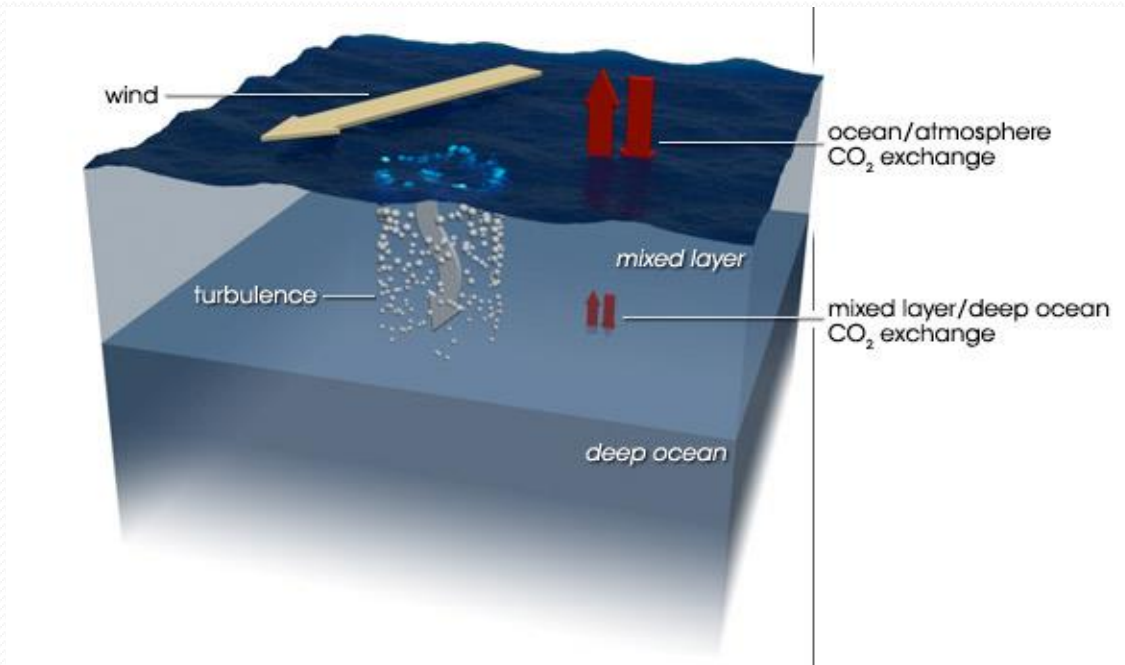# *Water Column Conditions in the Gulf of Thailand*
during 17 Aug - 11 Oct 2018

Anukul Buranapratheprat (Burapha U.)

Sukchai Arnupapboon (SEAFDEC)

Pontipa Luadnakrob (SEAFDEC)

Sakda Arbsuwan (DOF - Thailand)

Why water column is important?

- *It plays important role to vertical material transport.*
- *Well-mixing and stratification are related to primary productivity by phytoplankton.*
- *Hypoxia in near bottom water is triggered by strong water column stratification.*

# Water Column Stratification in the Gulf of Thailand

http://www.saltwedge.org/

- *Local factors: surface heat flux and fresh water discharge*
- *High stratification in summer due to strong surface heating and fresh water input*
- *More mixing in winter due to surface heat loss and strong wind*
- *External factor: the intrusion of sub-surface water from the South China Sea*
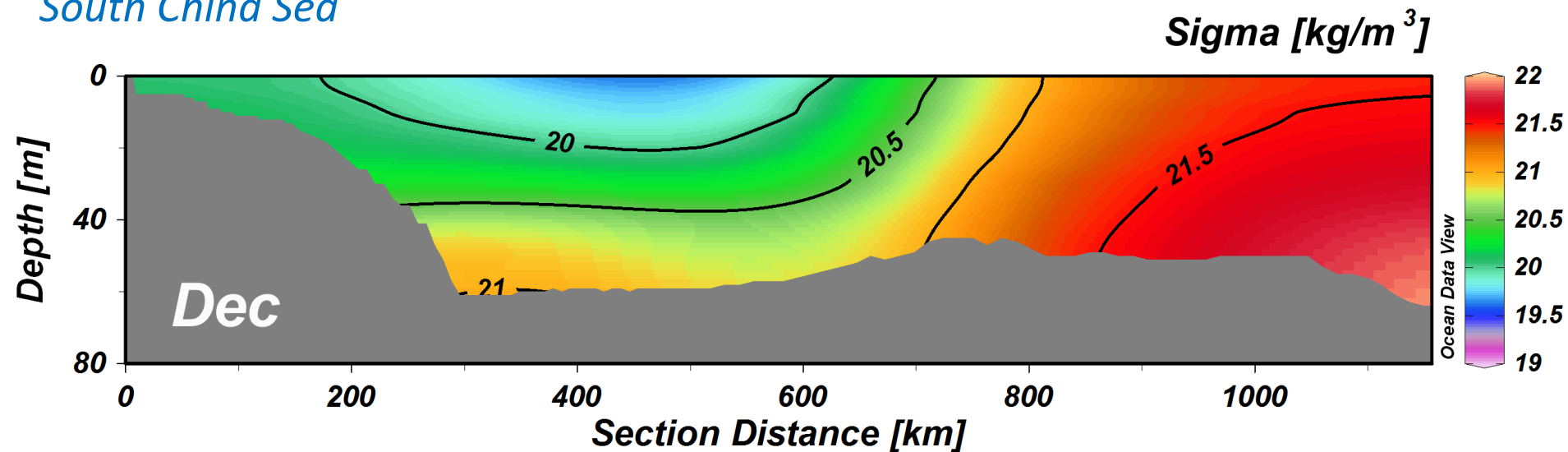
WOA database

