Geophysical Research Abstracts, Vol. 8, 04894, 2006
SRef-ID: 1607-7962/gra/EGU06-A-04894

Patterns of interannual variability in a changing climate

G. Branstator
NCAR, Boulder, USA (branst@ucar.edu)

Observations and theory suggest that the leading structures of interannual atmospheric variability are largely controlled by the mean state on which they are superimposed and thus change if the mean state is modified. On the other hand, any externally produced changes in the structure of the mean state are likely to project strongly onto the leading intrinsic interannual structures. In this study we examine a climate change experiment that is especially well-suited for examining the mutual interactions between the mean state and the patterns of interannual variability. The experiment we analyze is a 62 member ensemble of business-as-usual integrations that has been produced with NCAR's coupled climate model known as CCSM1.4.

A striking result of the analysis is that indeed the secular trend projects strongly onto a naturally occurring pattern of the system, namely the circumglobal waveguide pattern described by Branstator (2002). A second outcome of the analysis is that the phase space distribution of leading interannual states changes during the experiment. The large ensemble makes it possible to carefully examine this PDF change. It turns out that the change is not a simple linear shift but can be approximated as a redistribution of density between two clusters of states together with a repositioning of the modes of these clusters. One reason for this redistribution of states is that the structure of the circumglobal waveguide pattern changes during the experiment. Stochastic experiments with a linearization of the model governing equations show that important aspects of this change in the system's PDF are caused by dynamical effects of the trend in the model's mean state. Further analysis of the experiment involves examination of the preferred phase space trajectories of the system. This analysis is designed to determine how these trajectories are influenced by the changing climate and whether changes in the dominant trajectories give insight into why the PDF has changed.