Geophysical Research Abstracts
Vol. 15, EGU2013-1159, 2013
EGU General Assembly 2013

Relationships between the Limit of Predictability and Initial Error in the Uncoupled and Coupled Lorenz Models

Ruiqiang Ding and Jianping Li
Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing, China (drq@mail.iap.ac.cn; ljp@lasg.iap.ac.cn)

In this study, the relationship between the limit of predictability and initial error is investigated in two simple chaotic systems: the Lorenz model that possesses a single characteristic timescale, and the coupled Lorenz model that possesses two different characteristic timescales. The limit of predictability is defined here as the time at which the error reaches 95% of its saturation level; nonlinear behaviors of the error growth are therefore involved in the definition of the limit of predictability. It is shown that the logarithmic function performs well in describing the relationship between the limit of predictability and initial error in both models, although the coefficients in the logarithmic function are not constant across the examined range of initial errors.
Compared with the Lorenz model, the coupled Lorenz model—in which the slow dynamics and the fast dynamics interact with each other—has a more complex relationship between the limit of predictability and initial error. The limit of predictability of the Lorenz model is unbounded as the initial error approaches infinitesimal; therefore, the limit of predictability of the Lorenz model may be extended by reducing the amplitude of the initial error. In contrast, if there exists a fixed initial error in the fast dynamics of the coupled Lorenz model, the slow dynamics has an intrinsic finite limit of predictability that cannot be extended by reducing the amplitude of the initial error in the slow dynamics, and vice versa. The findings reported here reveal the possible existence of an intrinsic finite limit of predictability in a coupled system that possesses many scales of time or motion.