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# Maximum Entropy Production Temperature Profiles with a realistic radiative scheme

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The atmosphere of the Earth, like any fluid heated from below, is subject to vertical instability which triggers convection. Convection in the atmosphere occurs on small time and space scales. Even though the resolution of numerical climate models has refined over the years, the scales involved in convection cannot be represented explicitly in most global models, and sub-grid parameterizations are usually required. Here, we develop an alternative view based on a global thermodynamic variational principle. We compute convective flux profiles and temperature profiles at steady-state in an implicit way, by maximizing the entropy production rate associated with the vertical transport of energy.

Two different frameworks are examined, corresponding respectively to the idealized case of a gray atmosphere, and a more realistic radiative model. We use a narrow band model based on a Net Exchange Formulation radiative scheme: in the Net Exchange Formulation, the basic objects describing radiative transfer are not fluxes but rather the net rate of energy exchanged between two given layers of the atmosphere. This formulation is well suited for use in simple climate models, and it also allows for a finer description of the radiative exchanges.

In the second case, we are also able to discuss the effect of variations of the atmospheric composition, like a doubling of the carbon dioxide concentration. The first estimates of climate sensitivity obtained in this manner are consistent with — although slightly lower than — the results of traditional models of equivalent complexity.