Previous SEAFDEC cruises
14 March- 12 April 2013

Seasonal Thermocline
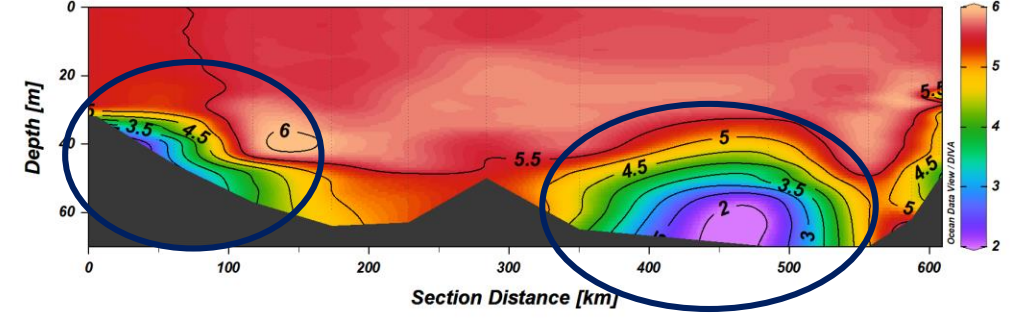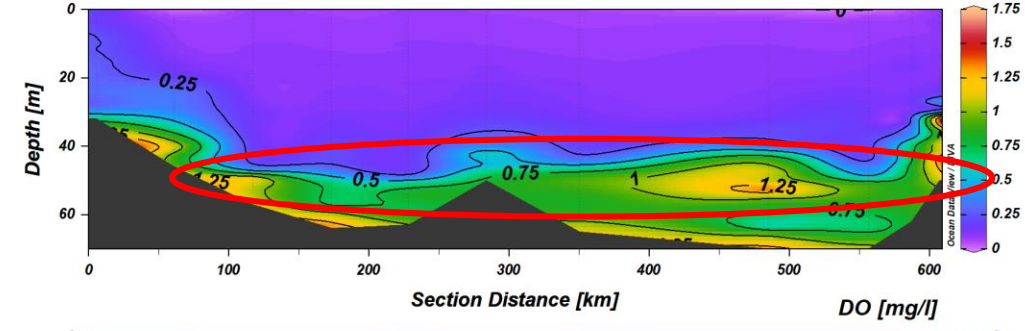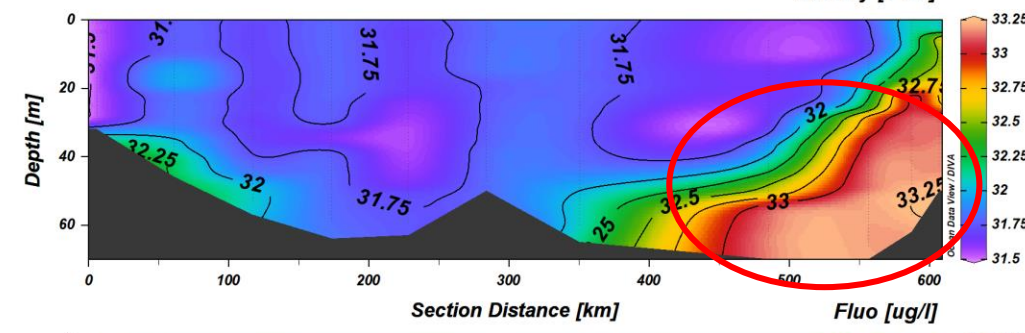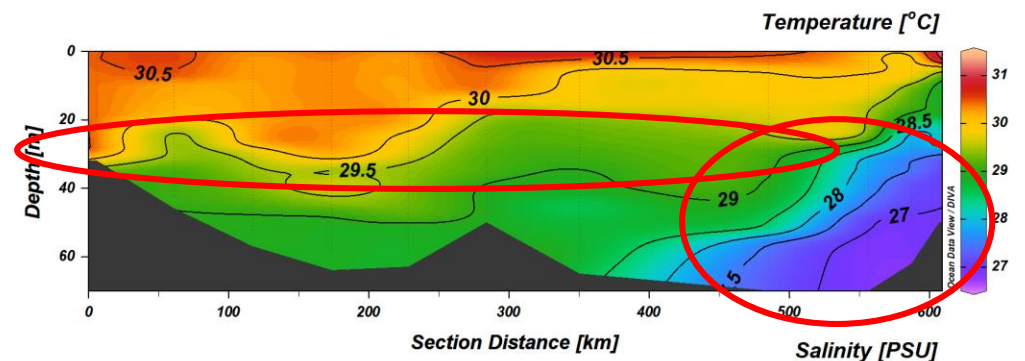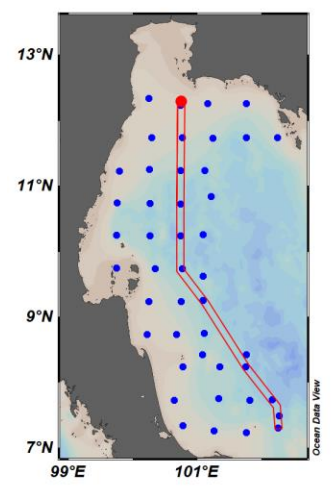
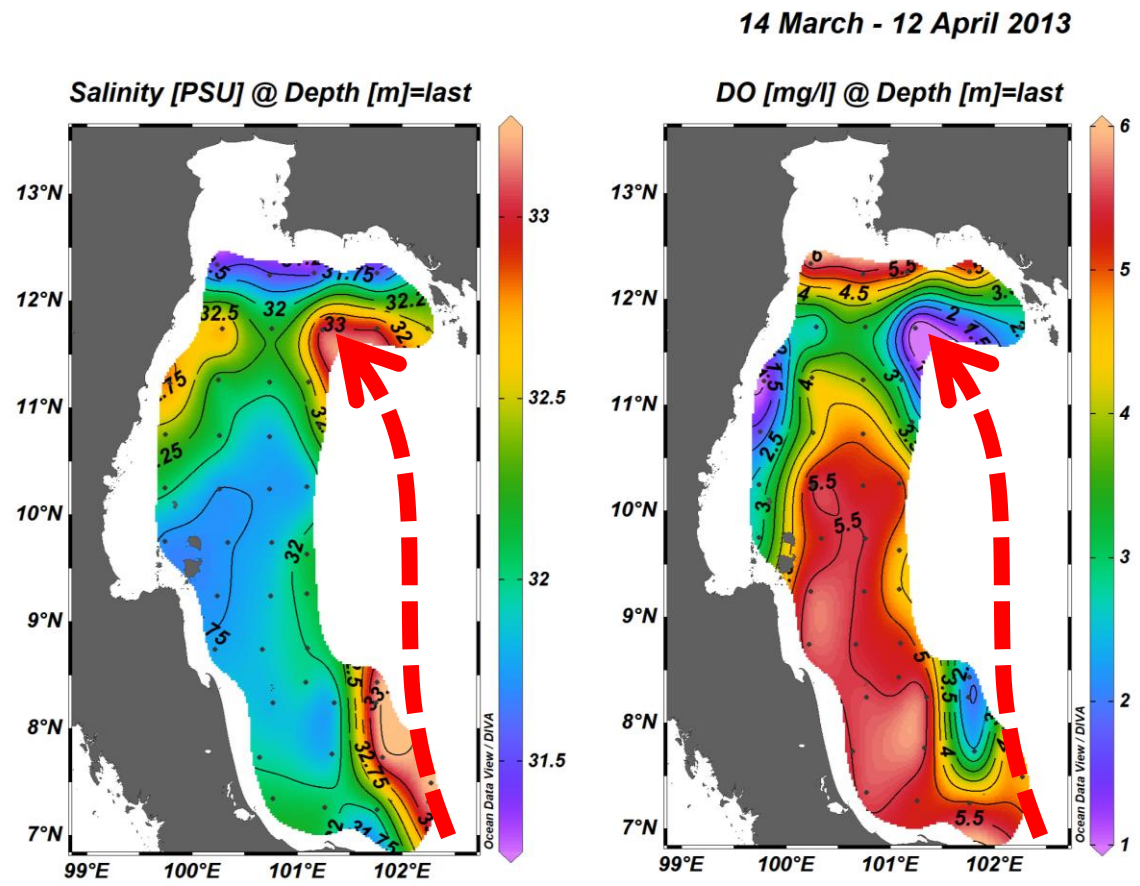The vertical distributions of temperature, salinity, fluorescence and DO in summer 2013

SCS water intrusion

Subsurface Chlorophyll Maxima
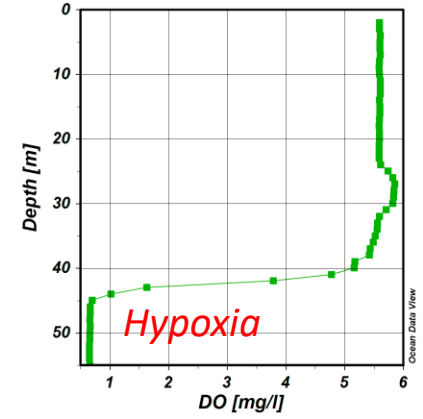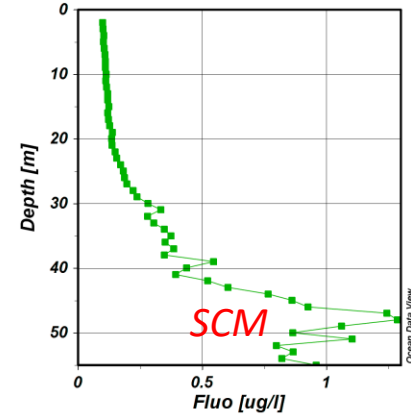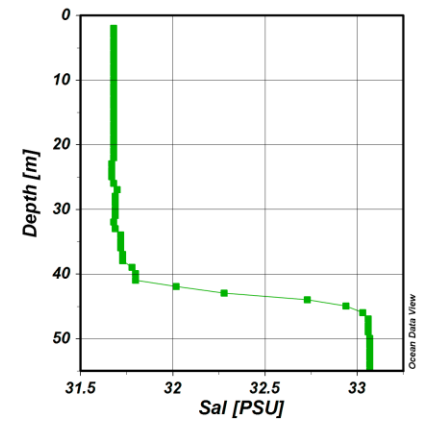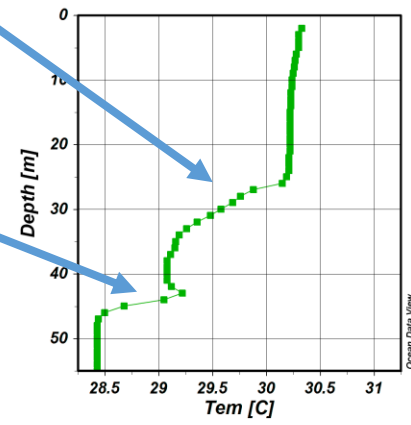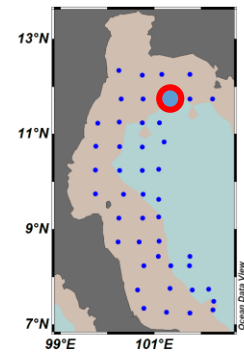
Near bottom water hypoxia

