

Session OS4.6: One Argo and its role in operational oceanography

Exploring Upper Layer Bio-Physical Processes in the Bay of Bengal using BGC-Argos

Sourav Sil^{*,1}

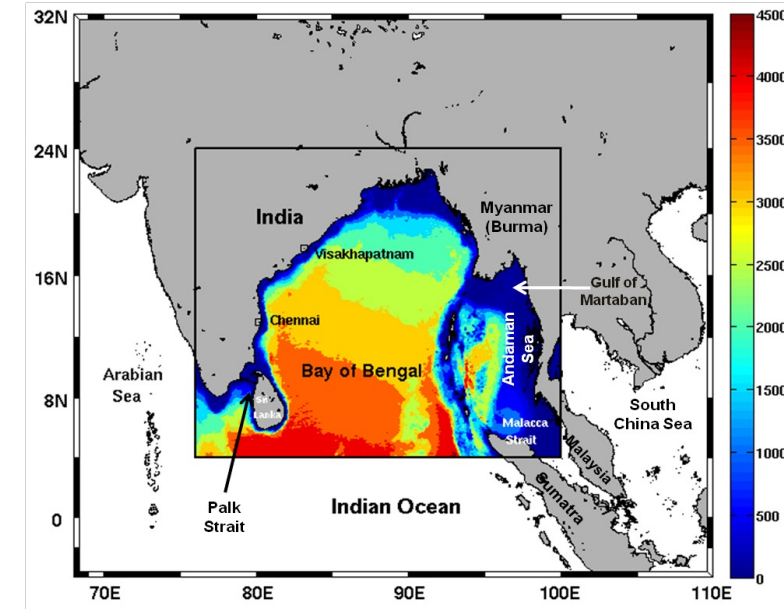
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Abhijit Shee^{3,1}, and Saikat Pramanik⁴**

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²School for Marine Science and Technology, University of Massachusetts at Dartmouth, USA

³Centre for Atmospheric and Oceanic Sciences, Indian Institute of Science, Bengaluru, Karnataka, India

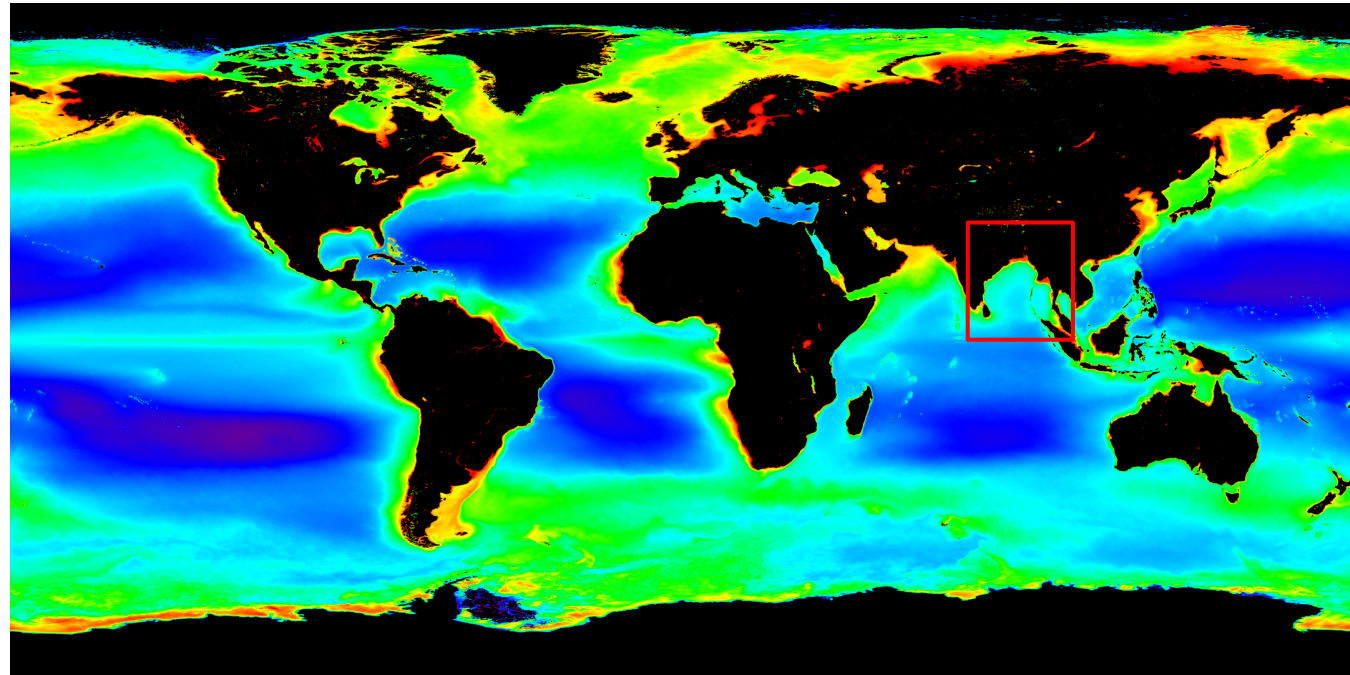
⁴Ministry of Earth Sciences, Indian Institute of Tropical Meteorology, Pune, India



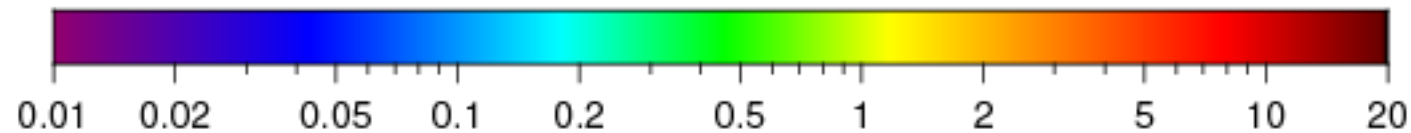
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Chlorophyll Observations

