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An infrared radiative transfer parameterization for a Venus General Circulation Model

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A new 3-dimensional General Circulation Model (GCM) of Venus' atmosphere is currently being developped at the Laboratoire de Météorologie Dynamique, in the context of the Venus-Express mission. Special attention was devoted to the parameterization of infrared radiative transfer: this parameterization has to be both very fast and sufficiently accurate in order to provide valid results over extented periods of time.

We have developped at the Laboratoire d'Energtique a Monte-Carlo code for computing reference radiative transfer results for optically thick inhomogeneous scattering planetary atmospheres over the IR spectrum. This code (named KARINE) is based on a Net-Exchange Rates formulation, and uses a k-distribution spectral model. The Venus spectral data, that was compiled at the Southwest Research Institude, accounts for gaseous absorption and scattering, typical clouds absorption and scattering, as well as CO2 and H2O absorption continuums.

We will present the Net-Exchange Rates matrix that was computed using the Monte-Carlo approach. We will also show how this matrix has been used in order to produce a first-order radiative transfer parameterization that is used in the LMD Venus GCM. In addition, we will present how the proposed radiative transfer model was used in a simple convective-radiative equilibrium model in order to reproduce the main features of Venus' temperature profile.