Supplementary information for

Widespread sea surface salinification induced by tropical cyclones over the Changjiang River Plume

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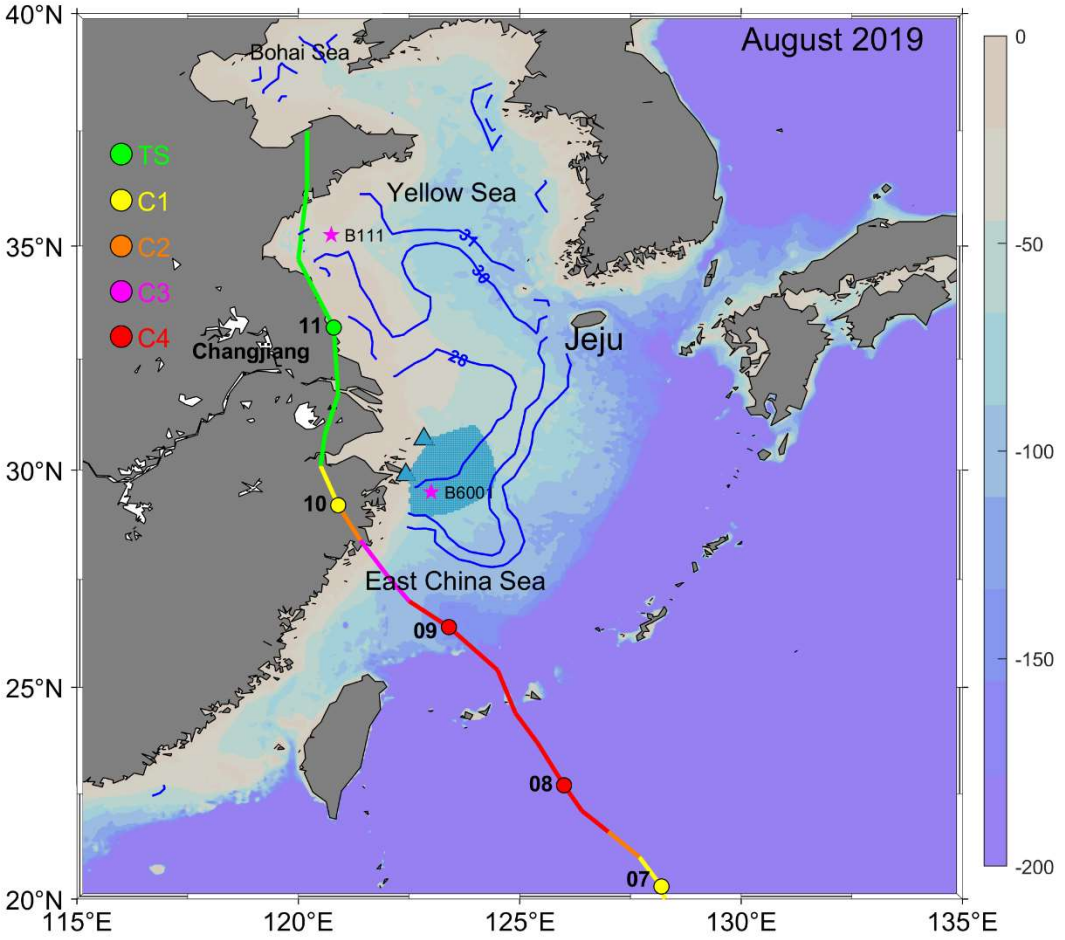
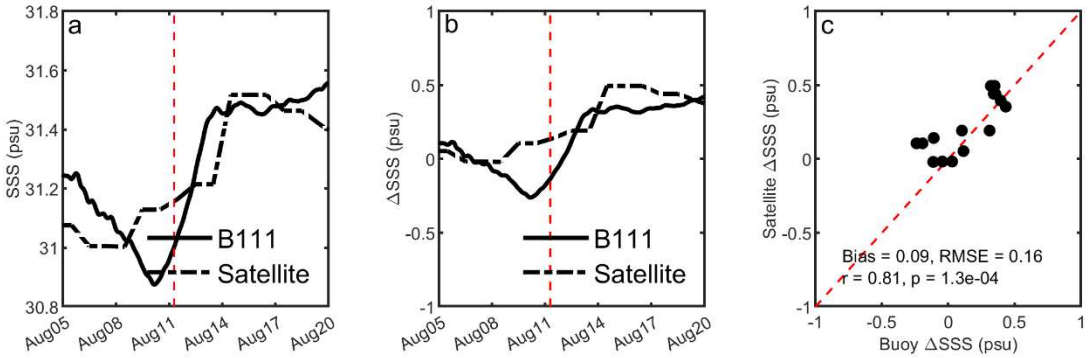
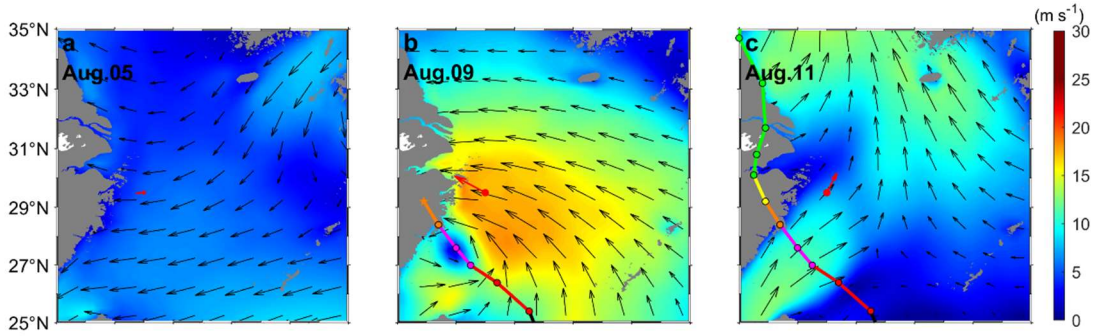


