Project: **802**

Project title: **COSMO-CLM simulations with 2-way nesting**

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## The current status of the project

In 2019 a new tow-way coupling between coarse and fine grid COSMO-CLM was developed. Hereto the OASIS3-MCT interface was extended and an interpolation between the z-grids was implemented. This development was finalized in 2020. At HZG in 2019/20 the coupling cclm+HD (HD: Hydrological Discharge Model) was developed. These developments are part of a strategy of the CLM-Community to develop a Regional Climate System Model for convection permitting scales.

The 2-way coupling (ESM/CCLM)+CCLM has the potential to reduce the boundary effect between the intermediate and convection resolving scales and to improve the capability of multiscale modelling. An important feature of CCLM+CCLM is an increase of vertical resolution in each nest. Hereby a bias of approximately 1Pa is achieved. This feature is not available with ICON+ICON 2-way coupling.

Development of a regional earth system model for convection resolving scales is a strategic goal of the CLM-Community. In a first step a unified OASIS interface for multiple couplings shall be developed for the COSMO regional climate system model (CSM) encompassing several couplings designed in such a way that it can be easily implemented in ICON. One coupling is the CCLM+HD (Hydrological Discharge model of HZG). Another is the CCLM+CCLM coupling.

A further development and application of (ESM/CCLM)+CCLM is justified by mainly two reasons. First, it allows using higher order non-dissipative schemes (HOS, see project bb722). HOS has been shown to increase the effective model resolution by approximately a factor of 2 and it exhibits several interesting improvements of atmospheric dynamics at convections permitting scales. This type of scheme cannot be implemented in ICON since no theoretical solution is known for an ICON grid. Second, convection resolving simulations exhibit significant reduction of model errors due to higher vertical resolutions, in particular in steep orographies (MeteoSwiss is using 80 vertical levels at 1km resolution), and without deep and shallow convection parameterization (see bb722 report).

In 2020 a development and application of the unified OASIS interface for COSMO_6 was planned. Hereto a dedicated support was granted by the IS-ENES project funded within HORIZON 2020. Due to Corona pandemie the development had to be shifted to 2021 since it requires a close collaboration between the institutions. Furthermore the development of COSMO_6 is not finalized as well.