"Super-Venus": a 1D radiative-convective model of primitive Earth atmosphere.

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A 1D radiative-convective model of a thick ($P \sim 300$ bar) H_2O-CO_2 atmosphere has been developped for a later inclusion in a coupled magmatic-atmospheric evolution model of primitive telluric planets. In a first stage, the thermal structure was assumed to follow the dry adiabatic lapse rate – including the non-ideal behavior of H_2O in the vicinity of its critical point – in the lower troposphere, then a wet adiabatic lapse rate as soon as saturation is reached for water vapor and finally an isothermal mesosphere in approximate radiative equilibrium. Thermal radiative fluxes could then be computed in several IR bands extending up to $6500\,\mathrm{cm}^{-1}$, taking into account the known infrared bands of CO_2 and H_2O, as well as H_2O-H_2O continuum opacity (which dominates the continuum opacity). Future improvements to be made include a simple cloud parameterization. Some preliminary results (mesospheric temperature, vertical extension, moderate effective temperature) are highly reminiscent of an "exaggerated Venus", but the stronger H_2O-H_2O continuum compared to CO_2-CO_2 opacity, which is dominant on present day Venus, brings strong limitations to the IR fluxes. The implications in terms of cooling time of the magmatic ocean or atmospheric escape rates could be very interesting.