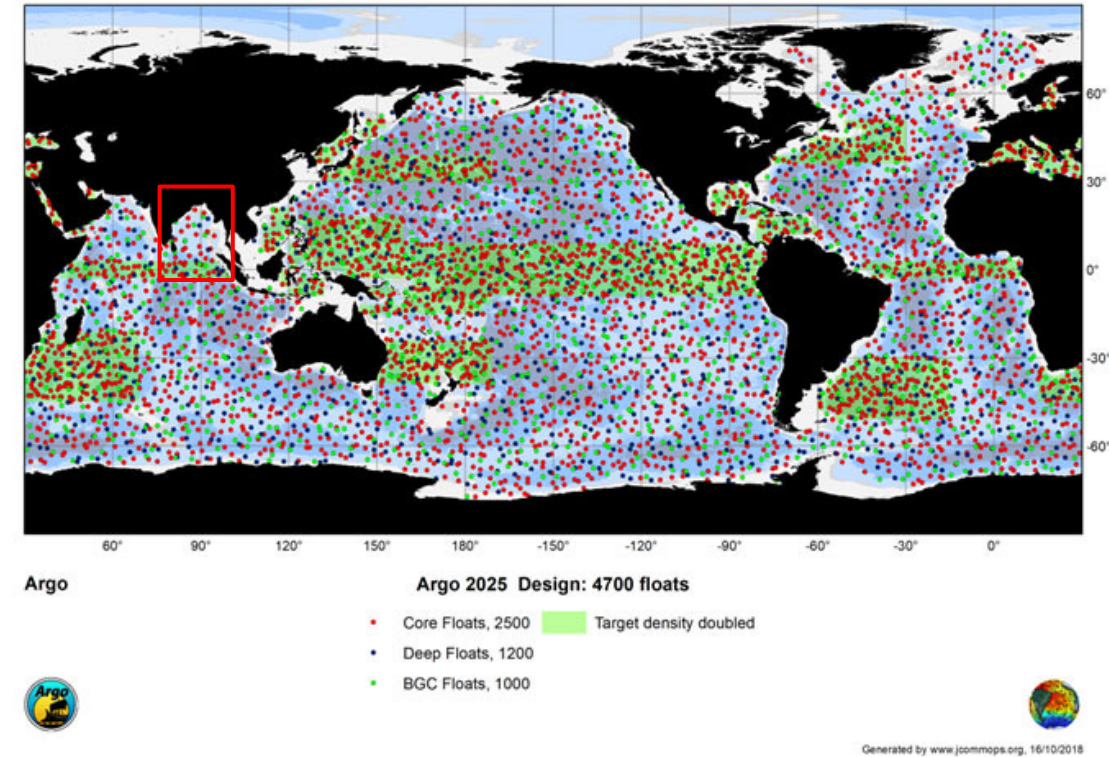
04 Jul 2002 to 28 Feb 2025



Chlorophyll Concentration, OCI Algorithm (mg m^{-3})



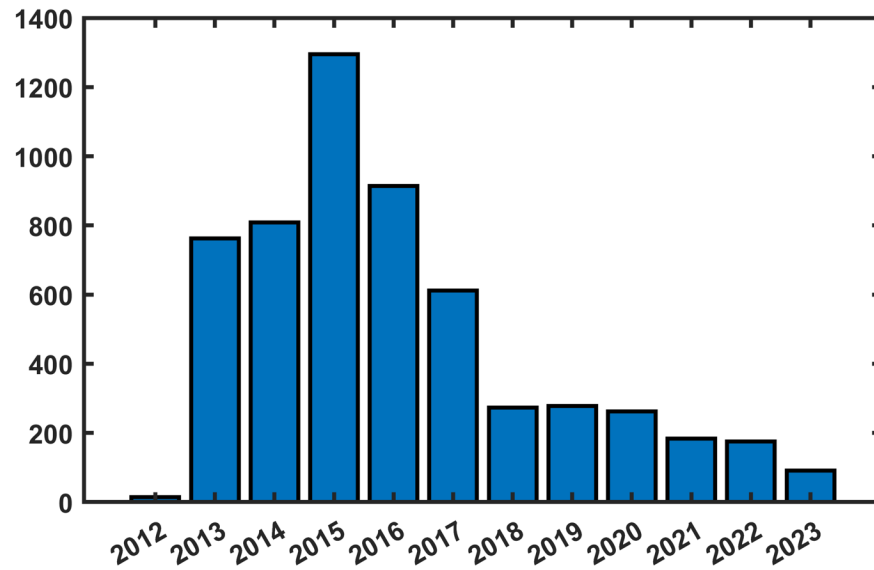
Source: <https://oceandata.sci.gsfc.nasa.gov/l3>



Source: <https://argo.ucsd.edu/oneargo/>

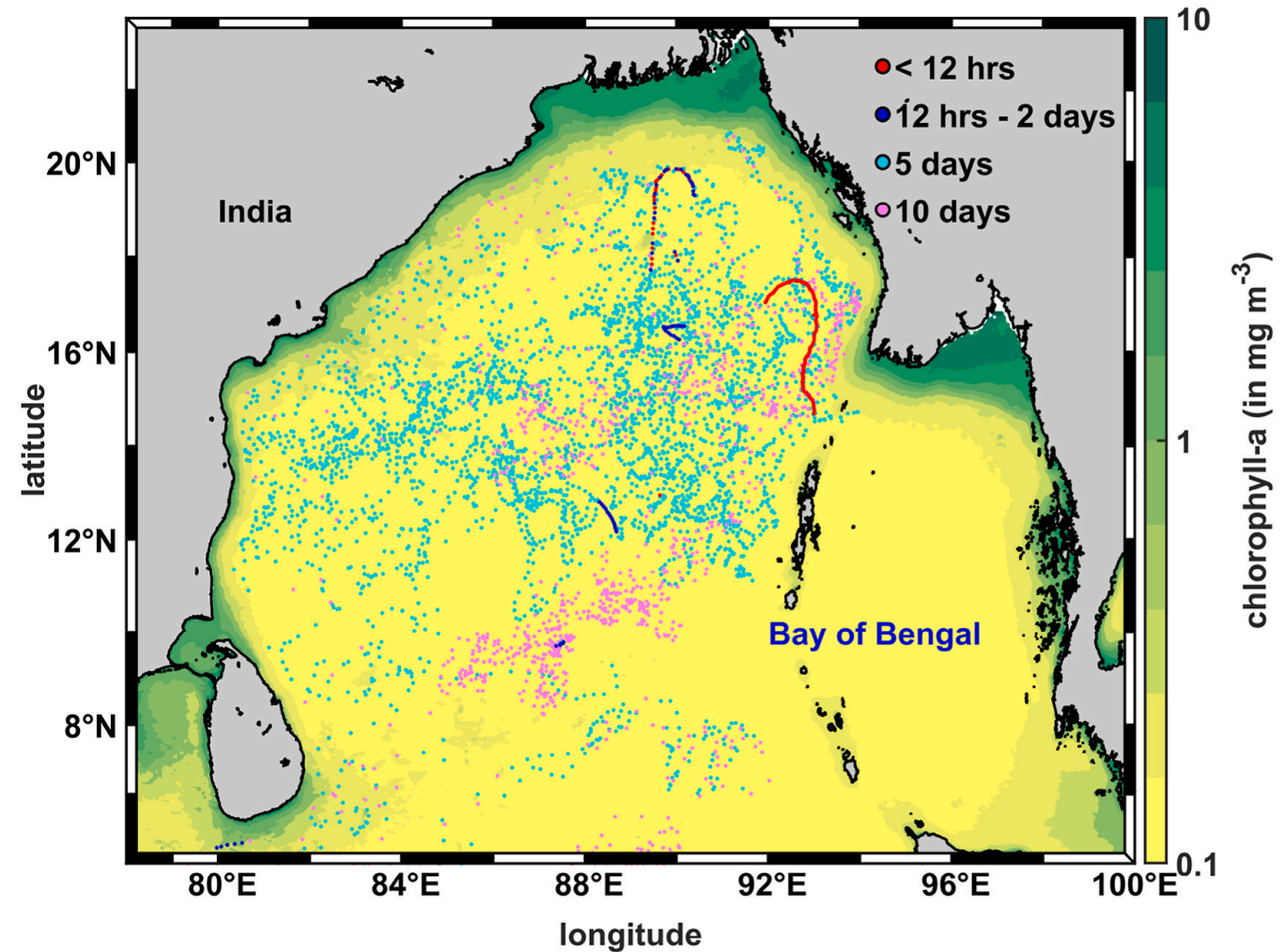
+ Numerical Model

Status of BGC-Argo in the Bay of Bengal



Number of BGC-Argo float profile measurements (5125 profiles) taken until December 2023.

