Abstract Details

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Title: (IWG6) Confirming Maximum Entropy Production with Model Simulations of the Atmospheric Circulation

Abstract:
Energy balance models suggest that the atmospheric circulation operates close to a state of maximum entropy production. Here we support this hypothesis with sensitivity simulations of an atmospheric general circulation model. A state of maximum entropy production is obtained by (i) using a sufficiently high model resolution which allows sufficient degrees of freedom for the atmospheric flow and (ii) adjusting boundary layer turbulence. The state of maximum entropy production is associated with the largest conversion of available potential energy into kinetic energy which is subsequently dissipated by boundary layer turbulence. It exhibits the largest eddy activity in the mid latitudes, resulting in the most effective transport of heat towards the poles and the least equator-pole temperature difference. These results suggest that GCMs have a fundamental tendency to underestimate the magnitude of atmospheric heat transport and, therefore, overestimate the equator-pole temperature gradient for the present-day climate, for the response to global climatic change, and for atmospheres of other planetary bodies. Figure 1: Entropy production by atmospheric heat transport as a function of (a) model resolution (in terms of number of latitudinal bands) and (b) boundary layer friction. References [1] A. Kleidon, K. Fraedrich, T. Kunz, F. Lunkeit, Geophys Res Lett 30, 2223 (2003).

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