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Team MIROC: Toward predicting the decadal changes of mesoscale eddy activities in the Kuroshio-Oyashio confluence zone

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For predicting a near-term climate up to year 2030 towards contributing to the 5-th assessment report of the IPCC, decadal hindcast/forecast experiments are in progress using MIROC4 developed at AORI/NIES/JAMSTEC with very high horizontal resolutions (atm. : T213, ocn.: 1/4^{o} x 1/6^{o}). In the initialization procedures, historical ocean subsurface data are assimilated into the ocean model. In this regard, mesoscale oceanic eddies in the model are filtered out in calculating analysis increments. This approach is used to assimilate only basin-scale and long-term variations resolved in the observational data and to generate high-frequency eddies physically in response to background currents and hydrographic structures. In the assimilation experiment, the interannual to decadal modulations of high frequency eddy activities in the Kuroshio-Oyashio interfrontal zone (KO zone) are represented reasonably as seen in observations, and in addition, the modulations seem to be predicted in a few cases of the hindcast experiments. The eddies in the KO zone are known to play an important role in transporting nutrient, large zooplanktons, and water masses in the subarctic North Pacific to the subtropics and in forming North Pacific Intermediate Water. The present results imply possibility in predicting ecosystem variations in the KO zone. However, such very high resolution modeling costs too much computational resources and thus a number of ensemble members for assimilations and predictions which is tightly linked with prediction skill is restricted. To solve this problem, we are modifying the climate model MIROC5, the latest version of MIROC, to incorporate a nested ocean model focused on the KO zone. The horizontal resolutions of the nested ocean model, global atmosphere, and ocean models are 0.2^{o}, T42, and 1o, respectively. This configuration is set just for preliminary experiments. At this stage, MIROC5 with the nested ocean model is integrated successfully for 30 years, and there are no significant trends in the global mean sea surface temperature and surface air temperature. In the KO zone where the nest model is adapted, the sharp meridional gradient of the SST associated with the Kuroshio Extension front and the Oyashio (or the subarctic) front are represented and mesoscale eddies spawned from the unstable fronts can be seen. The coupled model with the nested ocean model focused on some specific regions requires much smaller computational resources than the global high-resolution coupled model, and therefore it may be a powerful tool for predicting current and hydrographic structures, and furthermore ecosystem variations.