Geophysical Research Abstracts
Vol. 14, EGU2012-5436, 2012
EGU General Assembly 2012

Exploring efficiency of sea spray geo-engineering

K. Pringle (1), K Carslaw (1), T. Fan (1), G Mann (1), A Hill (2), P Stier (3), and K. Zhang (4)

(1) Insitute for Climate and Atmospheric Science, University of Leeds, UK (kirsty@env.leeds.ac.uk), (2) UK Met Office, Exeter, UK (adrian.hill@metoffice.gov.uk), (3) Atmospheric, Oceanic and Planetary Physics, University of Oxford, UK (philip.stier@physics.ox.ac.uk), (4) Pacific Northwest National Laboratory, Washington, United States (kai.zhang@pnnl.gov)

Artificially increasing the albedo of marine clouds by the mechanical emission of sea spray has been proposed as a possible geoengineering technique to slow the warming attributed to anthropogenic greenhouse gases. For the injected sea spray to cause a net cooling, the additional aerosol must result in an increase in cloud droplet number. In this study we use a physically based parameterisation of aerosol activation to quantify cloud drop number (CDN) changes over the entire parameter space of updraft speed and properties of the injected and background aerosol.

We suggest criteria for when geoengineering may be an effective strategy and also identify conditions where additional aerosol will have a negligible effect or act to decrease CDN. Undesirable decreases in CDN occur when particles are injected into clouds in environments where the number concentration of background accumulation mode aerosol is > 200 cm−3. The effect is particularly strong when (i) the in-cloud updraft velocity is low (< 0.2 ms-1); and (ii) the number concentration of the additional aerosol is low (< 200 cm−3). A large increase in CDN is achieved when the converse it true. After using the box model data to identify optimum conditions, we then assess the potential of sea spray geo-engineering on a global scale. Global fields of aerosol number, natural and geo-engineered CDN (derived in an idealised framework) from three aerosol models are presented. We find that there is considerable diversity in the calculated efficiency of geo-engineering between the three models which arises from the diversity in the simulated background aerosol distribution.