

# Resuspension of Aerosol Particles from Evaporated Rain Drops to the Coarse Mode

Objective: to improve the representation of cloud processing, aerosol spatial distributions, and impact of aerosols on clouds and radiation in the ACME model

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Collaborators: the ACME Atmosphere Team

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Challenges or needed resources/collaborators: In situ measurements of aerosol particle size distributions and chemical composition before, after and during rain events; the low number of particles in the coarse mode may cause large statistical fluctuations.

Summary of progress: a new treatment based on the assumption that one particle, an internal mixture of all aerosol materials, is regenerated for every evaporated drop was implemented to the Modal Aerosol Module in ACME, and initial results show that it can significantly reduce CCN number and impact cloud properties and radiation.

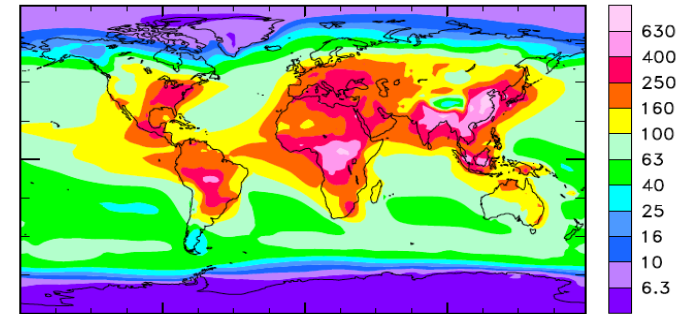
# Impact of the new treatment on global aerosols, CCN, and clouds

	Old	New	No
<b>CCN (cm<sup>-3</sup>)</b>	100	75	75
<b>AOD</b>	0.162	0.122	0.118
<b>AOD<sub>accu</sub></b>	0.088	0.061	0.061
<b>AOD<sub>coar</sub></b>	0.073	0.061	0.057
<b>A-AOD</b>	7.7e-3	6.2e-3	5.7e-3

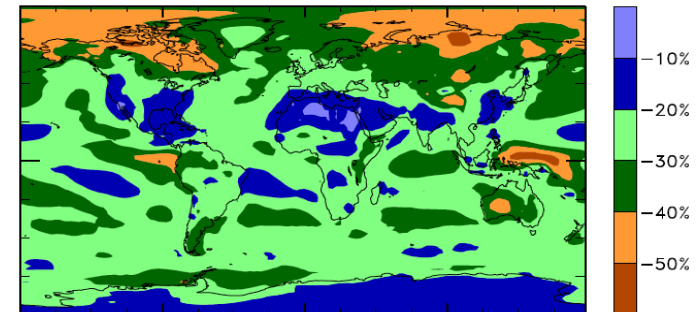
  

<b>C-CDNC (m<sup>-2</sup>)</b>	1.82e10	1.34e10	1.36e10
<b>LWP (g m<sup>-2</sup>)</b>	51.1	45.9	45.8
<b>SWCF (W m<sup>-2</sup>)</b>	-57.2	-55.2	-55.2

CCN (cm<sup>-3</sup>) at 0.1% S and ~500 m AGL from Old Method



Relative Difference:  $(\text{CCN}_{\text{NEW}}/\text{CCN}_{\text{OLD}} - 1) \times 100$



- Burden of all types of fine-mode aerosol species is largely reduced (~30%)
- The larger size of resuspended particles (7.2 μm vs. 3.1 μm emitted coarse mode) makes them shorter lived, and thus the original coarse-mode dust and sea salt are significantly reduced (~10%)
- The released aerosol material has a shorter lifetime, leading to a 20% reduction in sulfate, BC, POA and SOA burdens and AOD globally
- The released particle number is much less, leading to a 25% reduction in CCN and cloud drop number concentrations globally
- Global mean cloud drop number concentration has a 25% reduction; LWP decreases by 5 g/m<sup>2</sup> (10%), and shortwave cloud forcing (SWCF) is reduced by 2 W/m<sup>2</sup>.

Easter et al., in preparation