Geophysical Research Abstracts
Vol. 18, EGU2016-7711, 2016
EGU General Assembly 2016

Including latent and sensible heat fluxes from sea spray in global weather and climate models

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Most standard weather and climate models calculate interfacial latent (evaporation) and sensible heat fluxes over the ocean based on parameterisations of atmospheric turbulence, using the wave state only in the calculation of surface roughness length. They ignore latent and sensible heat fluxes generated by sea spray, which is an acceptable assumption at low wind speeds. However at high wind speeds (> 15 m/s) a significant amount of sea spray is generated from the sea surface which, while airborne, cools to an equilibrium temperature, absorbs heat and releases moisture before re-impacting the sea surface. This could impact, for example, the total heat loss from the Southern Ocean (which is anomalously warm in Met Office coupled models) or the accuracy of tropical cyclone forecasts.

A modified version of the Fairall sea spray parameterisation scheme has been tested in the Met Office Unified Model including the JULES surface exchange model in both climate and NWP mode. The fast part of the scheme models the temperature change of the droplets to an equilibrium temperature and the slow part of the scheme models the evaporation and heat absorption while the droplets remain airborne. Including this scheme in the model cools and moistens the near surface layers of the atmosphere during high wind events, including tropical cyclones. Sea spray goes on to increase the convection intensity and precipitation near the high wind events in the model.