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Drizzling Marine Stratiform Clouds in the ECHAM5-HAM

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Marine stratus and stratocumulus cover vast parts of the global oceans and have a substantial role in the Earth's radiative budget, inducing a net cooling. Although they only produce small amounts of precipitation, drizzle has been recognized to have an important impact on both cloud dynamics and microphysics [1]. The formation of drizzle is highly dependent on the onset of the collision-coalescence process, which requires that droplets above some critical size are formed. The mechanisms leading to these large enough droplets have been perceived to be related to the concentration of cloud condensation nuclei (CCN) [2] and/or turbulence, but they are still very uncertain. To achieve a more physical representation of the droplet spectrum, thereby maybe improving the possible microphysical, dynamical or thermodynamical mechanisms responsible for the production of large drops, an additional drizzle drop class will be added to the already existing classes of cloud liquid water and rain in the ECHAM5-HAM. The introduction of a drizzle class with radii between 25-100 μm and having non-negligible fall velocities is motivated by several more points:

- The representation of giant CCN (GCCN; e.g. sea salt aerosols $\geq$ 5 μm) induced drizzle can be improved, as GCCN can serve as a direct source for drizzle drops (cf. [3]).
- The often observed bimodal structure of the cloud droplet size distribution is better represented when accounting for drizzle [4].
- As the collision-coalescence mechanism will be enhanced in the presence of drizzle, this might initiate dynamical responses, e.g. open and closed cells [5].

The introduction of the drizzle drop class implies deriving new parameterizations for the micro-physical processes (self-collection, autoconversion and accretion). Following Seifert and Beheng [6] this is done by solving the stochastic collection equation for truncated moments for the three liquid water classes. Results from the new scheme using three liquid water classes and the new parameterization in ECHAM5-HAM will be presented, which comprise especially the influence on cloud properties, the hydrological cycle and possibly the radiative budget.

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