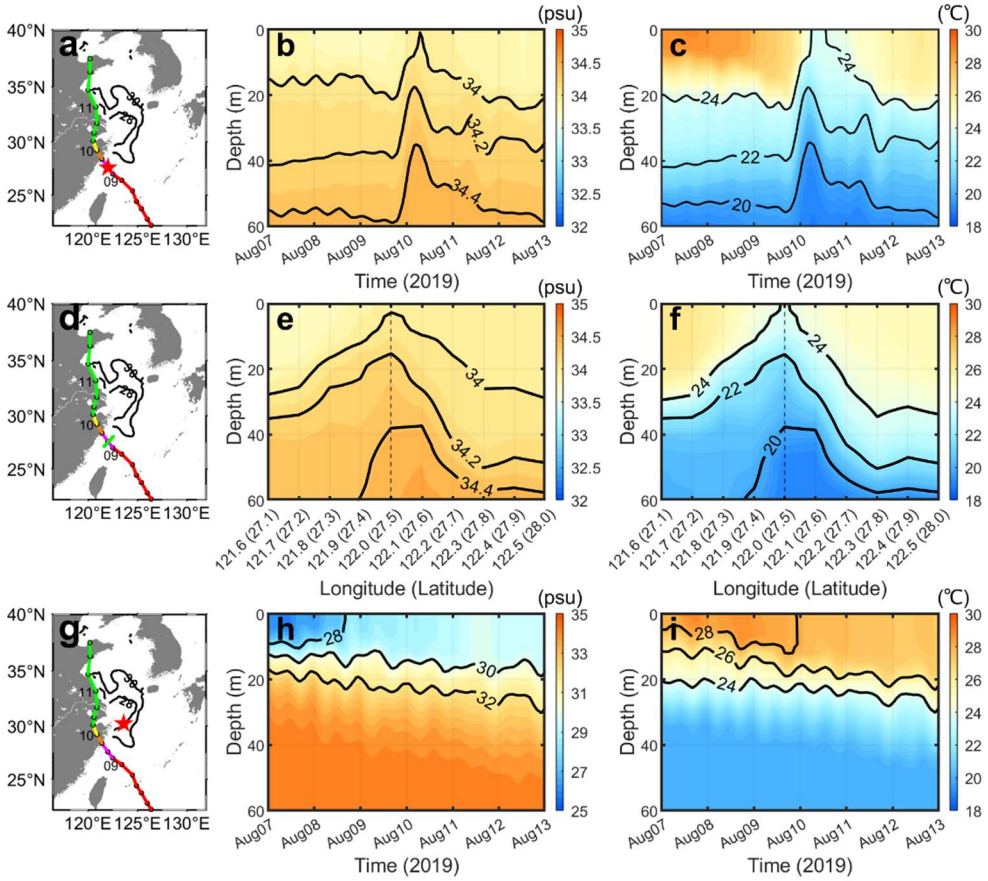
Supplementary Figure 1. Locations of in-situ buoys and radar. Magenta stars denote the locations of buoys B111 and B6001, which are located in the Yellow Sea and the East China Sea, respectively. Blue triangles indicate the location of the radar, and meshed area represents the area covered by high-frequency radar observations. Tracks of Lekima are colored based on the Saffir-Simpson Hurricane Scale, with UTC 00 h marked for each day. Sea surface salinity of 28, 30, and 31 psu before the Lekima passage are contoured. Background color denotes the topography. The topography data (ETOPO1) are downloaded from the U.S. National Geophysical Data Center (https://rda.ucar.edu/datasets/ds759.4/).



