Geophysical Research Abstracts
Vol. 20, EGU2018-13291, 2018
EGU General Assembly 2018
© Author(s) 2018. CC Attribution 4.0 license.

Global Entropy Production from Spectral Radiative Flux

Goodwin Gibbins (1,3) and Joanna Haigh (2,3)

(1) Mathematics of Planet Earth CDT, Imperial College London, UK (rig11@ic.ac.uk), (2) Grantham Institute - Climate Change and the Environment, Imperial College London, UK, (3) Atmospheric Physics Group, Imperial College London, UK

The Earth is in an approximate steady state, with the entropy produced by irreversible processes within the system balanced by a net outward flux carried by radiation. The spectral intensity of the radiation directly determines its entropy, with shorter-wavelength incoming solar radiation carrying lower-entropy (higher-quality) energy than outgoing thermal long-wave radiation. By examining the spectral details of these fluxes, a better understanding of the Earth's entropy budget can be obtained, including spatially and temporally resolved estimates of the total entropy produced within the system.

A new Python package has been created which generates radiative entropy flux maps from global atmospheric conditions by using Libradtran software to make detailed estimates of the resulting emission spectra. Importantly, this conversion from temperature and composition profiles to entropy fluxes only requires a snapshot of the momentary state of the climate and does not require the dynamical behaviour or heat transfers to be tracked. This allows for comparisons between model outputs and with observations, giving broad insight into our success at modelling irreversible processes.

Entropy flux maps for the current climate and various climate change scenarios are presented, and models contrasted. It is shown that the entropy fluxes reflect and summarise the changing climate structure. These results also inform speculation on the question of the fundamental relevance of entropy production optimisation as a climate predictor.