Physical Control of the Biogeochemical Processes in the Lower Changjiang (Yangtze River) Estuary

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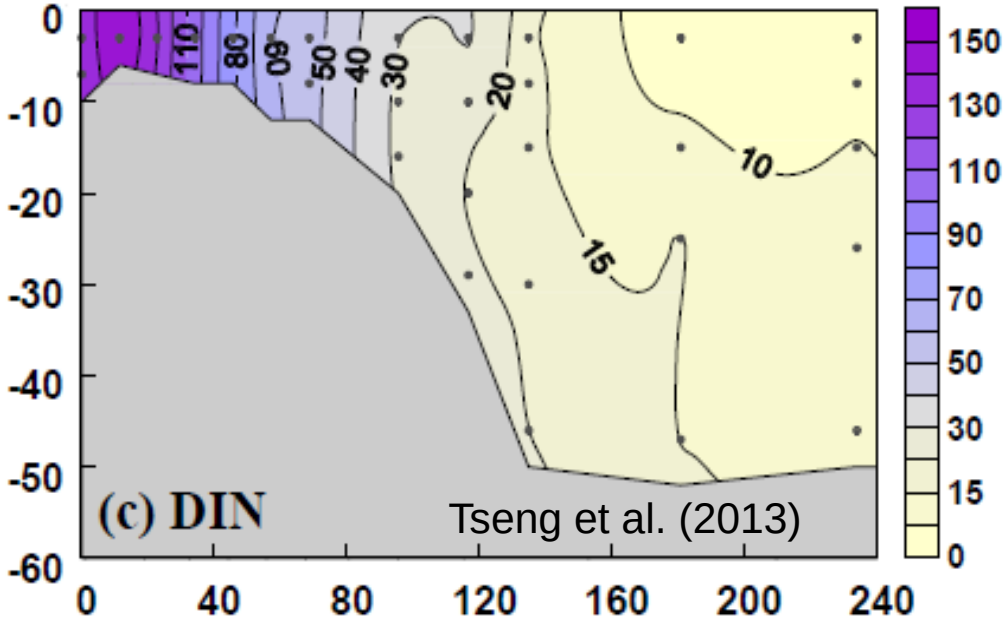
Key issues for the Changjiang Estuary biogeochemistry

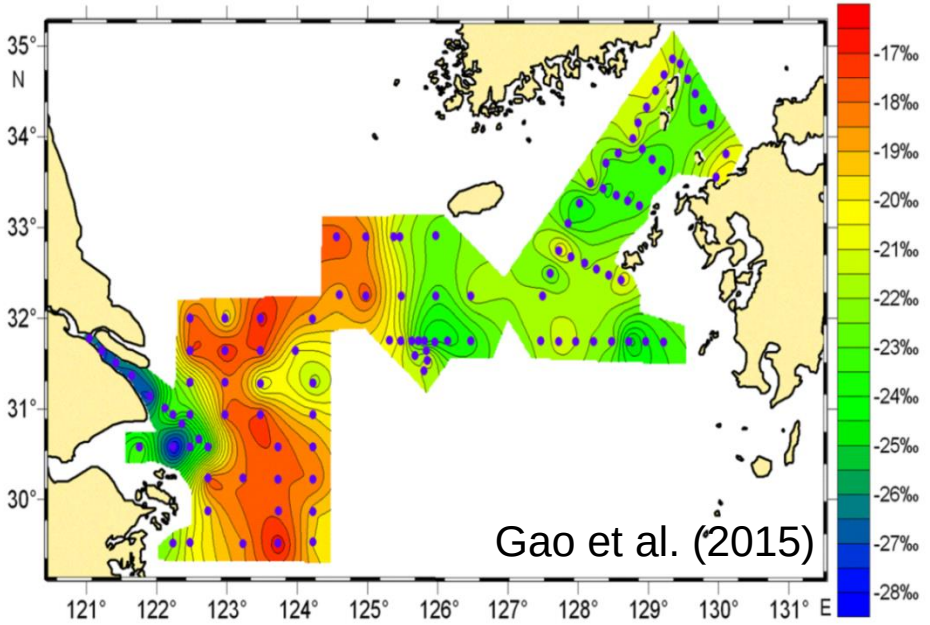
- **Fast nutrient decrease**

Is the nutrient gradient due to intense mixing or biological assumption?

