

**Inter-annual and inter-decadal variations and trends in global and regional precipitation and their relation to temperature and water vapor changes**Robert Adler<sup>†</sup>; Guojun Gu<sup>†</sup> University of Maryland, USALeading author: [radler@umd.edu](mailto:radler@umd.edu)

Global, satellite-based data sets are used to study inter-annual and inter-decadal variations and trends in surface temperature, water vapor and precipitation on both global and regional scales with data sets spanning the last 30 years. Techniques are applied to the satellite data sets to separate out the ENSO, volcano and long-term (trend or inter-decadal) changes. Special Attention is paid to the decades before and after 1998, when a "climate shift" may have occurred. During this overall 30-year period there has been a significant increase in temperature, an associated increase of atmospheric water vapor, but a near zero change in global precipitation. However, there is a significant increase in precipitation over tropical oceans, balanced mainly by a decrease in mid-latitudes, at least in the Northern Hemisphere. These relations among variables are also examined at the inter-annual and inter-decadal (pre/post 1998) scale to understand how they may relate to the long-term change relations. At the inter-annual scale water vapor responds to ENSO-related global, surface temperature variations, while the variation in global precipitation is very weak. A similar result is found when looking at trends of the three variables during the last 20-30 years. At the inter-annual time scale the impact of volcanoes is shown to be different than ENSO, with a distinct change in global precipitation. Calculations of precipitation change (and water vapor change) relative to temperature change are shown for the various time scales mentioned and similarities and differences among the scales are discussed and related to the processes involved. The interpretation of these results in the context of global warming is described.