Geophysical Research Abstracts
Vol. 20, EGU2018-9739, 2018
EGU General Assembly 2018

Strong control of Southern Ocean cloud reflectivity by ice-nucleating particles

Jesús Vergara Temprado (1), Annette Miltenberger (1), Kalli Furtado (2), Daniel Grosvenor (1), Ben Shipway (2), Adrian Hill (2), Jonathan Wilkinson (2), Paul Field (1,2), Benjamin Murray (1), and Ken Carslaw (1)

(1) University of Leeds, Leeds, United Kingdom (eejvt@leeds.ac.uk), (2) MetOffice

Large biases in climate model simulations of cloud radiative properties over the Southern Ocean cause large errors in modelled sea-surface temperatures and atmospheric circulation and climate sensitivity. Here we combine cloud-resolving model simulations with new estimates of the concentration of ice-nucleating particles in this region to show that our simulated Southern Ocean clouds reflect far more radiation than predicted by global models, in agreement with satellite observations. Specifically, we show that the clouds which are most sensitive to the concentration of ice-nucleating particles are low-level mixed-phase clouds in the cold sectors of extra-tropical cyclones, which have previously been identified as a main contributor to the Southern Ocean radiation bias. The very low ice-nucleating particle concentrations that prevail over the Southern Ocean strongly suppress cloud droplet freezing, reduce precipitation and enhance cloud reflectivity. The results help explain why a strong radiation bias occurs mainly in this remote region away from major sources of ice-nucleating particles. The results present a substantial challenge to climate models to be able to simulate realistic ice-nucleating particle concentrations and their effects under specific meteorological conditions.