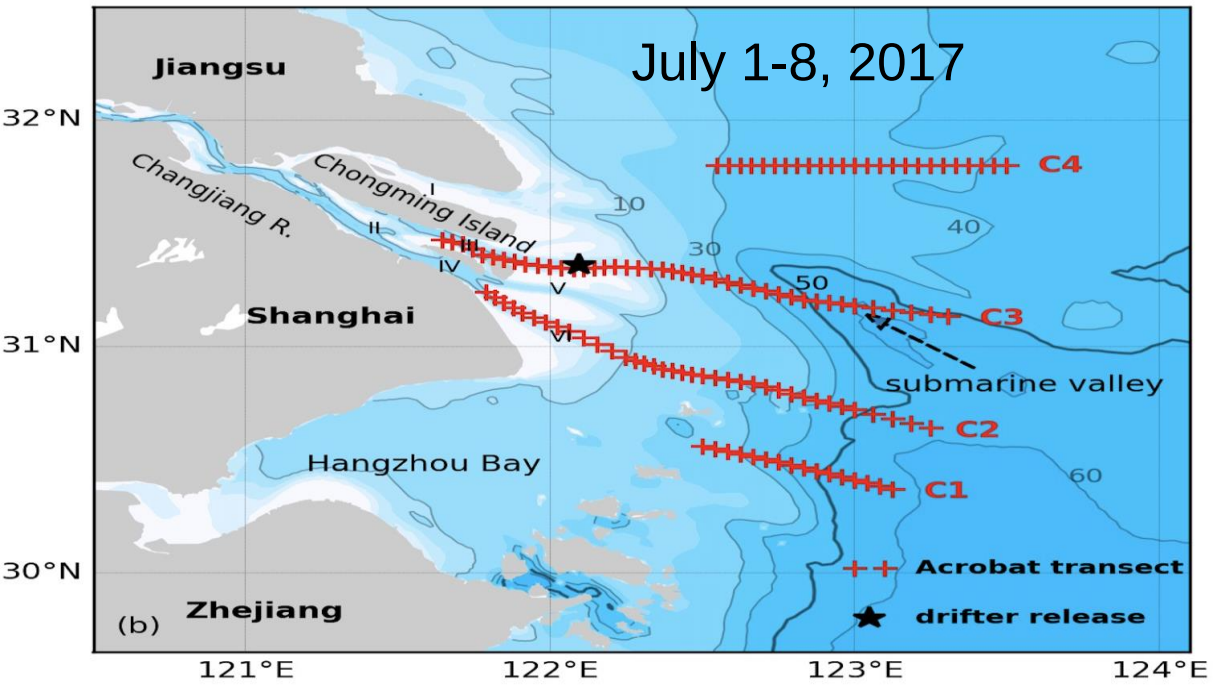


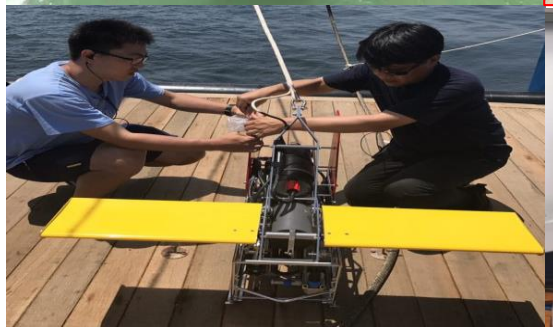
- **Phytoplankton blooms in the offshore areas**

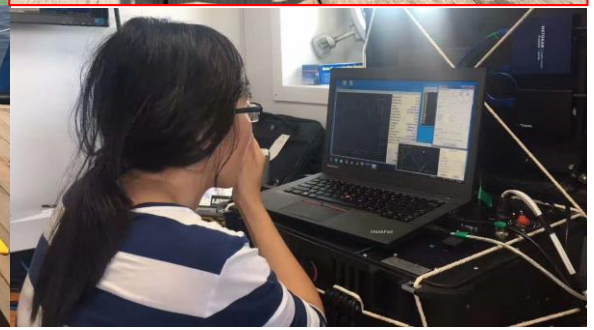
  - What is the relation of phytoplankton blooms to the river plume dynamics?
  - Are they controlled by single process or multiple processes?



Research cruise







Acrobat-Environmental Sensing System (AESS)

- **Acrobat (Sea Sciences)**

  a towed, undulated vehicle

- **AML-MVP CTD**

  sampling frequency: 25 Hz

- **RBR Concerto logger**

  sampling frequency: 12 Hz

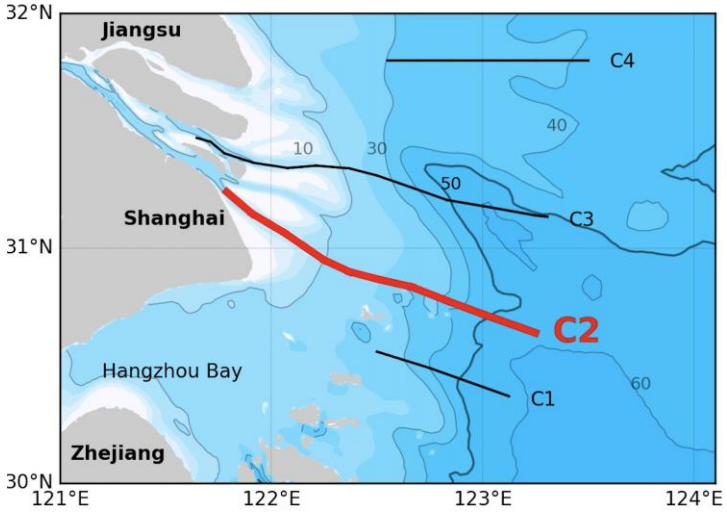
  - CDOM
  - turbitidy
  - PAR
  - fluorescence

