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Team MIROC: Initialization of the climate model MIROC for decadal prediction with hydrographic data assimilation

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The procedure to initialize climate models based on ocean data assimilation for decadal hindcast and forecast experiments designed by the IPCC AR5 and CMIP5 protocol are documented. Also the performance of the climate models MIROC4h with high resolution (T213 atmosphere and eddy-permitting oceans), MIROC5 and MIROC3m with medium resolution where the system for the ocean data assimilation is implemented are summarized. In our system, only anomalies of observed ocean hydrographic data are assimilated and high-frequency eddies permitted in MIROC4h are not constrained by coarse observations and they are physically generated or decayed in response to the assimilated background state. In the global domain, the anomaly correlation coefficients of the SST and the upper ocean heat content between the models and the observations are generally over 0.8. As for decadal climate variability, the PDO and the AMO in the coupled models are consistent with the observations. In particular, the atmospheric responses to the SST variations corresponding to the PDO and AMO are better represented in MIROC4h and MIROC5 than in MIROC3m thanks probably to higher resolution of MIROC4h and newly implemented cloud parameterizations of MIROC5. In the MIROC4h with the eddy-permitting ocean model, high-frequency oceanic eddy activities are clearly found around the western boundary currents and the Antarctic Circumpolar Current and their magnitudes are comparable with those in the 20th century runs. This means that undesirable suppression of eddies does not occur by the data assimilation. Focusing on the Kuroshio-Oyashio confluence zone, the long-term modulation of the oceanic eddies, which are of great importance in transporting nutrients, is reasonably represented in MIROC4h. It is expected that decadal climate predictions using the climate models MIROC contribute to the IPCC AR5 and thus political decision makings for the next decades.