The eastward trajectories in the Kuroshio upstream region

Yu-Hao Tseng* and **Chung-Ru Ho**

National Taiwan Ocean University, Department of Marine Environmental Informatics, Keelung, Taiwan
(*11181001@email.ntou.edu.tw)

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When the Kuroshio passes through the Luzon Strait from its upstream east of Luzon Island to its downstream east of Taiwan, there are three types of possible routes. First of them is the western component, also known as the western branch, which can be further divided into looping path and leaking path (the Kuroshio intruding into the South China Sea). The second type is the mainstream connecting the eastern Luzon Island and the eastern Taiwan Island, which has the pattern nearly as same as the long-term mean of the Kuroshio path in this region. Lastly, the third type of route is the eastern branch that is to be focused by this study. Its definition is that the east components of the current around the Kuroshio's route are greater than the north components and then taking the material away from the Kuroshio main stream in the eastward direction. Therefore, to find the possible routes of the Kuroshio and make the numbers of trajectories of each simulation to be fairly same with the other days, we use OpenDrift (an open-source Python-based framework for Lagrangian particle modeling) as a tool to simulate the trajectories of the Kuroshio started at a given position 18.375°N and 122.875°E from 1993 to 2020. The input data that used as simulation is the geostrophic current derived from altimeter data provided by CMEMS from January 1993 to December 2021. The spatial and temporal resolutions of the input data are 0.25° and one-day, respectively. The results revealed that the accumulated numbers of trajectories as the type of the eastern branch of the Kuroshio would be more frequently during March to June. Meanwhile, the averaged wind stress curl (WSC) of the 10-m wind field data from NCEP/NCAR Reanalysis 1 with a 4-times daily temporal resolution and a 1.875° horizontal resolution was calculated. The difference between the monthly WSC and the annual mean WSC over the entire Pacific Ocean from 1993 to 2020 showed that there is a significant eastward transport along the 20°N-21°N latitude in May. This implies that the eastern branch of the Kuroshio may be caused by WSC. Finally, the connection between Kuroshio in the Luzon Strait and southern branch of the subtropical countercurrent (STCC) (Noh et al., 2007; Kim et al., 2014; Zhang , 2020; Wu et al., 2023) needs to be clarify in the future work.

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The simulating method and module of this study is developed by Opendrift (Release v1.9.0). This is an open-source Python-based framework for Lagrangian particle modeling (Dagestad et al., 2018).

