Project: **893**

Project title: **Convection and Clouds in Earth System Modelling**

Principal investigator: **Holger Tost**

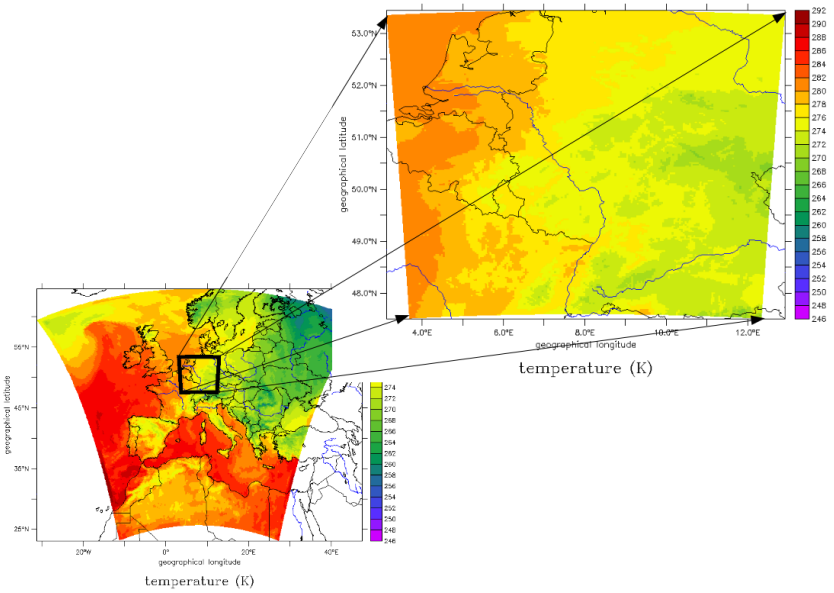
Report period: **2017-01-01 to 2017-12-31**

In the current allocation period, only some of the proposed workpackages have been attended to. This has been a consequence on an unsuccessful recruiting process for a postdoctoral condidate dealing with WP III and the maternity leave of the PhD candidate working on WP II. A postdoc candidate is now found and will start working on WP III of the past allocation period in the beginning of the new allocation period. The maternity leave of the PhD candidate will continue into the next allocation period, but the candidate will resume her work during the coming year.

Consequently, only a small fraction of the requested resources have been used.

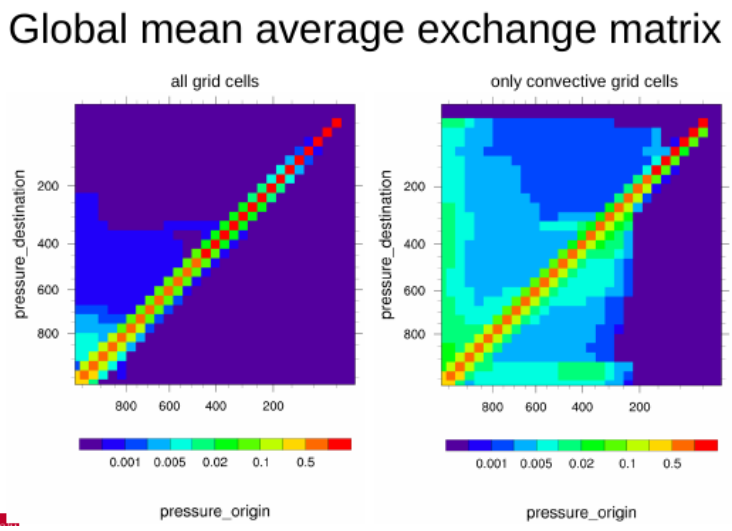
WP I: Regional air quality modelling

Within this project the PhD candidate has successfully set up a model configuration for the Rhine-Main area using the coupled MECO(n) system with a two times nested model setup. First meteorological simulations have been conducted making use of the downscaling capabilities of the system, as depicted in Fig.1. In addition to meteorological simulations also first test simulations with the aerosol module GMXE, which has not been tested in conjunction with the MECO(n) system before, have been successfully conducted and are currently analysed for the scientific soundness.



WPIII: Combined algorithms for convective transport and chemistry

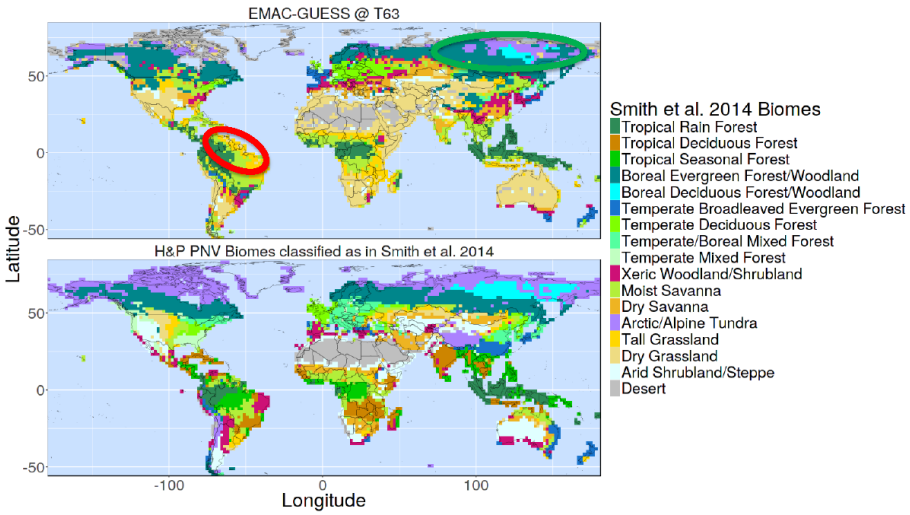
Because of the shortcomings of staff, only the PI has conducted simulations to determine the convective exchange of air masses designing and implementing a diagnostic for convective exchange, i.e. a convective exchange matrix (Tost et al., EGU, 2017). This allows the analysis of convective mixing for both individual convective events as well as for climatological studies. An example is givenin Fig.2, which depicts on the left hand side the overall convective mixing in an annual average picture. However, as convection does not occur everywhere at any time, the convective mixing in cases of active convection is shown on the right panel. The graphs depict the contribution of air from a pressure origin to a certain destination pressure.Clearly several modes can be detected, such as a shallow convection mode, i.e. transport from surface air to approx.



700 hPa, but also the deep convective mode with maximum transport of surface air up to 300 hPa. Furthermore, the mass balancing subsidence becomes obvious as an increase in mixing below the 1:1 line.

WPIV: Model development and maintenance of the EMAC model

Several test simulations have been performed with the currently released and new developer versions of the EMAC modelling system (v 2.53 +). Some of the testcases are part of the CMIP6 model contributions of the ESCiMo consortium. This also includes preparation of the input data for stratospheric aerosol properties for both radiation as well as for heterogeneous chemistry.



Additionally, some test simulations of the coupled EMAC-LPJ/GUESS system have been performed on the DKRZ architectures (manuscript in prep.) showing a sucessful coupling and implemetation of the dynamic vegetation within the EMAC modelling system. A corresponding graph showing the major biome distribution is depicted in Fig.3 (unpublished). So far all test give scientifically sound results and show reasonable agreement with observations for various vegetation parameters (LAI, carbon mass, tree height). Further two way coupling allowing for vegetation feedback on the meteorological fields is ongoing.

WPV: ICON simulations of convection

Some first test cases for ICON simulations with parameterised convection have been conducted an the system to obtain first experiences with the ICON model on the DKRZ HPC architecture. However, these were only technical test cases without a meaninful scientific interpretation so far.