Geophysical Research Abstracts, Vol. 8, 05977, 2006
SRef-ID: 1607-7962/gra/EGU06-A-05977

Potential predictability of atmospheric processes

V. Dymnikov, **A. Gritsun**

Institute of Numerical Mathematics, Russian Academy of Sciences, Moscow

The classical problem of the weather forecast is to give most precise estimate of a trajectory of the atmospheric system using some numerical model. Even if the equations of the system are known exactly there still exists an uncertainty in the initial state of the system so that we must study an evolution of some ensemble of states instead of a single system trajectory. Because of the chaotic nature of atmosphere this ensemble will spread with time filling up the system phase space. At some time T the pdf generated by this ensemble will become identical to the equilibrium pdf of the system (if the system is ergodic and mixing). We will call this time T as a potential predictability time since all the information contained in the initial ensemble is now lost. In our study we try to quantify T.

Using the theory of linear dynamical-stochastical systems we constructed a theoretical estimate for the potential predictability time. From this estimate it follows that this time is determined by the de-correlation time of "longest" autocorrelation functions of the system and correspondent directions should be the most predictable ones. Applying this estimate to the atmospheric GCM of INM RAS and calculating its covariance matrices we found that the predictability time is about 45days and most predictable directions should be the second and third EOFs that in our case are close to AO and PNA respectively.

These conclusions were verified by the series of direct ensemble integrations with the AGCM. As a result, it was demonstrated that the theoretical and numerical results are in a good agreement. The potential predictability time for our model is about 45 days and is close to the theoretical estimate based on the linear theory.