

Review of: Model intercomparison of COSMO 5.0 and IFS 45r1 at kilometre scale grid spacing

By: Zeman et al.

Overall Judgment: Minor Revisions

General Comments

This paper is a good example of a sensitivity study of 2 different models that operate at the kilometre scale. I am less sure the paper is very useful as an intercomparison as the differences between the models are so huge that it has turned out difficult to pinpoint physical and numerical reasons for the differences in simulation results between the 2 models. Of course many of the results beg for additional numerical experiments and I completely understand that these are beyond the scope of this paper. Having said that there is one sensitivity run that is strangely missing and that is a non-hydrostatic run of the IFS: One of the intriguing questions of this paper is at which resolution it is appropriate or even mandatory to switch to a non-hydrostatic formulation. In that spirit at least one non-hydrostatic run of the IFS would have so logical to include, even if the differences with the hydrostatic version would remain small, even for the highest resolution. So inclusion of results of at least the non-hydrostatic 2.9km resolution IFS would be strongly recommended.

Further Comments

- **Concerning the observational data sets:** I was under the impression that through OPERA there is already a European rain radar network that provides a (West) - European coverage, instead of being dependent on the radar data of only one European country. Perhaps the authors can comment on this
- **Shallow Convection on/off:** I would be interested if the authors could say something on the results where also the shallow convection is switched off. I ask this since I believe that COSMO at 2 km in general runs without a shallow convection parameterisation. In that sense it would be good to know the performance of COSMO in its "operational" setting.
- **Deep Convection on/off:** If the authors believe that the skill of both models with respect to precipitation is in general better without the deep convection parameterisation, even at coarser resolution, as also claimed by several other studies, could they please comment on the reasons why most operational models keep running with a (deep) convection parameterisation at these resolutions.
- **Downdrafts:** Why are the simulated up- and downdrafts at 850 mb symmetric as we know they are not in reality. Is this related to the fact that the resolution is not fine enough to resolve this asymmetry? Why are the too weak downdrafts of the IFS related to the hydrostatic formulation? (line 438) What could be a plausible physical reason?
- **Horizontal Diffusion:** The shift to stronger precipitation rates with larger horizontal diffusion in COSMO is indeed counter-intuitive, especially when realising that the updraft strengths are decreasing at the same time. What could be an explanation for this. Is there a similar sensitivity in the IFS? With which strength of horizontal diffusion of COSMO can the strength of horizontal diffusion used in the IFS be compared? How do these values compare with a more physical Smagorinski based horizontal diffusion strength? I presume

that would suggest a lower strength for horizontal diffusion of the IFS and prompts the question why the IFS is using a relatively strong horizontal diffusion strength. It would be important to know the answer to this question since it is suggested in this paper that the reason that IFS can still run hydrostatically is possibly related to the fact that it is using such a strong horizontal diffusion which reduces the difference between hydrostatic and non-hydrostatic formulation.

- **Fig 10:** This figure does not really seem to support the results in figure 9 as I essentially see less areas with precip in excess of 1.5 mm/hr.
- It would be nice to have a list of suggested follow-up sensitivity simulations for further studies such as : separate varying the time stepping for the physics and the dynamics. Sensitivity for horizontal diffusion in the IFS, effect of shallow convection parameterisation etc...

Typos

line 319 : are => is