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Are rapid adjustment to CO_2 forcings over Central Europe in the ICON-GCM and ICON-LEM representative of global adjustment variability?

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Rapid adjustments to an increase in CO_2 concentrations are an important component of the climate's total response. Rapid adjustments, however, vary considerably amongst general circulation models due to the fact clouds, turbulence, their coupling, and the resulting dynamical response are not calculated reliably by general circulation models [Gregory and Webb, 2008 & Sherwood et al., 2015]. One idea to tackle this problem is to use cloud resolving models, which resolves clouds and turbulence, to better understand rapid adjustments. Cloud resolving models, however, can only be run over a limited area and so one must select an area which has the same magnitude of variability found in rapid adjustments globally. In this work, we ask "Are rapid adjustment to CO_2 forcings over Central Europe in the ICON-GCM and ICON-LEM representative of global adjustment variability?", thus addressing these three concerns.

Using the newly released ICON-A (Icosahedral non-hydrostatic) atmospheric general circulation model (GCM) and large-eddy model (LEM) developed by the Max-Planck Institute for Meteorology (MPI) and Deutsche Wetterdienst (DWD), a study of rapid adjustments is performed across scales. First results of the changes in top-of-atmosphere radiative fluxes in the ICON-LEM are within the standard deviation of the ICON-GCM.