Pacific climate variability and the ENSO prediction

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Abstract

A new Pacific climate variability paradigm was recently proposed based on the two dominant coupled ocean-atmosphere (O–A) modes of surface variability and equatorial dynamics. These two leading modes explain most of the North Pacific climate variability and are linked with each other. The second O–A mode reflects the oceanic footprint of the meridional variability associated with North Pacific Oscillation through the tropical–extratropical teleconnection and commonly evolves into the El Niño–Southern Oscillation (ENSO) phase. This is confirmed by the occurrence of the warm Blob that developed after late 2013 in the northeastern Pacific, leading to the 2015 El Niño. Based on the new paradigm, a simple statistical model is derived to enhance the ENSO prediction through the evolution of the ocean heat condition and the oceanic Kelvin wave propagation associated with westerly wind events and easterly wind surges in the tropical Pacific. Including the additional extratropical forcing can further enhance the hindcast skill significantly, superior to many previous prediction models in terms of the monthly correlation, normalized RMSEs and ENSO occurrences. The longer lead-time of the hindcast skill than the other dynamical and statistical model predictions suggest that these processes are the keys to ENSO development.

Key word: ocean-atmosphere interaction, ENSO prediction, Pacific climate variability