The horizontal distributions of salinity and DO near the sea bottom

Near bottom hypoxia

Thermocline from surface heating

from SCS water intrusion

14 March - 12 April 2013

Salinity [PSU] @ Depth [m]=last

DO [mg/l] @ Depth [m]=last

SCM

Hypoxia

- *The intrusion of sub-surface water from the SCS is revealed although there were no data along the eastern area of the gulf.*
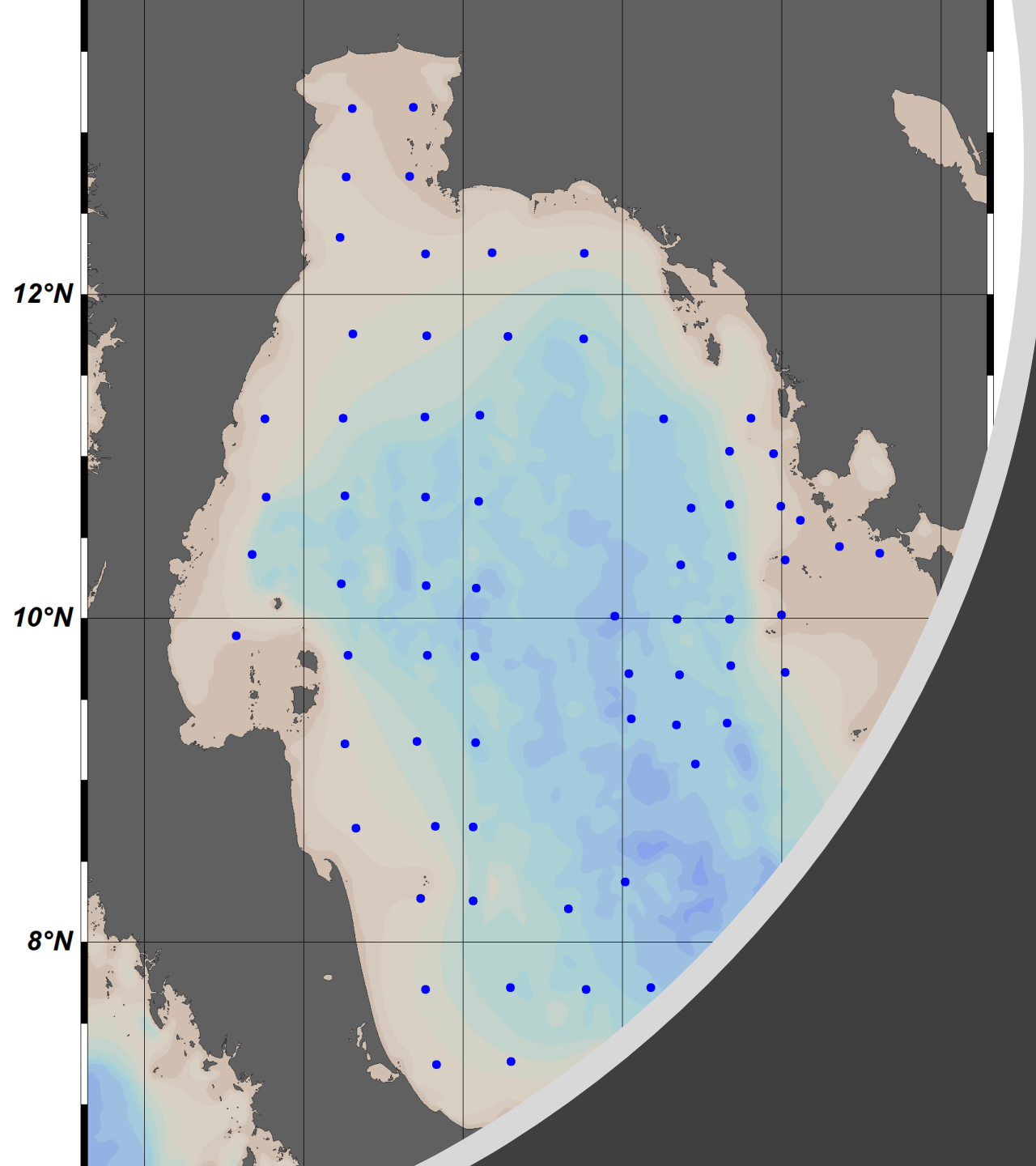
SEAFDEC Survey
in the Gulf of Thailand
17 Aug - 11 Oct 2018

SEAFDEC Survey in the Gulf of Thailand
17 Aug - 11 Oct 2018

- CTD data, wind and Chl-a measured from the survey were used in the analysis.
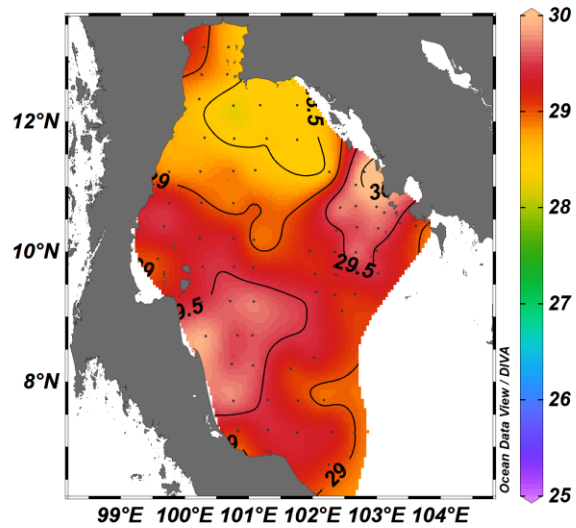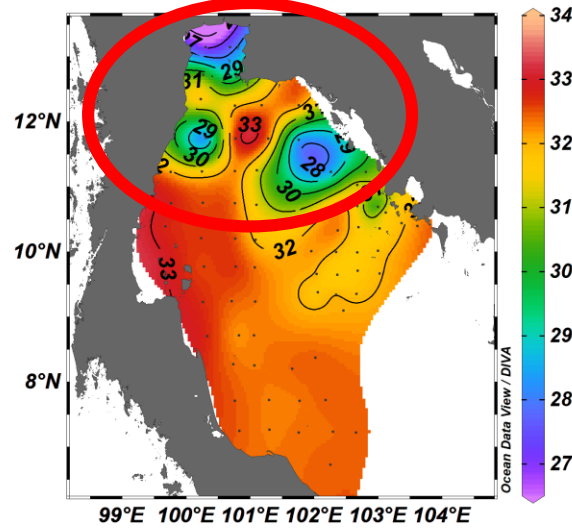
Water Column Condition
17 Aug - 11 Oct 2018

- *Low density water at the sea surface in the northern part is controlled by low salinity water.*

