Present-day Pattern Variations in the Central and Eastern Pacific El Nino

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El Niño and the Southern Oscillation (ENSO) is a cycle that is initiated in the equatorial Pacific Ocean and is recognized on interannual timescales by oscillating patterns in tropical Pacific sea surface temperatures (SST) and atmospheric circulations. Using correlation and regression analysis of datasets that include SST's and other interdependent variables including precipitation, surface winds, sea level pressure, this research seeks to quantify recent changes in ENSO behavior. Specifically, the amplitude, frequency of occurrence, and spatial characteristics (i.e. events with maximum amplitude in the Central Pacific versus the Eastern Pacific) are investigated.

The research is based on the question; "Are the statistics of ENSO changing due to increasing greenhouse gas concentrations?" Our hypothesis is that the present-day changes in amplitude, frequency, and spatial characteristics of ENSO are determined by the natural variability of the ocean-atmosphere climate system, not the observed changes in the radiative forcing due to change in the concentrations of greenhouse gases. Statistical analysis, including correlation and regression analysis, is performed on observational ocean and atmospheric datasets available from the National Oceanographic and Atmospheric Administration (NOAA), National Center for Atmospheric Research (NCAR) and coupled model simulations from the Coupled Model Inter-comparison Project (phase 5, CMIP5). Datasets are analyzed with a particular focus on ENSO over the last thirty years.

Understanding the observed changes in the ENSO phenomenon over recent decades has a worldwide significance. ENSO is the largest climate signal on timescales of 2 - 7 years and affects billions of people via atmospheric teleconnections that originate in the tropical Pacific. These teleconnections explain why changes in ENSO can lead to climate variations in areas including North and South America, Asia, and Australia. For the United States, El Niño events are linked to decreased number of hurricanes in the Atlantic basin, reduction in precipitation in the Pacific Northwest, and increased precipitation throughout the southern United Stated during winter months. Understanding variability in the amplitude, frequency, and spatial characteristics of ENSO is crucial for decision makers who must adapt where regional ecology and agriculture are affected by ENSO.