Hypoxia off the Changjiang River estuary and its relationships with plume front and upwelling in summer

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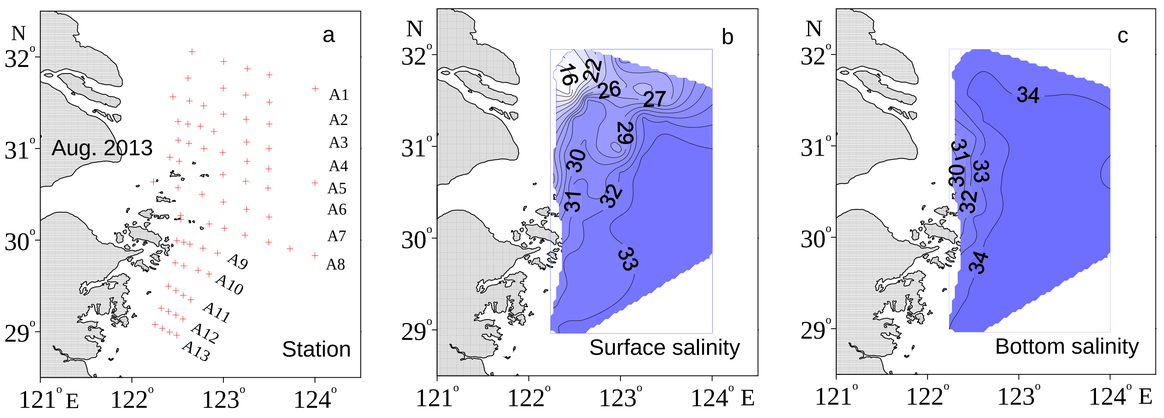
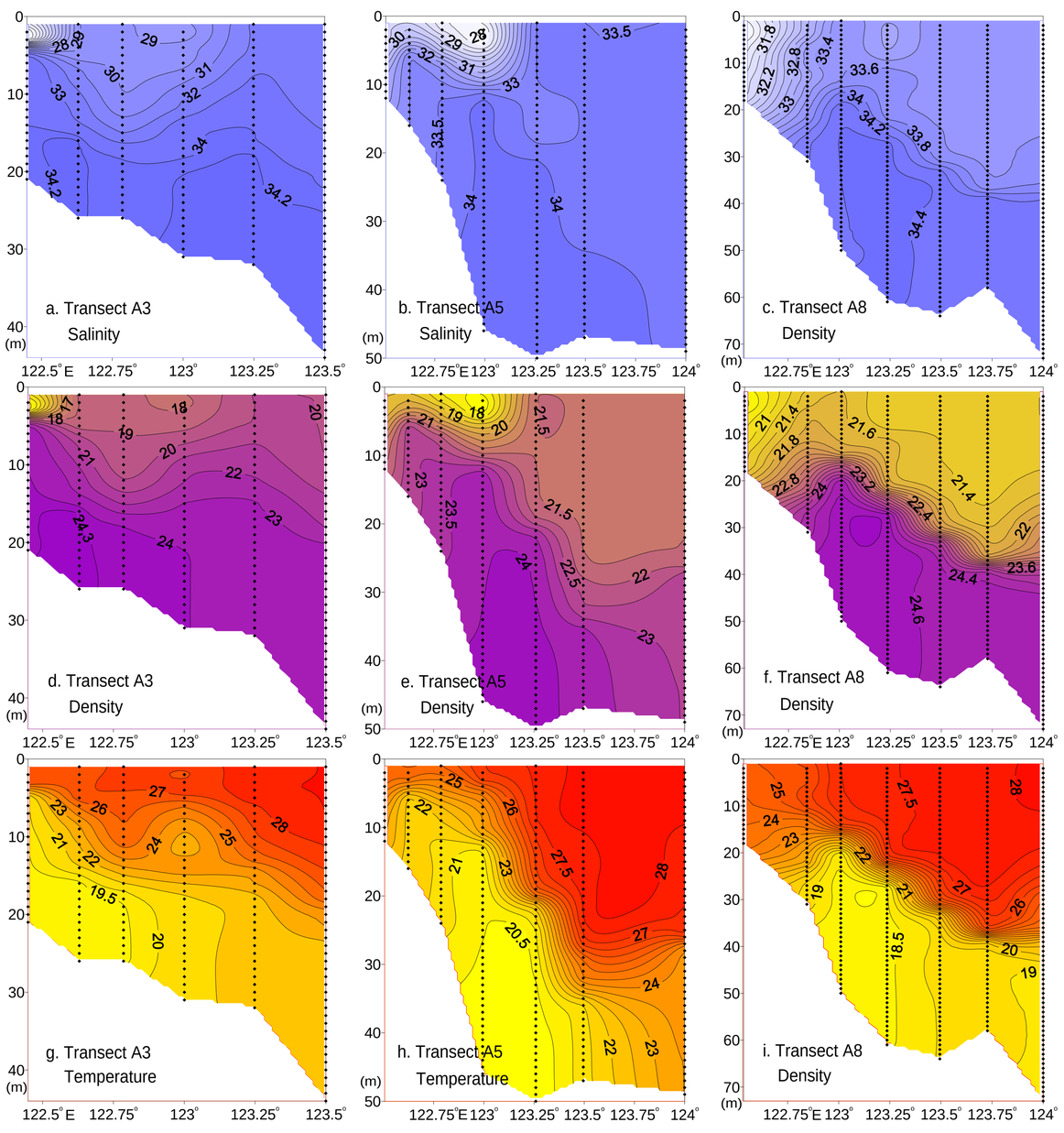
Introduction

