Dear Editor

Many thanks for your time. We have revised 8 figures in the manuscript (Figures 1, 2, 4, 5, 10, 11, 12 and 13) according to the simulator. Markers and legends have been also added into the figures, which is more convenient to follow. Moreover, authors have polished the manuscript marked by the blue font.

Looking forward to hearing from you. Have a good weekend!

Best regards,
Junyi Li
March 10, 2023

Details of modification

(1) The revised manuscript:

Lines 314-320:

As the PDO phase changed after 2014, the wind UI and Chl-a concentration seem to be positively correlated with each other. There was strong ENSO event in 2015-2016 and the strong wind stress curl in 2018. High wind UI and wind stress curl occurred in 2015-2016 combined with high Chl-a concentration. In 2018, though there was weak wind UI, the strong wind stress curl still induced a strong upwelling process as shown in Figure 4. However, low Chl-a concentration occurred in UHE in 2018 (Figure 5c). This further confirms the limited effects of upwelling on Chl-a in the study area. The environmental factors need to be further investigated.

Lines 492-509:

In the upwelling season, i.e., summer, the wind was larger during El Niño events than during La Niña events (Figure 12). In summer 2005 after an El Niño event, the wind stress and upwelling area were much larger than that in summer 2004 before the event. The upwelling area increased in 2005 as shown in Figure 4b, while the Chl-a concentration decreased to 0.6 mg m^{-3} in June 2005. During 2015-2016, the summer wind stress and curl were both strong and the upwelling area was larger than that in 2014. There was anomalously high Chl-a concentration occurred in June 2016. Jing et al. (2011) have reported analogously high Chl-a concentration anomaly in 1998. We should notice that a maximum SST occurred in summer 2016 with a maximum of Chl-a concentration. While, there were minimum values of background SST (Figure 4b) occurred in summer of the year 2008, 2011, 2012, 2017 and 2018 combined with minimum of Chl-a concentration (arrows in Figure 12). Therefore, ENSO events regulated the Chl-a concentration of the upwelling through wind stress and background SST. Further research is required to investigate the relationship between the Chl-a variability and ENSO in the HEC.

(2) The revised figures:

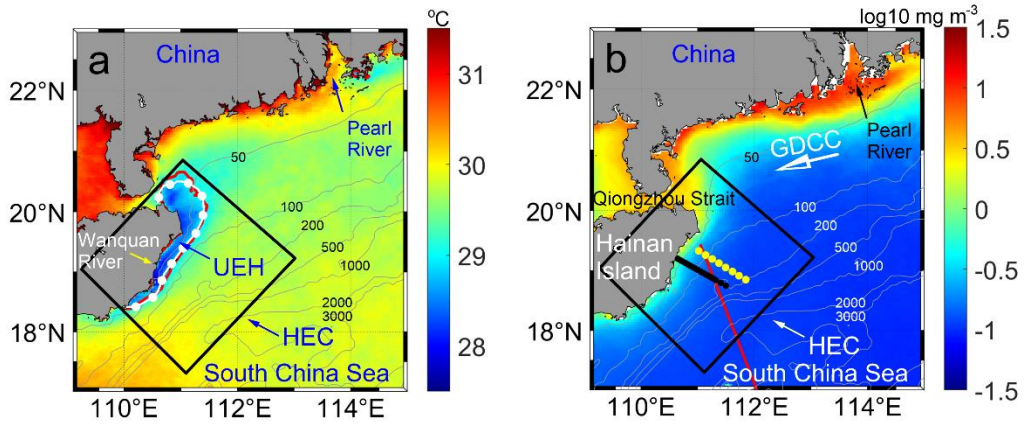

Figure 1. Study area (black square) and sampling sites. (a) Climatological (June-August) sea surface temperature (SST) and (b) Chl-a concentration during 2003–2020. In panel (a), the white dotted curve is the SST front for June-August; the red curve is the 29° isotherm. In (b), the dots are the observation sites for the cruise during July 14–15, 2021 (black), and October 2–3, 2019 (yellow), and the red curve is the altimeter satellite ground track (Track 114). The unit of the numbers on the isobaths is meters.

