

Detectability of fast cloud adjustments in large-scale high-resolution simulations

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Cloud adjustments to anthropogenic aerosol perturbations remain an important source of uncertainties on current radiative forcing estimates. Their detectability from space-borne observations is particularly difficult due to our lack of precise understanding of processes leading to these adjustment. In particular, large uncertainties on current satellite products and the difficulty to disentangle adjustments from aerosol-meteorological co-variability make the understanding of cloud adjustments from satellite alone challenging.

This study aims at better identifying, quantifying and understanding fast cloud adjustments through sensitivity studies based on large-scale large-eddy modelling. Realistic simulations were carried using the ICON (Icosahedral Nonhydrostatic) model over a domain larger than Germany with a spatial resolution of 156-m. Simulations using aerosol concentrations representative of 2013 and 1985 (i.e. peak of pollution in Europe) are compared to assess the expected cloud response between these two pollution levels.

Preliminary analyses show distinct responses of cloud properties to this perturbation over the entire domain that differ for micro- and macrophysical quantities. The resulting cloud radiative forcing also is investigated and put in the context of current estimates based on GCM studies. Comparisons to NWP simulations are analyzed to quantify the added-value from high-resolution assessments. Finally, the detectability of the identified adjustment from satellite and ground-base observations is discussed.

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