This study combined the field investigation data in the summer of 2013 and some historical data. By depicting the plume front and upwelling off the Changjiang estuary (CE) and the characteristics of an underlying hypoxia, the intrinsic mechanisms of the hypoxia caused by the plume front and upwelling were studied, and the driving forces of the frequent hypoxia off the CE were revealed from the perspective of physical-ecological oceanography.

1. Plume front and upwelling off the CE

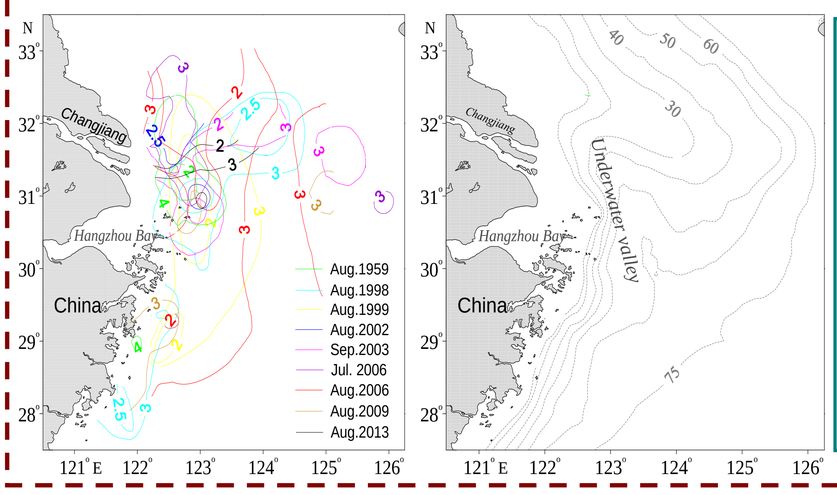


Plume fronts were formed in the intersection zone of the diluted water and the saline TWC.



