

Combination of aerosol sectional scheme and modal scheme in the Norwegian Earth System Model (NorESM)

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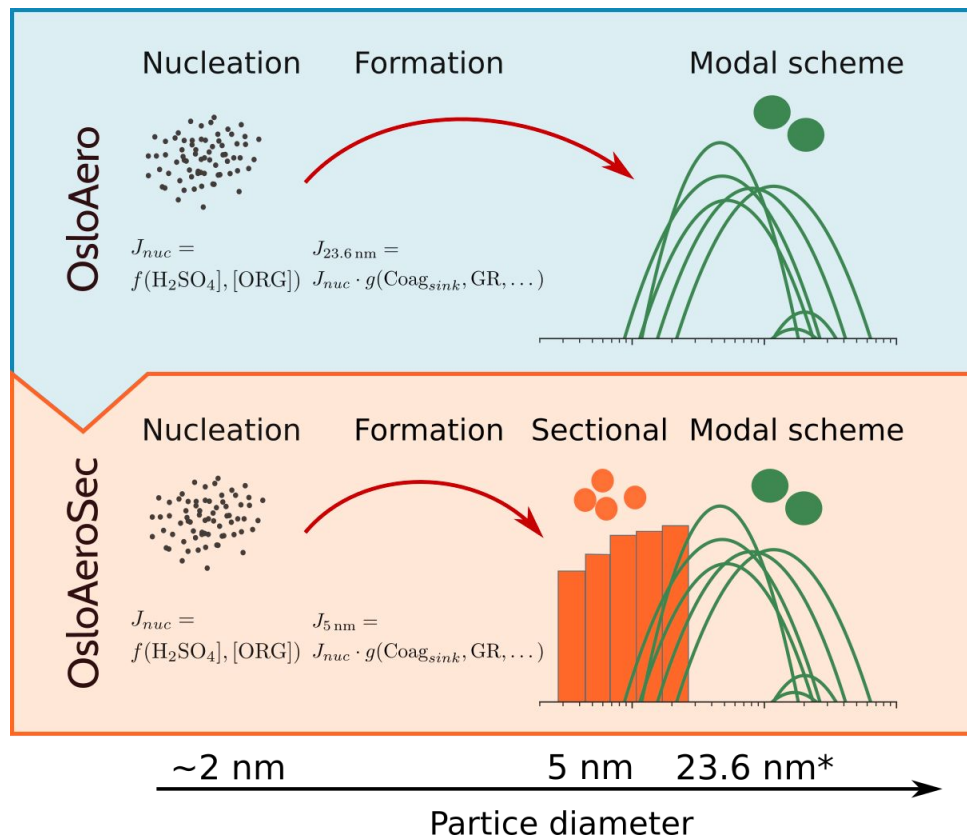
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What's new in OsloAeroSec

To better capture the dynamics of early growth in the Norwegian Earth System Model (NorESM), we have implemented a sectional scheme for the smallest particles (currently 5 - 39 nm), which proceeds to feed particles into the original modal scheme (Kirkevåg *et al*, 2018) after growth.

Two tracers (low volatile organics and sulphuric acid) currently contribute to growth in the sectional scheme and there are 5 bins