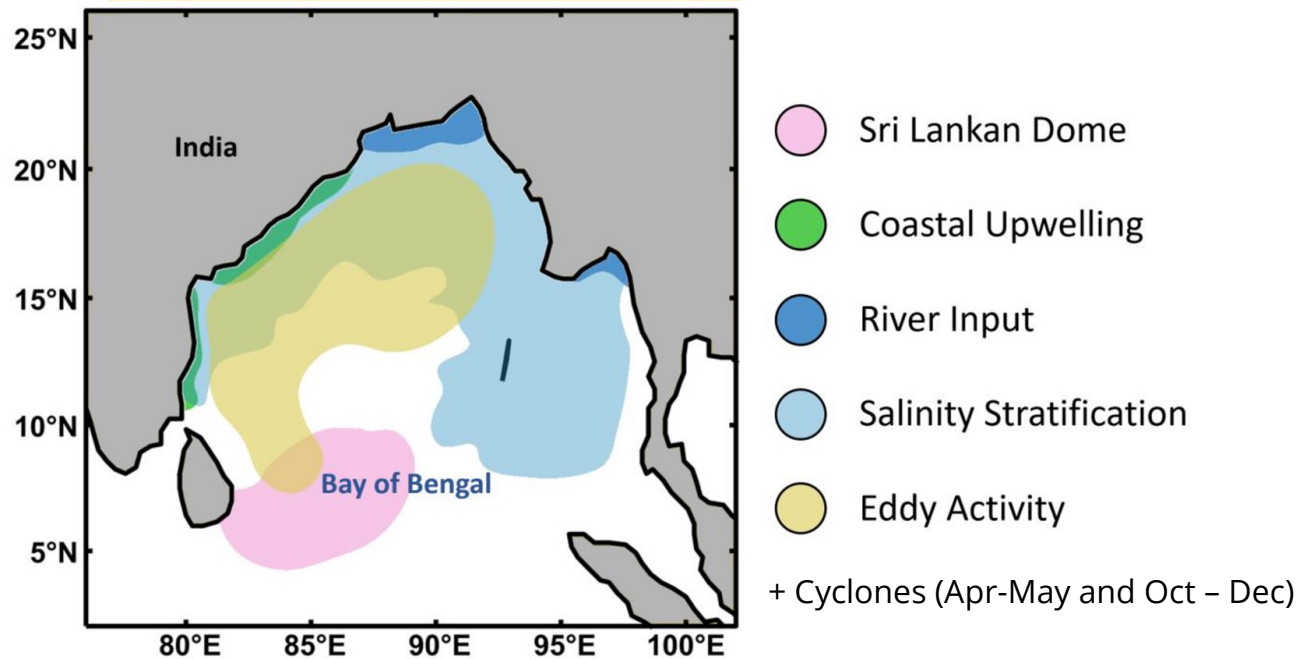
Data source: <https://dataselection.euro-argo.eu/>



Location of all BGC-Argo float profile measurements (5125 profiles) taken until December 2023.

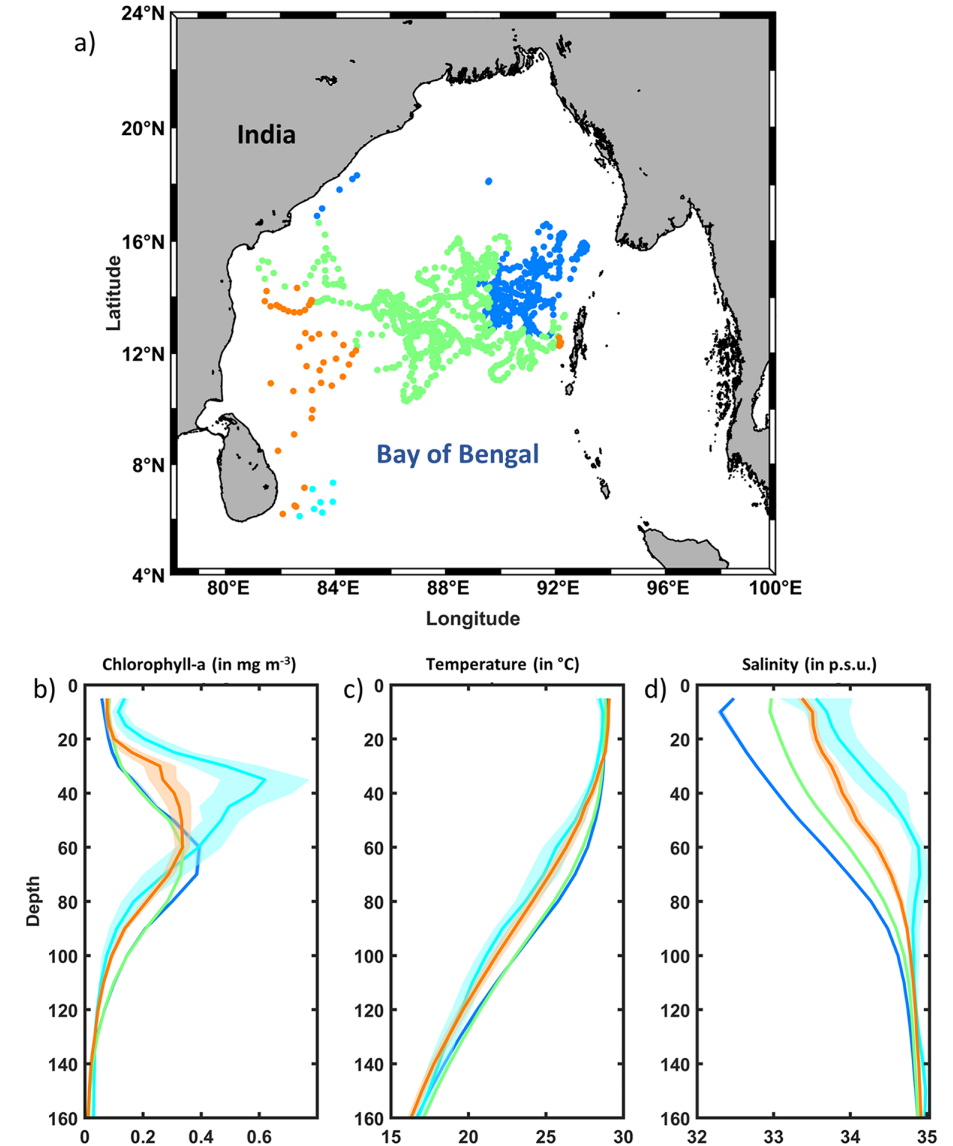
Spatiotemporal variability of productivity in the Bay of Bengal