- *High density water at near-bottom water near the gulf mouth is controlled by low temperature.*
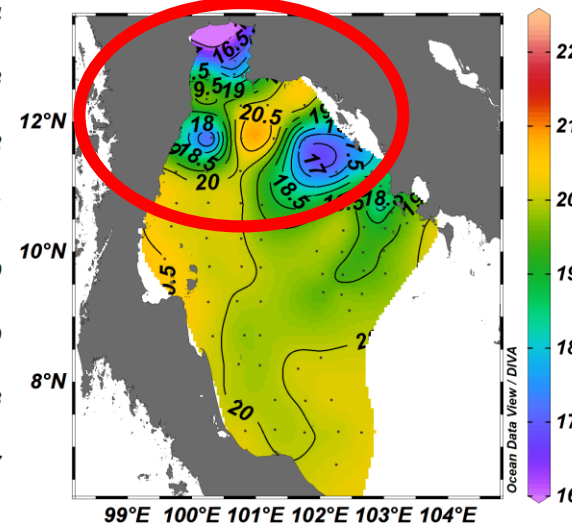
Water Column Condition
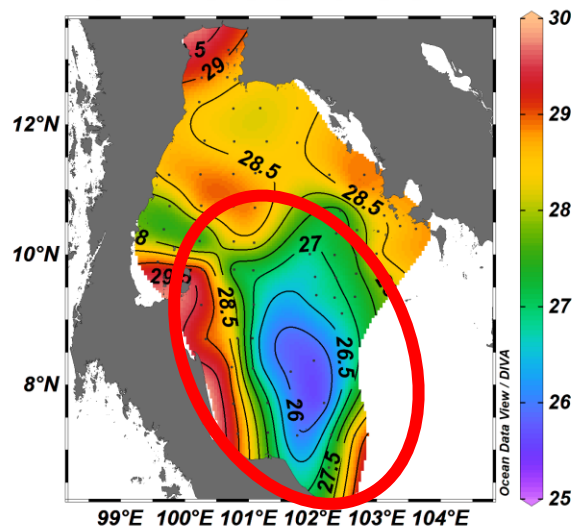## 17 Aug - 11 Oct 2018

Main GoT axis

- Water column in most survey area is well-mixed.
- Stratification near the mouth of the gulf is found.
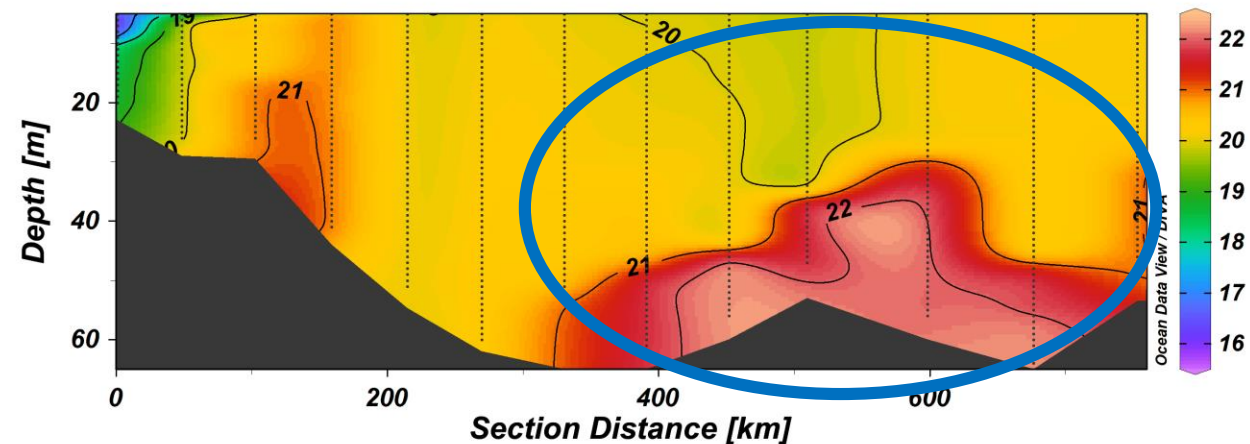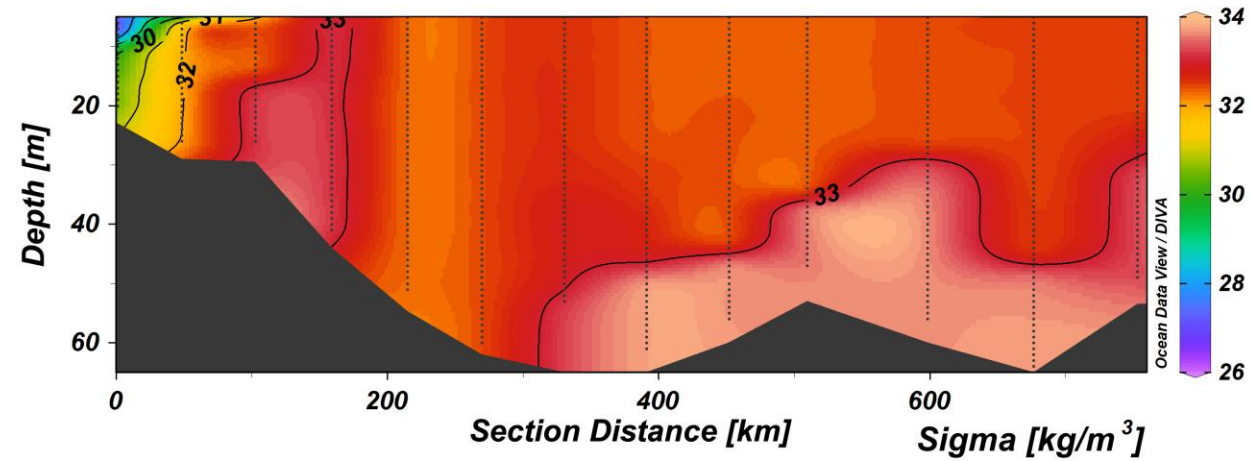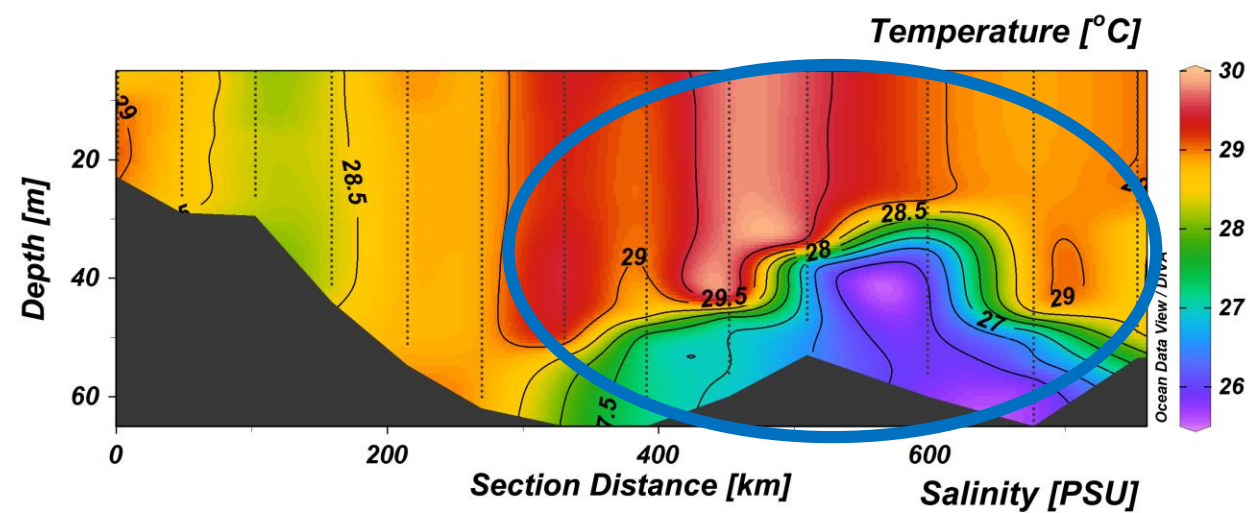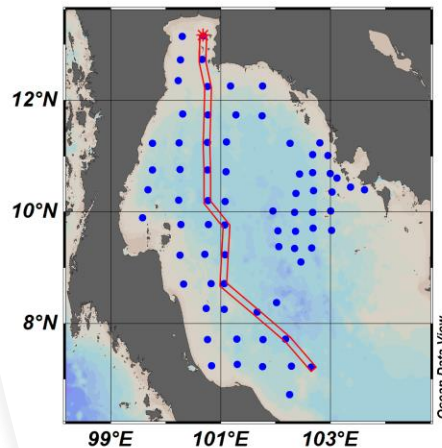
Water Stratification near the gulf mouth
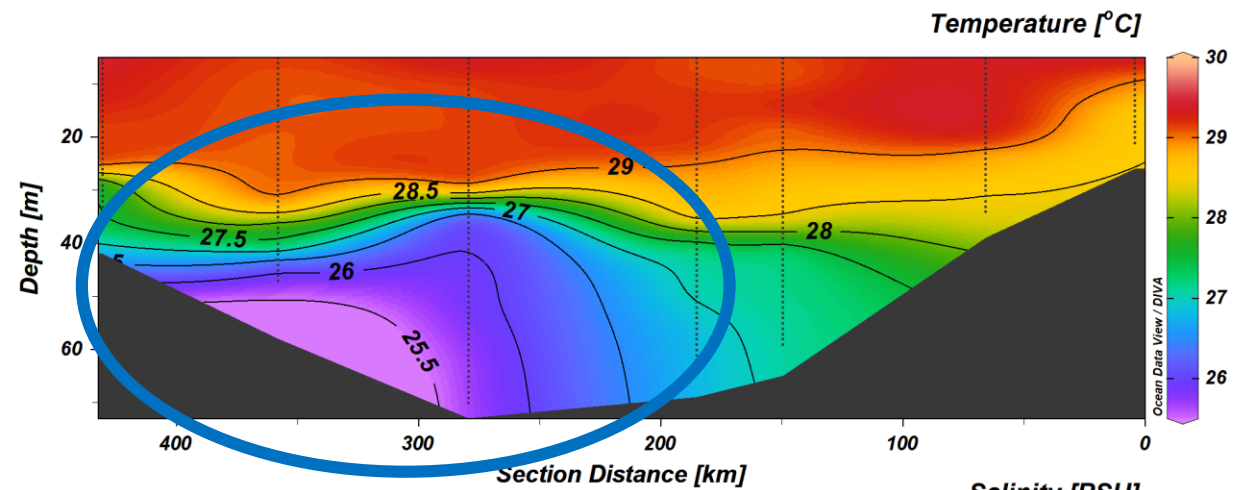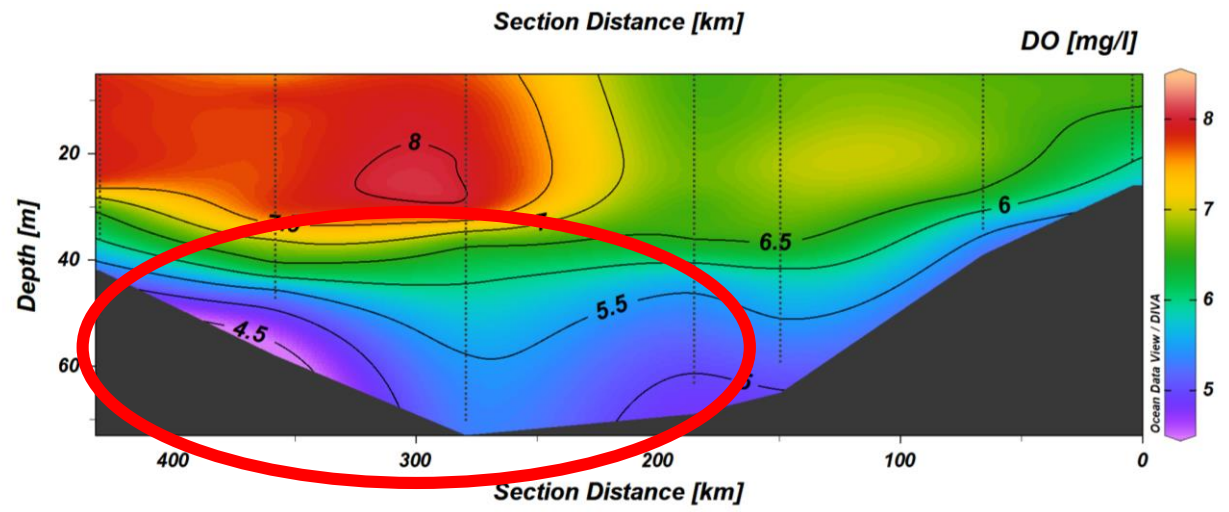
- Is it related to the intrusion form SCS?
- The development of low DO in near stratified bottom water

