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Dynamic Regulation of the Global Climate System and Fluid Turbulence at States of Maximum Entropy Production

HISASHI OZAWA[1], SHINYA SHIMOKAWA[2] and HARUO TERASAKA[1]

[1]*Frontier Research System for Global Change, Yokohama 236-0001, Japan*
[2]*National Research Institute for Earth Science and Disaster Prevention, Tsukuba 305-0006, Japan*

It has been known for quite some time that the climate system and fluid turbulence tend to exhibit states of maximum entropy production (MEP). This so-called MEP hypothesis has so far been regarded as an ad-hoc assumption without any solid physical bases. Here we propose a dynamical explanation of this hypothesis based on feedback growth of turbulent eddies that feed on available energy supplied from the surrounding system. If the growth of turbulent eddies leads to an increase in the supply rate of available energy, the growth tends to continue, while the growth that leads to a decrease in the supply rate tends to be suppressed. This feedback mechanism thus drives the system into a state with maximum supply of available energy, which in turn corresponds to MEP. This mechanism is found to exist in observed behaviour of transient eddies in the climate system as well as that of thermal convection under different boundary forcing, suggesting a general principle that seems to govern time evolution of a large variety of nonlinear dynamic systems including biological evolution.

Keywords: Global climate; fluid turbulence; entropy production; energetics.

Reference

[1] H. Ozawa, A. Ohmura, R. D. Lorenz and T. Pujol, *Rev. Geophys.* 41, 1018, doi:10.1029/2002RG000113 (2003).