Project title: **urbisphere — coupling dynamic cities and climate**

Principal investigator: **Swen Metzger**

Allocation period: **2022-01-01 to 2022-12-31**

Abstract

The EU-funded Synergy Grant „urbisphere“ (H2020-EU.1.1. ERC-2019-SyG Grant agreement ID: 855005, 2020-2026, https://cordis.europa.eu/project/id/855005, ERC-SyG PI, Freiburg, Prof. Dr. Andreas Christen, Faculty of Environment and Natural Resources at the University of Freiburg) will adopt a new approach in modelling dynamic cities within the climate system. The research initiative will develop schemes to forecast and project urban futures and climates using a dynamic framework that incorporates weather, air quality, differential exposure and vulnerability of people from neighbourhoods to cities. The ERC project will develop and link urban-surface models as well as human exposure and vulnerability models to climate models, and hence better forecast exposure, emissions and intervention potential in cities. The project will use high-performance computers to simulate climate impacts of cities and urban emissions on boundary layer physics and aerosol feedbacks. This DKRZ project aims to address only a small part of the overall modelling tasks. The main tasks will be carried out under the lead of Prof. Dr. Sue Grimmond, University of Reading, UK.

Here, we will study the effect of different horizontal resolutions on model results, using various ERA5 nudging data, i.e., down from approximately 300 km to 25 km. The ERA5 data is used as a meteorological constraint (nudging) to perform a numerical model study on the influence of horizontal resolution on aerosol hygroscopic growth effects on meteorology in urban and remote atmospheric locations. For this sensitivity study we only switch on/off the associated aerosol water mass. Aerosol water is crucial for climate impact and adaptation studies as it links air pollution with weather and climate through direct and indirect radiative feedbacks, see Metzger et al. (2018). We try to separate urban from continental-scale effects using the EMAC atmospheric chemistry climate and Earth system model. EMAC is applied globally in various horizontal resolutions, in a set-up similar to our previous PMAp evaluation study (https://www.eumetsat.int/PMAp), i.e., resolving weather time-scales. We compare our EMAC results of the aerosol optical depth (AOD) against CAMS reference simulations (40 km), various satellite data (MODIS-Aqua/Terra, PMAp) and AERONET surface observations (~ 30km radius around the instrument).