Processes in the Bay of Bengal

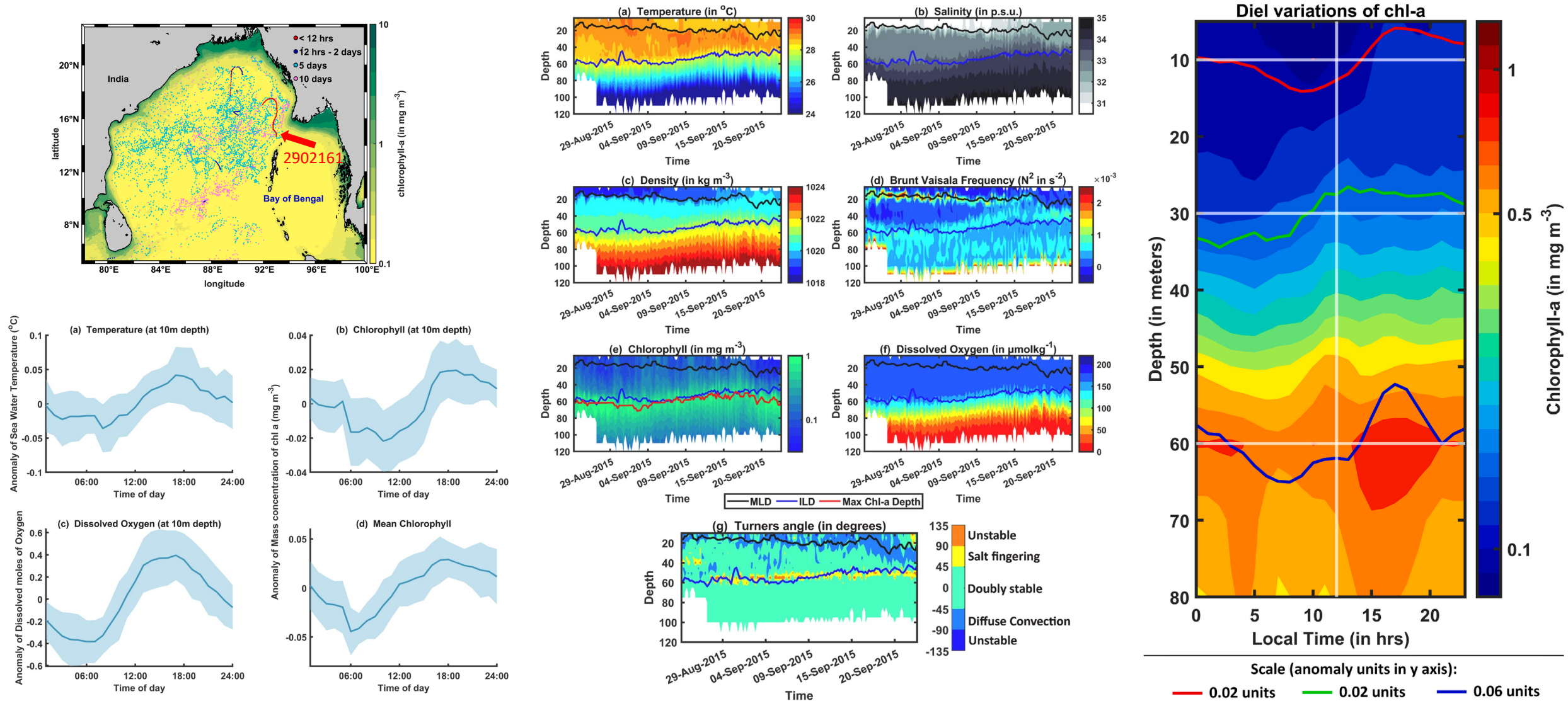


Das, S., Sil, S., & Boopathi, V. (2025). Cluster-based analysis of biophysical controls on spatiotemporal variability of productivity in the Bay of Bengal. *CSI Transactions on ICT*, 1-12. <https://doi.org/10.1007/s40012-025-00412-0>