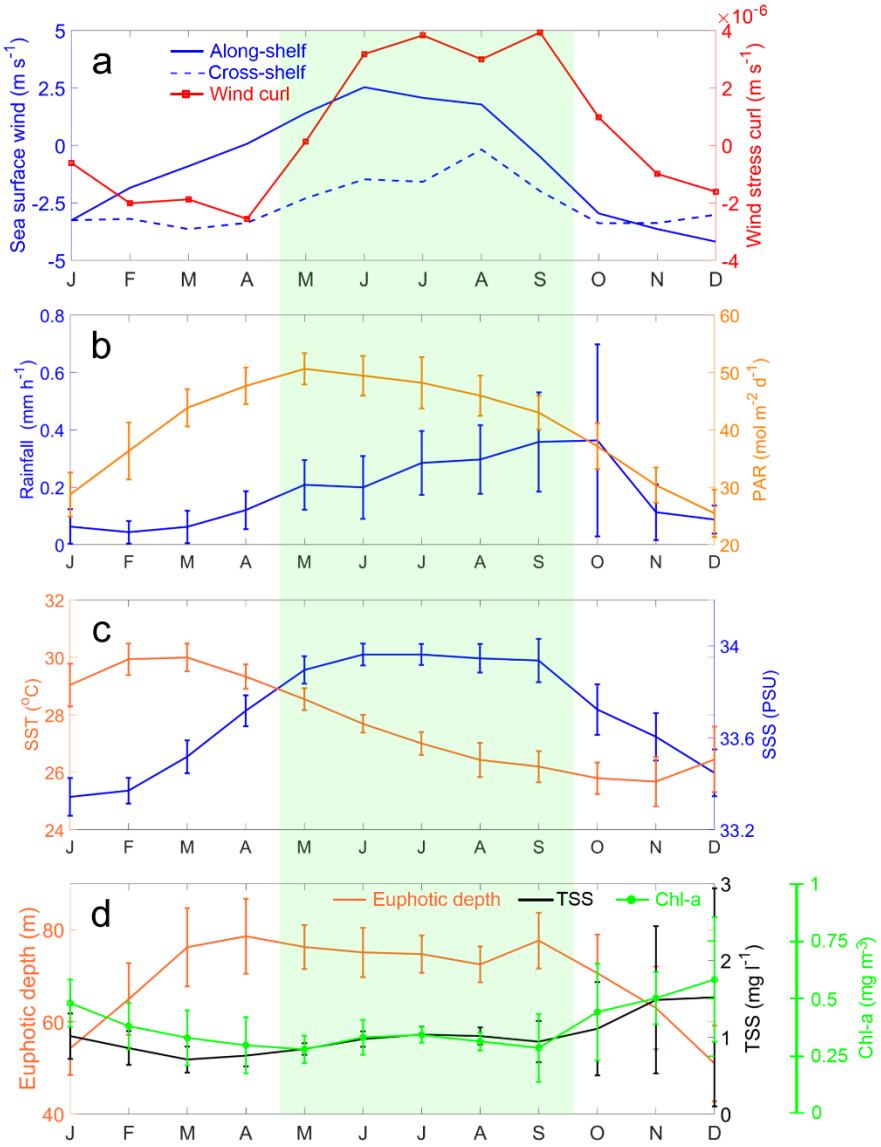

Figure 2. Monthly climatological (a) sea surface wind and wind stress curl, (b) rainfall and PAR, (c) SST and SSS, and (d) euphotic depth, Chl-a and TSS in the study area. The error bar indicates the standard deviation (STD). The shaded area indicates the upwelling season.

