2nd International Indian Ocean Expedition 2015-2025

Newsletter

(A basin-wide research program co-sponsored by IOC-UNESCO, SCOR and IOGOOS)

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To advance our understanding of interactions between geologic, oceanic and atmospheric processes that give rise to the complex physical dynamics of the Indian Ocean region, and to determine how those dynamics affect climate, extreme events, marine biogeochemical cycles, ecosystems and human populations.

Optimal parameters for generation of gridded product of Argo temperature and salinity using DIVA

Determining an oceanographic parameter on regular grid positions, using a set of data at random locations both in space and time, is a typical problem since long in the field of oceanography. This is usually called the gridding problem, and the outcome is useful for many applications such as data analysis, graphical display, forcing or initialization of models, etc. The oceanographic community is heavily dependent on the gridded fields (temperature, salinity, etc) for quantitative analysis of ocean general circulation. Gridded products are used to provide initial and boundary conditions for numerical ocean modeling. Many gridding schemes have been proposed in the past for generating data onto a regular grid. The objective analysis scheme is one such, which is based on the minimization of statistical error estimation. Kessler and McCreary (1993) proposed the Objective Analysis (OA) method which is being used at INCOIS to construct a gridded data product for the Indian Ocean region using Argo datasets. This method is relatively easy to implement and is often used to estimate grid-point values from observations existing within a radius of influence.

In the present study data on regular grids were generated from temperature and salinity profile data from argo profile floats (Figure-1). Data and Interpolating Variational Analysis (DIVA) method was chosen for generating the gridded product.

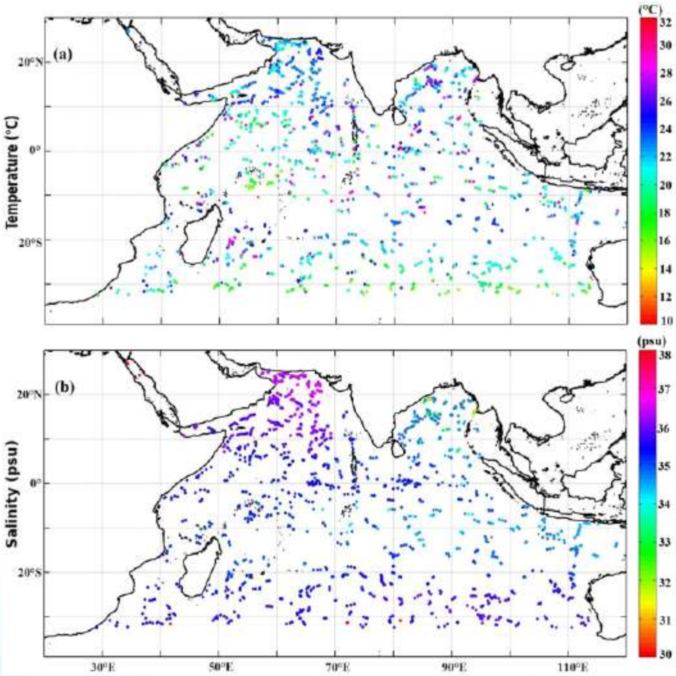


Figure-1. (a) Temperature (°C) and (b) Salinity (PSU) observations from Argo profiling floats used to perform the analysis for a sample month of January 2016. Each dot represents the data availability in the region. Color of each observation represents the parameter range as represented by the colorbar.

Extensive analysis was done to obtain correct choices of correlation length (L) and signal-to-noise ratio (λ), which results in an optimal gridded product. The gridded data obtained for different choices of L and λ was later validated with datasets deliberately (Figure-2) set aside before performing the analyses. For each combination of L and λ, the resultant gridded data was also validated with subsurface data from OMNI buoys. Based on the statistics of comparison with OMNI, the best-fit choice for L and λ was concluded. Later, a comparative analysis was performed with the obtained gridded products from DIVA against the gridded product obtained from Objective Analysis (OA) to demonstrate the method's reliability. The resultant optimal combination of L and λ is proposed to be used for generating Argo gridded data, which will be subsequently used for generating value-added products like mixed layer depth, ocean heat content, D20 etc.