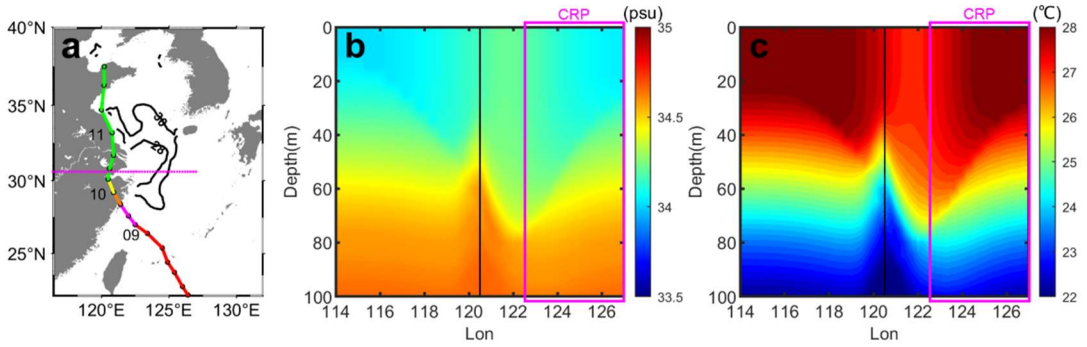
Supplementary Figure 2. Comparison of sea surface salinity (SSS) and its changes induced by Lekima between satellite and buoy B111 observations. a Time evolution of SSS from August 5 to August 20, based on satellite observation (dashed line) and buoy B111 observation (solid line). Red line denotes the time of Lekima passing the buoy B111. The buoy observations are smoothed for 24 hours. Note that an offset value of 0.5 psu is added to the satellite observations. **b** Same as (**a**), but for SSS changes induced by Lekima. **c** Scatterplot of satellite SSS observations and daily-mean buoy SSS observations. Red line denotes the perfect equality between the satellite and buoy observations. Bias and root mean square error (RMSE) of satellite observation, as well as correlation coefficient (r, and p values) between the satellite and buoy observations, are labeled at the bottom. The correlation coefficient is statistically significant above the 99% confidence level. Satellite SSS data are 8-day running mean while the buoy observations are hourly data, which may contribute to the inconsistency in the SSS results.



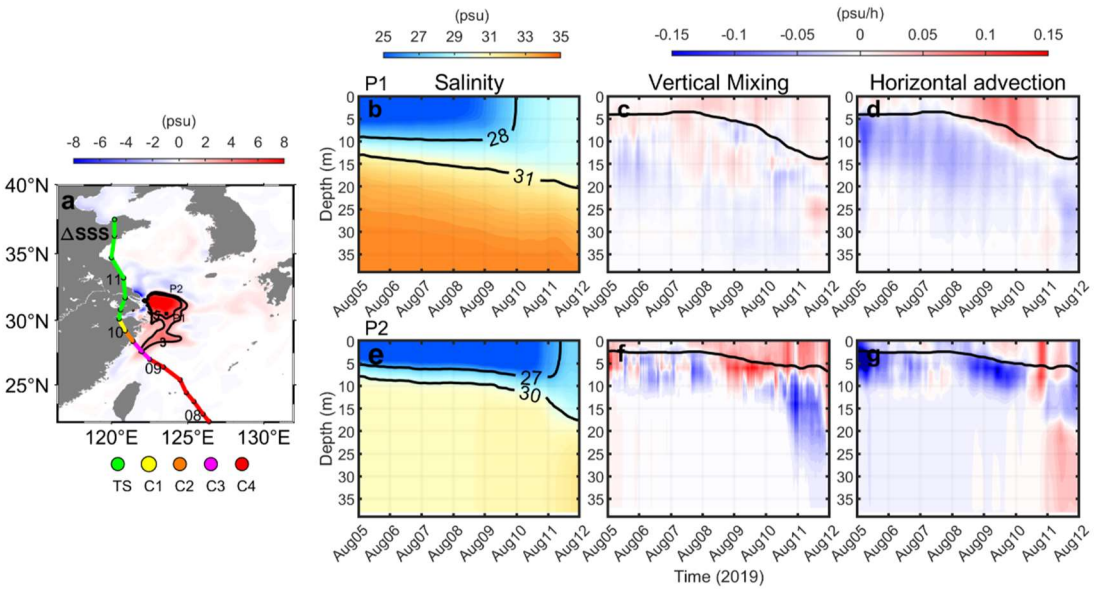
Supplementary Figure 3. Wind evolution. a Winds before the Lekima passage on August 5. Background color and black lines indicate ERA5 winds. Red arrow indicates winds from buoy B6001. **b** Winds during the Lekima passage on August 9. Solid line with dots denotes the track of Lekima that has occurred as of the current time. **c** Winds after the Lekima passage on August 11.



