Increasing resolution and resolving convection improves the simulation of cloud-radiative effects over the North Atlantic

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Numerical experiments were carried out using the ICON model with varying grid spacings between 2.5 and 80 km and with different subgrid-scale parameterization approaches. Simulations have been performed over the North Atlantic with either one-moment or two-moment microphysics and with convection being parameterized or explicitly resolved by grid-scale dynamics. Simulated cloud-radiative effects are compared to products derived from Meteosat measurements. Furthermore, a sophisticated cloud classification algorithm is applied for a decomposition of cloud-radiative effects. It is found that flux biases originate equally from clearsky and cloudy parts of the radiation field. Simulated cloud amounts and cloud-radiative effects are dominated by marine, shallow clouds, and their behaviour is highly resolution dependent. Bias compensation between shortwave and longwave flux biases, seen in the coarser simulations, is significantly diminished for higher resolutions.