Horizontal resolution

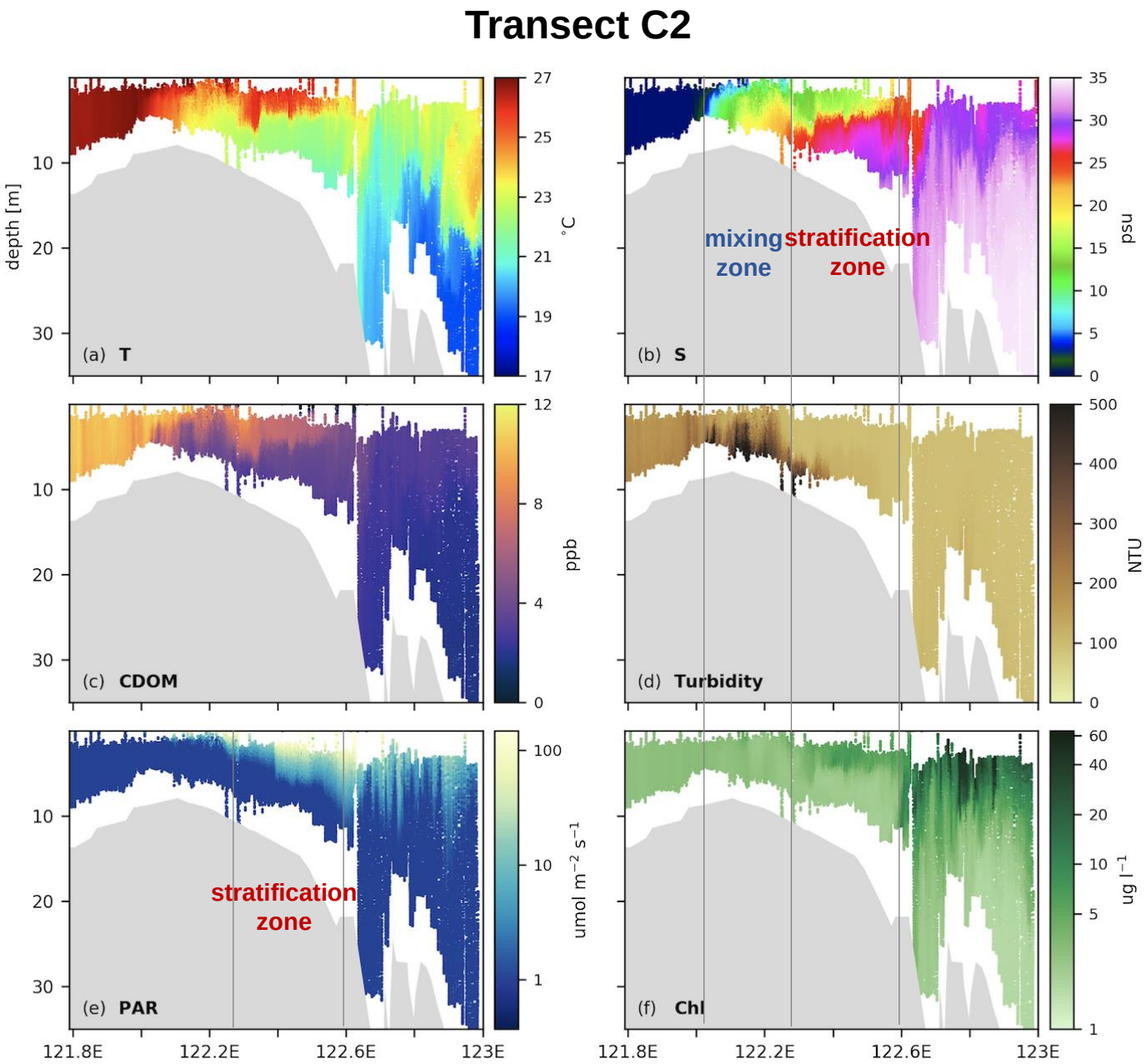
200-400m in shallow waters

~1km in offshore regions

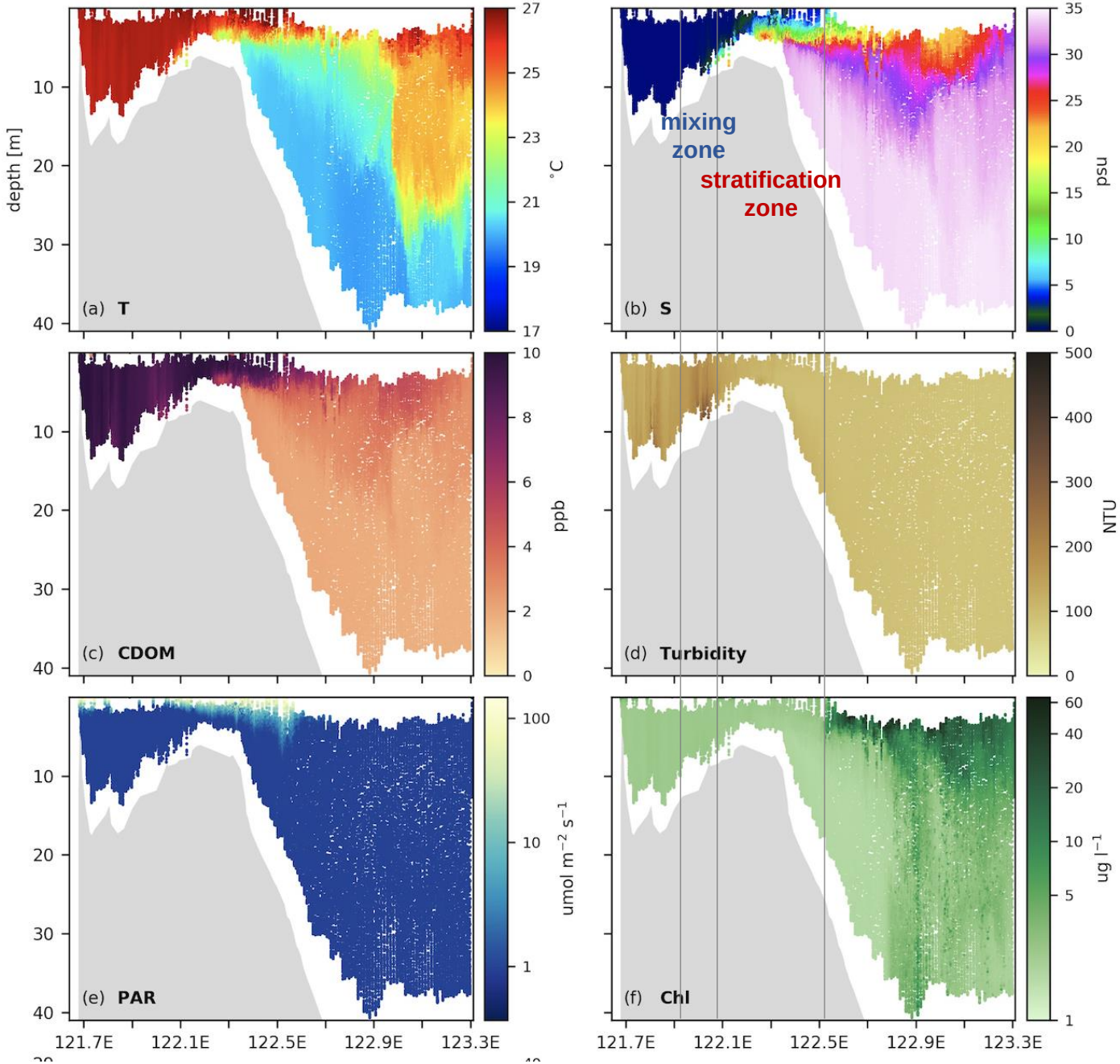
Role of mixing/stratification in sedimentation, light and primary production