Stratification Parameter
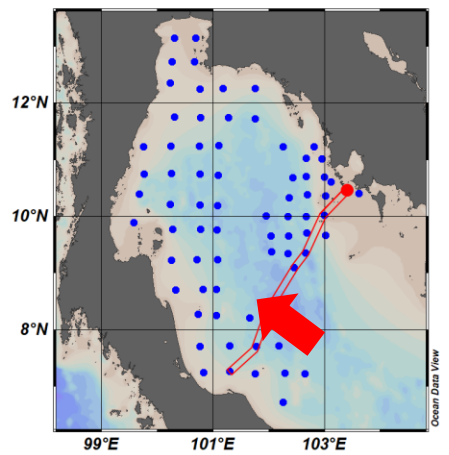
Stratification @ Depth [m]=last
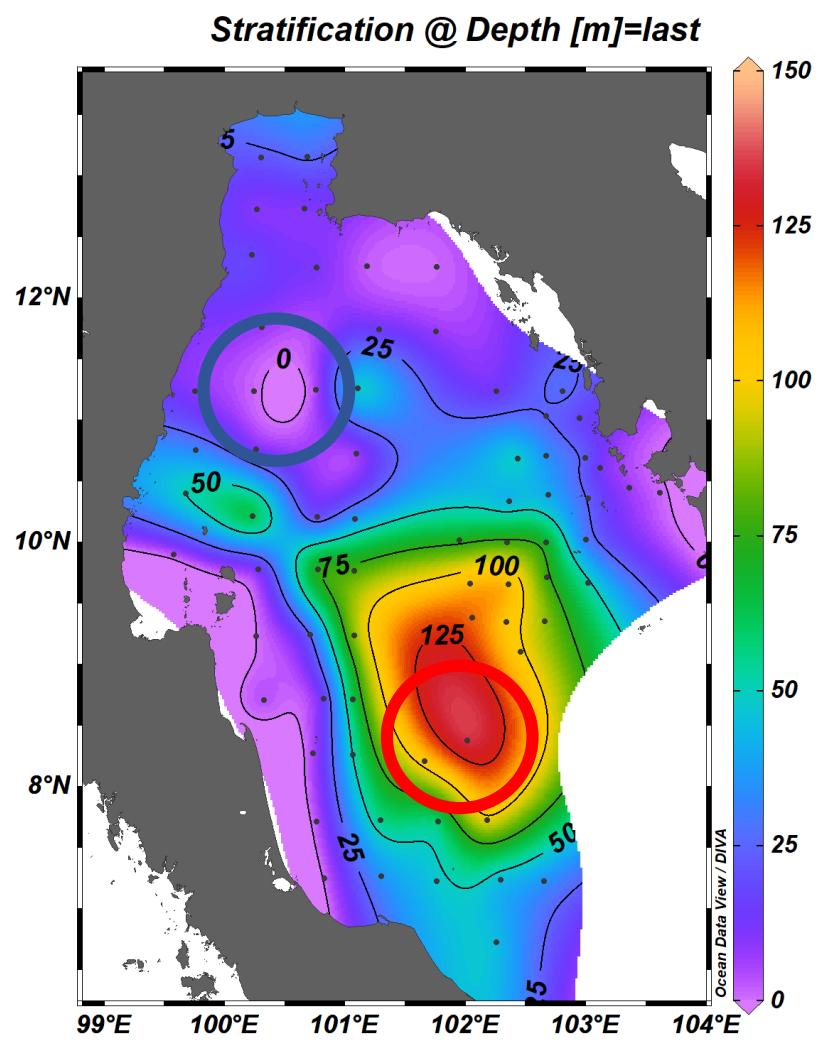
$$\Phi = \frac{1}{h} \int_{-h}^{0} gz(\rho_{ave} - \rho)dz$$

