Advanced diagnostics for tropical-midlatitude interactions and teleconnections on intraseasonal timescales

A proposal to Next Round of Research to Operations Initiative: NOAA Testbeds
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Advances in forecasts for weeks 3-4
from
George Mason University and Colorado State University in collaboration with NOAA/CPC

b. Abstract

Introduction of the problem

Tropical-extratropical interactions and the resulting teleconnections are emerging as a key modulator of high-impact weather events, and more generally represent an untapped source of subseasonal predictability. As an important example, tropical convection associated with a developing intraseasonal oscillation can result in enhanced predictability during particular midlatitude configurations. In order to translate this potential predictability to better long-range forecasts (e.g, 3-4 weeks) advanced diagnostics targeting the predictability of teleconnections and the underlying processes need to be developed.

Rationale

In addition to El Niño-Southern Oscillation (ENSO) and Madden Julian Oscillation (MJO) variability there are other modes of subseasonal variability that have been identified as potential sources of predictability for the 3-4-week time scales. On the one hand, the variability of the Northern Hemisphere's midlatitudes is influenced by two dominant oscillatory hemispheric wide modes with periods of 23 and 48 days, respectively. On the other hand, a number of recurrent and persistent large-scale flow patterns (called regimes) have been identified which strongly influence the probability of occurrence of localized (and possibly extreme) weather patterns over the contiguous United States. In addition, understanding the relationship of these modes with the various phases of the Wheeler and Hendon MJO index that is used in forecast operations may help to define periods of enhanced extra-tropical predictability.

Summary of work to be completed

Provided skill is demonstrated, we aim to deliver NWS forecast tools that will enhance Week 3 to 4 forecast outlooks, so forecasters can make use of changes in the circulation related to the aforementioned oscillatory modes and regimes. Specifically, we will implement two categories of advanced diagnostics designed to exploit the predictability conferred by the intrinsic variability of midlatitude circulation and its interaction with the organized tropical convection. The ultimate goal will be to provide the forecasted evolution and probability of transition for the phases of the oscillations and related weather regimes, and through this to enhance the prediction skill of anomalous surface conditions.