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The size resolved cloud condensation nuclei (CCN) activity and its prediction based on aerosol hygroscopicity and composition in the Pearl Delta River (PRD) Region during wintertime 2014

Mingfu Cai (1,2), Haobo Tan (2), Chak K. Chan (3,4), Misha I. Schurman (3), Hanbing Xu (1), Fei Li (2), Yiming Qin (3), Liu Li (1,2), and Jun Zhao (1)

(1) School of Atmospheric Sciences, Guangdong Province Key Laboratory for Climate Change and Natural Disaster Studies, and Institute of Earth Climate and Environment System, Sun Yat-sen University, Guangzhou, China, (2) Institute of Tropical and Marine Meteorology, Guangdong Provincial Key Laboratory of Regional Numerical Weather Prediction, CMA, Guangzhou , China, (3) Hong Kong University of Science and Technology, Hong Kong, China, (4) School of Energy and Environment, City University of Hong Kong, Hong Kong, China

Aerosol particles can indirectly exert climatic forcing on the Earth's atmosphere by acting as cloud condensation nuclei (CCN) which influence cloud formation, life time and optical properties. It is hence important to measure chemical composition and properties of aerosol particles in order to assess their abilities of acting as CCN and contribution to the cloud formation. In this study, a suite of advanced instruments including a hygroscopicity-tandem differential mobility analyzer (H-TDMA), a scanning mobility CCN analyzer (SMCA) and an aerodyne high resolution time-of-flight aerosol mass spectrometer (HR-ToF-AMS) were used to measure the hygroscopicity, activation, and chemical composition of aerosol particles at the Panyu site in the Pearl River Region during wintertime 2014. The results showed that the hygroscopicity parameter (κHTDMA) based on the H-TDMA measurements was slightly smaller than the one (κCCN) based on CCNc measurements at all the selected diameters (40, 80, 110, 150, and 200 nm) . For particles larger than 100 nm, the κ value based on the AMS measurements (κAMS) was significantly smaller than the others, which could be attributed to the underestimated hygroscopicity of the organics matters (κorg). The activation ratio (AR) calculated from growth factor-probability density function (Gf-PDF) without surface tension correction was lower than that from the H-TDMA measurements, due probably to the employed surface tension (σs/a) that did not consider the organic surfactant effects. We showed that better agreement between the calculated and measured AR could be obtained by adjusting σs/a value.
We also showed that the NCCN can be predicted with different schemes based on H-TDMA and AMS measurements and details of the comparison will be discussed in the presentation.