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Intercomparsion of three microwave/infrared high resolution line-by-line radiative transfer codes

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Line-by-line (Lbl) modeling of atmospheric radiative transfer is essential for the analysis of a growing number of high resolution infrared and microwave remote sensing instruments. Because the quality of the retrieval products critically depends on the accuracy of the radiative transfer codes used as forward model in the inversion process, verification and validation of these codes is crucial, and accordingly several code intercomparisons have been performed. In this contribution we present an intercomparison of three Lbl codes developed independently for atmospheric sounding.

ARTS — the Atmospheric Radiative Transfer Simulator is a public domain project initiated and developed jointly by the University of Bremen and Chalmers University, Gothenburg that originally focused on microwave applications with uplooking, downlooking and limb viewing instruments.
GARLIC — the Generic Atmospheric Radiation Line-by-line Infrared Code (a Fortran 2003 reimplementation of the Fortran 77 code MIRART) has been designed for far and mir IR applications, arbitrary observation geometries, instrumental field of view (FOV) and spectral response functions.
KOPRA — the Karlsruhe Optimized and Precise Radiative Transfer Model is a Lbl, layer-by-layer model for forward calculation of infrared atmospheric transmittance and radiance spectra for various geometries and was specifically developed for the analysis of MIPAS mid infrared limb emission sounder data.
ARTS – MIRART and KOPRA – MIRART intercomparisons (including some other models) have already been performed in the context of the "Third International Radiative Transfer Modeling Workshop" and the AMIL2DA project, respectively.

In this intercomparison we consider a thermal infrared nadir sounding application. In particular we use a HIRS (High resolution Infrared Radiation Sounder) setup and compute radiances for the HIRS infrared channels and a group of 42 atmospheric profiles (the "Garand dataset", comprising pressure, temperature, water vapor, carbon dioxide, ozone etc.) representative of most meteorological situations. Results of this intercomparison, lessons learned and potential future extensions will be presented.