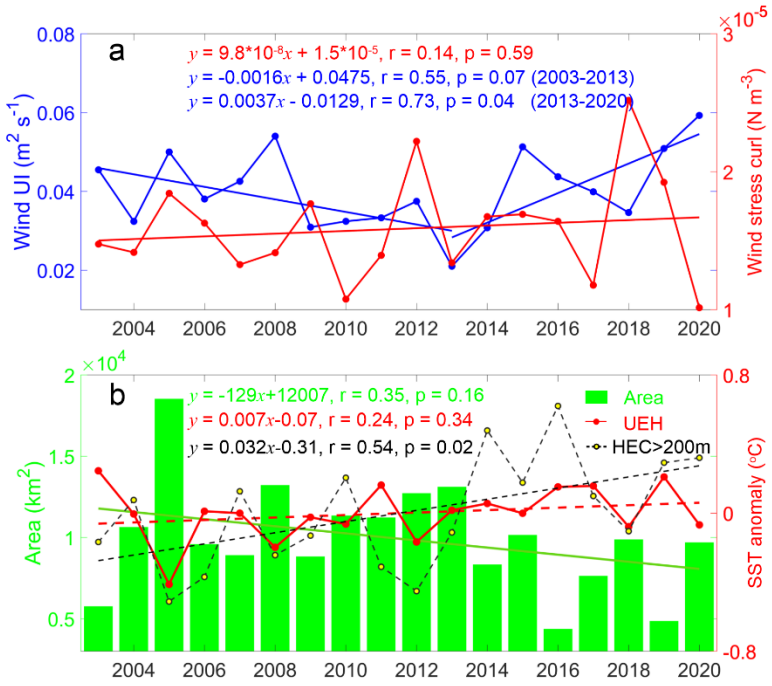

Figure 4. Time series of Upwelling index (UI) and upwelling characteristics. (a) Time series of mean sea surface wind UI and wind stress curl in HEC region. Blue dotted curve denotes the mean UI during June-August; the red dotted curve is mean wind stress curl during June-August; and blue and red curves are the trends of the UI and wind stress curl, respectively. (b) Time series of upwelling area and SST. Green bar denotes the area of UEH region. Red and black dotted curve denote mean SST of UEH region and slope region (depth>200 m) in HEC, respectively. Green, red and black lines are the trends of the upwelling area, mean SST in UEH and slope area, respectively.

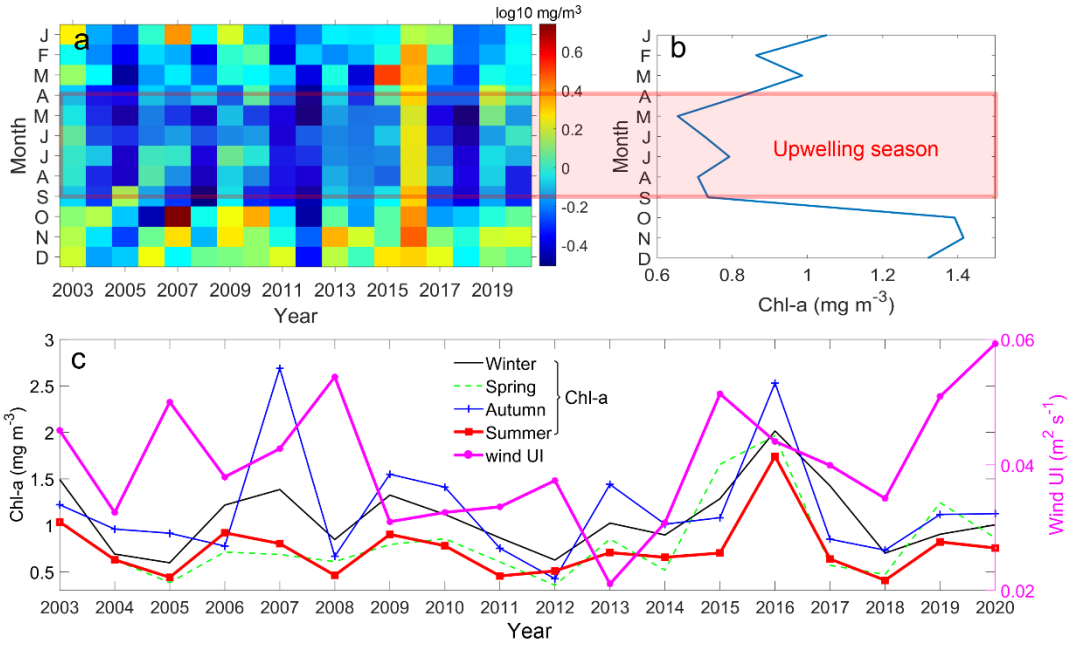

Figure 5. Time series of (a) the spatial mean of the Chl-a concentration in the upwelling area, (b) the monthly climatological mean Chl-a, (c) the seasonal mean Chl-a and wind UI. The red shading indicates the upwelling season from April to September.