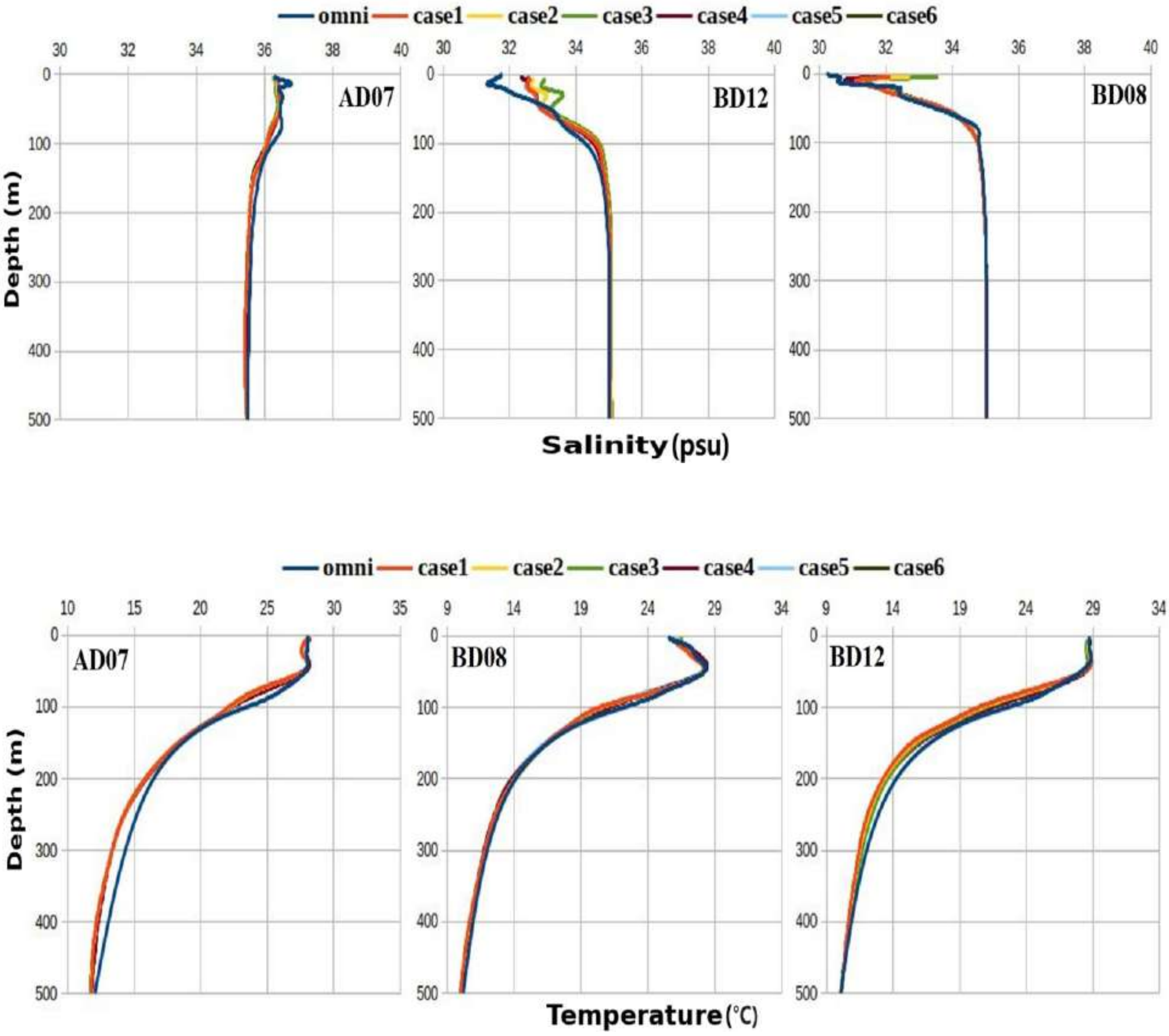


Figure-2. Intercomparison of profiles obtained from DIVA gridded products and OMNI buoys: (top) temperature (°C) and (bottom) salinity (psu). AD and BD indicate OMNI in Arabian Sea and Bay of Bengal respectively.

