# Simulation of aerosols, cloud properties and CCN concentrations at a regional scale over China by the WRF-CMAQ model

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The impacts of aerosols on cloud and precipitation properties are one of the greatest sources of uncertainty in quantifying the anthropogenic impacts on climate change, especially over China where the heavy air pollution makes this reach acute dimensions. Understanding the poorly quantified aerosol-cloud-precipitation interactions (ACPIs) is hampered by limited capabilities of observations and models. In this work, we use the newly-developed two-way coupled WRF-CMAQ model, which includes both direct and indirect aerosol effects, to simulate aerosols, cloud properties and CCN concentrations at a regional scale over China. The anthropogenic emissions of $SO_2$, NOx, CO, NMVOC, $NH_3$, $PM_{10}$ and $PM_{2.5}$ were estimated on the basis of Emissions Database for Global Atmospheric Research. Biogenic VOC were estimated on the basis of MEGAN. We use a nested grid configuration with an outer grid encompassing the mainland China (12 km grid resolution) and the inner grid covering the Central China (4 km grid resolution) with Mt. Hua as the domain center. The cloud related microstructure properties (cloud base temperature, height, drop number concentration, updraft, CCN concentrations) and precipitation forming processes in convective cloud (height of initiation of rain, ice and glaciation temperature) retrieved on the basis of the NPP/VIIRS satellite will be used to evaluate the model peroformance. In addition, evaluations of model performance on $PM_{2.5}$, $PM_{10}$, $O_3$, $SO_2$, $NO_2$, CO, AQI and aerosol optical depth (AOD) are also carried out by comparing to satellite observation data such as MODIS and surface monitoring networks over the China. The results will shed light on the physical relationships between the various aerosols and their impacts on cloud and precipitation properties under various meteorological and topographical conditions.