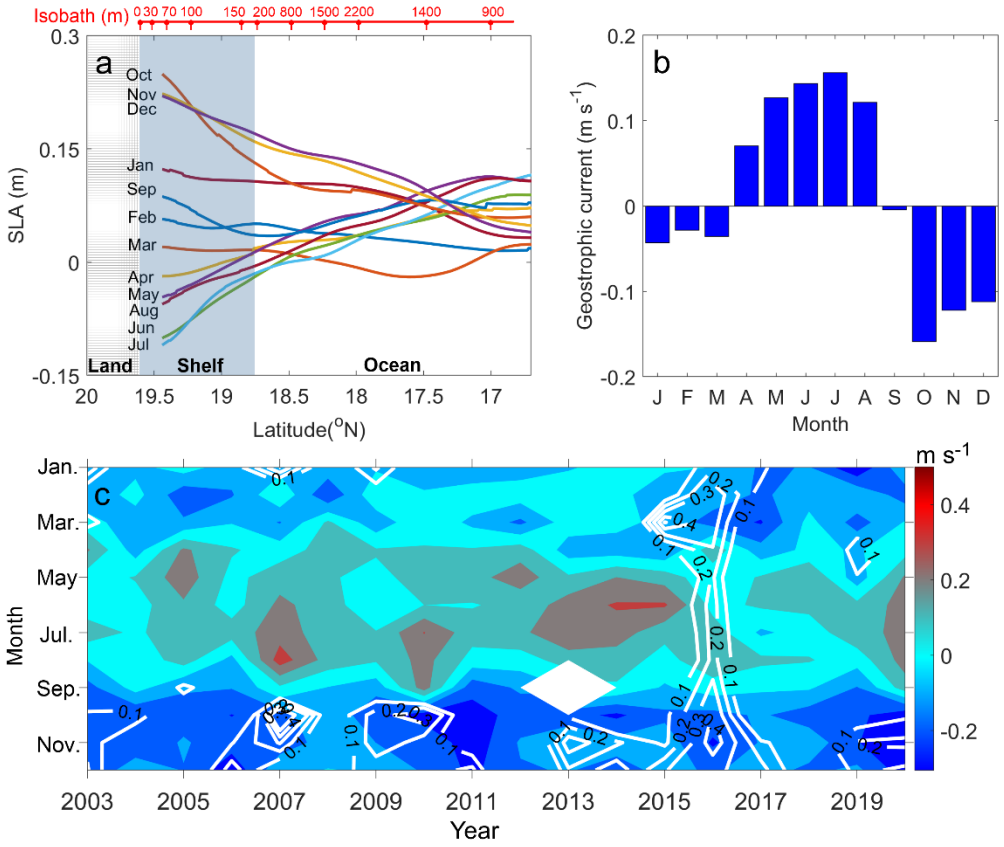

Figure 10. (a) Latitudinal distribution of climatological along-track SLA (track number: 114). (b) Geostrophic current retrieval from climatological along-track SLA. (c) Time series of geostrophic current (contours) and Chl-a concentration (white contour curves). The shadings in (a) represent the ocean, continental shelf, and land areas, respectively. The red bar with numbers in (a) indicates the water depth of the along-track SLA data. The values in (c) are the exponents of the Chl-a concentration.

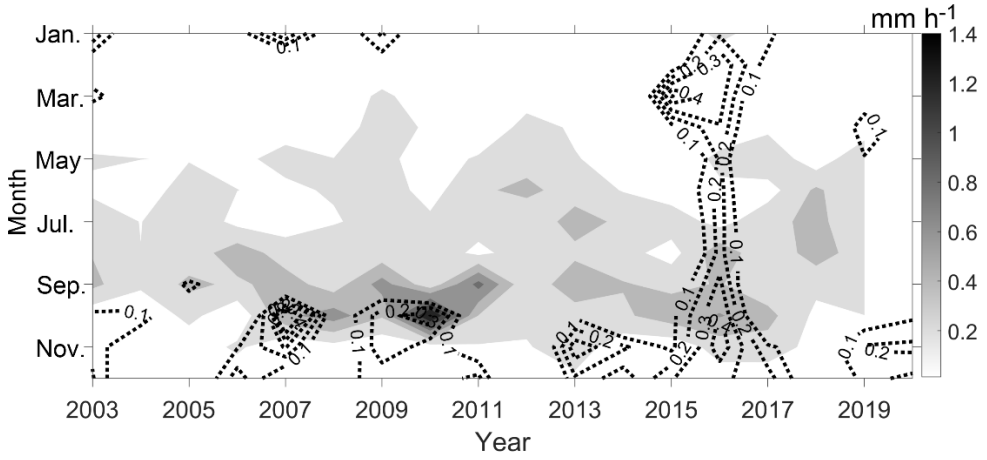

Figure 11. Time series of the rainfall rate (contours) and Chl-a concentration (dotted curves with text labels). The values on the contours are the exponents of the Chl-a concentration.