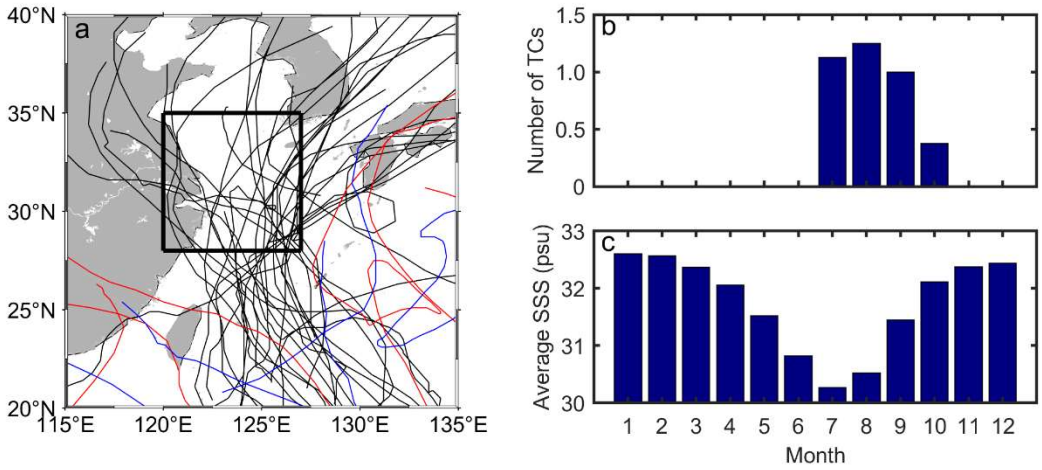
Supplementary Figure 4. Salinity and temperature profiles beneath Lekima and in the Changjiang River Plume. a Colored-solid line with dots denotes the track of Lekima. Red star denotes the location of salinity and temperature profiles in (**b,c**). Black lines denote 28 psu and 30 psu isohalines of pre-Lekima sea surface salinity. **b** Salinity profiles at the red star location at (**a**). The salinity profiles are 6-hourly smoothed. Black lines denote isohalines. **c** Same as (**b**), but for temperature profiles. **d** Green line denotes the cross-track line. **e** Salinity profile from 121.6°E (27.1°N) to 122.5°E (28.0°N). The salinity profiles are 6-hourly smoothed. Solid black lines denote isohalines. Dashed black line denotes the location of the Lekima center represented by the red star in (**a**). **f** Same as (**e**), but for temperature profile. **g–i** Same as (**a–c**), but for a location at the rad star (123.6°E, 30.2°N) far from Lekima center.



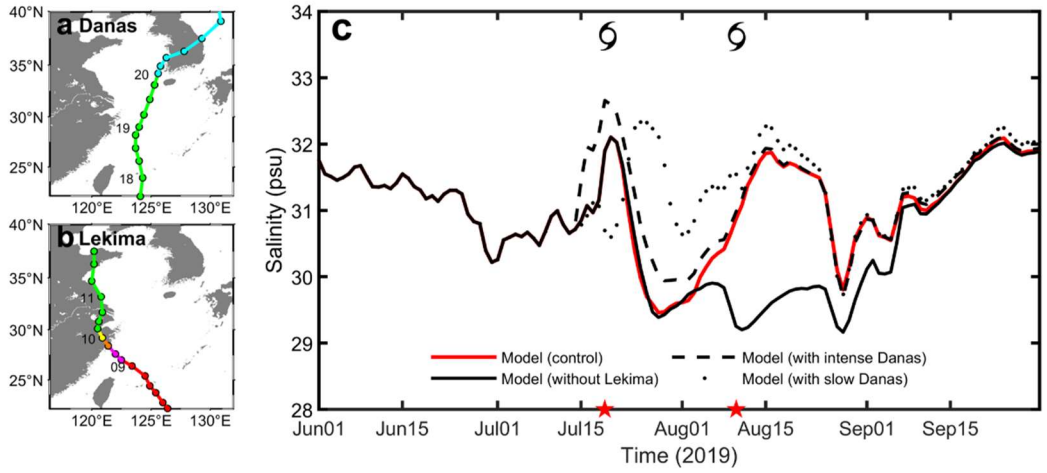
Supplementary Figure 5. Cross-track salinity and temperature profiles in a three-dimensional Price-Weller-Pinkel model. In reality, Lekima was inland on August 10. We explore the potential range of upwelling that Lekima would have induced if it had not moved inland, using the model. **a** Colored-solid line with dots denotes the track of Lekima. Purple line denotes the location of cross-track salinity and temperature profiles in (**b,c**). Black lines denote 28 psu and 30 psu isohalines of pre-Lekima sea surface salinity. **b** Salinity profiles from 114°E to 127°E (30.6°N). Black line denotes the passage of Lekima. Red box denotes the range of the main Changjiang River Plume region (except land and Changjiang River mouth area). **c** Same as (**b**), but for temperature profiles. The results indicate that even if no land was present, the upwelling induced by Lekima would not influence the sea surface salinification of the Changjiang River Plume.