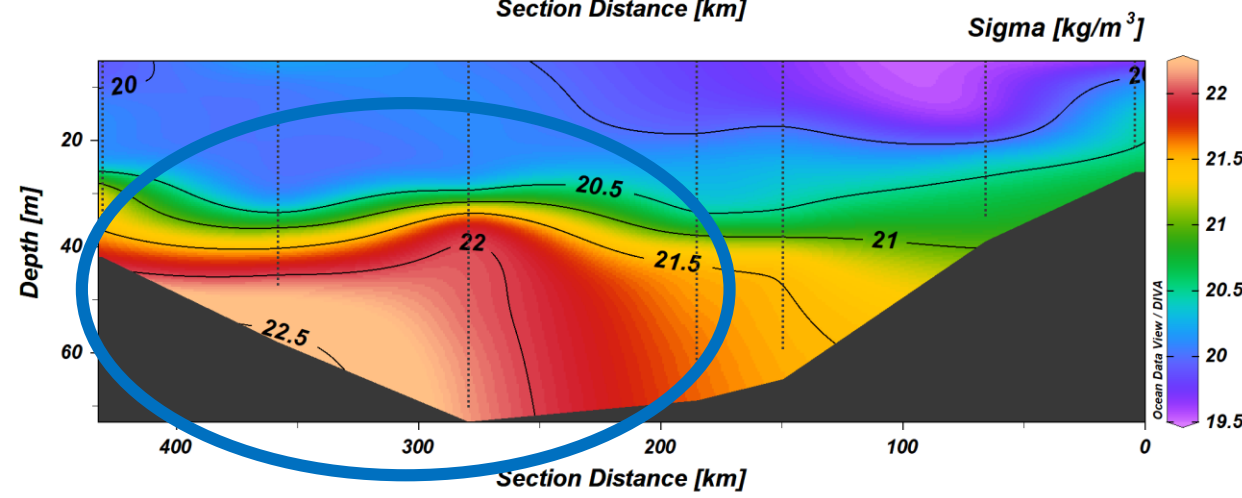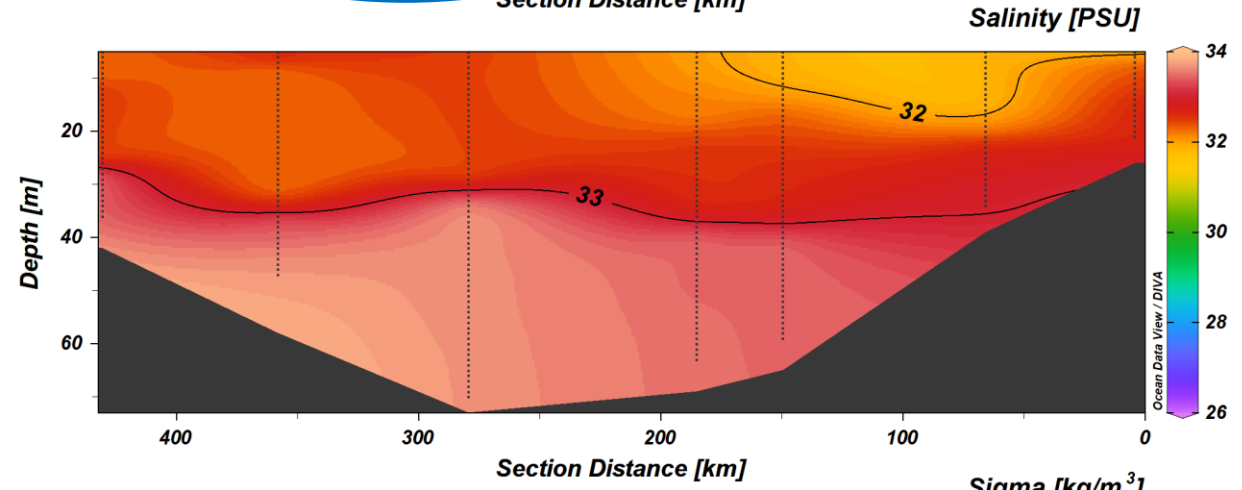h : depth, ρ : density, ρ_{ave}: vertical average density
g : gravitational acceleration

$\Phi = 135$ $\Phi = 1$
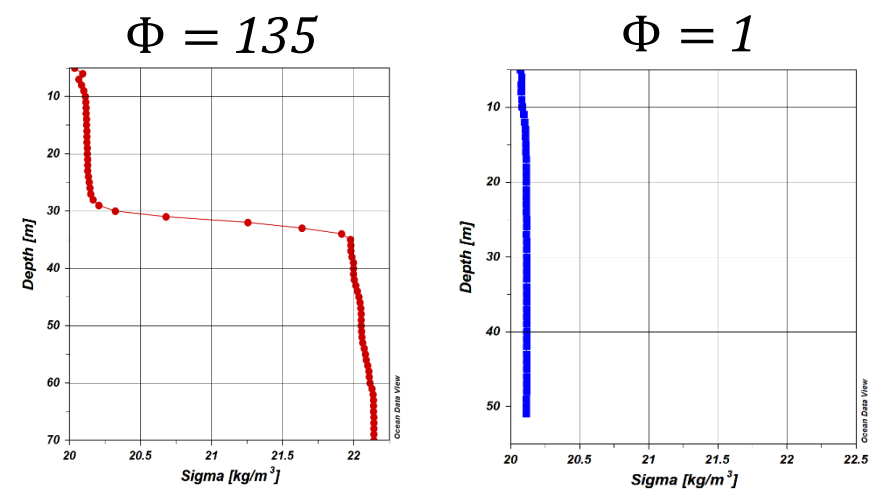
- *Well-mixed water was dominant throughout the gulf except the area near the gulf mouth.*