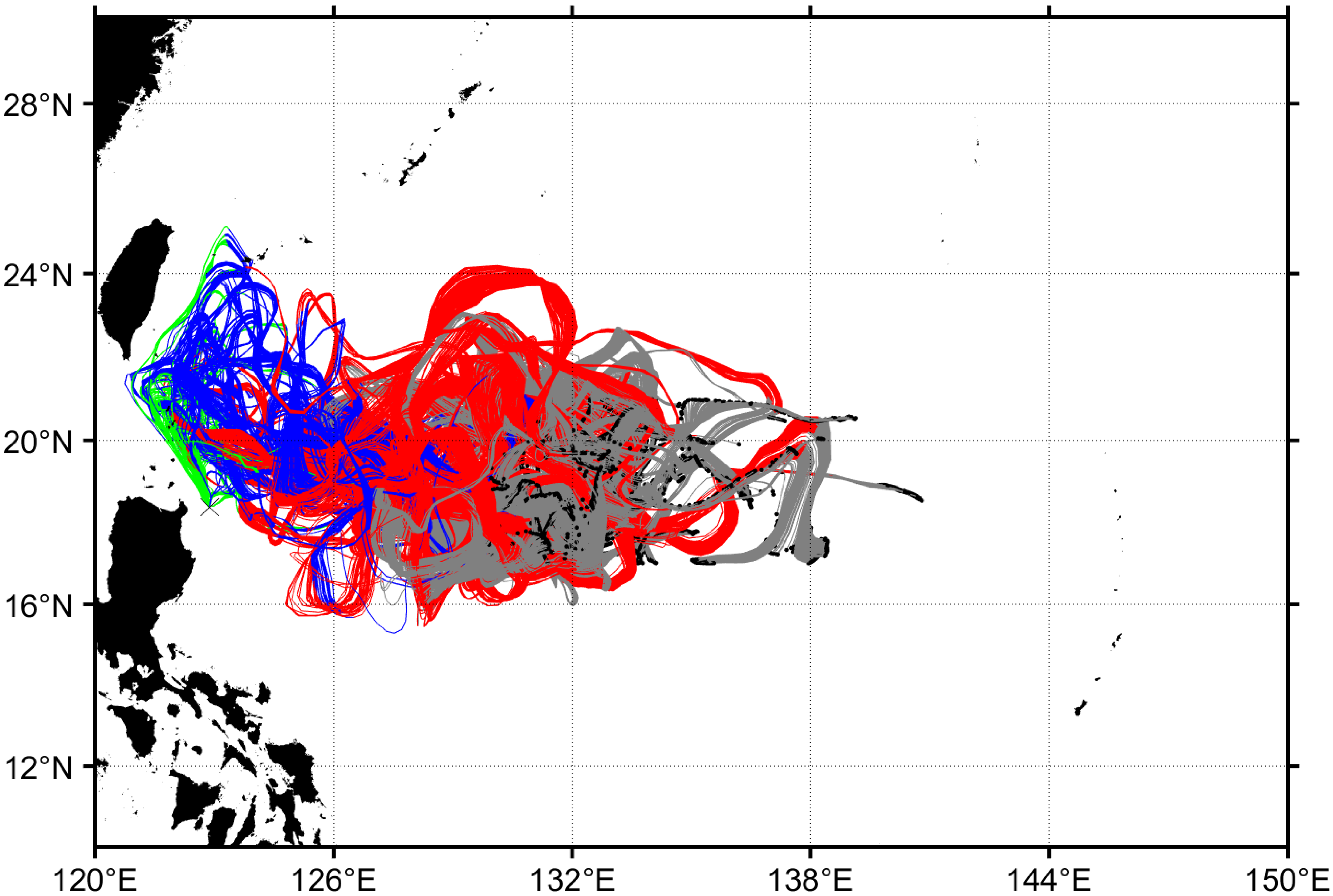

Figure 1.
The eastward trajectories simulated by OpenDrift from 1993 to 2020.
Green: March, blue: April, red: May, gray: June.
The black X-cross sign stands for the initial point of the simulated drifter
The black dots denote the final points of the simulated drifters.
All of these trajectories were simulated at the initial points seeding from 1 March to 31 March.

