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An oceanic mechanism for decadal variability in the North Pacific

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Many studies have noted decadal scale sea surface temperature (SST) variability in the North Pacific Ocean. The spatial SST pattern has a cold anomaly in the central North Pacific that extends to the Pacific western boundary and resembles a broader and weaker El Nino signal in the tropics. This pattern of variability is often referred to as the Pacific Decadal Oscillation (PDO). Despite extensive research, the nature of the apparent oscillation between warm and cold SST anomalies in the central North Pacific is still surrounded by much uncertainty. A generally agreed upon point is that decadal-scale SST variability appears to be somehow linked to El Nino. However, the mechanism by which such variability is generated, be it an independent dynamical process or a stochastic reddening of other climate signals, is not well understood.

Decadal variability in the North Pacific has impacts both locally and remotely. Temperature changes in the North Pacific can have a significant effect on the local ecosystem. Remote effects of the PDO include changes to the surface climate (e.g., temperature and precipitation) in Australia, South and North America, the Russian Far East, much of eastern Asia, and the maritime continent. Improved understanding of decadal variability in the North Pacific could lead to a better understanding of climate variability in these remote regions.

Here we use a state-of-the-art high-resolution coupled climate model, HiGEM, to show that anomalous ocean transport in the North Pacific can largely account for the decadal-scale SST variability. We also demonstrate that it is likely that the same mechanism occurs in the real ocean, and therefore that internal ocean dynamics play a key role in regulating decadal-scale variability in the North Pacific.