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Team MIROC: Pacific decadal oscillation hindcasts relevant to near-term climate prediction

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Decadal-scale climate variations over the Pacific Ocean and its surroundings are strongly related to the so-called Pacific decadal oscillation (PDO) which is coherent with wintertime climate over North America and Asian monsoon, and have important impacts on marine ecosystems and fisheries. In a near-term climate prediction covering the period up to 2030, we require knowledge of the future state of internal variations in the climate system such as the PDO as well as the global warming signal. We perform sets of ensemble hindcast and forecast experiments using a coupled atmosphere-ocean climate model to examine the predictability of internal variations on decadal timescales, in addition to the response to external forcing due to changes in concentrations of greenhouse gases and aerosols, volcanic activity, and solar cycle variations. Our results highlight that an initialization of the upper-ocean state using historical observations is effective for successful hindcasts of the PDO and has a great impact on future predictions. Ensemble hindcasts for the 20th century demonstrate a predictive skill in the upper-ocean temperature over almost a decade, particularly around the Kuroshio-Oyashio extension (KOE) and subtropical oceanic frontal regions where the PDO signals are observed strongest. A negative tendency of the predicted PDO phase in the coming decade will enhance the rising trend in surface air-temperature (SAT) over east Asia and over the KOE region, and suppress it along the west coasts of North and South America and over the equatorial Pacific. This suppression will contribute to a slowing down of the global-mean SAT rise.