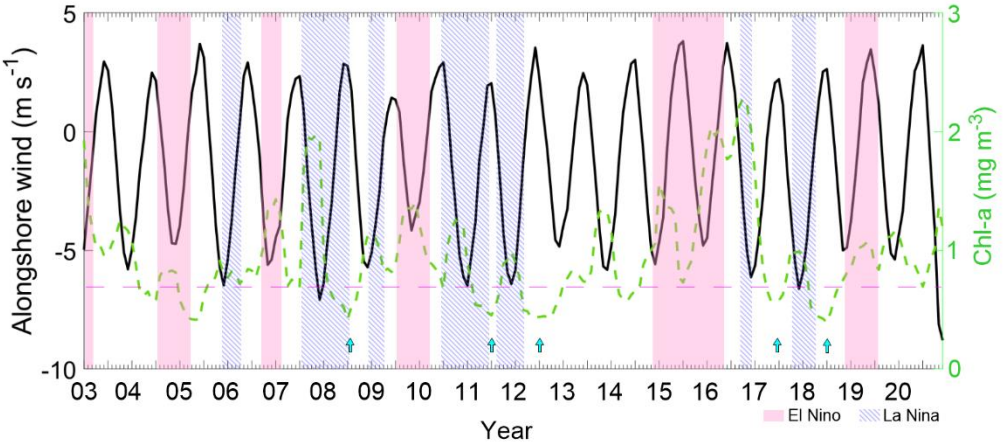

Figure 12. Time series of Chl-a (green curve) and along-shelf wind (black curve). Stripes point out the El Nino (magenta) and La Nina (blue) events. Blue with black arrows point out the minima value of Chl-a concentration. Magenta dashed line indicate high Chl-a concentration during El Nino events.

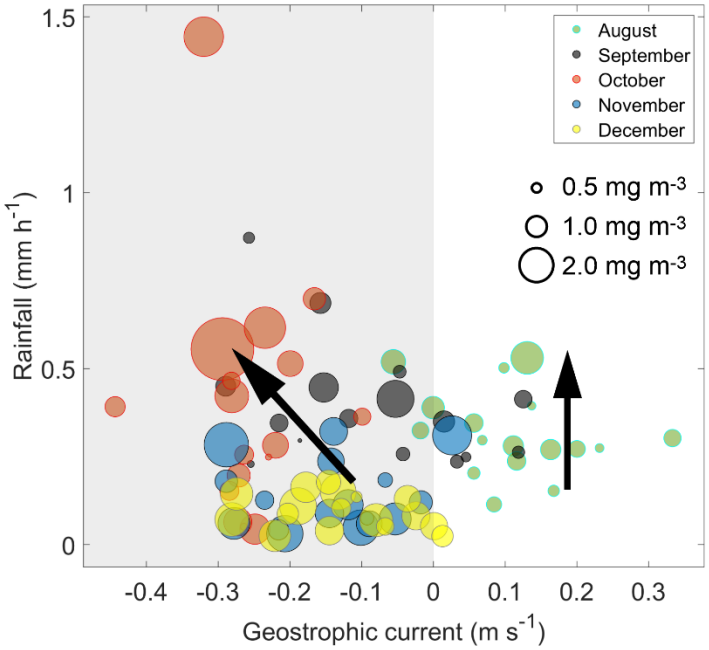

Figure 13. Bubble diagram showing the relationships between the geostrophic current and rainfall and the Chl-a concentration. The size of the bubble represents the Chl-a concentration. The left panel in grey represents the southwest along-shelf current in winter. The right panel represents the northeast along-shelf current in summer. Black arrows represent the relationship between the geostrophic current and rainfall and the Chl-a concentration.