Vertical Profiles of Chl-a from BGC-Argo

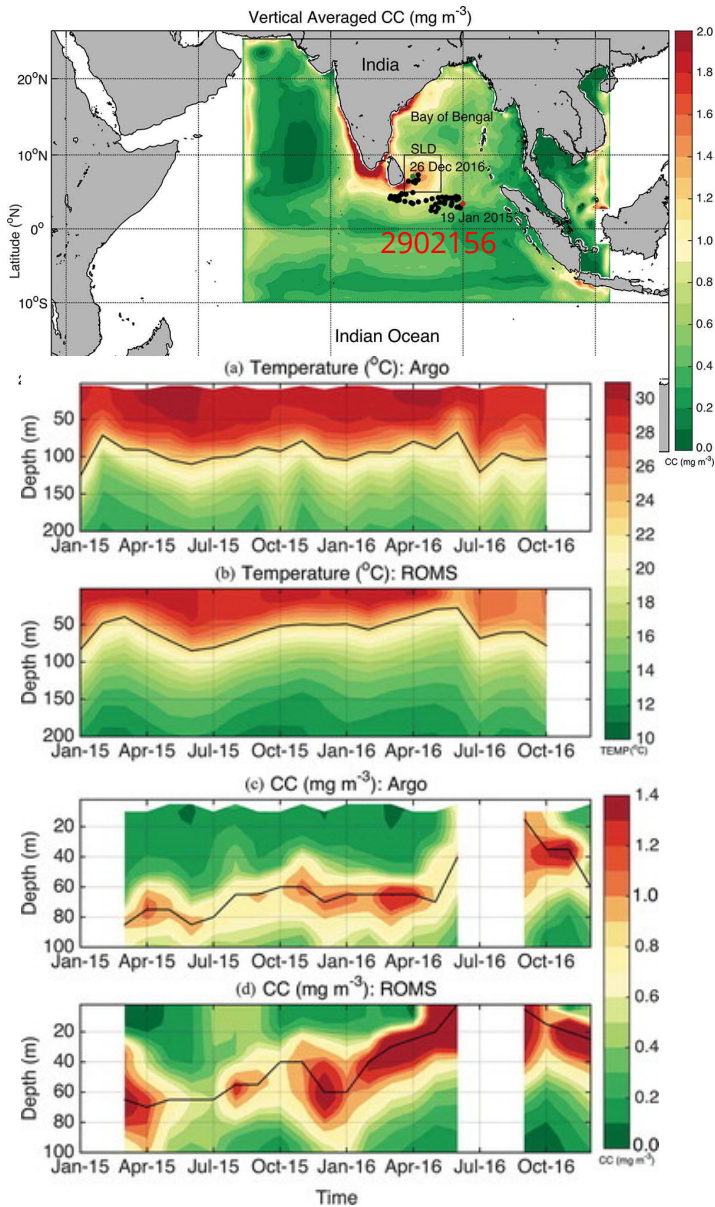


Diel Variations in the Upper Layer Biophysical Processes

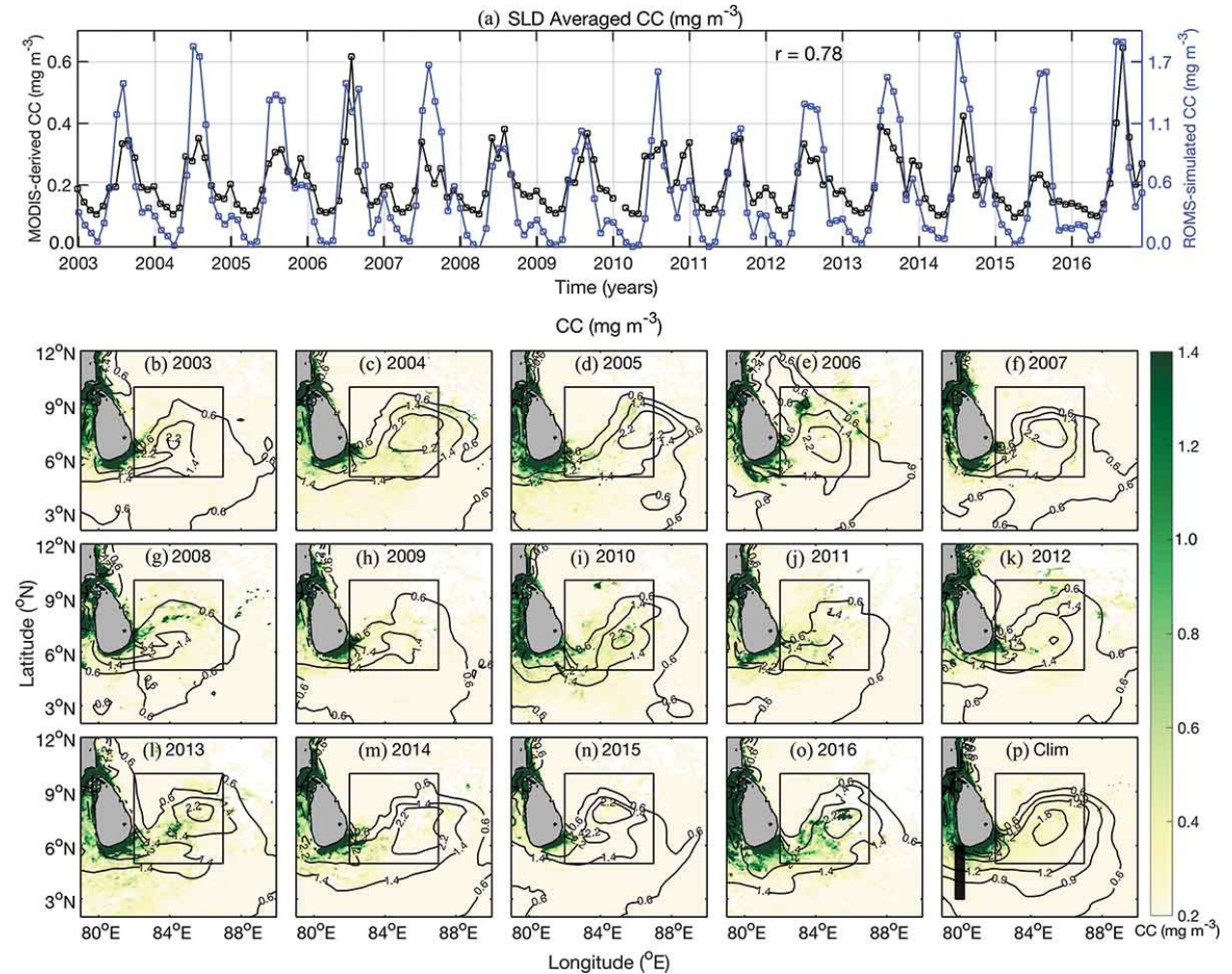


Das, S., & Sil, S. (2024). Diel Variations in the Upper Layer Biophysical Processes using a BGC-Argo in the Bay of Bengal. Deep Sea Research Part II: Topical Studies in Oceanography, 216, 105392. <https://doi.org/10.1016/j.dsr2.2024.105392>

ROMS-NPZD Model (25 km) Validation



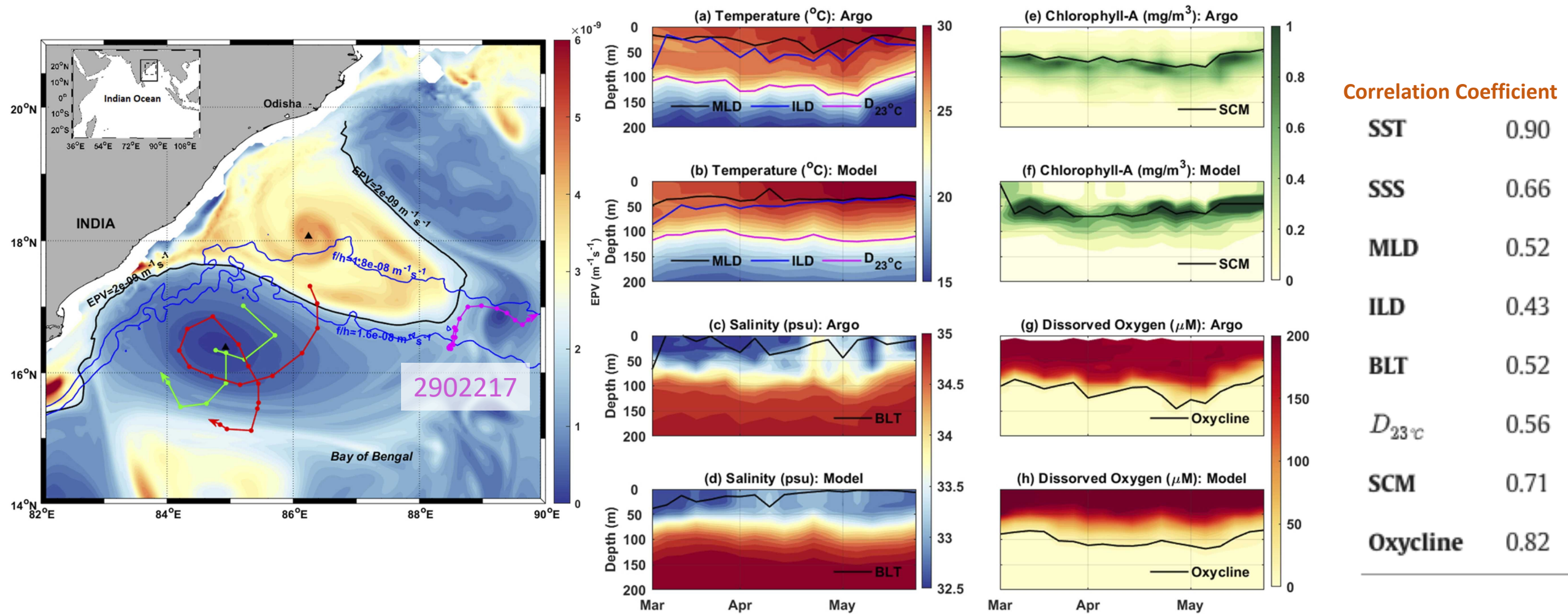
Model chlorophyll (shaded) vs satellite-derived chlorophyll (contours)



S. Pramanik, S. Sil, A. Gangopadhyay, M. K. Singh & N. Behera (2020) Interannual variability of the Chlorophyll-*a* concentration over Sri Lankan Dome in the Bay of Bengal, International Journal of Remote Sensing, 41:15, 5974-5991, <https://doi.org/10.1080/01431161.2020.1727057>

