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Maximum Entropy Production (MEP) in Global Heat Transfer (GHT) model

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According to the Maximum Entropy Production (MEP) principle by Kleidon et al., dissipative systems in the state far from equilibrium are stabilized when entropy production is maximized. It is supposed that heat transportation on the Earth from the equatorial to the polar area occurs in such systems where the MEP principle is applicable. So far, the KL model by Kleidon and Lorenz [1] and the RB model by Reis and Bejan [2] are known as representative heat transfer models to testify such optimal theories. However, both are two-partitioned models that divide the Earth surface into only two parts, i.e., the heat absorption and the heat rejection regions, so we cannot help saying that these are too simple. In this exhibition, we provide the original multi-partitioned Global Heat Transfer (GHT) model to testify the MEP principle. The constructal theory by Bejan et al. [2] is another optimal theory similar to the MEP theory. The difference between two is that the former insists the maximization of heat transfer itself, while the latter does that of entropy production. Finiteness of the Earth surface is required as a necessary condition for the invocation of the constructal law, which restricts the choice of the model parameter. Meanwhile, the MEP theory does not necessitate such restriction, which guarantees a broader application to various kinds of climatic models.

[1] Kleidon, A., Lorenz, R.D. (2004) Entropy production by Earth system processes. In: Kleidon, A., Lorenz, R.D. (Eds.), Non-equilibrium thermodynamics and the production of entropy: life, Earth, and beyond. Springer Verlag, Heidelberg, Germany, pp 1-20.

[2] Reis, A.H., Bejan, A (2006) Constructal theory of global circulation and climate. Int. J. Heat Mass Transfer. 49:1857-1875.

[3] Kleidon, A. (2010). Life, hierarchy, and the thermodynamic machinery of planet Earth. Physics of Life Reviews 7:424-460.

[4] Bejan, A. (2010). Design in nature, thermodynamics, and the constructal law. Comment on Life, hierarchy, and the thermodynamic machinery of planet Earth by Kleidon. Physics of Life Reviews 7:467-470.

[5] Kleidon, A. (2010). Life as the major driver of planetary geochemical disequilibrium. Reply to comments on Life, hierarchy, and the thermodynamic machinery of planet Earth. Physics of Life Reviews 7:473-476.

Keywords: Global Heat Transfer (GHT) model, Principle of Maximum Entropy Production (MEP), Constructal theory, Dissipative structure, Far from equilibrium