previous ALARO versions, we were lacking cloudiness in winter season.
- Now at high resolution with a new tuning, the bias is almost gone.
- We also get nice gravity waves – compared to the satellite picture it looks very realistic.
- AROME results for the same case (below) seem to exaggerate cloud cover.









Conclusions and outlook

- Thanks to a more intensive work at higher resolution we opened several questions linked to the multi-scale treatment:
  - Critical relative humidity used in radiative cloudiness computation has not been put in relation with the horizontal resolution;
  - In the e923 procedure sub-grid-scale orography characteristics are not taken from better and finer GMTED2010 database; nor from the SURFEX PGD file, while these are important for the related family of parameterizations and their multi-scale character;
- So far we have not been experiencing some "fire-works" cases or similar.