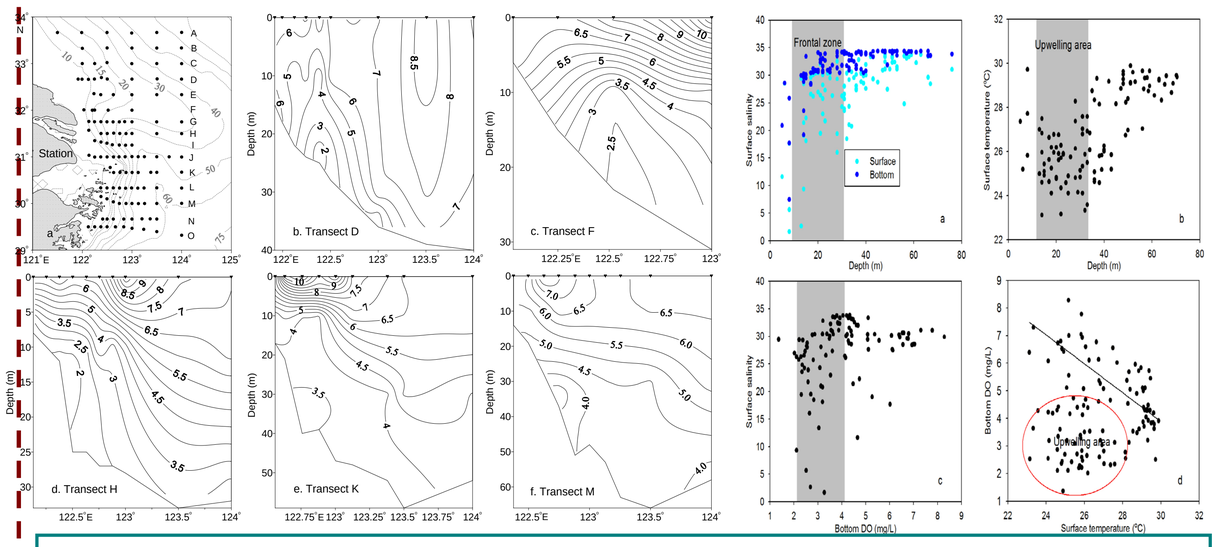
The contours of salinity, density and temperature along the typical transects were upwarped significantly, suggesting the upwelling off the CE. These two physical processes, the plume front and upwelling off the CE, were coupled.

2. Characteristics of the hypoxia off the Changjiang estuary



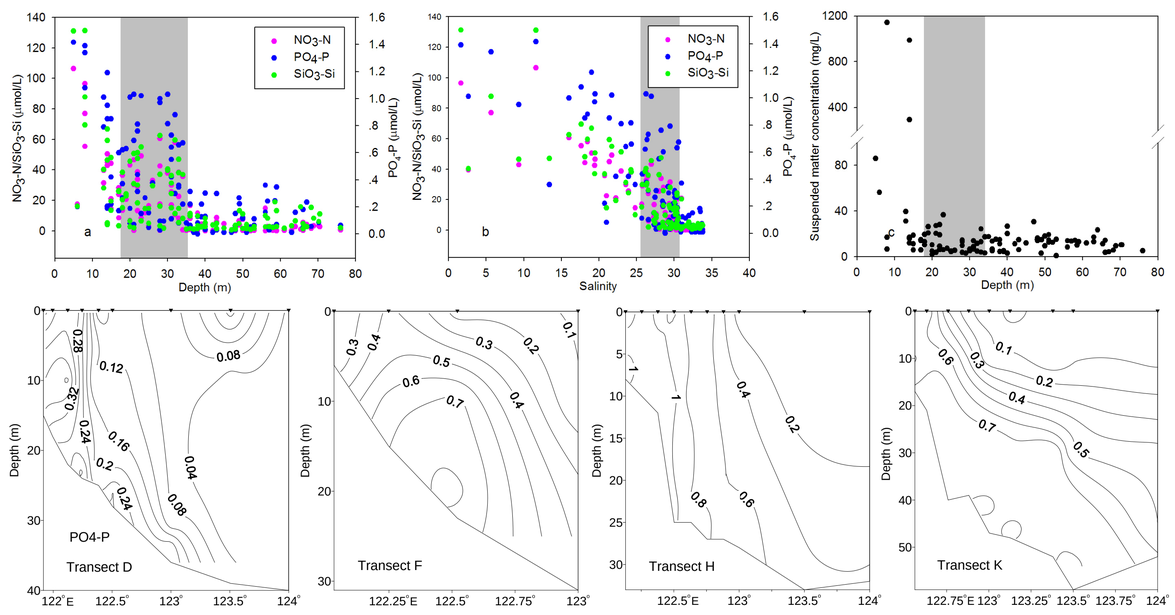
Hypoxia frequently occurred in the northeast area off the CE and on the west slope of the underwater valley, and also in the sea area outside of Zhejiang.

