The role of NOx in the formation of highly oxygenated organic molecules and new particles

*Wei Nie[1], Chao Yan[2], Pontus Roldin[3], Mikael Ehn[2], Aijun Ding[1]

1. Joint International Research Laboratory of Atmospheric and Earth System Sciences, School of Atmospheric Sciences, Nanjing University, 2. Institute for Atmospheric and Earth System Research/Physics, Faculty of Science, University of Helsinki, 3. Division of Nuclear Physics, Department of Physics, Lund University

NOx is abundantly distributed in the present-day atmosphere and has been demonstrated to participate in the troposphere chemistry prevalently, including the formation of highly oxygenated organic molecules (HOMs), who have been demonstrated to be key precursors in new particle formation and growth (NPF). Here, with CERN CLOUD chamber facility, we investigated the complicated roles of NO_x in the formation of HOMs from the oxidation of monoterpenes, and in turn the new particle formation and growth. We find that NOx influences the HOM formation deeply and nonlinearly via forming a large amount of organonitrate and suppressing the HOM dimer formation. In addition, we showed that NO_x suppresses particle growth in general, but the suppression is rather non-uniform and size-dependent, which can be quantitatively explained by the shifted HOM volatility after adding NO_x. By illustrating how NO_x affects the early growth of new particles - a critical step of CCN formation, our results help to provide a refined assessment of the potential climatic effects caused by the diverse changes of NO_x level in forest regions around the globe.

Keywords: highly oxygenated organic molecules, new particle formation and growth, NOx

