



Projected Changes of Kuroshio in a Warming Climate

The projected changes in the Kuroshio and the associated mechanisms in response to future warming scenarios remain unclear. While some studies propose a negative midlatitude wind stress curl (WSC) tendency could expedite Kuroshio recirculation, others suggest that the isopycnal transport of warmer subtropical mode water (STMW) to the east of the Kuroshio enhances only the velocity in the upper ocean. In the future projections under the Shared Socioeconomic Pathways 5-8.5 (SSP5-8.5) within the Coupled Model Intercomparison Project Phase 6 (CMIP6) model ensemble, a consistent enhancement of the Kuroshio along the Japanese coast (JP-Kuroshio) is observed. Particularly, the response of the JP-Kuroshio to WSC changes is more pronounced in high-resolution (HR) models compared to low-resolution (LR) ones. However, diverse results emerge in the East China Sea (ECS-Kuroshio). While most CMIP6 HR models indicate a reduction of Kuroshio within the upper 1000 m in the ECS-Kuroshio, the ensemble of CMIP6 LR models shows an intensification of Kuroshio within the upper 300 m and a deceleration below, suggesting a consistent baroclinic feature in ECS-Kuroshio. Additional ocean model sensitivity experiments confirm that the WSC influences the Kuroshio throughout the entire water column, particularly below 300 m. Within the upper 300 m, the primary driver of Kuroshio changes is the surface warming, aligning with the STMW mechanism. Moreover, it is suggested that the surface salinity flux may also play an important role in the dynamics of Kuroshio changes.

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