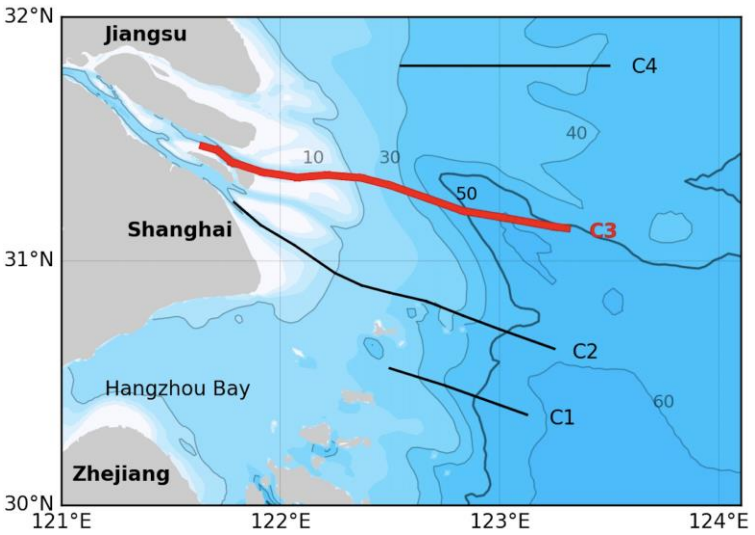


- Primary production is initialized by a rapid development of stratification seaward of the mixing zone.



Transect C3



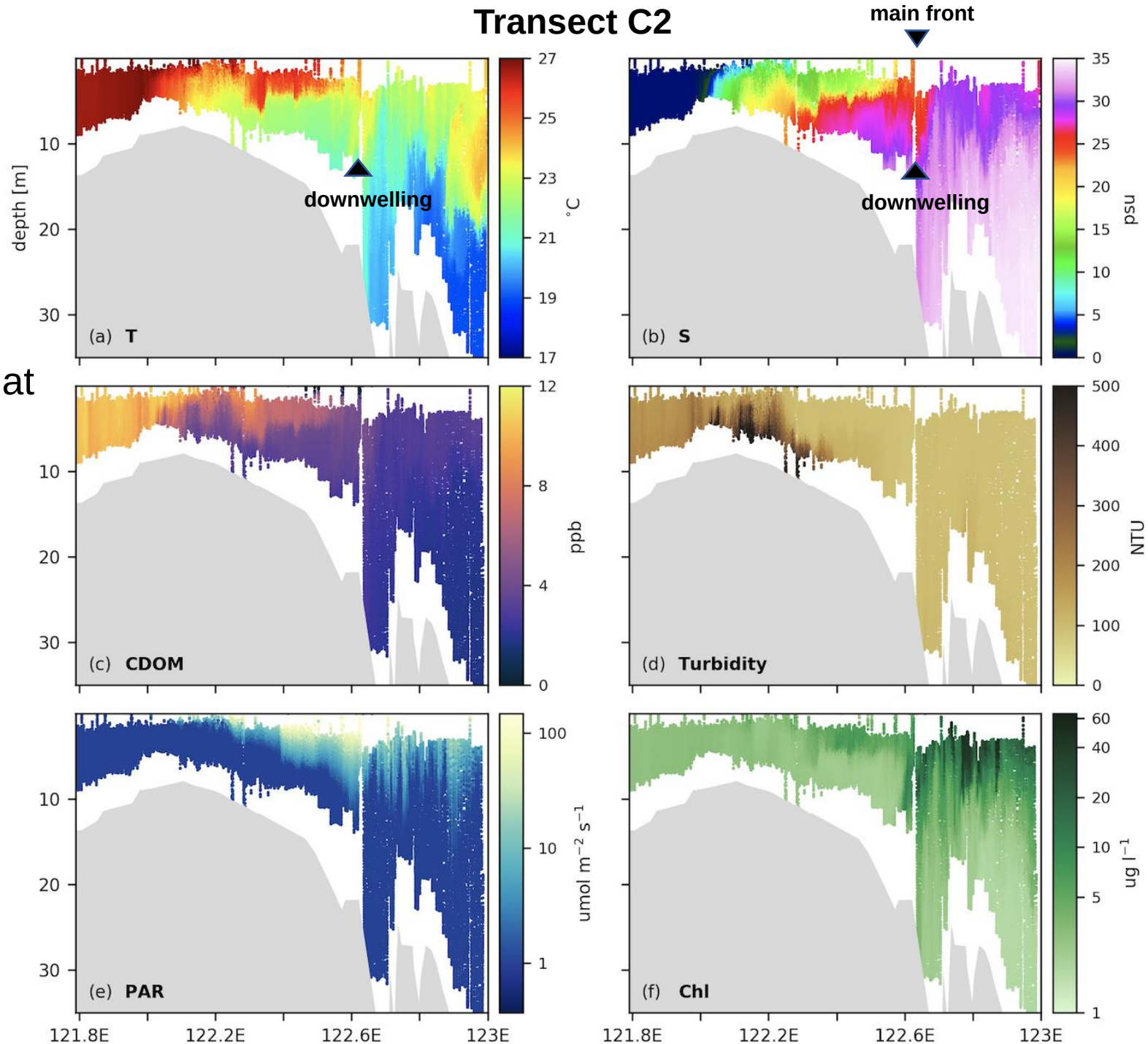


- The turbidity maximum zone is less prominent.
- Strong plume currents due to shallow topography prevent accumulations of phytoplankton in the stratified area.

