Applications of WRF-Chem at GeoSphere Austria

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For almost 13 years, operational air-quality forecasts have been conducted at GeoSphere Austria using the WRF-Chem model. Three different operational model settings ensure that high quality forecasts can be performed for each application and each area considered: WRF-Chem EUROPE, WRF-Chem AUSTRIA and WRF-Chem SDS-WAS. A fourth model run will be introduced into the operational system in 2023: WRF-Chem GLOBAL.

The WRF-Chem EUROPE run aims to produce air-quality forecasts for Europe with a horizontal resolution of 12x12 km and up to 72 hours into the future. Furthermore, the output of this model domain serves as a boundary condition for the WRF-Chem AUSTRIA setting. Forecasts from this model run focus on Austrian territory with a horizontal resolution of 4.5x4.5 km, covering a forecast time range of 48 hours. For forecasts of even higher resolution WRF-Chem AUSTRIA also contains a nested domain with 1.5x1.5 km horizontal resolution for Eastern Austria. These domains receive their anthropogenic emissions from global and regional CAMS emission inventories. Chemical and temporal disaggregation of emission datasets is performed with the HERMES tool (BSC). The forecasts of both model domains are evaluated operationally using the forecasts of CAMS-regional models and observations from the Austrian air-quality measurement network.

Since summer 2022, GeoSphere Austria is part of the WMO Sand and Dust Storm Warning Advisory and Assessment System (SDS-WAS). A separate model configuration was set up to fulfil the requirements of WMO (e.g. only dust emissions, regular longitude-latitude grid). The forecasts are run daily, spanning a forecast time range of 72 hours. Model performance evaluation is conducted operationally, taking into account MODIS AOD, AERONET AOD and the forecasts of other SDS-WAS models.

In 2023, a global WRF-Chem run will be operationalised, which will focus on emissions from natural sources: Dust, sea-salt and wildfires. The wildfire emissions will be obtained from the CAMS Global Fire Assimilation System (GFAS).

In order to suit different user needs, several products have been developed for the different model runs, including air quality model output statistics (MOS) or probability maps of threshold exceedances. Some of those products - together with the operational modeling systems of GeoSphere Austria - will be presented at MeteorologInnentag 2023 in Innsbruck.