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## The impacts of ENSO and PNA teleconnections on upper-level coupling to the Great Plains low-level jet

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The United States (U.S.) Great Plains southerly low-level jet (GPLLJ) is a ubiquitous feature of the summertime climatological flow in the central U.S. contributing to a large percentage of mean and extreme summertime rainfall, the generation of vast quantities of U.S. renewable wind energy, and severe weather outbreaks. Like other LLJs across the globe, the GPLLJ can be 1) vertically coupled to the large-scale cyclone-anticyclone flow pattern associated with an upper-level jet stream or 2) uncoupled to the large-scale flow but sustained in response to various local land-atmosphere coupling mechanisms. Many studies have focused on the interactions between teleconnection patterns and associated GPLLJ variability, treating the GPLLJ as a singular phenomenon. Here, we treat the GPLLJ as two phenomena, coupled and uncoupled to the upper-level flow, and explore the multiscale impacts of SST forced and internally generated modes of variability on the GPLLJ. With mounting evidence for the low-frequency control on higher frequency GPLLJ variability, the current study analyzes the contribution of the Pacific/North America (PNA) pattern on sub-seasonal timescales and ENSO on interannual timescales to changes in the frequency distributions of both coupled and uncoupled GPLLJs.

This analysis utilizes 1) the Coupled ERA 20th Century (CERA-20C; 1901-2010) reanalysis from ECMWF which provides a large sample of teleconnection conditions and their impacts on GPLLJ variability and 2) a recently developed automated technique to differentiate those GPLLJs that are coupled or uncoupled to the upper-level flow. Many studies have already shown that two distinct synoptic regimes dominate GPLLJ variability, a western U.S. trough and a central U.S. ridge. This leads to changes in the frequency ratio of coupled and uncoupled GPLLJ events and ultimately in the location and intensity of precipitation across the GP. Recently, Burrows et al. (2019) showed that during the Dust Bowl period of 1932-1938, the central and northern GP experienced anomalously high (low) uncoupled (coupled) GPLLJ event frequencies that coincided with a multi-year dry period across the entire region. Understanding the upscale and lower frequency forcing patterns that lead to these distinct synoptic regimes would lead to greater predictability and forecasting skill. On sub-seasonal timescales, it is shown that the negative phase of the PNA, which is associated with a southerly displaced Pacific jet stream and a western U.S. trough, leads

to increases in the frequency of GPLLJs that are coupled to the upper-level flow, increases in Gulf of Mexico moisture flux and a redistribution of GP precipitation. On interannual timescales, the location of ENSO events, i.e., eastern or central Pacific, is explored to determine the relationship between tropical forced variability and upper-level coupling to the GPLLJ. In line with recent studies, it is hypothesized that central Pacific ENSO events may lead to increases in coupled GPLLJ events and precipitation, particularly in the southern GP.