Plume frontal processes and phytoplankton accumulation

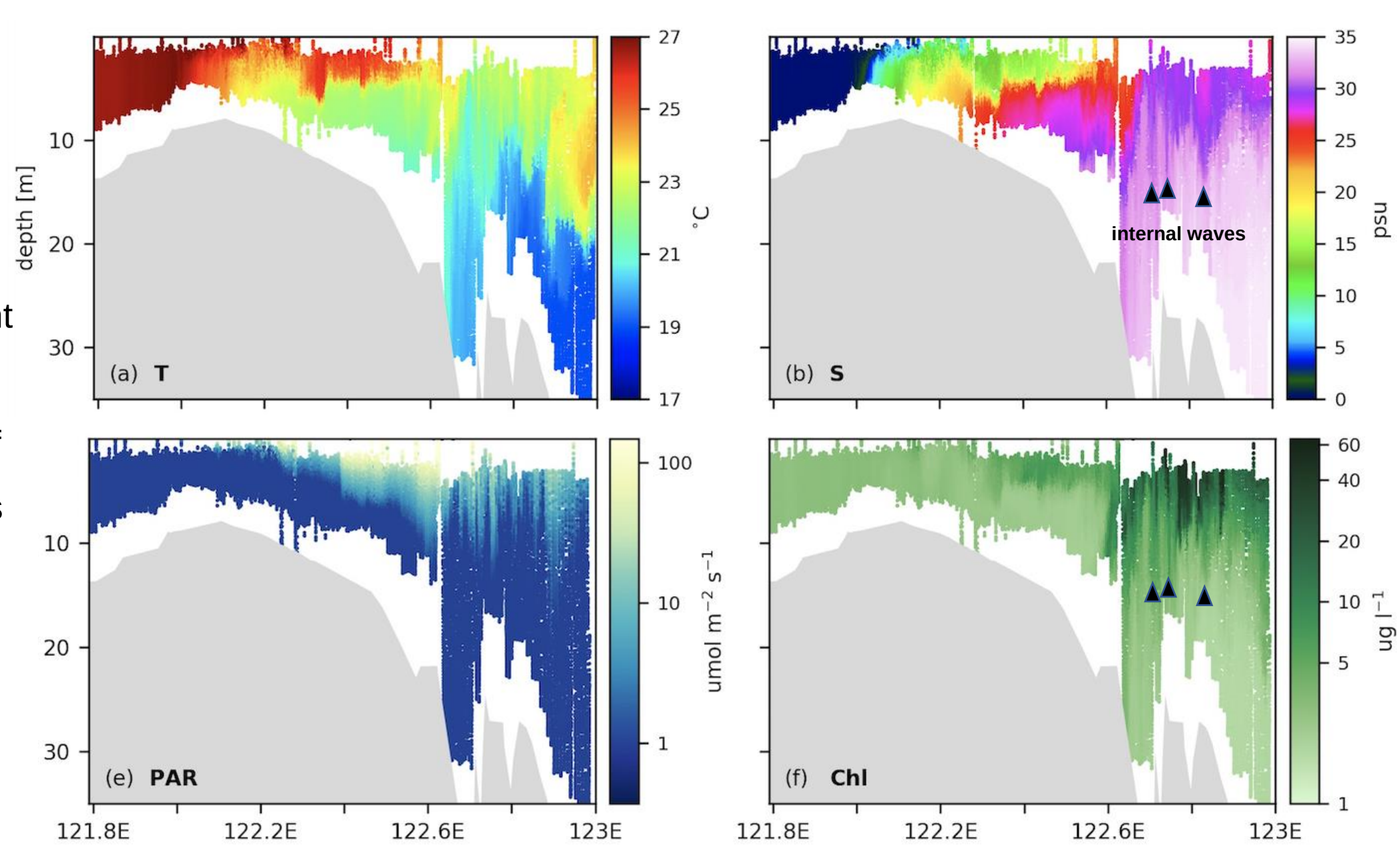
Phytoplankton blooms are initialized at the main plume front due to

- downwelling
- mass convergence
- vertical mixing



Internal waves

- seaward of the main plume front
- an undulation of plume thickness and high-Chl layers up to ~10m.



