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LOD - An independent Indicator for Climate Variability & Change ?

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This study assesses whether trends in the length-of-day (LOD) have occurred in concert with observed changes in atmospheric hemispheric circulation patterns since any change in the wind-driven axial atmospheric angular momentum (AAM) results in variations of the LOD. For this purpose we examine the low-frequency behavior of the LOD excited by large scale atmospheric circulation patterns using ERA40 reanalysis data (1958-2001). Since the El Niño/Southern Oscillation (ENSO) is the most important coupled ocean-atmosphere phenomenon to cause global climate variability on interannual time scales, we correlate observed changes in the strenght of the interannual LOD signal with ENSO sensitive parameters to explore the relative influence of the ocean and atmosphere on the LOD during ENSO events. Strong correlations between changes of the interannual amplitude of the LOD and ENSO sensitive parameters such as the sea-surface temperature (SST), the AAM, the southern Oscillation Index (SOI), the Multivariate ENSO Index (MEI), and the El Niño (NINO3.4) index demonstrate a significant relation between the interannual LOD variability and the ENSO phenomenon. However, our analysis also suggests that during ENSO events the influence of the ocean and atmosphere on the LOD signal varies highly.

Observations suggest that during the warm phase of ENSO the diabatic heating in the eastern tropical Pacific associated with El Niño amplifies the generation of the Rossby wave train over North America carrying over to observed enhanced patterns of the Pacific-North American teleconnetion (PNA). To further explore this relation, we examine the meridional transport of the AAM on the northern hemisphere. As a result the largest momentum transport of the AAM can be observed around 30˚N for

warm years of ENSO. For those years, our analysis displays strong cells of the PNA over the North American region.

Our results suggest that observed variations in the amplitude of the LOD signal can be used as an indication for changes in the low- and high frequency spectrum of hemispheric circulation systems led off by warm ENSO events. However, the highly variable influence of ocean or atmosphere on the variability of LOD during EL Niño events needs to be further followed along.