Project: 677

Project title: Evaluierung der Atmosphärenchemie in MECO(n)

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Report period: 2021-11-01 to 2022-10-31

As stated in the request for 2022, this project is a pure model development and user support project for issues arising around the further development of the MESSy software. This has 2 consequences: First, the amount of required computing time and /work storage space is highly speculative, as it depends on the arising debugging requirements. Second, the range and the prioritising of the work to be done is fastly changing. One example is, that due to the decision by DWD to support the development of a Community Interface (ComIn) for ICON, the cooperation with Hereon (project 2 below) will shift to getting the combination of MESSy and OASIS3MCT coupled software running in ICON instead of further developing the COSMO part (project 2 below).

The application for 2022 ordered the planned work into five subproject:

- 1. MESSy DWARF development (t8code implementation)
- 2. OASIS3MCT implementation of NEMO and HD coupling in COSMO/MESSy
- 3. Development of an ICON-CLM/MESSy package for COPAT2
- 4. Further implementation of MESSy chemical submodels into ICON/MESSy
- 5. (Part of) the User Support for MESSy

Unfortunately, we had not enough human resources available to pursue project 1. and 2..

The CLM-Community project group ICON, which had the aim to provide the CLM-Community with an ICON-CLM code version which produces reasonable results for regional climate applications, just finished its work. Thus, only now the status is reached, where it is reasonable to combine both software packages (ICON-CLM and MESSy). Therefore, no work was done for **project 3** in 2022.

Most of the computing resources were used for the implementation and testing of the MESSy chemistry submodels (**project 4**) and the User support (**project 5**) or general model improvements.

The following MESSy submodels have been made available in ICON/MESSy with the help of resources of this project in the reporting period:

- JVAL (photolysis rate calculation)
- MECCA (kinetic solver for gas phase chemistry)
- ORBIT (orbit calculations, e.g. required for JVAL)
- ONEMIS (online emissions, i.e., emissions depending on prognostic variables)
- Pseudo-aerosol by PTRAC (passive tracer definition)
- SEDI (sedimentation of aerosol particles)
- DDEP (dry deposition of gas species and aerosols)
- TROPOP (calculation of different diagnostic variables, e.g. tropopause height, boundary layer height, Richardson number, sea level pressure etc.)
- GRID_DEF (grid information in the format required by MESSy infrastructure)

Furthermore, changes for the general implementation of the MESSy infrastructure in ICON became necessary.

Additionally, a number of User Support requests / bug reports have been processed (to explain these in detail would go beyond the scope of this report), but could be checked in the MESSy GitLab at DKRZ). Last but not least, some further model code consolidations have been introduced.