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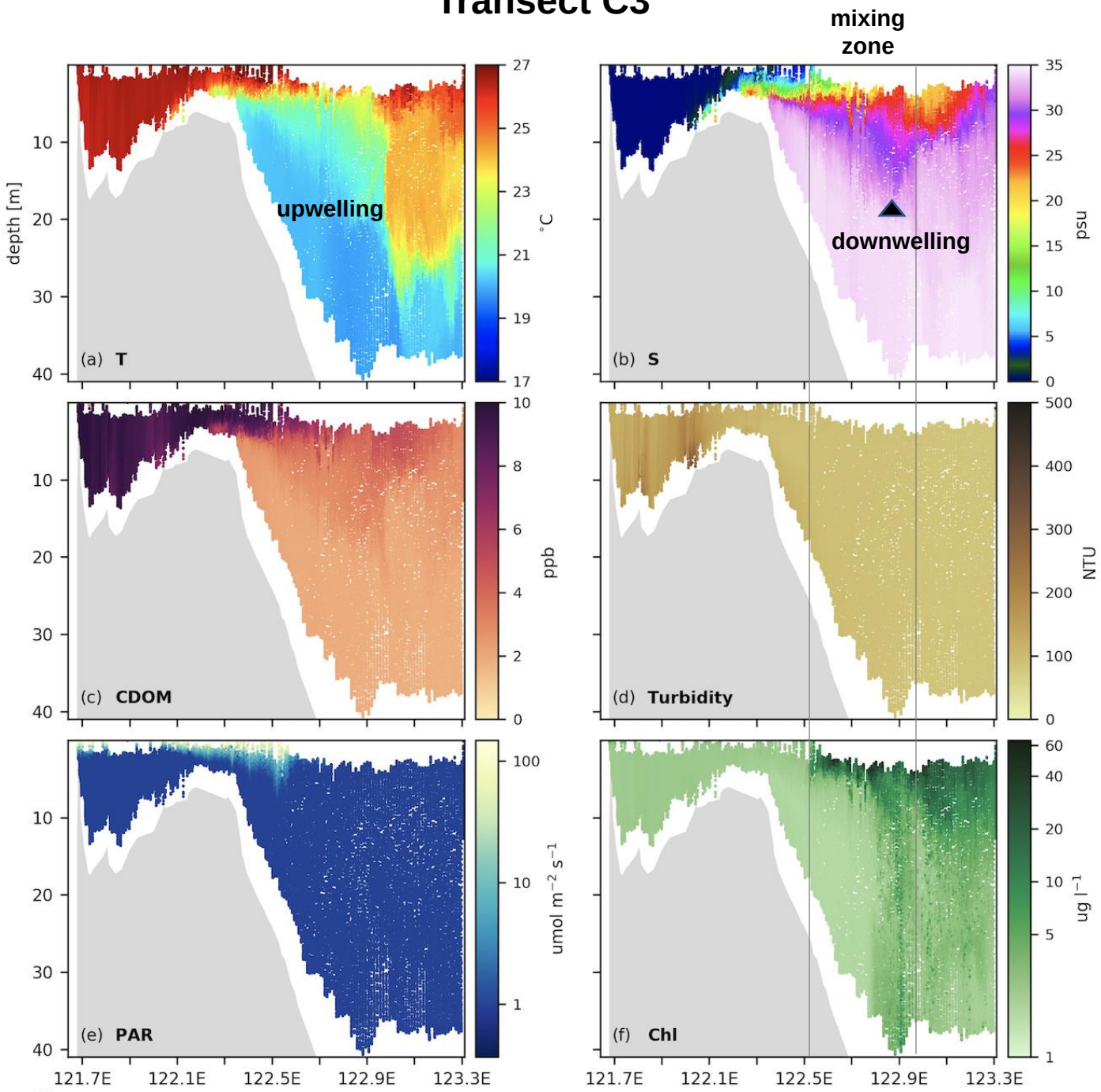
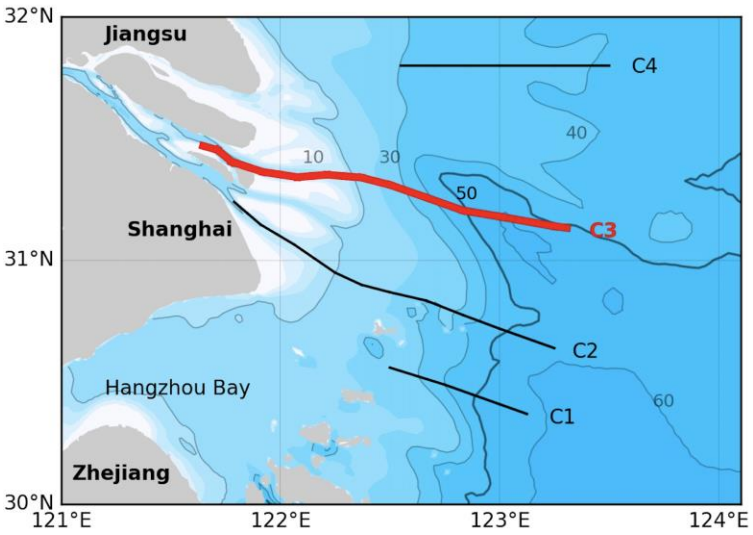
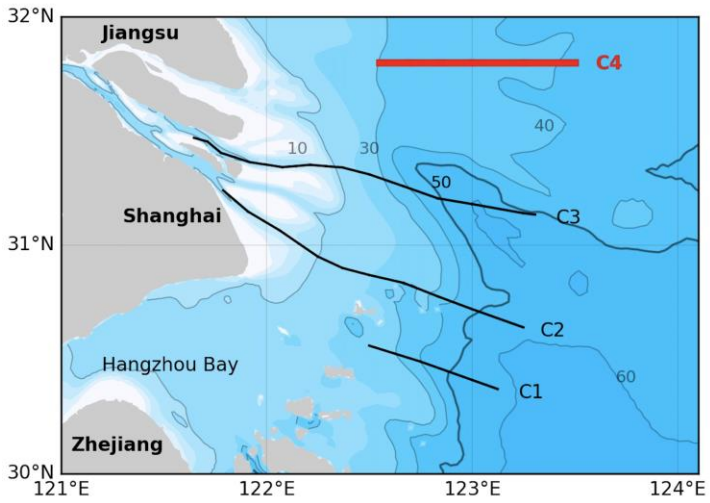




- The frontal mixing occurs over a wide region.
- Phytoplankton blooms are initialized by the frontal mixing.
- Upwelling occurs on the west flank of the submarine valley.

Upwelling and the ecosystem production in the northern estuary



Upwelled water enhances the local primary production in the northern estuary.

