Drivers of Variability in the Position of the Subtropical Jet Over Nepal in the Last Millennium Ensemble

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Abstract

Nepal is positioned at the intersection of the Indian Summer Monsoon (ISM) and Subtropical Jet (SJ). Although the ISM is responsible for ~two thirds of annual precipitation, the SJ supplies precipitation in the winter and spring, with the jet migrating southwards to the subcontinent beginning in October and reaching its most southerly position in May before moving northward in June. Using the state-of-the-art Community Earth System Model Last Millennium Ensemble, we investigated potential drivers of the latitudinal position of the SJ over Nepal (referred to as the Himalayan Jet) between 850-2005 CE. The Himalayan Jet Latitude [HJL] is defined as the latitude with the highest wind speed at 200 mb for every longitude containing Nepal (Thapa et al., 2022). In order to identify dominant periodicities in HJL positioning, power-spectral-density analyses were used. For the purpose of evaluating drivers of HJL position, we identified years with a northward or southward displaced HJL, defined as being two standard deviations above or below the average annual HJL position, and used anomaly composites of precipitation, winds (upper- and lower-level), sea surface temperature, moisture transport (lower-level at 850mb), and geopotential height (upper-level at 200mb). Our analyses seem to point toward a link between HJL and the phases of the El Niño Southern Oscillation and Indian Ocean Dipole (IOD): Southerly HJL years often occur during years with an El Niño and a positive IOD event. Northerly HJL years often occur when a Rossby wave train appears to be present over Nepal, indicative of a remote teleconnection. We provide an initial quantification of the physical mechanics of how these climate modes in the Pacific, Indian, and Atlantic Oceans, including remote teleconnections transmitted via atmospheric Rossby Waves, affect HJL. These climate model simulation results are also compared with a sub-decadally-resolved, precisely-dated, composite stalagmite isotope record of ISM variability from Siddha Baba cave, central Nepal.