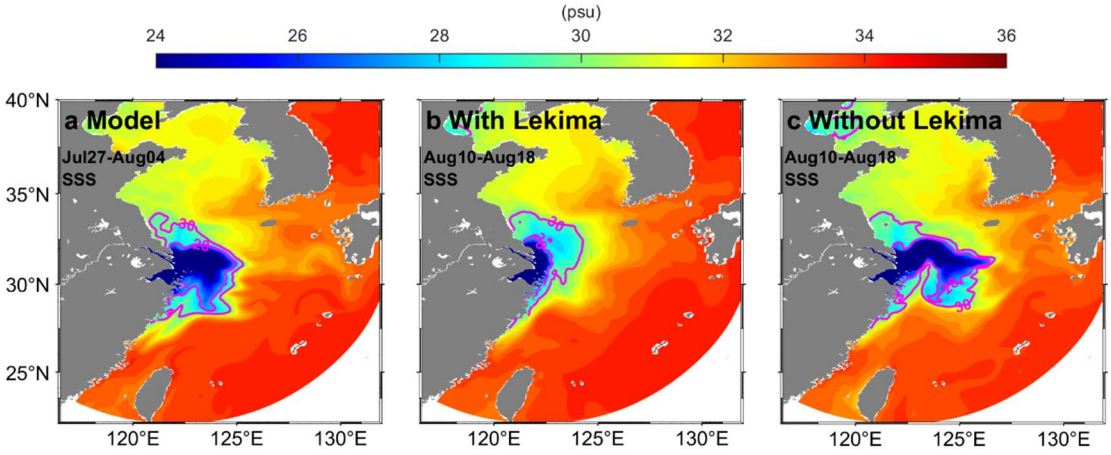
Supplementary Figure 6. Contribution of vertical mixing and horizontal advection at two points. a Black dots denote locations of points P1 and P2, respectively. Background color denotes sea surface salinity (SSS) changes induced by Lekima. Colored-solid line denotes the track of Lekima. **b** Evolution of salinity profiles from August 5 to 12. Salinity change rates (psu h^{-1}) attributed to (**c**) vertical mixing and (**d**) horizontal advection at point P1. The profiles are 6-hourly smoothed. **e–g** Same as (**b–d**), but at point P2. Black lines in (**b,e**) denote isohalines, and in (**c,d,f,g**) denote mixed layer depth.



Supplementary Figure 7. Tropical cyclone (TC) and sea surface salinity (SSS) information from 2015 to 2022. a Tracks of TCs in July and August passed through a black box region from 2015 to 2022. Red and blue lines indicate TC tracks in July and August of 1996 and 2016, respectively. **b** Number of TCs passing the Changjiang River Plume region each month. **c** Monthly SSS averaged within the Changjiang River Plume region.



Supplementary Figure 8. Dependence of sea surface salinity changes of Changjiang River Plume on tropical cyclone attributes. a Track of Danas. **b** Track of Lekima. **c** Red line denotes sea surface salinity in the control run with tropical cyclones (Danas and Lekima). Black solid line denotes sea surface salinity in the experiment without Lekima. Black dashed line denotes sea surface salinity in the experiment with intense Danas. Black dotted line denotes sea surface salinity in the experiment with slow Danas. Red stars on the x-axis denote the passage of tropical cyclones Danas and Lekima.



Supplementary Figure 9. Comparison of simulated sea surface salinity (SSS) between with and without the Lekima passage. a Average SSS from July 27 to August 4, the same time as pre-Lekima in (**Fig. 1a and 3a**). 28 psu and 30 psu isohalines are contoured. **b** Average SSS from August 10 to 18, the same time as post-Lekima in (**Fig. 1b and 3b**), in the experiment with Lekima. **c** Same as (**b**), but in the experiment without Lekima.