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Detecting early warning signal of the Pacific Decadal Oscillation phase transition using complex network analysis

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Obtaining an efficient prediction of the Pacific Decadal Oscillation (PDO) phase transition is a worldwide challenge. Here, we employed the climate network analysis to uncover early warning signals prior to a PDO phase transition. This way an examination of cooperative behavior in the PDO region revealed an enhanced signal that propagated from the western Pacific to the northwest coast of North America. The detection of this signal corresponds very well to the time when the upper ocean heat content in the off-equatorial northwestern tropical Pacific reaches a threshold, in which case a PDO phase transition may be expected with the arising of the next El Niño/La Niña event. The objectively detected early warning signal successfully forewarned all the six PDO phase transitions from the 1890s to 2000s, and also underpinned the possible PDO phase transition around 2015, which may be triggered by the strong El Niño event in 2015-2016.