

Decadal variability of the Atlantic – Pacific tropical bridge and its effect on Texas hydrology

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Beginning the late 1990's, the South-Central region of the United States has seen a climate shift from the historically wet conditions of the late 20th century to drier conditions in the 21st century. Variations in atmospheric and oceanic circulation over the North Pacific Ocean have been shown to play a substantial role in the climate regimes of the South-Central region at multiple time scales, and the Pacific Decadal Oscillation (PDO) is thought to be the major low frequency contributor. Through monthly analysis of the general atmospheric circulation we demonstrate a link between low frequency Pacific variability and a multidecadal drift in the intensity of the Pacific-North American (PNA) teleconnection pattern during the boreal fall, winter, and spring months. Also, in the summer months, we show a teleconnection bridge between the tropical Pacific and the North Atlantic Subtropical High (NASH) through expansion and contraction of the global tropical belt. Does the PDO induce a preferred phase of the PNA during specific months in fall, winter, and spring? Can we identify the mechanisms that trigger the tropical belt expansion and contraction that are associated with the PDO and variability of the NASH? The methods that we employ to intimate these questions include: a) analysis of 500 hPa geopotential height to determine the monthly progression of the PNA teleconnection pattern associated with the PDO, b) analysis of zonal and meridional wind to elucidate changes in the global general circulation, including tropical belt expansion, total stratospheric variability, and circulation changes in the upper troposphere/lower stratosphere, c) analysis of 850 hPa geopotential height to determine how decadal changes in the southern NASH boundary relate to expansion of the tropical belt. Understanding the timing and teleconnection relationships between the PDO, the PNA, the NASH, and tropical belt expansion will help to increase the skill of decadal climate predictions for the South-Central United States.

Keywords: Drought, Decadal Climate Variability, Pacific Decadal Oscillation, North Atlantic Subtropical High, Pacific North American Pattern