Session: C34 Poster: W243A

Mechanisms and detection of changes in the Walker circulation in response to global warming

Pedro DiNezio[†]; Amy Clement; Gabriel Vecchi; Brian Soden
[†] University of Miami, USA
Leading author: pdinezio@rsmas.miami.edu

We plan to address several outstanding questions regarding the detection and attribution of long-term trends in the tropical Pacific climate by comparing observations and climate model experiments of 20th Century anthropogenic climate change coordinated by the Coupled Model Intercomparison Project Phase 5 (CMIP5). Previous-generation climate models (i.e. CMIP3) show that the coupled ocean-atmosphere response of the tropical Pacific to increasing greenhouse gases is governed by changes in the hydrological cycle that we have high confidence in. This confidence stems from the fact that they are derived from relatively simply physical arguments and are robust in all model simulations of global warming. These robust responses include: a weakening of the Walker circulation, a weakening of the equatorial ocean currents, a less tilted and shallower thermocline, and enhanced equatorial warming. Not all these changes have been detected in observations of the 20th century. Climate model projections are consistent with observations, which exhibit a 3.5% reduction in the east-west sea level pressure (SLP) gradient on the equatorial Pacific during 1854-2005. However, the weakening of the Walker circulation depends on the sensitivity of global-mean precipitation to warming, for which there is still no agreement between GCMs and observations over the period 1987-2006. During the 1980-2010, the period where global warming has been strongest, the Walker circulation has strengthened, just opposite to the forced model projections. By comparing the signature of the forced and unforced mechanisms in models and observations, we plan to evaluate whether the recent changes are a spurious trend associated with the strong low frequency variability of the Pacific basin, or result from the response of the hydrological cycle to global warming.