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# Influence of Indian Ocean Dipole and Pacific recharge on following year's El Niño: interdecadal robustness.

T. Izumo (1,2), M. Lengaigne (2), J. Vialard (2), J.-J. Luo (3), T. Yamagata (1), and G. Madec (4)

(1) University of Tokyo, Tokyo, Japan (izumo@eps.s.u-tokyo.ac.jp), (2) IRD, LOCEAN, Paris, France, (3) RIGC, JAMSTEC, Yokohama, Japan; presently at Bureau of Meteorology, Melbourne, Australia, (4) CNRS, LOCEAN, Paris, France

Better understanding the onset of El Niño/La Niña events is crucial to improve their seasonal forecasts, but remains a challenging issue. Recent studies suggest that the Indian Ocean Dipole (IOD) can affect the El Niño-Southern Oscillation (ENSO) state of the following year, in addition to the well-known preconditioning by equatorial Pacific Warm Water Volume (WWV) recharge. The IOD is thought to influence ENSO through modulation of the Walker circulation and oceanic wave dynamics similar to the delayed oscillator. This scenario is based on data analysis over the recent satellite era. Here we investigate the interdecadal robustness of this scenario, over a longer period (1870s-2000s).

We first develop an improved IOD index that fully exploits sparse historical observations in the Indian Ocean. We then show that zonally and temporally integrated equatorial Pacific zonal windstress is an efficient proxy of WWV interannual variations, allowing a long-term reconstruction of the WWV using atmospheric re-analysis data. A linear hindcast model based on these IOD and WWV indices in boreal fall explains 50% of ENSO peak variance 14 month later, with both influences remaining significant over most of the historical period. The hindcasts are equally skillful for both El Niños and La Niñas onset cases: negative (positive) IOD tends to induce El Niño (La Niña) the following year. The IOD is also a more robust ENSO predictor than uniform basin warming/cooling of the Indian Ocean, the Indian Monsoon or ENSO itself. Analysis of a 200 years-long coupled general circulation model also confirms that, despite some decadal fluctuations, the IOD and WWV influences on following year's ENSO almost always remain significant.

Based on these results and detailed analyses of teleconnections, we propose a conceptual scheme of Indo-Pacific interactions that slightly differs from the Tropical Tropospheric Biennial Oscillation (TBO) or Webster and Hoyos (2010) framework. The IOD-ENSO interactions favour a biennial timescale, and interact with the slower recharge-discharge cycle intrinsic to the Pacific Ocean. The Indian Monsoon responds rather passively to the IOD-ENSO coupled system. This study, based on statistical analyses, needs to be complemented by further modelling studies.