Geophysical Research Abstracts
Vol. 21, EGU2019-14102, 2019
EGU General Assembly 2019

Implementation of a sectional scheme for early growth of aerosols in NorESM

Sara Marie Blichner (1), Moa Sporre (1,2), Risto Makkonen (3,4), Terje K. Berntsen (1,5)

(1) Department of Geosciences, University of Oslo, Oslo, Norway, (2) Department of Physics, Lund University, Lund, Sweden, (3) Institute for Atmospheric and Earth System Research / Physics, Faculty of Science, University of Helsinki, Finland, (4) Climate System Research, Finnish Meteorological Institute, Helsinki, Finland, (5) CICERO Center for International Climate Research, Oslo, Norway

Cloud-aerosol interactions are responsible for much of the uncertainty in climate forcing, estimation of climate sensitivity and future climate projections. As much as 70% of the cloud condensation nuclei could be due to secondary particles from new particle formation. However, the modelling of growth from new particle formation through early growth to CCN sizes in global models is intrinsically difficult, both because of uncertainly about species involved, but also due to the fine scale and high sensitivity to coagulation. A common approach in global models is to use modal schemes to parameterize the size distribution of aerosols, while sectional schemes are in general considered closer to first principles because they do not make an a priori assumption about the size distribution.

In order to better capture dynamics of early growth, we implement a sectional scheme for the smallest particles (5-25 nm) in the Norwegian Earth System Model (NorESM), feeding particles into the original modal scheme. The motivation is: (1) Including a sectional scheme for the smallest sizes gives added precision to the early growth while computational cost is limited due to the limited number of condensing species involved in the model (currently H_2SO_4 and low volatile organics), (2) In the current version of NorESM, the growth from 3-25 nm is parameterized by the survival rates of particles based on the ratio between growth rate and coagulation sink [Lehtinen 2007] and thus does not include potential dynamics within this size range (e.g. competition for condensing vapours and growth of particles over more than one time step). A sectional scheme within this range represents a good alternative to a nucleation mode which is known to have problems with growing particles to larger sizes because newly formed particles will decrease the mean radius of the particles.
We present preliminary results and comparisons to observations.

References

[Lehtinen 2007] Lehtinen, K. E. J., M. D. Maso, M. Kulmala, and V.-M. Kerminen (2007). “Estimating Nucleation Rates from Apparent Particle Formation Rates and Vice Versa: Revised Formulation of the Kerminen–Kulmala Equation.” Journal of Aerosol Science. https://doi.org/10.1016/j.jaerosci.2007.06.009.