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Radiation sensitivity tests of the HARMONIE 37h1 NWP model

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Abstract. When short-wave (SW) radiation fluxes modelled with a numerical weather prediction (NWP) model or climate model do not match observed SW fluxes it can be challenging to find the cause of the differences. Several elements in the model affect SW fluxes. This necessitates individual testing of each of the physical processes in the NWP model. Here we present a focused study of the SW radiation schemes in the HIRLAM (High Resolution Limited Area Model) Aladin Regional Mesoscale Operational NWP In Europe (HARMONIE) model, which is the primary NWP model used and developed by several National Weather Services in Europe. Detailed calculations have been made with the DISORT model run in the libRadtran framework, which is a collection of state-of-the-art radiative transfer software and data sets. These are used to test the NWP radiation calculations. Both models are given the same atmospheric properties as input. We also perform a separate test of cloud liquid optical property parameterisations with Mie calculations. This leads us to introduce a new parameterisation for calculating these properties. In addition, we show that the results of a simpler radiation scheme, introduced into HARMONIE, compare well with those of the comprehensive default parameterisations. The methodology applied here may be used for testing radiation schemes in other NWP or climate models.

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