Citation: Ravi Kumar Jha, T.V.S. Udaya Bhaskar, Optimal parameters for generation of gridded product of Argo temperature and salinity using DIVA, J. Earth Syst. Sci. (2021) 130:170.
https://doi.org/10.1007/s12040-021-01675-2

[Report Courtesy: Ravi Kumar Jha, *INCOIS, Hyderabad , India E-mail: ravikumarjha@incois.gov.in]*

Formation of an Intrathermocline Eddy Triggered by the Coastal-Trapped Wave in the Northern Bay of Bengal

Intrathermocline eddies (ITEs) are subsurface-intensified eddies that are often seen as double-convex shapes in the thermocline. Compared to surface-intensified eddies, ITEs play a greater role in the distribution of heat, salt, and water masses in the intermediate and deeper parts of the ocean. In addition, they cause enhanced plankton blooms in the intermediate depths. These special types of subsurface-intensified vortices in the thermocline are seen in all ocean basins, but their generation and characteristics are not well understood in the Bay of Bengal (Fig.-1a).

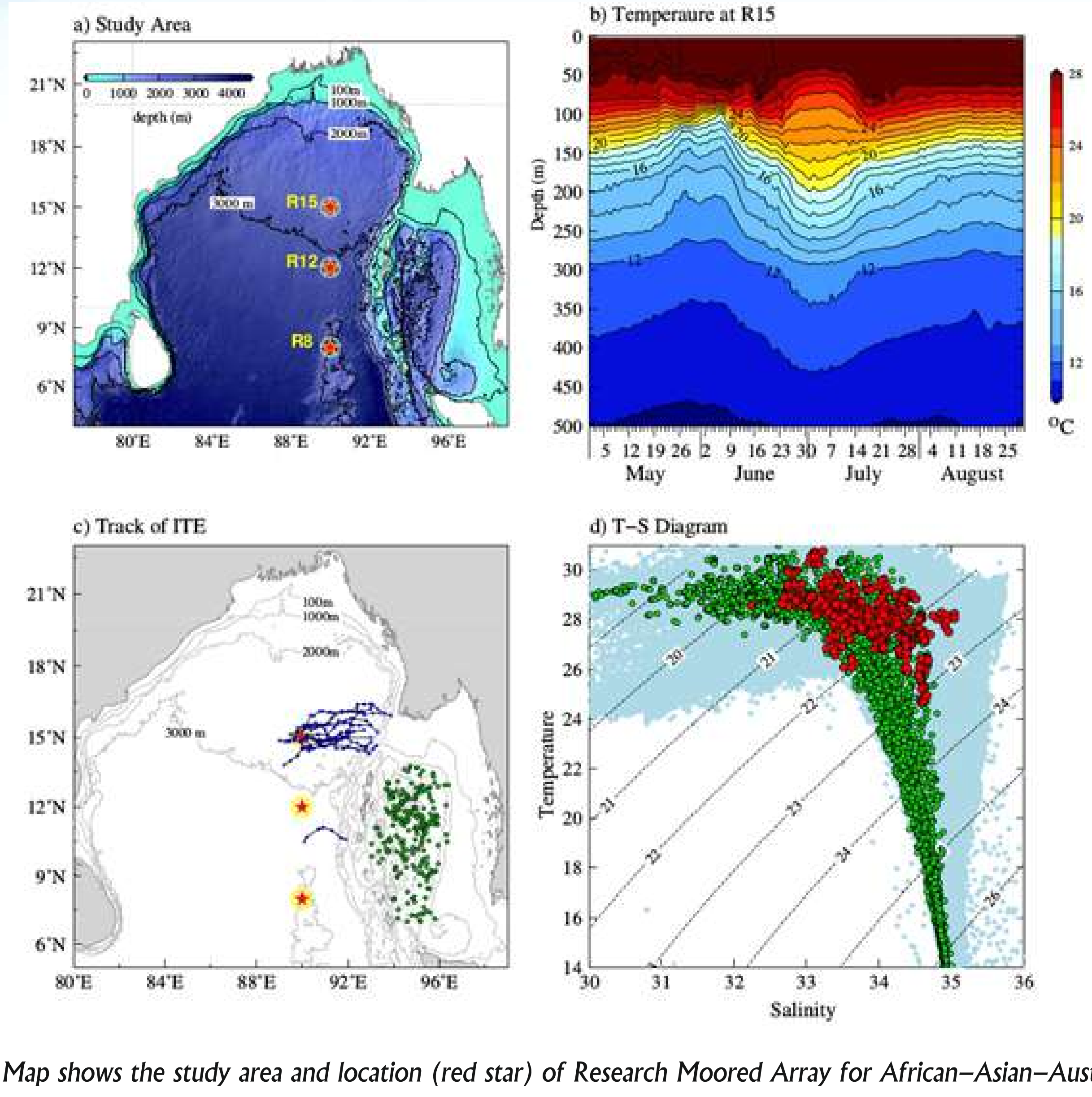


Fig.-1: (a) Map shows the study area and location (red star) of Research Moored Array for African–Asian–Australian Monsoon Analysis and Prediction (RAMA) mooring in the Bay of Bengal (BoB). (b) Observed temperature variability associated with the passage of ITE at RAMA buoy location at 15°N during June–July 2013. (c) Track of ITEs (blue) in the BoB identified from the RAMA mooring data. Green circles in the map indicate the locations of ARGO profiles in the Andaman Sea. Red stars inside yellow circles in the map indicate the RAMA mooring locations in the