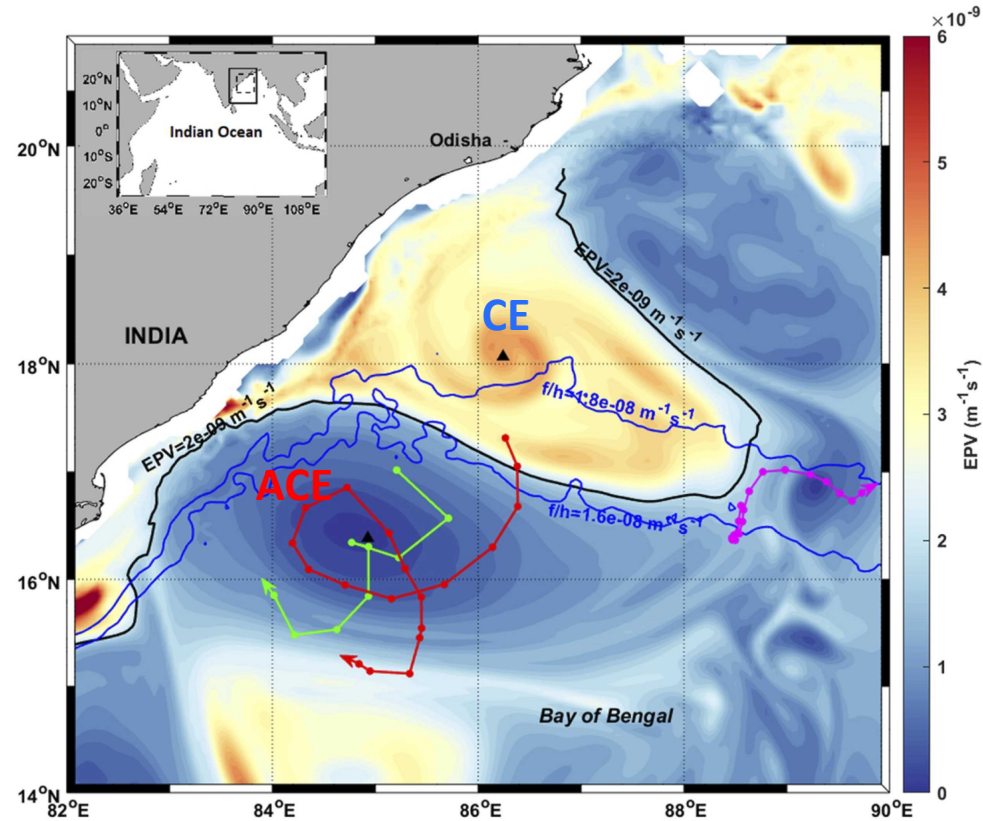
ROMS NPZD Model (5 km) Validation

ROMS-NPZD vs Argo-BGC (WMO ID 2902217)

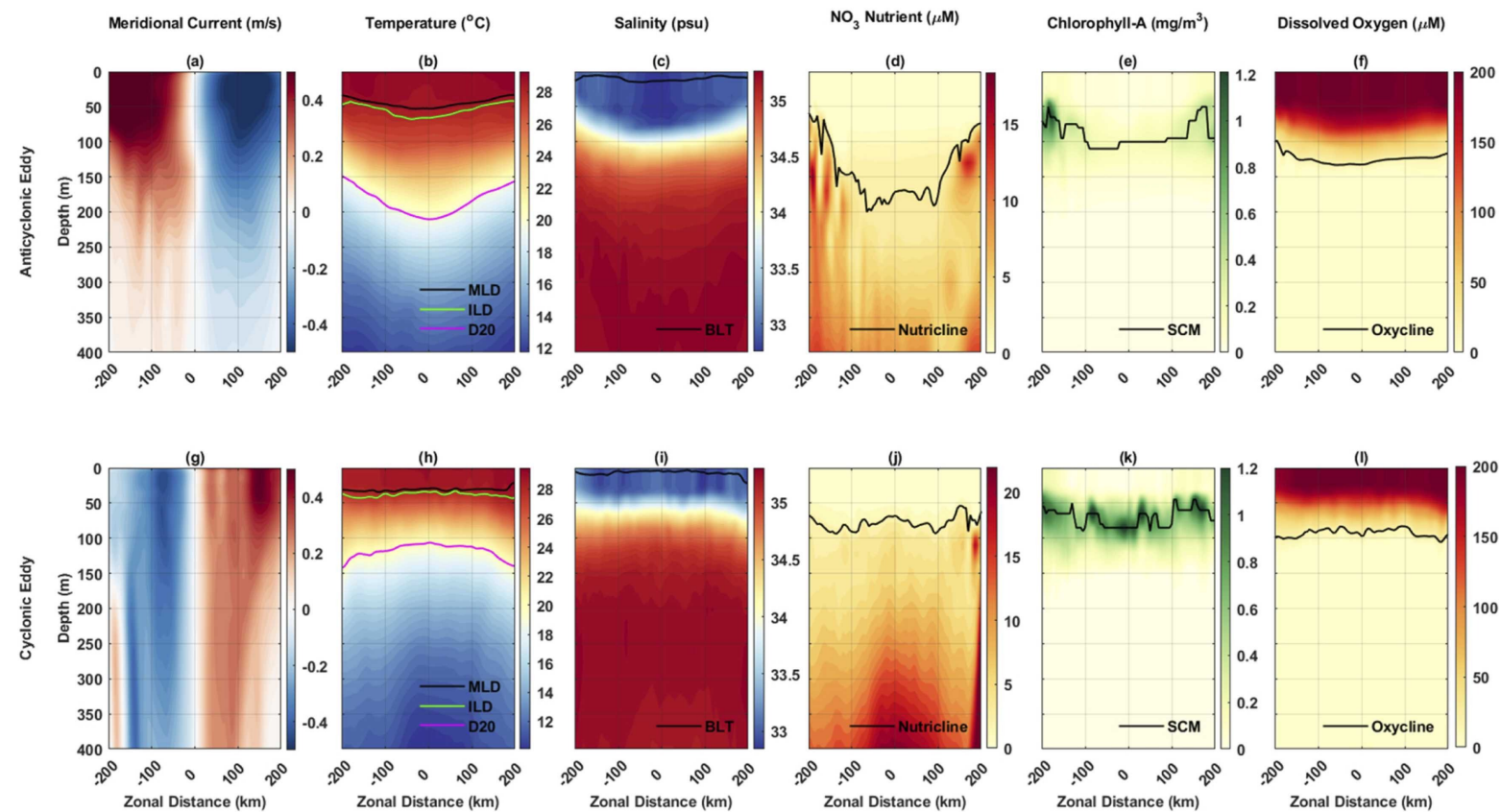


Shee, A., Sil, S. & Deogharia, R. (2024): Three-dimensional Characteristics of Mesoscale Eddies in the Western Boundary Current Region of the Bay of Bengal using ROMS-NPZD, Dynamics of Atmospheres and Oceans, 105, 101424, 1-18, <https://doi.org/10.1016/j.dynatmoce.2023.101424>

