MIS021-P01   Room:Convention Hall   Time:May 22 14:00-16:30

Entropy Production in Planetary Atmospheres: Earth, Mars, Titan

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We explore the state of the atmosphere of Earth, Mars, and Titan through the hypothesis: the mean state of the planetary atmosphere is consistent with a maximum entropy production (MEP) state due to nonlinear heat transport in the turbulent atmosphere [Sawada, 1981].

We estimate latitudinal distribution of temperature and longwave and shortwave radiation with the multi-box model based on a two-box model for latitudinal heat transport [Lorenz et al., 2001]. The model may be useful in the point of calculability with a few parameters.

The results of estimate values indicate good agreement with the observed values of Earth and Mars except for Martian shortwave radiation and Titan's values. They will be much better if the model includes latitudinal dependence of albedo and cloud effect for Earth. There is an error (-10 to +5) for Titan's temperature.

The investigation is now in progress, for the reason of error and the lack of observed radiation data for Mars and Titan.

References
Lorenz, R.D. et al., Geophysical Research Letters, Vol 28, 415-418, 2001.
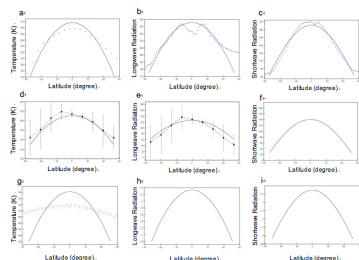Sawada, Y., Progress of Theoretical Physics, Vol 66, No. 1, 68-76, 1981.

Figure 1, Latitudinal distributions of (a) surface temperature, (b) longwave radiation (W/m^2), (c) shortwave radiation (W/m^2) in the Earth. Latitudinal distributions of (d) surface temperature, (e) longwave radiation (W/m^2), (f) shortwave radiation (W/m^2) in Mars. Latitudinal distributions of (g) surface temperature, (h) longwave radiation (W/m^2), (i) shortwave radiation (W/m^2) in Titan. Solid line curves indicate those predicted with the model of maximum entropy production. Dotted lines indicate those observed. The error bars (d, e) are caused by seasonal changes.

Keywords: Entropy Production, Planetary Atmosphere, Radiation