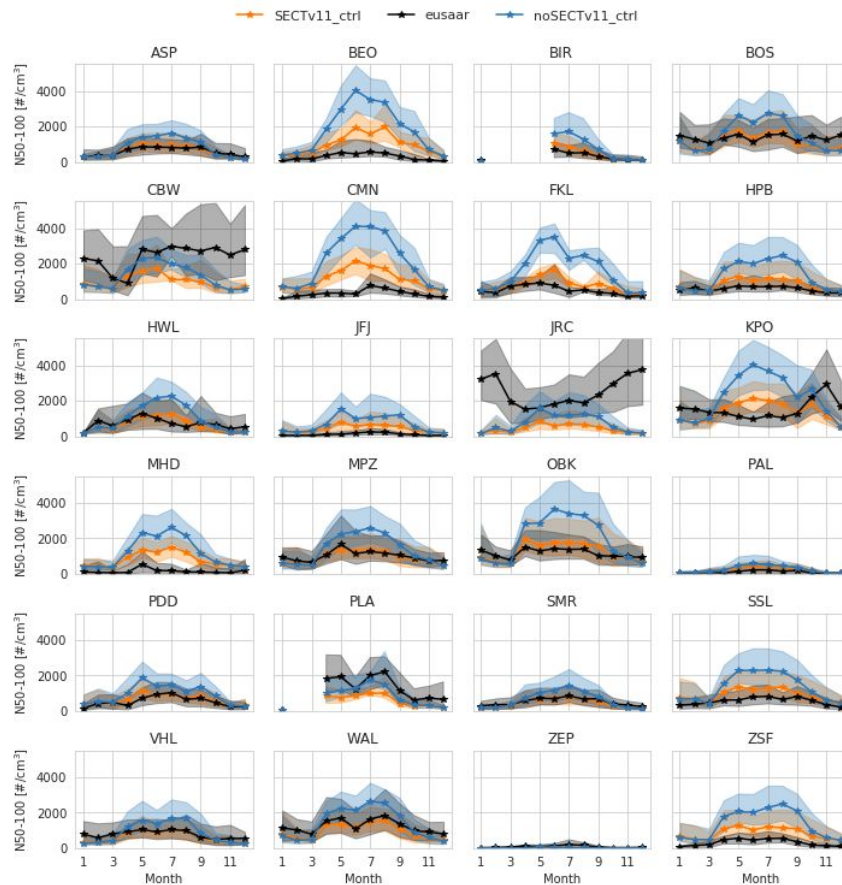


Motivation

1. In the original scheme in NorESM, newly formed particles are added to the smallest mode which has a number median diameter of 23.6 nm. The survival of particles from NPF (formed at ~4 nm diameter) to this mode is calculated based on Lehtinen *et al* (2007). Thus it does not take into account dynamics within this size range, i.e. competition for condensing vapours and growth of particles over more than one time step.
2. Including a sectional scheme in this range adds precision for this crucial stage of growth while keeping the computational cost low due to the limited number of species involved (currently 2 in the model).
3. A sectional scheme within this size range is an interesting alternative to a nucleation mode, which is known to have problems with moving particles to larger sizes at the same time as adding newly formed particles.

Comparison to observations

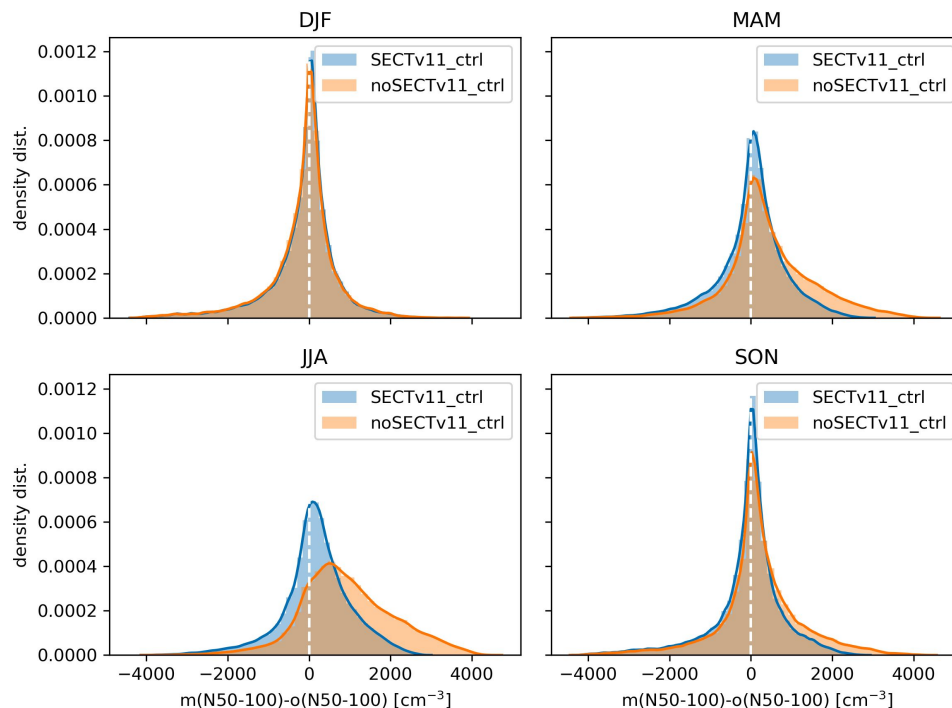
Comparing to the number concentrations from 24 stations in Europe from Asmi et al 2011 show improved precision



N50-100 monthly median at each station from either modelled values (OsloAeroSec, SECTv11_ctrl, Original scheme, noSECTv11_ctrl) or observations (eusaar)

Comparison to observations

Comparing to the number concentrations from 24 stations in Europe from Asmi et al 2011 show improved precision



Seasonal distribution of modelled N50-100 with the original scheme (noSECTv11_ctrl) and OsloAeroSec (SECTv11_ctrl) minus observed N30-100 for all EUSAAR stations with hourly mean values for both modelled and station.