ROMS NPZD Model (5 km) Validation

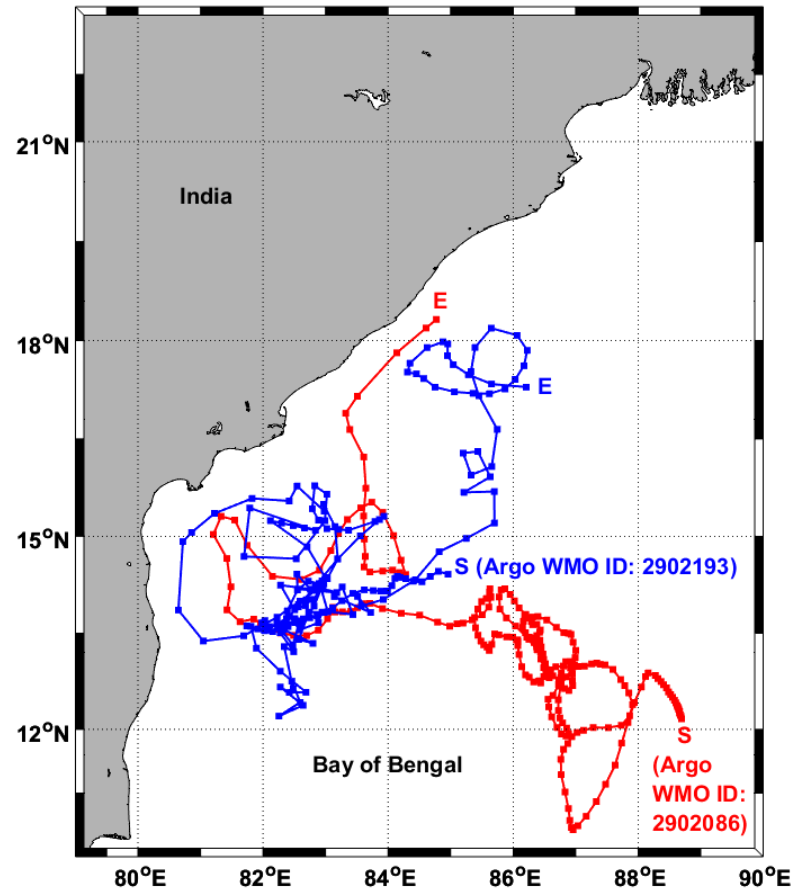


Vertical structure of Eddies



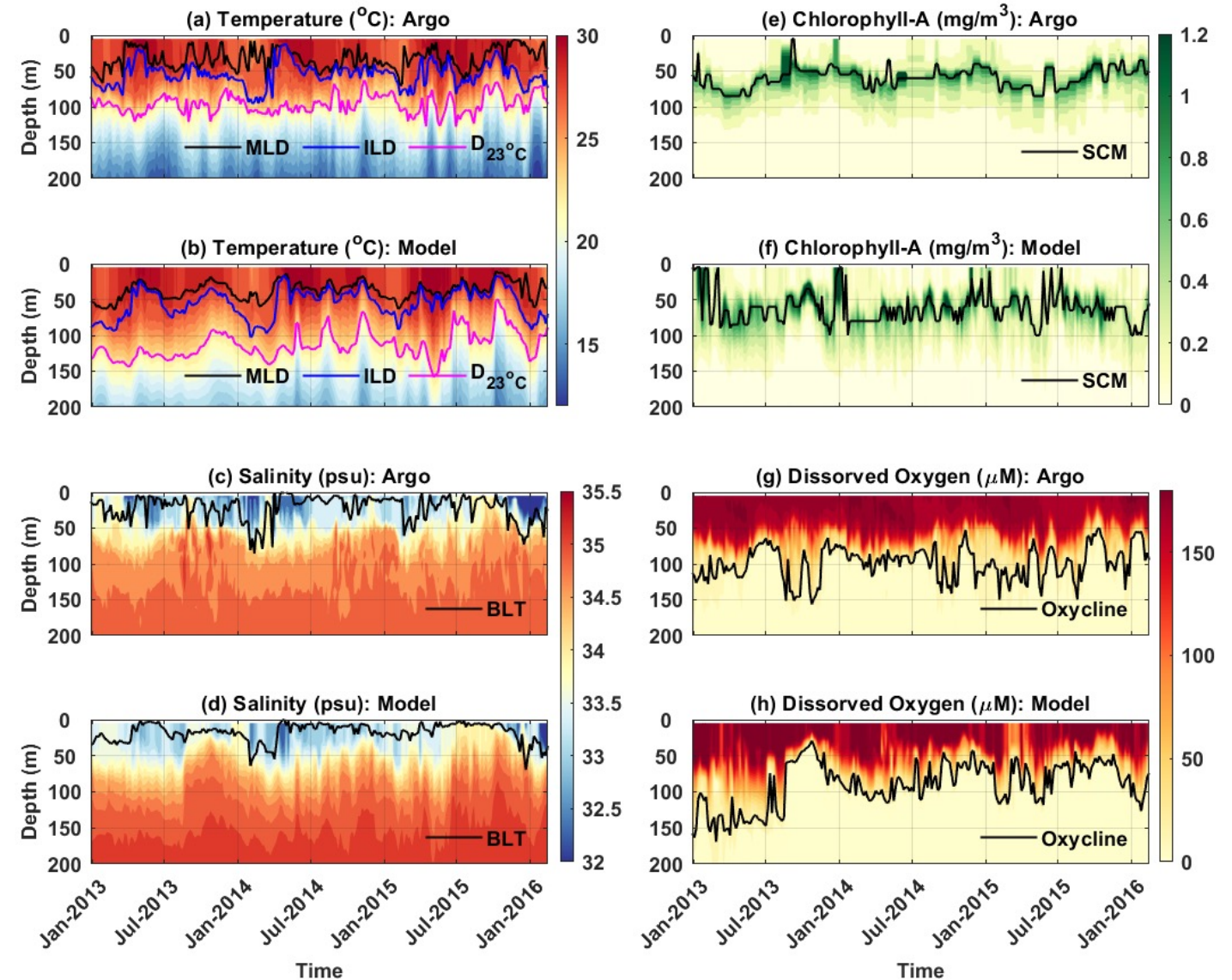
Shee, A., Sil, S. & Deogharia, R. (2024): Three-dimensional Characteristics of Mesoscale Eddies in the Western Boundary Current Region of the Bay of Bengal using ROMS-NPZD, Dynamics of Atmospheres and Oceans, 105, 101424, 1-18, <https://doi.org/10.1016/j.dynatmoce.2023.101424>

ROMS NPZD Model (5 km) Validation

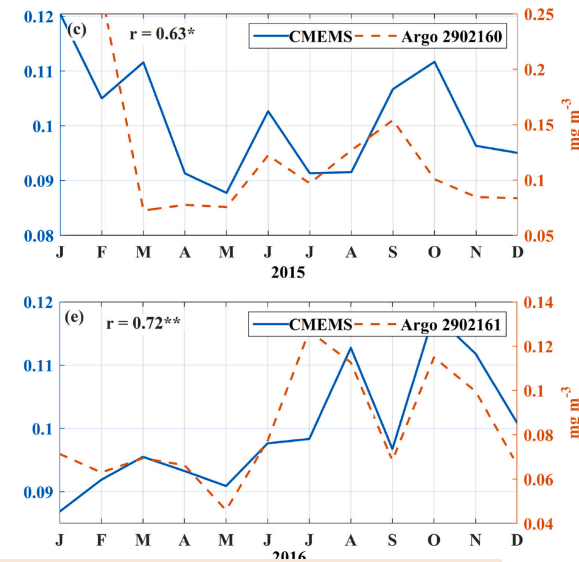
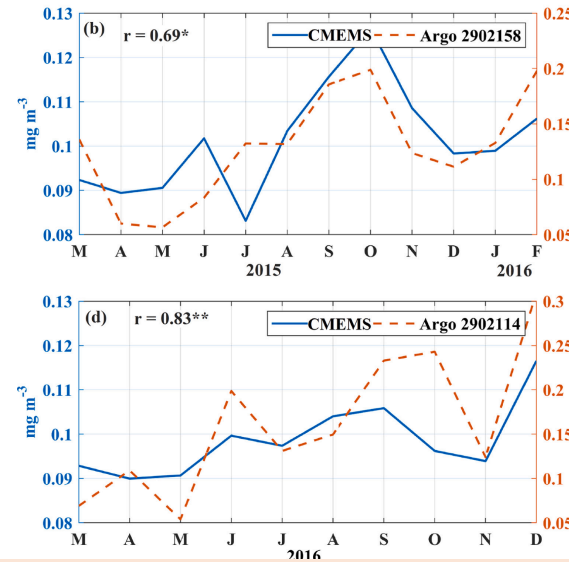
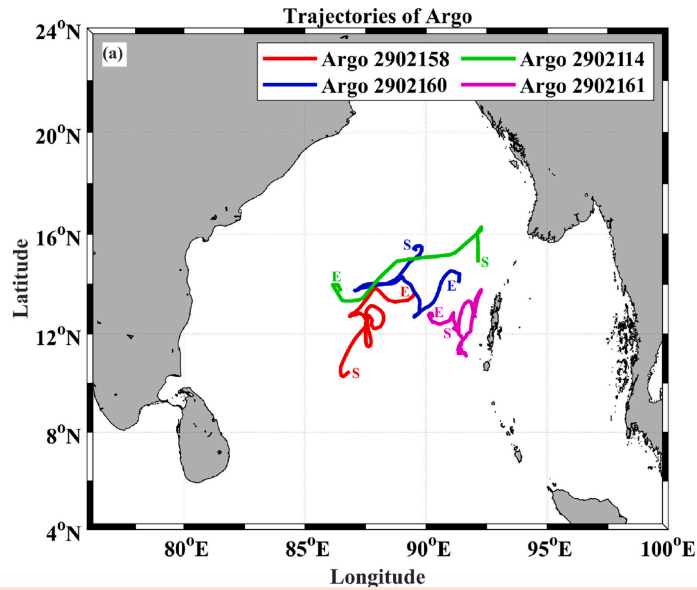


