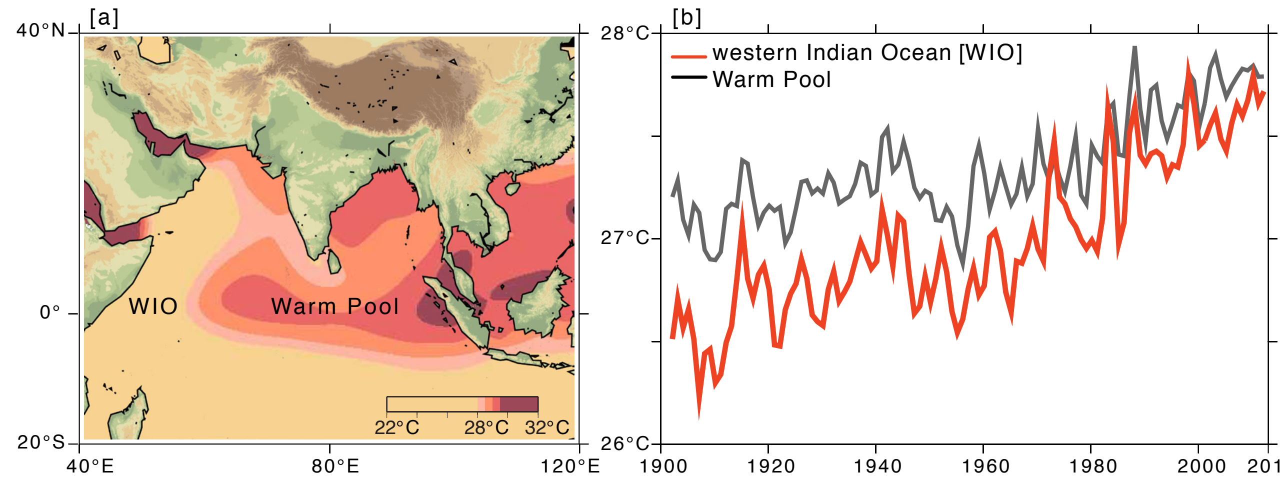
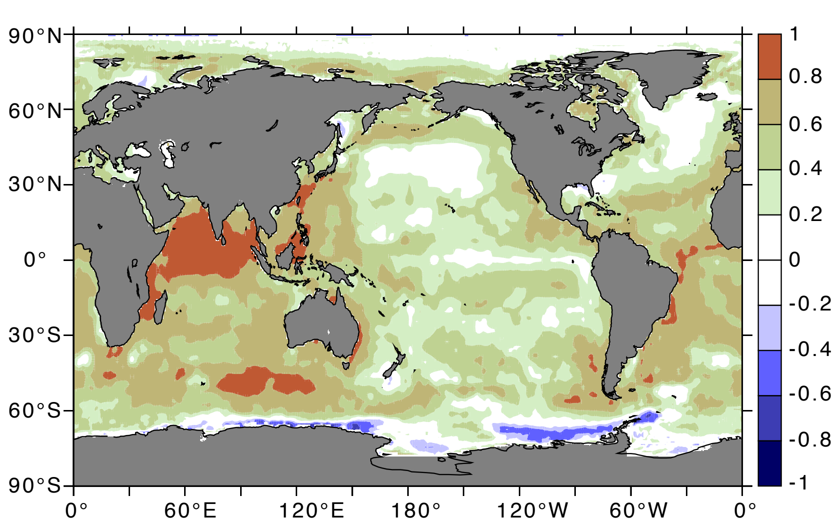


***Warmer WIO.* (a) The western Indian Ocean (WIO) is relatively cool, while the rest of the Indian Ocean is a warm pool region with sea surface temperatures (SSTs) greater than 28.0°C (shades of red) during summer. (b) In the past century, the WIO has warmed up tremendously, reaching the SST values of the warm pool and weakening the zonal SST gradient.**

For the period 1950–2013, this model yields a correlation coefficient of 0.71 when compared with the observed number of annual hurricanes. It also performs well for the independent period 1900–1949 with an average error of 1.8. Performing simulated real-time hindcasts, compared with a no-skill metric based on a 5-year running average, this model improves the mean absolute error by 38% for the period 2001–2013. Compared with predictions from three well-known seasonal hurricane forecasting groups, including Tropical Storm Risk, Colorado State University, and NOAA's Climate Prediction Center, there is an improvement of at least 23% in mean absolute error from 2001 to 2013. It is important to mention, however, that hindcast skill does not always translate to forecast skill.—Kyle Davis (University of Arizona), X. Zeng, E. A. Ritchie. "A New Statistical Model for Predicting Seasonal North Atlantic Hurricane Activity," in a forthcoming issue of *Weather and Forecasting.*