BoB. (d) Temperature–salinity (T–S) diagram for the ARGO profiles in the Andaman Sea (green circles). Red circles show the T–S relationship for the profiles during the occurrence of ITE in RAMA mooring at 15°N. Light blue shade indicates T-S relationship for Bay of Bengal from ARGO profiles. Note that salinity observations from RAMA mooring are available in the upper 100 m (red circles).

A recent study carried out by researchers from Indian National Centre for Ocean Information Services (INCOIS) used subsurface measurements of temperature from RAMA moorings located at 8°N, 12°N and 15°N and simulations from a high-resolution numerical ocean model to investigate the presence and formation ITEs in the Bay of Bengal. The study showed that a relatively large number of ITEs are observed in the northern locations compared to the south. The observed ITEs are characterized by a double-convex shape of isotherms in the thermocline with a vertical extent of about 100-200 m and a positive sea level anomaly in the surface (Fig. 1b). The velocity-core of the ITEs lies in the thermocline (50-150 m) along with a strong negative potential vorticity anomaly. Interestingly, the temperature/salinity properties are nearly uniform at their core and water mass properties suggests that the Andaman Sea water is trapped at the core of the ITEs in the BoB (Fig. 1d). Trajectories of these ITEs (especially at 15°N), identified using their Sea Surface Height anomalies, show that most of them are formed in the vicinity of Preparis Channel, which is the northernmost passage between the Bay of Bengal and the Andaman Sea (Fig. 1c).

