Geophysical Research Abstracts
Vol. 19, EGU2017-4639, 2017
EGU General Assembly 2017

Assessing the role of the West Pacific Gradient for global climate teleconnections over the past Millennium

Jens Zinke (1), Stuart A. Browning (2), Andrew Hoell (3), and Ian D. Goodwin (2)

(1) Section Paleontology, Freie Universität Berlin, Germany (jens.zinke@fu-berlin.de), (2) Department of Environmental Sciences, Macquarie University, Sydney, Australia, (3) NOAA Earth System Research Laboratory, Meteorologist, Physical Sciences Division, Boulder, USA

The Maritime Continent (MC) is the hydrological power house of the planet being collocated within the Indo-Pacific Warm Pool, where sea surface temperatures (SST) exceed 28°C associated with strong convective rainfall year-round. The convective activity over the Maritime Continent associated with the El Niño-Southern Oscillation (ENSO) is intimately linked to large- scale variations in the climate system and global rainfall-drought patterns. New research has shown that during both El Niño and La Niña events the global impacts in terms of atmospheric circulation and precipitation were more severe when the SST anomalies in the westernmost Pacific (WP; 0-10°N, 130-150°E) were strongly opposing those in the central Pacific (Niño4 region; 5°S-5°N, 160-210°E) than when the west Pacific SST anomalies were near neutral. This temperature gradient is referred to as the West Pacific Gradient (WPG; Hoell and Funk, 2013; Zinke et al., 2015). A positive WPG is when WP SST anomalies are colder than those in the central Pacific, thus El-Niño-like conditions prevail.

Recent changes in the WPG towards a negative phase, combined with strong WP warming after the Indo-Pacific climate regime shift of the late 1990s, are driving significant thermal anomalies from the Indonesian seas to the southern coast of Western Australia and along the southwest Pacific (Zinke et al., 2015). The reconstruction of the WPG for the past Millennium might provide novel insights into past tropical climate variability since more long proxy archives are available to assess the WPG than for the Niño3.4 region.

WPG variability over the past millennium is reconstructed using an experimental paleoclimate based reanalysis (PaleoR). PaleoR is analogous to modern reanalysis products, but constrained by paleoclimate data instead of meteorological observations (Goodwin et al., 2014). PaleoR employs an offline assimilation scheme where each year (or decade) is individually reconstructed by using information from a multivariate proxy data array to select best matching analogues from the Last Millennial Ensemble simulations (LME; Otto-Bliesner et al., 2015). The PaleoR approach preserves dynamical relationships between ocean and atmospheric variables and accommodates periods of non-stationary teleconnections.

Our results reveal a sustained positive WPG between AD 1250 to 1650 (a period that Goodwin et al. 2014 identified as being persistent El Niño like) and a mostly negative WPG between AD 1650 and 2000, the latter interrupted by multi-decadal periods with a positive WPG centered around 1760, 1830 and 1900. The periods between AD 1125-1175 and 1185-1250 were characterized by a negative WPG (a period that Goodwin et al. 2014 identified as being persistent La Niña like) with positive WPG excursions in decades around AD 1000-1050, 1100 and 1175. We investigate the spatial climate anomaly fields for periods of sustained positive and negative WPG to reveal potential global climate teleconnections in terms of SST, rainfall, winds and sea-level pressure during the past Millennium.

References

Goodwin et al. 2014, P. Natl. A. Sci., 111, 14716–14721
Hoell and Funk 2013, J. Clim., 26, 9545–9562
Otto-Bliesner et al., 2015, B. Am. Meteorol. Soc., doi:10.1175/BAMS-D-14-00233.1
Zinke et al. 2015, Nature Communications, 6:8562, doi: 10.1038/ncomms9562