

Addressing radiation and cloud uncertainties with the new radiation scheme ecRad in ICON

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Cloud-radiation interactions strongly impact atmospheric energy and water balance, but are challenging to capture for radiation schemes in global weather and climate models, due to cloud complexity on sub-grid scales. Simplifying assumptions are used to parametrise cloud geometry and cloud particle size, shape and scattering functions. These assumptions introduce uncertainties in cloud-radiation interaction and the climatic role of clouds.

The new modular radiation scheme ecRad significantly improves global radiation, clouds and energy balance in ICON, and also allows us to vary the parametrisations, providing a choice of solver, cloud ice and water optical properties, vertical overlap and horizontal inhomogeneity treatment. We analyse the uncertainty and impact of these radiation parametrisations and cloud parametrisations in ICON and evaluate against exact radiation models and various satellite observations, guiding improvement in the representation of clouds and radiation.