Indian Ocean Warming—The Bigger Picture

Being the warmest among the major oceans, the Indian Ocean plays a critical role in regulating the mean climate and variability of the Asian monsoon, as well as the dynamics over the tropics. During boreal summer, the central-east Indian Ocean is characterized by a warm pool with sea surface temperatures (SSTs) greater than 28.0°C, making it highly conducive for enhanced convection. Studies on SST trends during the



***Correlated warming.* Observed correlation between annual values of global mean SST and the SST time series, from 1901 through 2012. The SST over the Indian Ocean appears to be a major contributor and "in phase" with global ocean surface warming. Color shading denotes correlation coefficients significant at the 99% confidence level.**

past half-century have pointed out substantial warming over this warm pool, though the reasons behind the monotonous warming have remained ambiguous.

However, our analysis of SSTs in the period 1901–2012 reveals a more comprehensive picture of Indian Ocean warming. The focus shifts to the relatively cool western Indian Ocean. We find that the western tropical Indian Ocean has been warming for more than a century, at a rate faster than any other region of the tropical oceans, and its SST values now match those of the warm pool at 28.0°C. While the warm pool went through a summertime warming of 0.7°C, the western basin experienced an anomalous increase of 1.2°C in summer SSTs during the period of study. The warming of the generally cool western Indian Ocean against the warm pool region weakens the zonal SST gradients, and has the potential to change the Asian monsoon circulation and rainfall, as well as to alter the marine food webs in this biologically productive region.

Using observations and climate model simulations, our research gives compelling evidence that the long-term warming trend over the Indian Ocean during summer is highly dependent on asymmetry in the El Niño-Southern Oscillation (ENSO) teleconnection—El Niño events induce anomalous warming over the western Indian Ocean and La Niña events fail to do the inverse. A second, prominent reason for the warming is that the frequency of El Niño events has increased during recent decades.

El Niño appears as an event through which the Pacific Ocean throws out its heat, which partially gets accumulated in the Indian Ocean via a modified Walker circulation. Though the frequency of El Niño events has increased in recent decades, a strong warm event has not been recorded since 1997–98 and, correspondingly, both the Pacific and Indian Ocean SST anomalies show a slight dampening in recent years. This could be a reason for the recent hiatus in global surface warming.

Indian Ocean warming turns out to be a major contributor "in phase" with the overall increasing trend in the global mean SST. Post-1950, a few warm events over the Indian Ocean have attained the threshold value for El Niño (SST anomalies greater than 0.77°C). This places these warm events almost on par in magnitude with Pacific-wide El Niño warming. Considering the long-term persistence of these events, the Indian Ocean warming scenario and related climate dynamics are factors to be vigilant of while assessing long-term climate change and variability.—Mathew Koll Roxy (Indian Institute of Tropical Meteorology), K. Ritika, P. Terray, and S. Masson. "2014: The Curious Case of Indian Ocean Warming," in a the mid-November issue of *Journal of Climate*.

CONFERENCE NOTEBOOK

Defining Sudden Stratospheric Warmings

Sudden stratospheric warmings (SSWs) are impressive temperature rises in the winter polar stratosphere driven by the breaking of planetary waves propagating up from the troposphere. In extreme cases, the sudden warming causes the entire stratospheric polar vortex circulation to reverse direction from its normal wintertime westerly state to easterly. Occurring more often in the Northern Hemisphere, these events are associated with changes in tropospheric surface climate, such as midlatitude cold air outbreaks, on time scales of weeks to months.

The current classification and detection of SSWs are largely based on a definition developed by the World Meteorological Organization (WMO) in the decades after their discovery in 1952. An examination of literature suggests that pinpointing an exact reference for the standard SSW definition is elusive, but in general the definition involves the reversals of the meridional temperature gradient and of the zonal circulation poleward of 60° North latitude, at the 10-hPa level. This definition was likely based on the observational system available during the 1970s, largely comprised of radiosondes and rocketsondes.

However, the details of the definition and its calculation are ambiguous, resulting in inconsistent classifications of SSW events. These discrepancies are problematic for understanding the observed frequency and statistical relationships with SSWs, and for maintaining a robust metric with which to assess wintertime stratospheric variability in observations and climate models. Our research shows that SSW detection is sensitive to the latitude of circulation reversal, the dataset