Contribution ID: **130** Type: **Oral**

Non-chemistry coupled PM10 modeling in Chiang Mai City, Northern Thailand: A fast operational approach for aerosol forecasts

Thursday, 25 May 2017 13:50 (15 minutes)

An optimum cumulus parameterization scheme was determined for the Weather Research and Forecasting (WRF) model for Northern Thailand. This was then applied to model PM10 data in Chiang Mai city for 10-days during a high haze event using an updated WRF version (v. 3.7) and updated land use categories from the Moderate Resolution Imaging Spectroradiometer (MODIS). A higher resolution meteorological lateral boundary condition (from 1 degree to 0.25 degree) was also used from the NCEP GDAS/FNL Global Tropospheric Analyses and Forecast Grid system. A 3-category urban canopy model was also added and the Thompson aerosol-aware microphysics parameterization scheme was used to model the aerosol number concentrations that were later converted to PM10 concentrations. Aerosol number concentration monthly climatology was firstly used as initial and lateral boundary conditions to model PM10. However, this could not capture the variability, underestimated the high PM10 spikes and overestimated low PM10 values (R = 0.29) during the period studied when compared to surface data obtained from the Pollution Control Department (PCD). The authors then added satellite data to the aerosol climatology that improved the comparison with observations (R = 0.45). The authors then tried to use the ERA-Interim meteorological lateral boundary conditions to model the PM10. This captured the variability better (R = 0.4830) and the low PM10 concentrations. However, this setup underestimated the high PM10 spikes. In all cases, the simulations were not able to model one high PM10 spike. This is due to a local emission source that the meteorology, aerosol climatology and satellite data failed to pick up as proven by adding a hypothetical source upstream of the measurement site.

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Session Classification: A14: Environment

Track Classification: Environmental Physics, Atmospheric Physics, Geophysics and Renewable Energy