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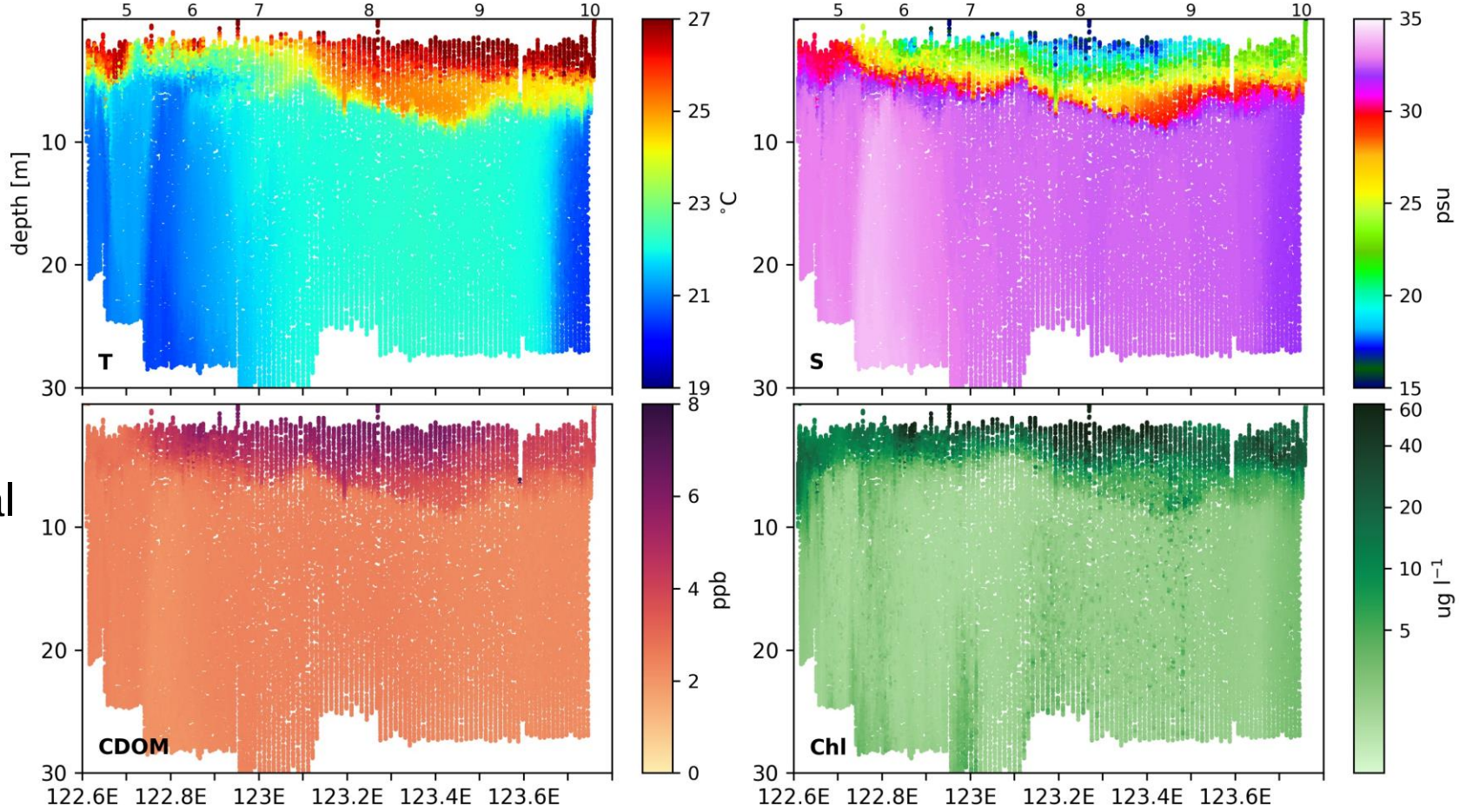
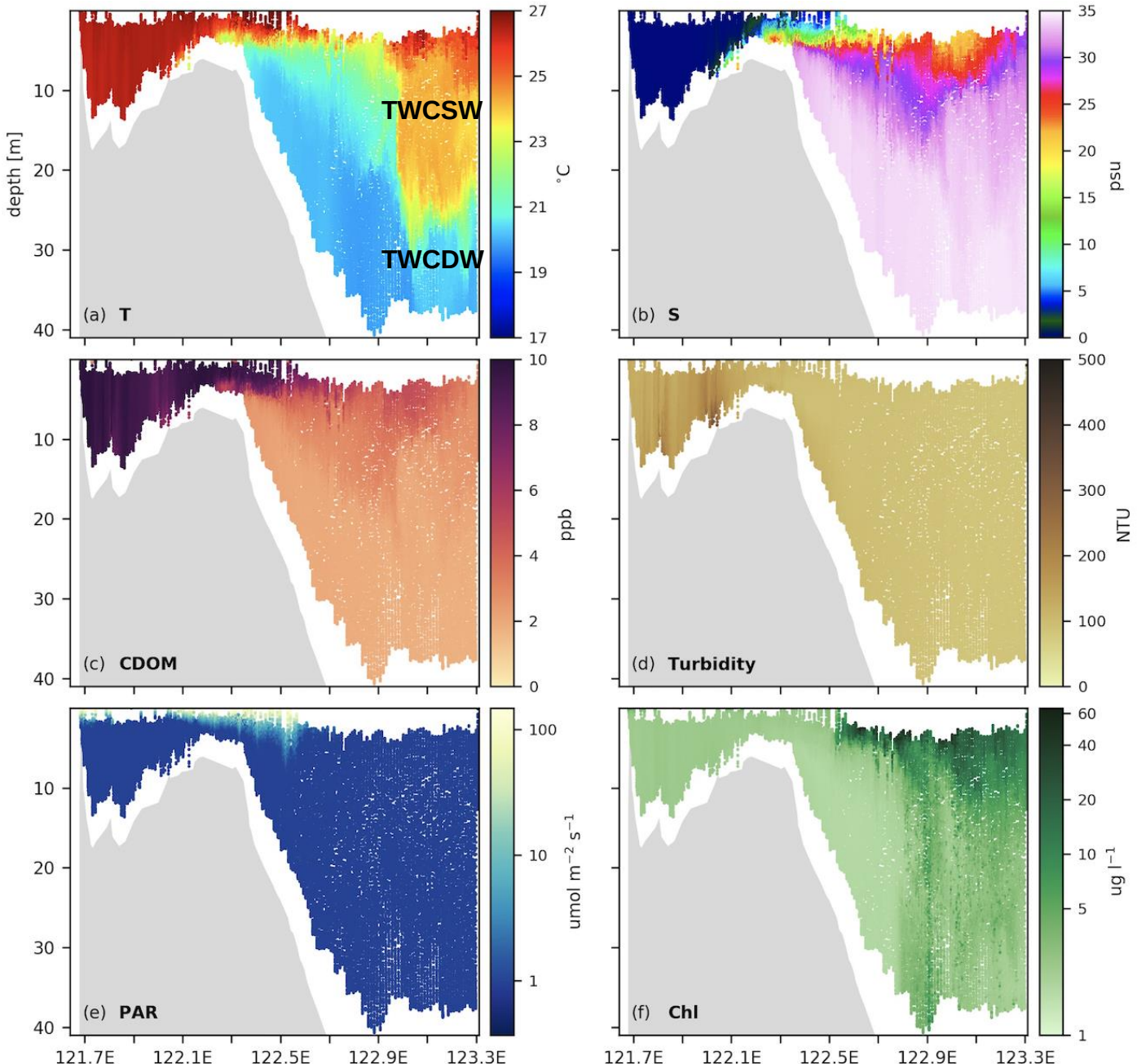
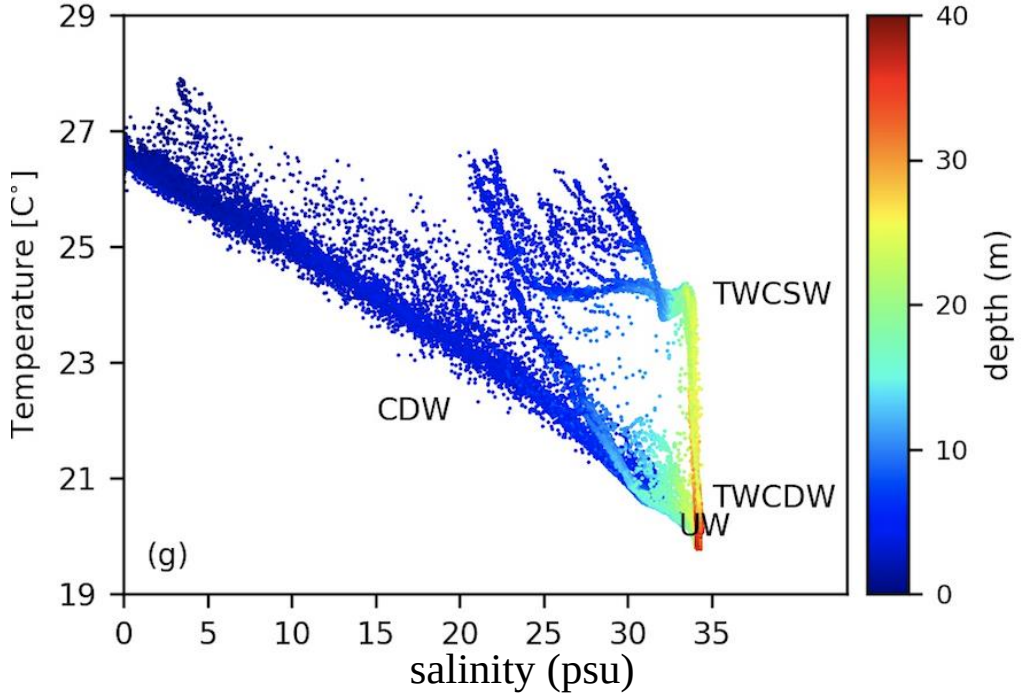


