Geophysical Research Abstracts
Vol. 21, EGU2019-15024, 2019
EGU General Assembly 2019

Air quality modeling with WRF-Chem v3.8.1 over the Arabian Peninsula

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Ambient air pollution is a major environmental health concern, contributing to 7.6% of all worldwide deaths in 2016, according to World Health Organization. Air quality over the Arabian Peninsula has deteriorated over the past few decades due to the natural and anthropogenic dust, sand transportation and anthropogenic chemical activities. Despite that there have been few air quality studies over Arabian Peninsula, largely as a result of limited ground measurements.
We have conducted nested simulations using WRF-Chem v3.8.1, with CBMZ gas-phase and MOSAIC-VBS aerosol mechanisms, to study summertime air pollution over Middle East, Arabian Peninsula and Northern part of Oman. The three model domains have grid spacings of 36 km, 12 km and 4 km respectively. In the absence of regional anthropogenic emission data for the region, the simulations have been performed using the global EDGAR HTAP v2 emission dataset for the year 2010, with a spatial resolution of 0.1deg x 0.1deg and a monthly seasonal variation. Biogenic and dust emissions are calculated online using Model of Emissions of Gases and Aerosol from Nature (MEGAN) and GOCART with Air Force Weather Agency (AFWA) modules respectively.
The model predicted surface meteorological parameters (temperature, relative humidity, wind speed and wind direction) have been evaluated against surface based observations from seven weather stations over the Northern part of Oman (inner domain). The preliminary results show reasonable agreement with the observations. Air quality pollutants (ozone, nitrogen dioxide, nitric oxide, sulfur dioxide, carbon monoxide and particulate matter with aerodynamic diameter smaller than 10, 5 and 1microns) have been evaluated against ship-based air quality measurements from the Air Quality and Climate Change in the Arabian Basin (AQABA) campaign, conducted during Summer 2017. Results will be presented, showing good agreement for ozone and carbon monoxide, and more variable agreement with the PM and SO_2 loadings.