Stratification Parameter and bottom DO

Stratification @ Depth [m]=last

DO [mg/l] @ Depth [m]=last

- *Bottom DO is low where water column is stratified.*

$y = -0.0097x + 6.1493$
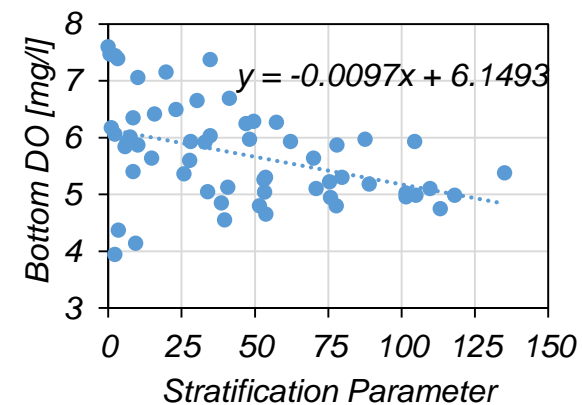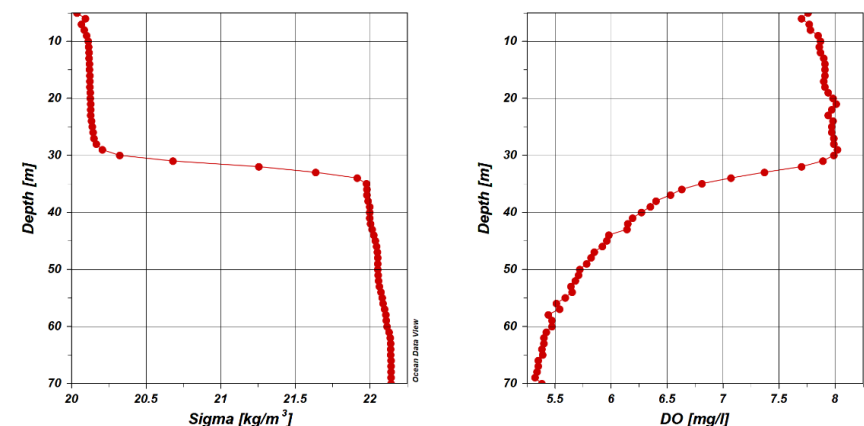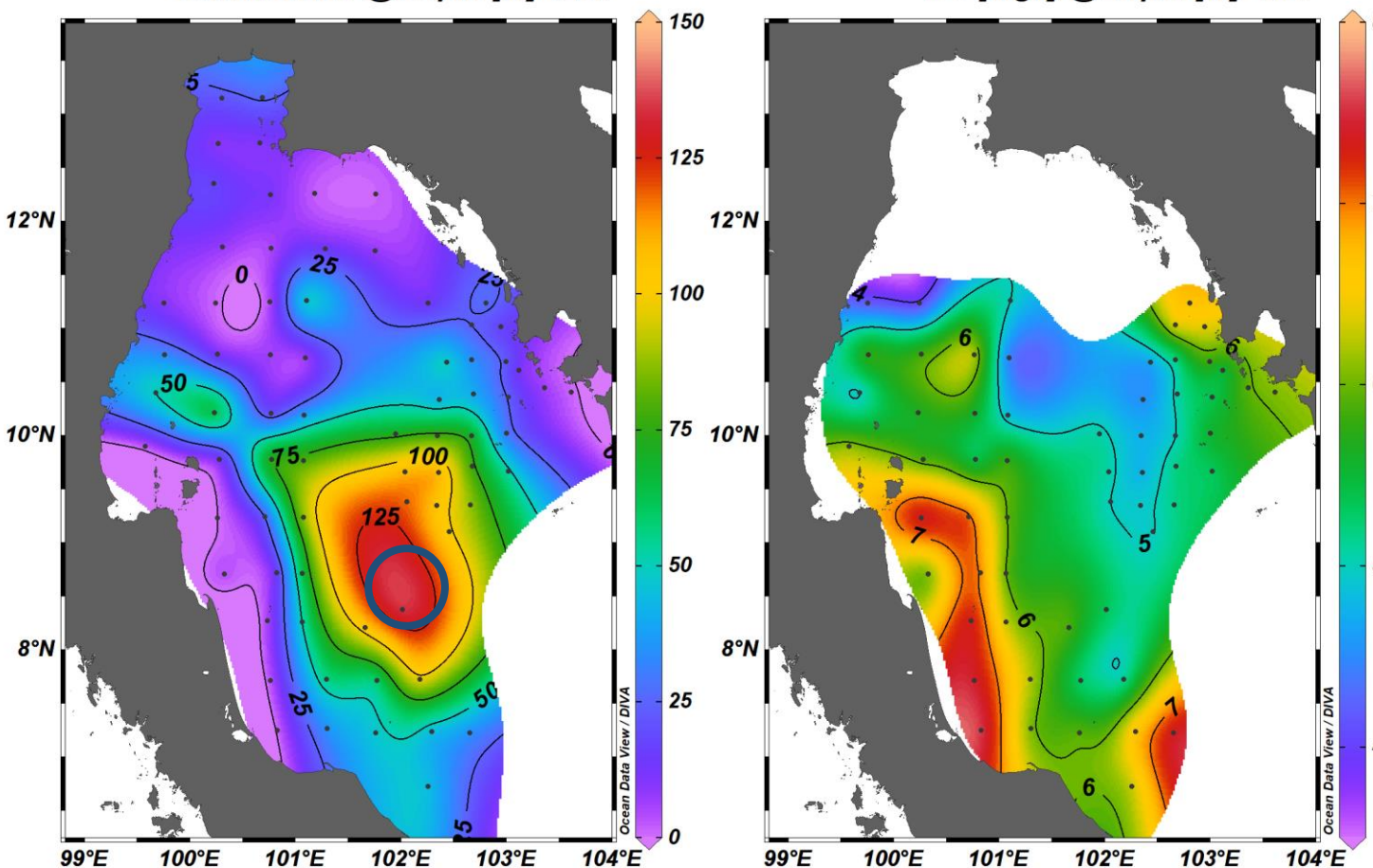
Stratification Parameter and surface Chl-a

Stratification @ Depth [m]=last
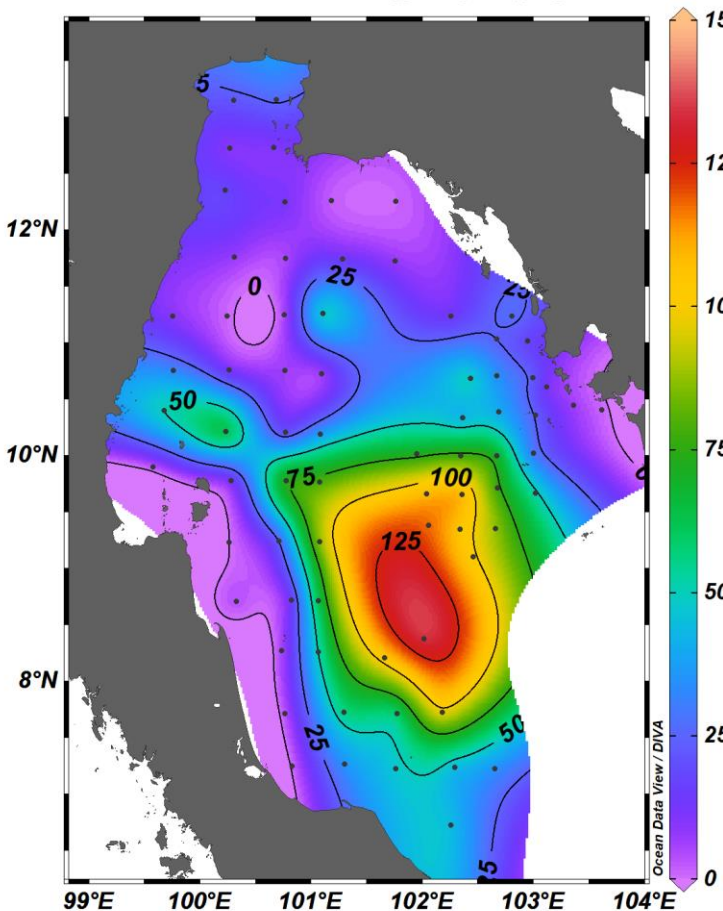
Chl-a [mg/³] @ Depth [m]=first
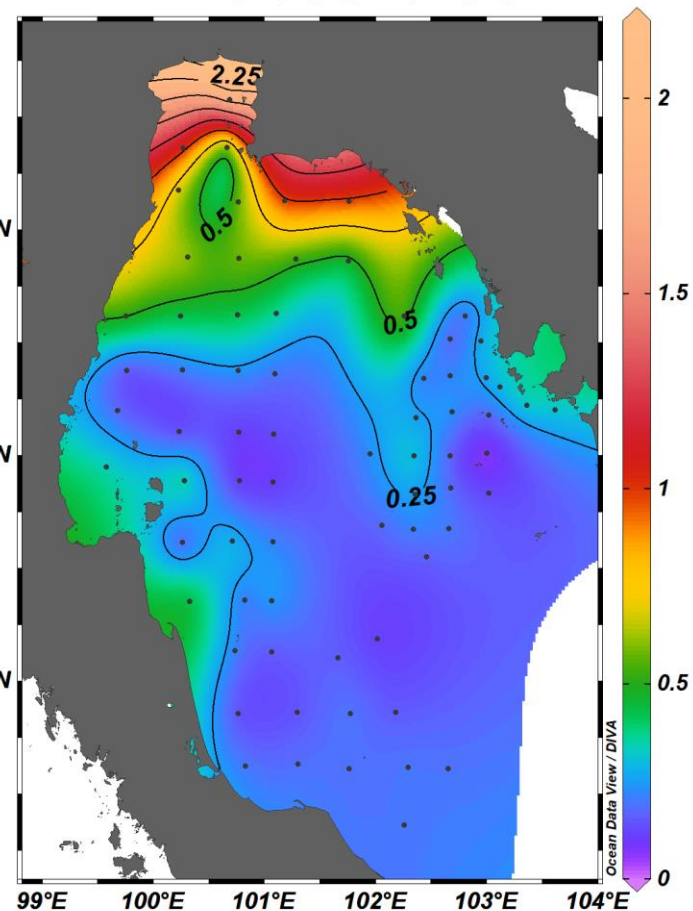
- *Chl-a is high where water column is less stratified (high mixing).*
- *Why?*

