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Idealized marine cloud brightening experiments G4cdnc from the geoengineering model intercomparison project GeoMIP

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Climate engineering could be considered as part of a response portfolio to contribute to reach such ambitious climate targets as those set by the Paris Agreement. Marine cloud brightening (MCB) is one of these techniques, which falls into the category of solar radiation management, or albedo modification, and aims to cool the climate by increasing the amount of solar radiation reflected by clouds. Existing model assessments of MCB have very different experimental set-ups, making comparison difficult. Therefore, the experiment G4cdnc was designed, in which several Earth system models performed the same perturbation of cloud properties, to assess the climate impacts. The G4cdnc experiment starts in year 2020 in the RCP4.5 scenario and dictates a 50% increase in cloud droplet number concentrations of low level clouds over global oceans for a duration of 50 years.
Many of the models significantly underestimate low level cloud amounts; nevertheless, all the models simulate a cooling effect from MCB. The resulting net radiative forcing is of -1.8 Wm$\hat{}$-2 in the ensemble mean with large inter-model spread. The ensemble mean global cooling achieved is of -0.95 K with a particularly strong cooling over low latitude land masses. There is a global precipitation decrease of -0.08 mm/day due to a cooler climate, but in low latitudes there is a 0.03 mm/day increase over land from circulation changes. Inter-model differences can be partly explained by different cloud susceptibilities, but more studies are needed to fully understand the mechanisms involved.