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Early warning of the Pacific Decadal Oscillation phase transition using complex network analysis

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The different phases of the Pacific Decadal Oscillation (PDO) are a primary source of internal decadal climate variability which have distinct impacts on global climate and human society. However, obtaining a reliable prediction of the PDO phase transition is still challenging. Here, we employed the new technique of climate network analysis to uncover early warning signals prior to a PDO phase transition. An examination of cooperative behaviors in the PDO region revealed an enhanced signal that propagated from the western Pacific, passed through the Kuroshio extension (KE) and the subtropical oceanic frontal (STF) regions, and finally reached the northwest coast of the Americas. This signal captured all six of the PDO phase transitions from the 1890s to 2000s, with a warning time of 6.5±2.3 years in advance. It also underpinned the possible PDO phase transition at years around 2015, which may be triggered by the strong El Niño in 2014-2016.