The authors further investigated the vertical structure and formation of the ITE with the help of numerical simulation from a very high-resolution (1/48°) Regional Ocean Modelling System (ROMS) configured for the Bay of Bengal. Their findings show that vorticity developed downstream of Preparis Channel due to the strong subsurface flow (~100 cm/s), which carries Andaman Sea (AS) water into the BoB, resulting in the formation of observed anticyclonic ITE in the northern BoB (Fig. 2). Further analysis revealed that this strong subsurface flow through the Preparis Channel is caused by the propagation of downwelling coastal-trapped waves along the boundaries of BoB, which originates from the equatorial Indian Ocean. Findings from the study suggest that ITEs could be an important pathway of water mass distribution in the intermediate layers in this region.

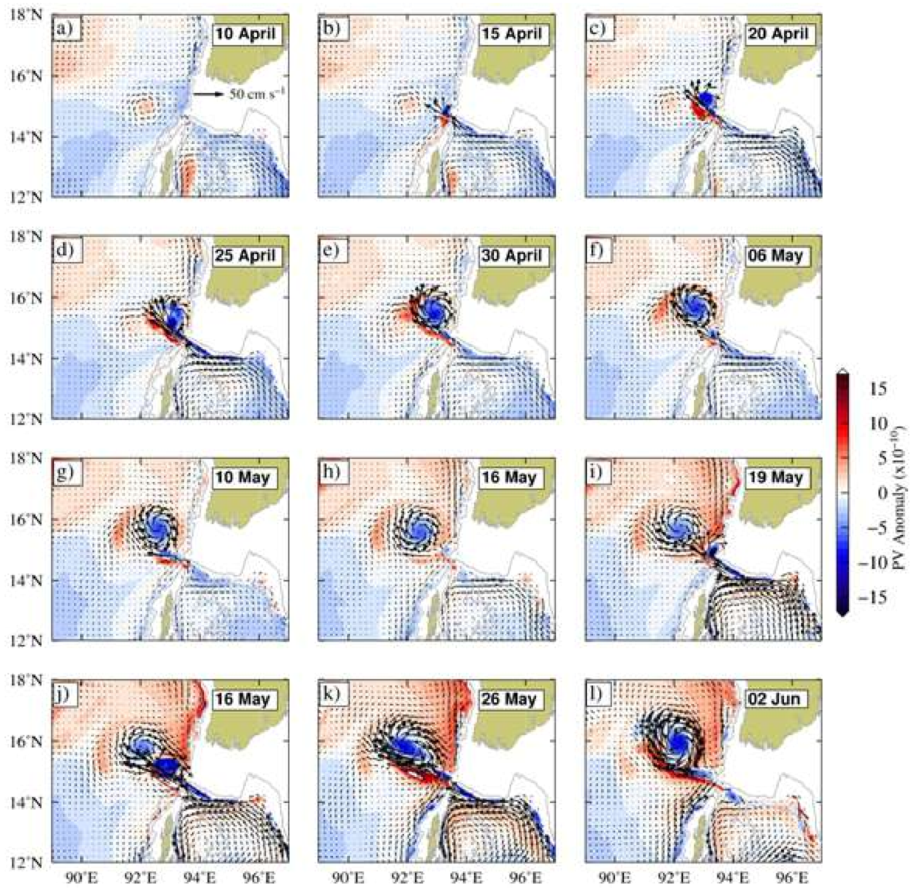
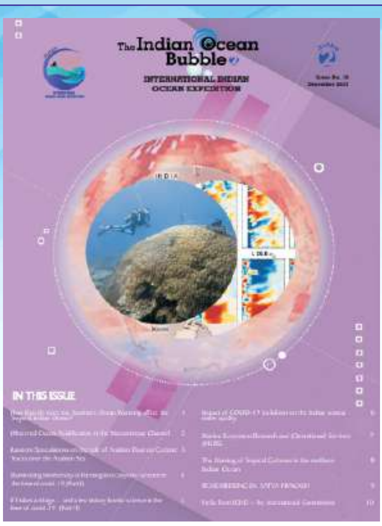


Figure 2. Spatial map of potential vorticity (filled color) and currents (vector) at 100 in the northern BoB during April-May from the model simulations

