

# The impacts of aerosol on precipitation in the Pearl River Delta region

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In this paper, the regional air quality model WRF/Chem (Weather Research and Forecasting Model with Chemistry) has been used to have a research on the impact of aerosol on precipitation in the Pearl River Delta region (PRD). Two numerical experiments are compared. In the base experiment, all meteorological and chemical processes of gas and particulate matter (PM) as well as the feedbacks are included. In the case experiment, PM emissions and secondary PM formation are turned off, which essentially shuts off the feedbacks between meteorology and aerosols. The result shows that: The rainfall center and precipitation in base simulation coincide with that of TRMM. Without considering the influence of aerosol, the areas of high rainfall (>30 mm) become larger, the precipitation accumulation is increased by 51 % and the start time is 4 hours earlier. Analysis of the reasons that, the reduction of aerosol decreases the cloud droplet concentration, which results in a decrease in total water condensed on the cloud droplets, the cloud liquid water content is reduced by 93.7 %. But the amount of water that condensed on a single cloud droplet rises, the cloud droplet effective radius increases by 62.5 %, leading to the increase of effective coagulation between cloud droplets, and promote the formation of raindrops, thus raise precipitation. The reason for the early rainfall is mainly due to the reduction of aerosol, which will accelerate the water vapor adhesion and shorten the time of cloud droplet formation. Through the vertical distribution of cloud liquid water content, the loss of aerosol causes the high value of cloud water to occur 4 hours in advance. Combined with the vertical velocity distribution at the corresponding time, the aerosol decreases and vertical convection enhances in 1000-850 hPa. In the early stage of the precipitation, the decrease of aerosol will increase the solar radiation to the surface, thus the surface temperature increases, which makes the regional convection strengthen and the precipitation is ahead of time.

Key words: Aerosol, Precipitation, Pearl River Delta, WRF/Chem