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A new parameterization of ice cloud optical properties for NWP models: application to the Limited Area Model Lokal-Modell

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A new parameterization for cold clouds is developed and implemented into the Limited Area Model Lokal-Modell (LM). LM is currently the operational forecast model used by the Consortium for Small Scale Modelling (COSMO).

Short- and long-wave broad-band optical properties of ice clouds are investigated with the aid of LbL multiple scattering computations, in order to retrieve a more accurate parameterization suitable for LAMs.

Single-scattering properties of cirrus clouds depend not only on the ice water content (IWC) and the crystals' size, but also on the crystal shape. The new parameterization accounts for the ice habits combining optical properties of 4 ice crystal shapes. The amount of habit type on every size bin is retrieved from recent in situ measurements.

Since most of the global circulation models (GCMs) or limited area models for numeric weather predictions (NWP-LAMs) do not provide any information about ice crystal's size, the effective dimension (De) has been parametrized as function of temperature and ice content only whereas bulk radiative properties are derived as a function of De.

Preliminary comparisons between the two-stream broad-band radiation scheme of LM and an accurate Line-by-Line (LbL) multiple scattering model (RTX), have been set up in order to test the operational LM cloud-radiation scheme quality. Results show an overall agreement between the two models in clear sky conditions.

Extended experiments will be performed in order to test the new parameterizations in the operational forecast model of the German meteorological office (DWD). The model sensitivity to cloud optical parameterizations changes will be explored considering various synoptic meteorological patterns over the operational grid area of LM.