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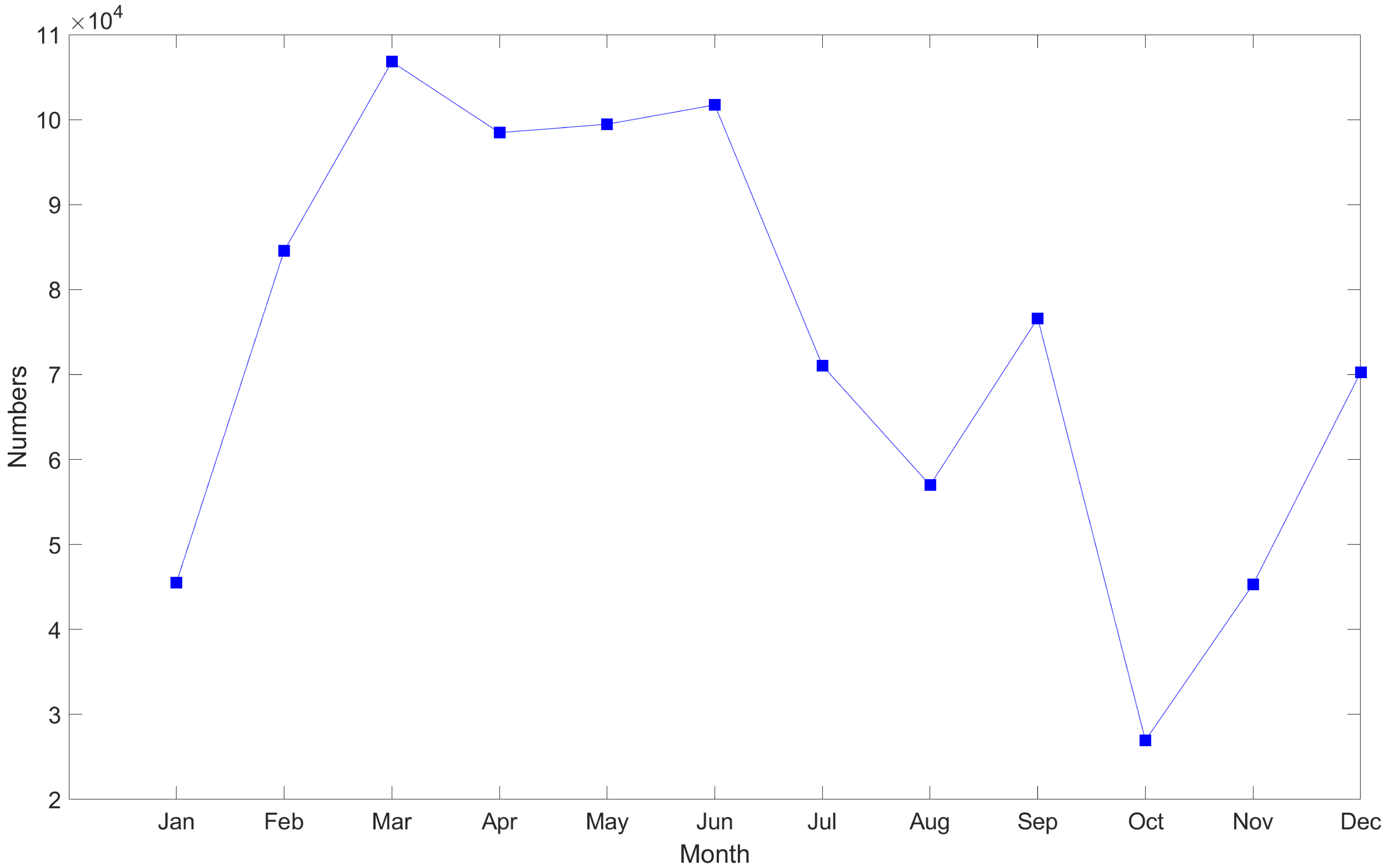

Figure 2.
The monthly accumulated numbers of eastward trajectories simulated by OpenDrift from 1993 to 2020.

