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NEWS Climatology Project: Spatial patterns of interdecadal/long-term changes in global precipitation and oceanic columnar water vapor during 1979-2008

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This study explores how global precipitation and tropospheric water vapor vary on the interdecadal/long-term time scale during 1979-2008. Various satellite- and station-based observations including precipitation, surface temperature, and tropospheric water vapor content, are applied. EOF analyses indicate that the first two modes of precipitation and water vapor are dominated by the ENSO signals. The spatial patterns of their third modes are similar to their corresponding linear changes estimated at each grid point during the time period. An EOF analysis of long-record (1949-2009) sea surface temperature (SST) within the Pacific basin (60oN-60oS) is further made. Its first and third modes are dominated by the ENSO variations, while the second mode shows a strong shift around 1999. This sudden shift indicates the existence of a climate regime change related to the Pacific Interdecadal Variability (PDV) as suggested in past studies. Thus the long-term changes in both precipitation and tropospheric water vapor during 1979-2008 result from a combined impact of global surface warming and PDV. It is further suggested that this combined impact shapes the spatial structure of long-term changes in these two components. In particular, in the central-eastern tropical Pacific, a band of increases along the equator in both precipitation and water vapor sandwiched by strong decreases south and north of it are likely caused by opposite impacts from global-mean surface warming and PDV-related cooling.