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Cross-shelf Water Exchange Between the Kuroshio and the Northern Marginal Seas of China

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Satellite ocean color and sea surface temperature data and satellite-tracked surface drifter trajectories are used to study the shelf circulation in the Yellow and East China Seas. The ocean color images show a significant turbid water plume extending in the southeast direction from the Subei coasts of China to the shelf edge southwest of Cheju during fall-winter, suggesting significant cross-shelf current in the Yellow Sea/East China Sea in winter. The turbid plume grows in fall, reaches its maximum expansion and intensity in winter-spring, and subsides in late spring. Cold sea surface temperature is associated with the cross-shelf currents, suggesting its nearshore origin in winter. The cross-shelf current is also expressed explicitly by the latest surface drifter trajectories released in the Yellow and East China Sea and tracked by the satellite. The dynamics of the cross-shelf current are found to be induced by the divergence of the wind-driven currents over the middle shelf in winter. A southward sea level gradient is set up by the northerly winds through the propagation of topographic Rossby waves, which forces a broad cross-shelf current in the Yellow and East China Seas in winter.

Satellite images also suggest that the East China Sea shelf is frequented with the Cross-shelf Penetrating Fronts (CPF), which are direct and large-distance excursions of coastal mean fronts across the shelf for distances usually exceeding 50 km. The CPFs bring nearshore waters to the middle-to-outer shelf of the East China Sea, representing an important path of material transport across the shelf.