were manifested in the improved interchain arrangement. Compared with the compounds, the bulky pendent group of **1ac** was the main factor interfering in the molecular packing. Moreover, the superior performance of the **1bb** FET can be attributed to the geometric difference in **1ab**; the interior Mes moiety of **1bb** results in a more twisted backbone. The results thus demonstrated that the absence of a bulky pendant moiety and increased twisting of the helical structure of the studied helicenes enhance molecular packing and the resulting charge-transport properties.

The study not only presents a successful synthetic method for preparing helicenes but also highlights the effectiveness of helical structures for charge transportation. On the basis of our findings, additional extended helicene derivatives can be designed, and they are expected to show better performances in certain applications.

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Long-term observations reveal variability of the Kuroshio east of Taiwan

Currents act as rivers in the sea. Like a giant river in the western Pacific Ocean, Kuroshio is the western boundary current of the North Pacific subtropical gyre, and it originates from the northern branch of the North Equatorial Current (NEC) bifurcation off the east coast of the Philippines. The Kuroshio links the Asian marginal seas by flowing northward to the east of Luzon Island, by the Luzon Strait, east of Taiwan, along the continental slope of the East China Sea, and along the south coast of Japan. The current discharges approximately ~20 million tonnes (or Sv) of warm water every second, which is ~20 times the discharge value of all the world's rivers, from the tropics to the cold zone. Therefore, the Kuroshio plays a critical role in regulating the Earth's climate. The research team at the Institute of Oceanography at National Taiwan University investigated the variability of the Kuroshio east of Taiwan at a cross-stream transect using an array of three moored acoustic Doppler current profilers (ADCPs) that collected measurements for ~23 months (Figure 1). The dataset was collected through the Observations of the Kuroshio Transport Variability (OKTV) and Observations of the Kuroshio and Mindanao Currents (OKMC) collaborative programs that are sponsored by Taiwan and the United States, respectively.

Figure 1. The technicians onboard R/V Ocean Researcher I are deploying ADCP moorings within the Kuroshio off the coast of Hualien.

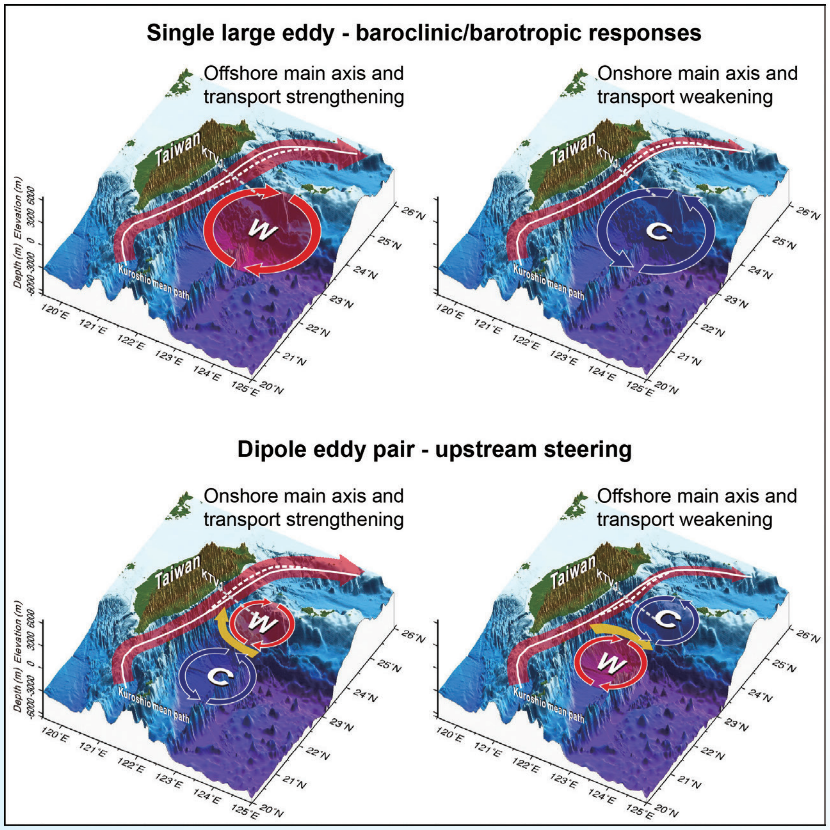

Figure 2. Schematic diagram showing the zonal migration and transport variation of the Kuroshio induced by the eddy impingements.

In the upper 500 m across a 150-km section, the Kuroshio transport value was 17.2 Sv, with a standard deviation of 5 Sv. The estimated Kuroshio transport was 4.3 Sv lower than an estimate observed ~18 years ago. This difference is likely due to the interannual variations related to the abundance of mesoscale eddies in the Subtropical Counter Current (STCC) region. Analysis indicates that the Kuroshio has stronger variability than rivers on the ground in terms of its transport and stream pathway. The standard deviation of 5 Sv is attributed to the modulation of the flow by cyclonic and anticyclonic eddies.

Observations of the velocity structure of the Kuroshio reveal significant variability at the 70-200 day period for both maximum velocity axis migration and transport due to the impingement of westward-propagating mesoscale eddies, which were generated thousands of kilometers east of Taiwan. The migration and transport explained 46% and 29% of the total variance in current velocity, respectively (Figure 2). When single anticyclonic (cyclonic) eddies encounter the Kuroshio, they enhance (reduce) poleward transport, presumably by increasing (decreasing) the sea level anomaly (SLA) along the eastern flank of the Kuroshio (geostrophic balance). When a pair of eddies impinge on the Kuroshio, the upstream confluence and diffluence caused by the dipole eddies increase and decrease the Kuroshio transport, respectively. Furthermore, the eastward (westward) currents that result from either the single eddy or the dipole eddy produce flow divergence (convergence) adjacent to the eastern edge of the Kuroshio, which favors the offshore (onshore) migration of the Kuroshio axis. It is expected that the observed Kuroshio variability will contribute to ocean modeling/forecasting, climate models, and green power development.

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