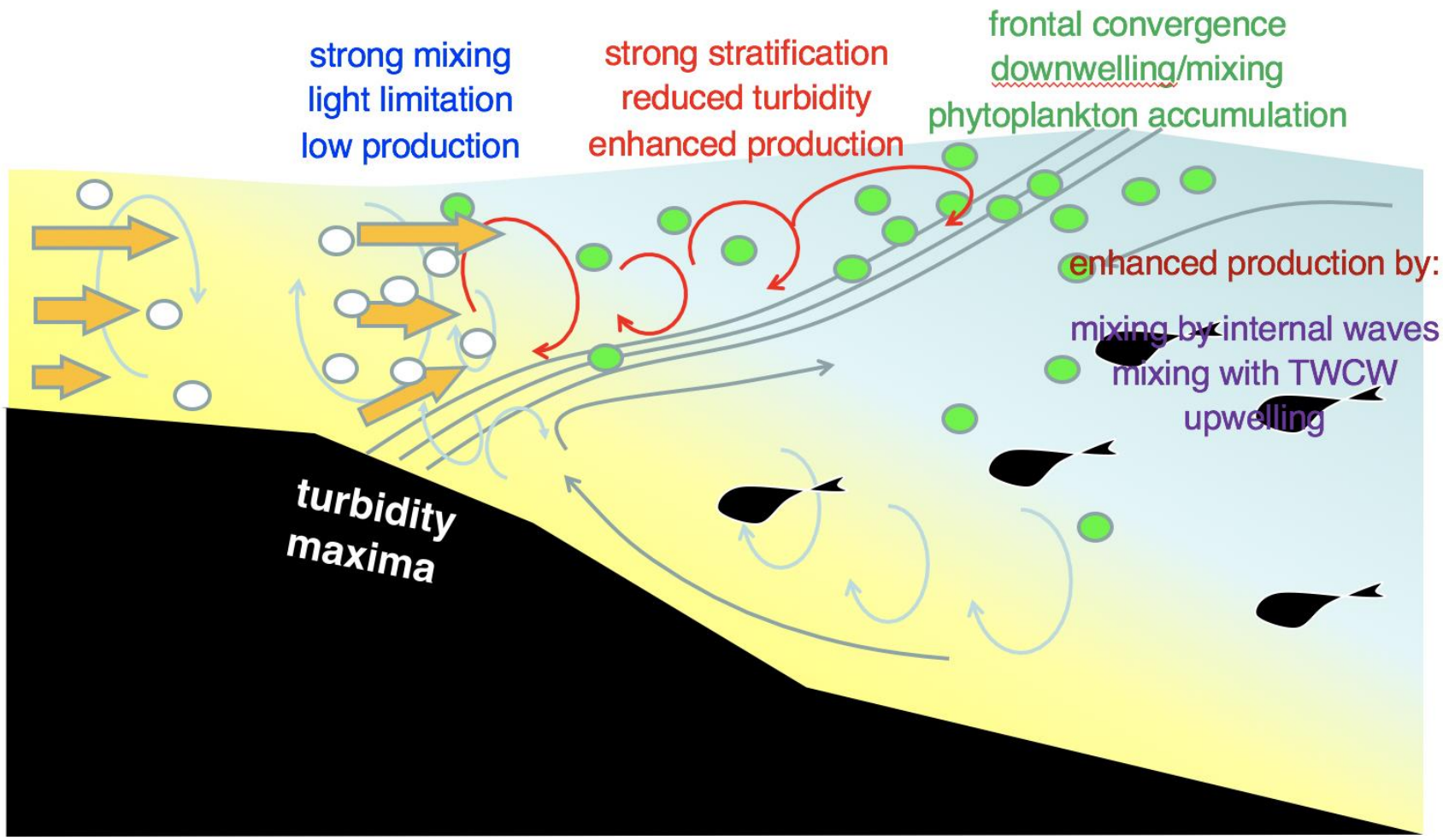
The Taiwan Warm Current Water (TWCW) and biological production





Interaction between the plume water and the TWCW by frontal mixing results in high production.

Conclusions



- The estuary primary production is initialized by a rapid development of stratification seaward of the mixing zone, which creates the large nutrient gradient.
- Phytoplankton blooms can be initialized by a couple of frontal processes including convergence, downwelling, vertical mixing and internal waves.
- Upwelling and the intrusion of oceanic waters can promote the production and phytoplankton blooms.