Shee, A., Sil, S., Gangopadhyay, A., Agarwal, N., & Sandeep, K. K. (2025). Upper Ocean Biophysical Budget Analysis during a Cyclone using Regional Ocean Modeling System. Ocean Modelling, 195. 102524. <https://doi.org/10.1016/j.ocemod.2025.102524>

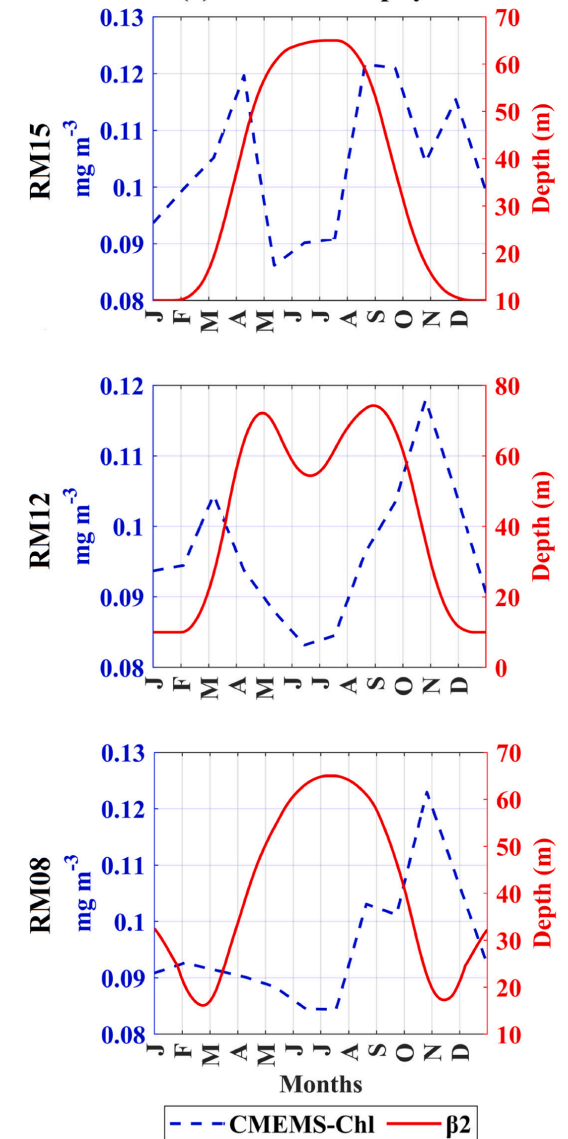
ROMS-NPZD vs Argo-BGC (WMO ID 2902086)



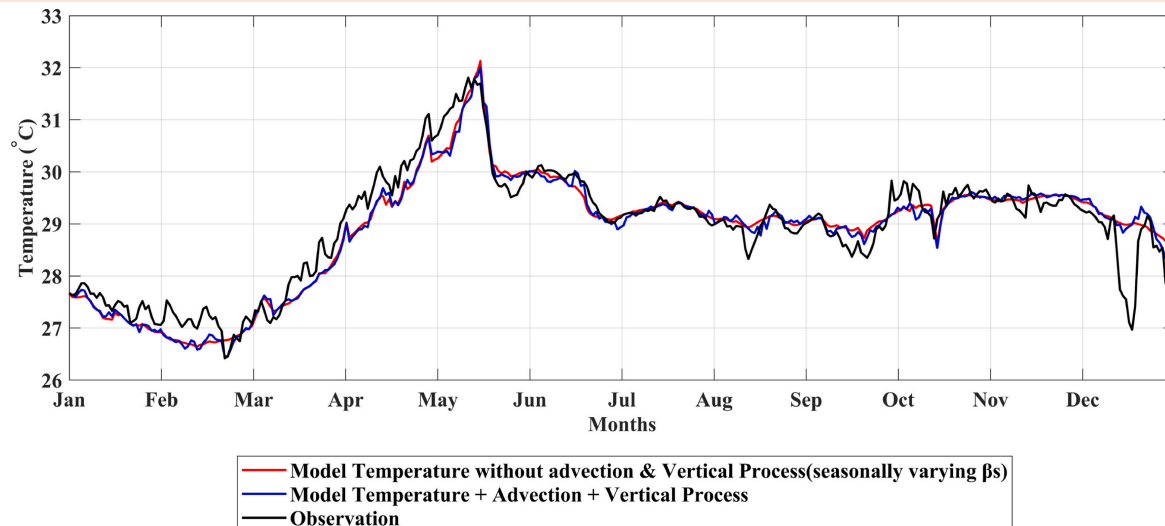
CMEMS-Chl vs ARGO



CMEMS-Chl vs penetration depth (β_2).



SST using PWP Model



Gupta, H., Deogharia, R., & Sil, S. (2024). Influence of the solar penetration depth and heat-fluxes on the sea surface temperature using an ocean mixed layer model. Regional Studies in Marine Studies, 74, 103551. <https://doi.org/10.1016/j.rsma.2024.103551>

Summary

- BGC-Argos provide good quality Chlorophyll and Dissolve Oxygen (few Nitrate) Profiles. In the recent time (2018-2023), the number of profiles is significantly less compared to previous years (2013-2017).
- The high-resolution, in-situ measurements provided by BGC-Argo floats are instrumental in capturing temporal and spatial variations, thereby supporting the development of more accurate oceanographic models and assessments.
- Regional Biophysical Ocean Model reproduce the seasonal and interannual cycle reasonably well. However, there is a limitation of initial biological condition and there is a need to generate new observations and better datasets.
- Systematic monitoring of the biophysical processes through observations and modeling is useful for the blue economy and developing a sustainable marine ecosystem.

Thank you



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