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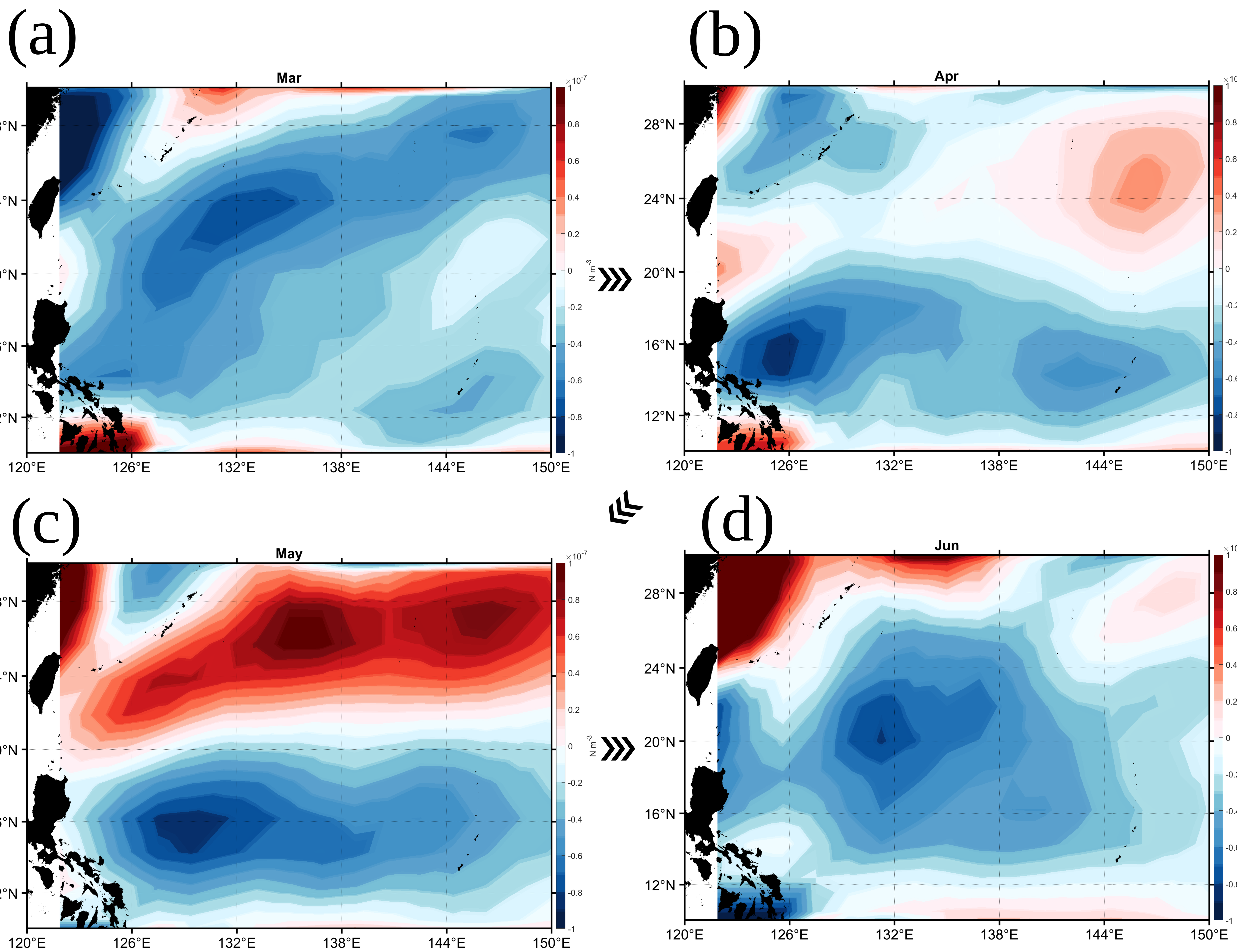

Figure 3.
(a) Monthly anomaly of WSC from 1993 to 2020 (March).
(b) Monthly anomaly of WSC from 1993 to 2020 (April).
(c) Monthly anomaly of WSC from 1993 to 2020 (May).
(d) Monthly anomaly of WSC from 1993 to 2020 (June).

The positive (red) WSC and the negative (blue) WSC distributing at north and south form an eastward direction force to the ocean current.

References

1. Dagestad, K. F., Röhrs, J., Breivik, Ø., & Ådlandsvik, B. (2018). OpenDrift v1. 0: a generic framework for trajectory modelling. *Geoscientific Model Development*, *11*(4), 1405-1420.
2. Kim, E., Jeon, D., Shin, C. W., & Kim, D. G. (2014). Variation of the southern subtropical countercurrent related to sea surface height and eddies in the Northwest Tropical Pacific. *Ocean Science Journal*, 49, 35-46.
3. Noh, Y., Yim, B. Y., You, S. H., Yoon, J. H., & Qiu, B. (2007). Seasonal variation of eddy kinetic energy of the North Pacific Subtropical Countercurrent simulated by an eddy-resolving OGCM. *Geophysical Research Letters*, 34(7).
4. Wu, B., & Gan, J. (2023). Seasonal Modulation of the Eddy Kinetic Energy and Subtropical Countercurrent Near the Western North Pacific Boundary. *Journal of Geophysical Research: Oceans*, e2022JC019160.
5. Zhang, Z. (2020, May). The possible formation mechanism of the Subtropical Countercurrent in the Pacific Ocean. In *EGU General Assembly Conference Abstracts* (p. 6635).