3. Relationships between the hypoxia and the physical processes of front and upwelling



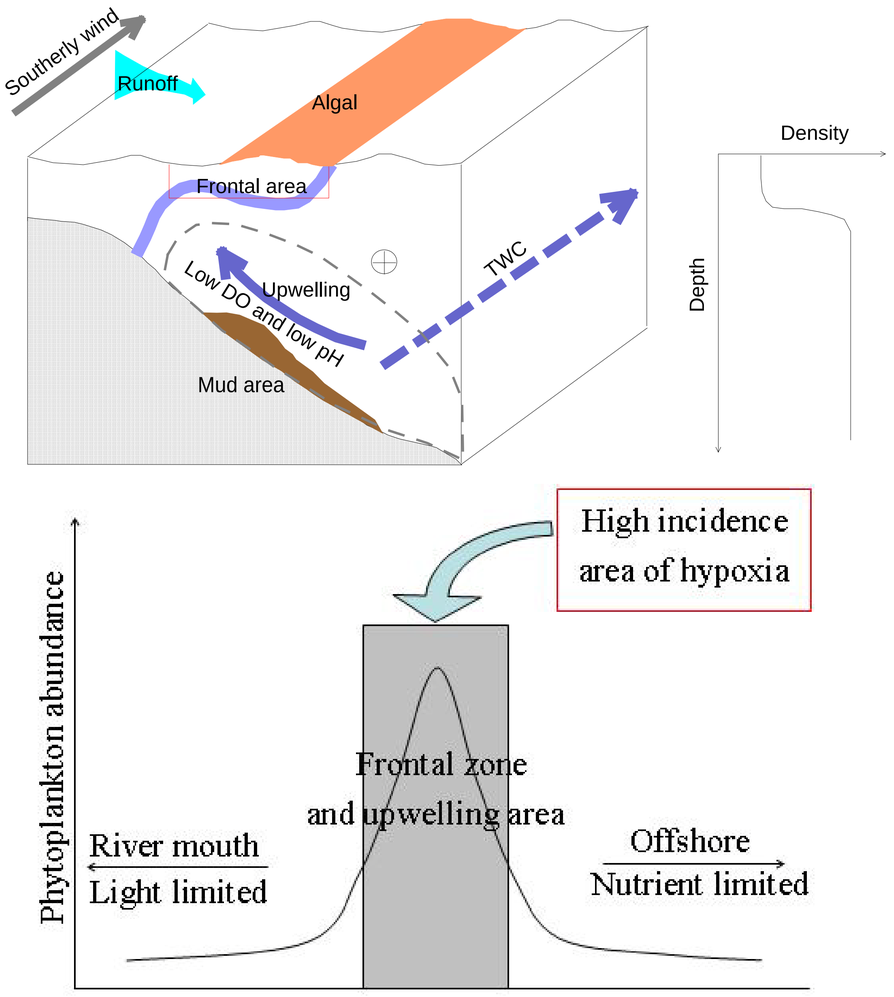
The hypoxic zone off the CE was associated with a specific physical environment (i.e. there was a certain correspondence between the location of hypoxia and those of plume front as well as upwelling.

4. Mechanisms of hypoxia induced by plume front and upwelling



When biological consumption near the surface plume front results in a rapid decline in nutrients, the upwelling coupled with the frontal process could help to balance the loss of nutrients (especially for PO_4-P). Moreover, the light condition can also be greatly improved, resulted in the decreasing in the concentration of suspended sediment.

5. Conceptual model illustrating the mechanisms of hypoxia off the CE



Conclusion: **This study demonstrates the internal mechanisms of the hypoxia induced by the plume front and upwelling and reveals the causes and driving forces of the frequent hypoxia off the CE from the perspective of physical-ecological oceanography.**

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