Séminaire vendredi le 26 janvier 2018 11:00 / Seminar Friday Jan 26th 2018 11:00h

Sujet/Subject:

1- Linking Plume-Scale Processes to Global Aerosols and Climate: Parameterization of Aerosol Formation and Growth in Coal-Fired Power-Plant Plumes
2- A Model Intercomparison of CCN-Limited Tenuous Clouds in the High Arctic

Langue/language : Anglais/English

Conférenciers/Lecturers: Robin Stevens (ARQI, Dorval)

Résumé/Abstract:

1. Linking Plume-Scale Processes to Global Aerosols and Climate: Parameterization of Aerosol Formation and Growth in Coal-Fired Power-Plant Plumes

New-particle formation in the plumes of coal-fired power plants and other anthropogenic sulphur sources may be an important source of particles in the atmosphere. It has been unclear, however, how best to reproduce this formation in global and regional aerosol models with grid-box lengths that are tens of kilometers and larger. The predictive power of these models has thus been limited by the resultant uncertainties in aerosol size distributions. Based on the results of a Large-Eddy Simulation (LES) model with detailed aerosol microphysics, we developed the Predicting Particles Produced in Power-Plant Plumes (P6) parameterization: a computationally-efficient, but physically-based, parameterization that predicts the characteristics of aerosol formed within sulphur-rich plumes based on parameters commonly available in global and regional aerosol models. We implement the P6 parameterization in a global chemical-transport model in order to evaluate the contribution of coal-fired power plants globally to particle number and cloud condensation nuclei (CCN) concentrations. We find that sub-grid scale new particle formation is sensitive to pre-existing aerosol condensation sink. For constant SO2 emissions, fewer new particles are formed in more polluted regions.

2. A Model Intercomparison of CCN-Limited Tenuous Clouds in the High Arctic

We perform a model intercomparison of summertime high Arctic (> 80 N) clouds

observed during the 2008 Arctic Summer Cloud Ocean Study (ASCOS) campaign, when observed CCN concentrations fell below 1 cm−3. Previous analyses have suggested that at these low CCN concentrations the liquid water content (LWC) and radiative properties of the clouds are determined primarily by the CCN concentrations, conditions that have previously been referred to as the tenuous cloud regime. The intercomparison includes results from three LES models and three numerical weather prediction (NWP) models. We test the sensitivities of the model results to different treatments of cloud droplet activation, including prescribed cloud droplet number concentrations (CDNC) and diagnostic CCN activation based on prognostic aerosol concentrations with in-cloud processing. The results strongly support the hypothesis that the liquid water content of these clouds is CCN-limited, but the sensitivity of the clouds to changes in CCN is strongly model-dependent.