Project: **677**
Project title: **Evaluierung der Atmosphaerenchemie in MECO(n)**
Project lead: **Astrid Kerkweg**
Report period: **2018-01-01 to 2018-12-31**

The activity plan for this project for the year 2018 was split into six parts:

1. (TS) Test simulations: upgrade to a COSMO version with unified COSMO-ICON physics package. Testing / Tuning of new turbulence scheme to improve tracer transport in boundary layer.
2. (SVAT) Implementation of the “Community Land Model” (SVAT-CLM) as a COSMO/MESSy submodel
3. (COMP) Comparison of the performance of COSMO/MESSy including SVAT-CLM with the COSMO-CLM^2
4. (IM) ICON/MESSy development
5. (FOGDEV): implementation of the PAFOG model into COSMO/MESSy
6. (FOGTUN): Parameter Tuning (especially turbulence scheme) of the COSMO-PAFOG model

Three workpackages [**1: TS**], [**5: FOGDEV**] and [**6: FOGTUN**] depend on the availability of the new COSMO model version including the new turbulence scheme by M. Raschendorfer.

The German Weather Service provided a stable COSMO model version including the new unified ICON-COSMO physics package end of February 2018. The technical adaption of the MESSy interface to the code changes (“blocking”) parallel to other ongoing projects, was finished in August 2018. Currently, the code is tested for scientific correct results. The parameter tests for the turbulence scheme are still pending, as are the development and the tuning of the COSMO-PAFOG version.

[**2: SVAT**] Due to its structure, the community land model (SVAT-CLM) can not be implemented directly as a MESSy submodel. Therefore we decided, to develop a MESSy submodel OASIS3MCT to couple the community land model via this submodel to MESSy-fied basemodels.

The OASIS3MCT submodel should generalise the access to the coupling features, i.e., coupling fields are simply specified via namelist and dynamically accessed via pointers using the MESSy infrastructure submodel CHANNEL instead of being hard-coded.

To evaluate the performance of the MESSy coupled SVAT-CLM, we additionally ported the TerrSysMP model system (Shrestha et al. 2014) and the COSMO-CLM^2 model (Davin et al. 2016) to mistral and did first test simulations.

Current status: The COSMO-CLM^2 model is now ready for production. The new coupling via the MESSy submodel OASIS3MCT is still in the developing and testing phase. Especially, it needs to be reconciled with the Multi-Driver-Model (MMD) which performs the coupling of different ECHAM/MESSy and COSMO/MESSy instances. Therefore, further test simulations are required, but are expected to be finished end of 2018.

[**3. COMP**] As the system developed in [2: SVAT] is still in the development and testing phase, the evaluation simulations need to be shifted to 2019 (to the new accounting period).

[**4. IM**] In the context of the ICON/MESSy development the MESSy infrastructure submodel IMPORT-GRID has been further expanded and new functionalities have been added to the TIMER submodel (required for the time-substeps due to ICON patches). The CHANNEL output control was expanded to enable reading / writing of restart-files. The submodels RND (creation of random numbers) and QTIMER (force check-pointing after a certain time in the queue is over) have been implemented in ICON.

[**ADDITIONAL ACTIVITIES**]

In addition to the projects explicitly listed in the last application, a COSMO-CLM/MESSy version has been developed and set up to be usable via the starter package software of the CLM-Community.

Literature:

Davin, E.L., E. Maisonnave and S.I. Seneviratne (2016): Is land surface processes representation a possible weak link in current Regional Climate Models?*Environmental Research Letters*, **Vol. 11**, Number 7, doi:10.1088/1748-9326/11/7/074027

Shrestha, P., M. Sulis, M. Masbou, S. Kollet, and C. Simmer, 2014: A Scale-Consistent Terrestrial Systems Modeling Platform Based on COSMO, CLM, and ParFlow. *Mon. Wea. Rev.,* **142**, 3466–3483, https://doi.org/10.1175/MWR-D-14-00029.1