The Seasonality of the Great Plains Low-Level Jet and ENSO Relationship

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The Caribbean and Great Plains low-level jets of the Intra-Americas Seas serve as an important source of moisture for adjacent land and oceanic regions. The Caribbean low-level jet (CLLJ) transports moisture from the tropical Atlantic into the Intra-Americas Seas, which is further transferred over to the continental United States by the Great Plains Low-Level Jet (GPLLJ). Thus, the GPLLJ acts as a crucial conduit of moisture from the tropical Atlantic to the continental United States. The GPLLJ serves as an important source of rainfall over the agricultural land in the Great Plains and affects the tornadoes over the United States, by changing the vertical shear and moisture availability. On a seasonal basis, the GPLLJ has societal impacts on forestry and human health through its effect on seed dispersion, assisting the migration of birds and insects, which would further contribute to the influx of pests and disease causing agents. Therefore, better understanding of the controls on the variations of the GPLLJ has profound socio-economic implications over the US and is in line with NOAA objectives.

We investigate the seasonality of the relationship between the GPLLJ and the Pacific Ocean from spring to summer based on observational analysis and coupled model experiments. We assess the ability of global coupled climate model with high-resolution atmospheric and land components, FLOR to simulate the observed seasonality in the GPLLJ-ENSO relationship.

The key findings from this paper are,

1. The observed GPLLJ and El Niño-Southern Oscillation (ENSO) relation undergoes seasonal changes with a stronger GPLLJ associated with La Niña-like in spring and El Niño-like conditions in summer.

2. We investigated if the observed seasonality in the ENSO-GPLLJ relationship is a statistical artifact (from a finite sample) or a true seasonal change using long control simulations of the GFDL model FLOR and a flux-adjusted version of FLOR that corrects for most of the SST biases. We show that FLOR fails to capture the seasonality in the observed relationship, but the results from FLOR flux-adjusted run suggest that the observed seasonality in the relationship is real.

3. Using targeted coupled model experiments, we suggest that improvements in the ENSO-GPLLJ relation in the FLOR flux-adjusted run arises from a better simulation of ENSO variability compared to FLOR.

4. We emphasize the importance of coupled climate models to accurately simulate the phase locking and magnitude of ENSO in order to better simulate its seasonal teleconnections with the Intra-Americas Seas. We suggest that climate models with better ENSO variability would advance our ability to predict seasonal variations of the GPLLJ and its associated impacts on the United States.