Geophysical Research Abstracts
Vol. 13, EGU2011-10794, 2011
EGU General Assembly 2011

The climate impact of biofuels in shipping: global model studies of the aerosol indirect effect

Mattia Righi (1), Carolin Klinger (1), Veronika Eyring (1), Johannes Hendricks (1), Axel Lauer (2), and Andreas Petzold (1)

(1) DLR Institut für Physik der Atmosphäre, Oberpfaffenhofen, Germany, (2) International Pacific Research Center, University of Hawaii, Honolulu, USA

Aerosol emissions from international shipping are recognized to have a large impact on the Earth's radiation budget, directly by scattering and absorbing solar radiation and indirectly by altering cloud properties. New regulations have recently been proposed by the International Maritime Organization (IMO) aiming at progressive reductions of the maximum sulfur content allowed in marine fuels from current 4.5% by mass down to 0.5% in 2020, with more restrictive limits already applied in some coastal regions. In this context, we use a global bottom-up algorithm to calculate geographically resolved emission inventories of gaseous (NO_x, CO, SO_2) and aerosol (black carbon, organic matter, sulfate) species for different kinds of low-sulfur fuels in shipping. We apply these inventories to study the resulting changes in radiative forcing, attributed to particles from shipping, with the global aerosol-climate model EMAC-MADE. The emission factors for the different fuels are based on measurements at a test bed of a large diesel engine. We consider both fossil fuel (marine gas oil) and biofuels (palm and soy bean oil) as a substitute for heavy fuel oil in the current (2006) fleet and compare their climate impact to that resulting from heavy fuel oil use. Our simulations suggest that ship-induced surface level concentrations of sulfate aerosol are strongly reduced, up to about 40-60% in the high-traffic regions. This clearly has positive consequences for pollution reduction in the vicinity of major harbors. Additionally, such reductions in the aerosol loading lead to a decrease of a factor of 3-4 in the indirect global aerosol effect induced by emissions from international shipping.