Geophysical Research Abstracts
Vol. 19, EGU2017-6030, 2017
EGU General Assembly 2017

Predictability of Forced Lorenz Systems

Baosheng Li (1,2), Ruiqiang Ding (1,3), Jianping Li (4,5), Quanjia Zhong (1,2)

(1) State Key Laboratory of Numerical Modeling for Atmospheric Sciences and Geophysical Fluid Dynamics (LASG), Institute of Atmospheric Physics, Chinese Academy of Sciences,Beijing, China , (2) College of Earth Sciences, University of Chinese Academy of Sciences, Beijing,China, (3) Plateau Atmosphere and Environment Key Laboratory of Sichuan Province, Chengdu University of Information Technology, Chengdu, China, (4) College of Global Change and Earth System Science,Beijing Normal University,Beijing,China, (5) Joint Center for Global Change Studies, Beijing,China

Based on the nonlinear local Lyapunov exponent (NLLE) approach, the influences of external forcing on the predictability are studied in the Lorenz systems with constant and quasi-periodic forces in this paper. The results indicate that for the Lorenz systems with constant and quasi-periodic forces, their predictability limits increase with the forcing strength. With the same magnitude and different directions, the constant or quasi-periodic forcing shows different effects on the predictability limit in the Lorenz system, and these effects become significant with the increase of the forcing strength. Generally speaking, the positive forcing leads to a higher predictability limit than the negative forcing. Therefore, when we think about the effects of positive and negative elements and phases in the atmosphere and ocean research, the predictability problems driven by different phases should be considered separately. In addition, the influences of constant and quasi-periodic forces on the predictability are different in the Lorenz system. The effect of the constant forcing on the predictability is mainly reflected in the linear phase of error growth, while the nonlinear phase should also be considered for the situation of the quasi-periodic forcing. The predictability limit of the system under constant forcing is longer than the system under quasi-periodic forcing. These results based on simple chaotic model could provide insight into the studies of the actual atmosphere predictability.