Citation: Jithin, A. K., & Francis, P. A. (2021). Formation of an Intrathermocline Eddy Triggered by the Coastal-Trapped Wave in the Northern Bay of Bengal. Journal of Geophysical Research: Oceans, 126(12), e2021JC017725 https://doi.org/10.1029/2021JC017725

[Report Courtesy : Jithin, A. K., Project Scientist - B, INCOIS, Hyderabad, India. E-mail: jithin.k@incois.gov.in]

The Indian Ocean Bubble, Issue No.15 is now available online



Web Link: https://iioe-2.incois.gov.in/IIOE-2/pdfviewer_pub.jsp?docname=IIOE-2-DOC_OM_231.pdf

Informal articles are invited for the next issue. Contributions referring Indian Ocean studies, cruises, conferences, workshops, tributes to other oceanographers etc. are welcome.

Articles may be up to 1500 words in length (Word files) accompanied by suitable figures, photos (separate .jpg files)

Deadline extended upto : 15 March, 2022

Send your contributions as usual to iioe-2@incois.gov.in

IIOSC-2022 Conference IS NOW HOSTED VIRTUALLY

International Indian Ocean Science Conference (IIOSC) 2022 is to held virtually during 14-18 March 2022.

Please visit the Conference web-site https://iiosc2020.incois.gov.in/

If you have any general queries regarding the conference, program schedule please contact us at iiosc2020@nio.org / iiosc2020@incois.gov.in

The tentative programme schedule can be found at the link

https://iiosc2020.incois.gov.in/IIOSC2020/ProgramSchedule.jsp

We look forward for your active participation.

DEEP-SEA RESEARCH PART II

THE SUBMISSION PORTAL FOR VOL. 6 OF THE DEEP-SEA RESEARCH II SPECIAL ISSUE SERIES ON THE IIOE-2 IS NOW OPEN

Submission of manuscripts that describe the results of studies related to the physical, chemical, biological, and/or ecological variability and dynamics of the Indian Ocean (including higher trophic levels) is encouraged.

Submission of manuscripts from students and early career scientists is also encouraged.

If you are interested in submitting a manuscript, please contact Raleigh Hood (rhood@umces.edu).

Endorse your projects in IIOE-2

Don't miss the opportunity to network, collaborate, flesh out your research project and participate in IIOE-2 cruises!!

The endorsement of your scientific proposal or a scientific activity focusing on the Indian Ocean region is a recognition of the proposal's or activity's alignment with the mission and objectives of IIOE-2, of its potential for contributing to an increased multi-disciplinary understanding of the dynamics of the Indian Ocean, and of its contribution to the achievement of societal objectives within the Indian Ocean region. Over 45 international, multi-disciplinary scientific projects have already been endorsed to date by the IIOE-2. Yours could be the next one!

Visit https://iioe-2.incois.gov.in/IIOE-2/EndorsementForm.jsp for further details and for projects already endorsed by IIOE-2 https://iioe-2.incois.gov.in/IIOE-2/Endorsed_Projects.jsp.

CLIVAR February 2022 Bulletin is available online

The International CLIVAR Project Office distributes a monthly bulletin with announcements, funding opportunities, meeting notifications relevant to the ocean/climate science community.

The latest CLIVAR Bulletin February, 2022 is available at:

https://mailchi.mp/clivar.org/clivar-february-2022-bulletin

Call for Contributions

Informal articles/short notes of general interest to the IIOE-2 community are invited for the next (March-end) issue of the IIOE-2 Newsletter. Contributions referring IIOE-2 endorsed projects, cruises, conferences, workshops, "plain language summary" of published papers focused on the Indian Ocean etc. are welcome. Articles may be up to 500 words in length (Word files) accompanied by suitable figures, photos.(separate.jpg files).

Deadline: **25 March, 2022**

The Indian Ocean Bubble 2

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