$y = -0.0028x + 0.4106$

Stratification Parameter and wind speed

Stratification @ Depth [m]=last

W.Spd [m/s] @ Depth [m]=first
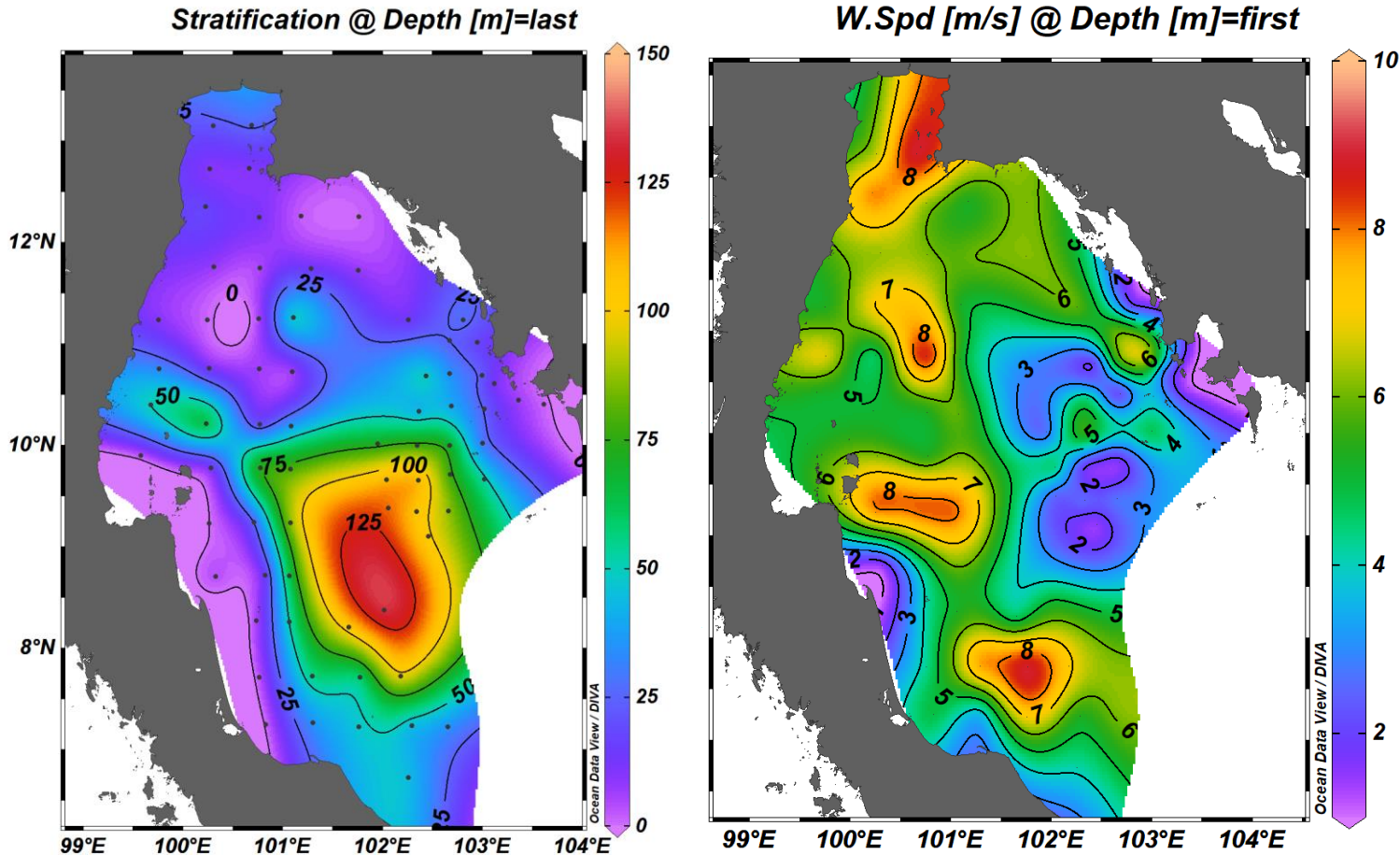
- *Relationship is unclear but has a trend of inverse relationship.*

$y = -0.0148x + 5.7133$
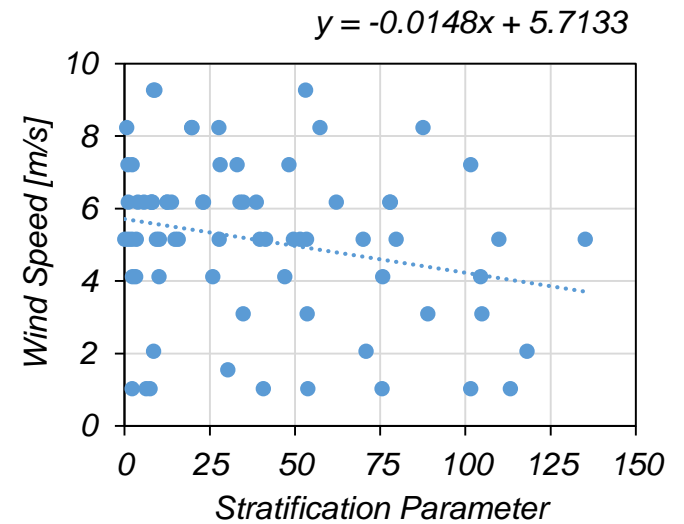
Conclusions

- *Water column during observation period (17 Aug - 11 Oct 2018) was mostly well-mixed with some stratification near the mouth of the Gulf of Thailand.*

- *Analyzed stratification was inversely related to bottom DO and surface Chl-a.*
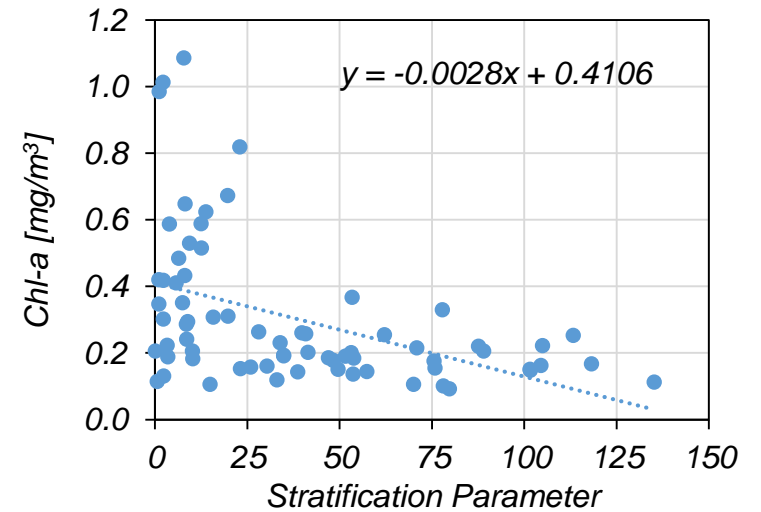
- *Relationship between stratification and wind speed was unclear but it has a trend of inverse relationship.*

- *The results confirm the evidence of the intrusion of the South China Sea water and its influence on environmental condition in the Gulf of Thailand.*

Key questions for future studies

- *What mechanisms are related to the variability of hypoxic water development?*

- *What are the roles and impacts of the South China Sea water intrusion and near-bottom hypoxic water on ecosystem and fishery resources in the Gulf of Thailand?*

- *Does high surface chlorophyll during mixing time occur because supporting nutrients from the South China Sea stimulates phytoplankton growth, or mixing bring phytoplankton from subsurface water to the sea surface?*

- *How does climate change modify all above phenomena and will those impact food security in this regions?*

Thank you

Everyone and organizations to support this survey!