

Improvements in ICON with ecRad radiation scheme and plans for ecRad in Météo-France models

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Radiation in the atmosphere provides the energy that drives atmospheric dynamics and physics on all scales, from cloud particle growth to global weather and climate. Radiation schemes in global weather and climate models have to simplify the complex interaction of radiation with the Earth system. Capturing the interactions of gases and clouds with radiation is particularly challenging, since gas effects are extremely wavelength-dependent, while clouds vary strongly on small spatial and temporal scales, and they both interact strongly with radiation. Uncertainties in the radiation scheme and the cloud, aerosol and gas and inputs lead to uncertainties in weather and climate processes, such as energy balance, cloud development and dynamics.

The radiation scheme ecRad has been operational in the IFS model at ECMWF since July 2017 and in ICON at Deutscher Wetterdienst (DWD) since April 2021 and will be the next radiation scheme in AROME, ARPEGE and MésoNH at Météo-France. As a modular scheme, ecRad provides the opportunity to vary parametrisations and assumptions individually. Several options are available for the radiation solver, cloud vertical overlap and horizontal inhomogeneity treatment and cloud hydrometeor optical property parametrisations. The solver SPARTACUS is the only radiation solver in a global model that can treat 3D radiative effects. The new gas optics model ecCKD can improve both precision and cost of the gas optics calculation.

We evaluate radiation, energy balance, weather and climate and clouds against observations on local to global scales in the ICON model with ecRad and investigate the sensitivity of results to gas and cloud parametrisations in ecRad and to cloud properties and interactions. This allows us to build on the improvements in local and global radiation balance already seen due to the ecRad radiation scheme, and further improve model energy and physics and forecast performance.

Finally, I will give an outline of the status and future plans of radiation work in th Météo-France models.

References:

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