Investigating the scale-dependency of COSMO-CLM for Climate Projections

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October 2019

Increasing the resolution of Regional Climate Models (RCMs) for climate projections is usually justified by the requirement of information at a local scale. Such high resolution simulations are necessary for the development of adequate adaptation and mitigation strategies. However, an effective strategy has to be formed on reliable information: climate models projections need to be conducted in a way to properly characterize models' uncertainty. A common approach is to conduct ensemble simulations, employing different climate models or, alternatively, the so-called Physically Perturbed Ensembles (PPEs), using different physical configurations of the same model.

High resolution is important in order to effectively and accurately reproduce different physical processes in a climate model, such as cloud cover or cumulus convection, that are normally expressed using simplified descriptions referred to as parameterizations. At the same time, higher resolution allows to have a better reproduction of geographical and geophysical features of a region, for example land cover and topography. Recognizing the benefits of such factors for climate modeling, one thing that should also be considered when conducting climate projections is whether the reliability of the results is affected by the increase in resolution and how do uncertainties propagate in the different cases. Increasing the resolution of a model, which allows an effective consideration of smaller-scale processes, will also lead to an increase in the complexity of the simulations, both from a physical and computational point of view. This, paradoxically, could lead to less reliable results. In this project, a set of PPEs will be produced using the RCM COSMO-CLM, for a present climate period and a future time-slice, following different Representative Concentration Pathways. The spatial scales that will be investigated will be the ones considered by the Coordinated Regional climate Downscaling Experiment (CORDEX, Giorgi et al. 2009), from approximately 50 km down to approximately 12 km. Simulations will be performed for the European CORDEX domain. The main goal of the project is to investigate the dependency of COSMO-CLM to different spatial resolutions and how model uncertainties evolve under different climate scenarios. The results will contribute to assess the effective value of increasing an RCM resolution for climate projections, of critical importance for interna-

tional frameworks such as CORDEX and Intergovernmental Panel on Climate Change (IPCC).