Improved Version of the Roldan et al's Non-Local Thermodynamic Equilibrium Model for the Infrared Emissions in the Atmosphere of Venus

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Roldan et al. (2000) described a state of the art non-local thermodynamic equilibrium model for the calculation of the vibrational populations of CO$_2$ and the cooling and heating rates in the atmosphere of Venus. This is currently the most comprehensive and sophisticated model up to date for the study of the CO$_2$ infrared emissions and the radiative equilibrium temperature in the atmosphere of Venus. It allows the calculation of the populations of 68 vibrational levels of the 4 major isotopes of CO$_2$ and the cooling and heating rates of 100 transitions. In spite of its unique capabilities this model has been abandoned several years. Here we present an update of the code with an improved treatment of the physics of the problem (including more accurate radiative transfer and line mixing calculations and aerosol treatment) and state-of-the-art line spectroscopic parameters. This new model also includes the calculation of the near-infrared emissions from the O$_2$ electronic states. Two versions of the model (in Fortran 77 and Fortran 90) are now available. The modular structure of the Fortran 90 code allows for an easy adaptation to any General Circulation Model of the Venus atmosphere or planetary mission retrieval processor. In this paper we present the new capabilities and features of the model and their impacts in the calculations.

References: