A new perspective on El Niño diversity and its genesis

With the support by the National Natural Science Foundation of China and the Ministry of Science and Technology of China, Prof. Chen Dake's group at the State Key Laboratory of Satellite Ocean Environment Dynamics, the Second Institute of Oceanography, State Oceanic Administration, reported a study on the classification and genesis of El Niño diversity, which was published in *Nature Geoscience* (2015, 8: 339—345).

El Niño is by far the most energetic and influential interannual fluctuation in the Earth's climate system. Despite the tremendous progress in the theory, observation and prediction of El Niño over the past three decades, there is still considerable debate on the classification of El Niño diversity and on the genesis of such diversity. This uncertainty renders El Niño prediction a continuously challenging task, as manifested by the absence of the large warm event in 2014 that was expected by many. This study provides a unified perspective on El Niño diversity as well as its causes, supported by a fuzzy clustering analysis and model experiments. Specifically, the interannual variability of the tropical Pacific sea surface temperature can be generally classified into three warm patterns and one cold pattern, which together constitute a canonical El Niño/La Niña cycle and its different flavors. Whereas the genesis of the canonical cycle can be readily explained by classic theories, the asymmetry, irregularity and extremes of El Niño may well result from westerly wind bursts, a type of state-dependent atmospheric perturbation in the equatorial Pacific, which strongly affects El Niño but not La Niña due to its unidirectional nature. This suggests that properly accounting for the interplay between the canonical cycle and westerly wind bursts may improve El Niño prediction.

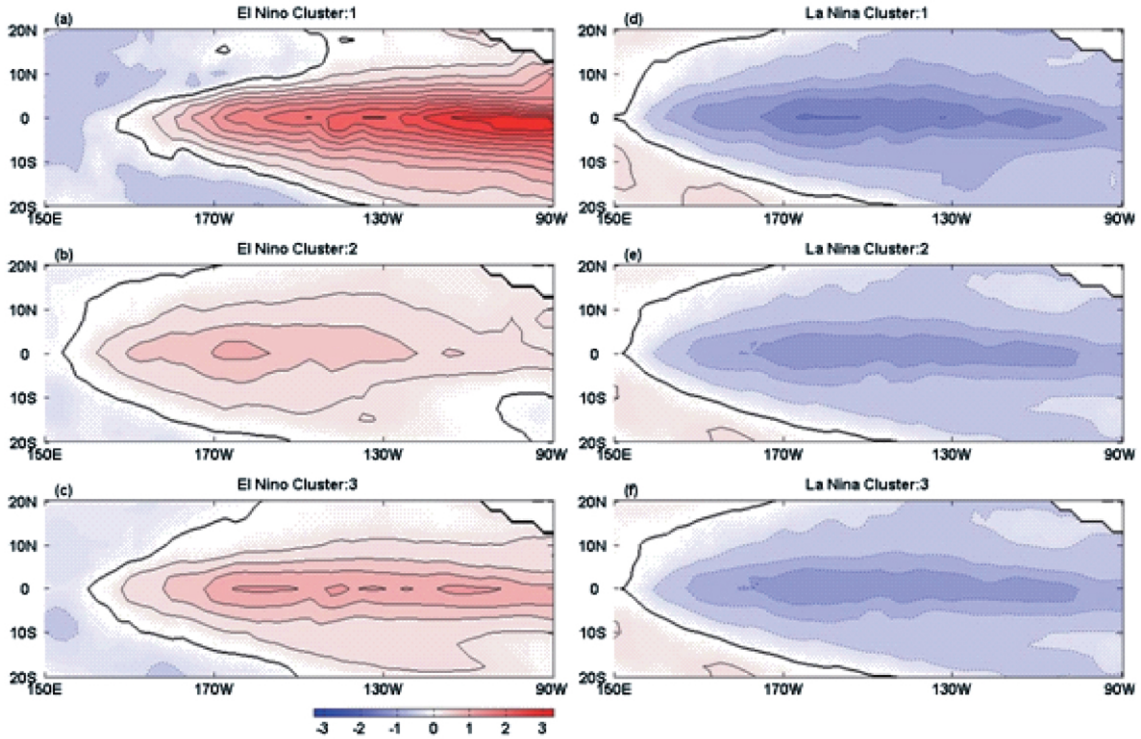

Figure The first three El Niño and La Niña clusters identified by the fuzzy clustering method. a-f, The identification of these warm (a-c) and cold (d-f) clusters of the tropical Pacific SST variability is based on 1961—2010 HadISST data. The contour interval is 0.3℃, and negative contours are dotted. The three El Niño patterns are distinctively different, whereas the three La Niña patterns are essentially identical.