Predictability of anomalous synoptic variability from Interannual to interdecadal timescales

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The primary goal of this study is to go beyond investigations of predictability of the seasonal-mean atmospheric flow towards that of the seasonal-mean weather statistics (or storm-tracks) that are often represented in terms of the statistics of band-pass filtered (2- to 6-day) synoptic variability. We are interested in such issues as: What determines the interannual and interdecadal variations of the storm-tracks? To what extent are the storm-track variations predictable? What is the role of ENSO in such variations? Are the predictable storm-track signals linear enough to justify a linear diagnosis of their sources? To address these issues, we are taking both observational and modeling approaches to the problem.

We have constructed an empirical linear storm-track model that is able to capture many elements of anomalous wintertime storm-tracks given the anomalous hemispheric seasonal-mean 200 mb flow. To the extent that the seasonal mean 200 mb flow itself is predictable, it is then possible to predict the anomalous storm-track using this model. We show further, from very large ensembles of seasonal AGCM integrations for El Nino and La Nina tropical SST forcing, that there is a significant predictable SST-forced storm-track signal in ENSO winters, but one that can differ substantially from case to case and between El Nino and La Nina events. The signal is modest, but has large implications for the predictability of seasonal precipitation over North America and Europe. Indeed we are able to demonstrate that the predictability of seasonal mean precipitation in these regions is as much tied to that of the anomalous storm-track as it is to the predictability of the anomalous seasonal-mean vertical motion.

The linear storm-track model is able to capture most aspects of the nonlinear AGCM's ensemble-mean storm-track signal for ENSO forcing given the AGCM's ensemble-mean seasonal flow. It is also able to capture many aspects of the OBSERVED 50-year trends of northern hemispheric synoptic variability over the last half-century given the 50-year trends in the 200 mb flow. An investigation is currently in progress using large ensembles of half-century AGCM integrations to determine what aspects of the trends in the 200 mb flow itself were predictable. The storm-track model is also being used to determine what aspects of the predictable 200 mb flow are most important in enhancing storm-track predictability.