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## Research/teaching interests: Satellite Oceanography

- Satellite remote sensing applications for advance understanding of the polar sea-ice, ocean-ice-atmosphere interaction, ocean color, and marine phytoplankton blooms in a warming climate.
- Retrieval and validation of oceanic environmental products from satellite observations to monitor the physical and biological processes in the marine environment.
- Exploration of sea floor features using multibeam swath bathymetric survey and satellite altimetry.

## Academic background

2001-2007: Ph.D (Marine Science) from Berhampur University/NRSC, ISRO. Thesis title: Studies on the retrieval, validation and applications of geophysical parameters from MSMR onboard Indian Remote Sensing Satellite (IRS P4).

1999-2001: M.Phil (Marine Science), Berhampur University, India.

1996-1998: M.Sc (Oceanography, Specialization: Remote Sensing), Berhampur University, India.

## Peer-Reviewed Scientific Publications

- Turner, J., Holmes, C., Harrison T C., Phillips, T, **Jena, B.**, Francois, T. R, et al., (2022). Record low Antarctic sea ice cover in February 2022. *Geophysical Research Letters*, 49, e2022GL098904. DOI: 10.1029/2022GL098904 (**IF: 5.576**).
- **Jena, B.**, Bajish, C.C., Turner, J., Ravichandran, M., Anilkumar, N., Kshitija, S., (2022). Record low sea ice extent in the Weddell Sea, Antarctica in April/May 2019 driven by intense and explosive polar cyclones. *Nature Portfolio Journal: Climate and Atmospheric Science*, 5 (19), DOI: 10.1038/s41612-022-00243-9 (**IF: 9.448**).
- **Jena, B.**, Bajish, C.C., Turner, J., Ravichandran, M., Kshitija, S., Anilkumar, N., et al. (2022). Mechanisms associated with the rapid decline in sea ice cover around a stranded ship in the Lazarev Sea, Antarctica. *Science of The Total Environment*, 821, 153379. <https://doi.org/10.1016/j.scitotenv.2022.153379> (**IF: 10.753**).
- Mishra, R. K., **Jena, B.**, Venkataramana, V., et al. (2022). Decadal changes in global phytoplankton compositions influenced by biogeochemical variables, *Environmental Research*, 206, <https://doi.org/10.1016/j.envres.2021.112546> (**IF: 8.431**).
- Bajish, C. C., **Jena, B.**, Anilkumar, N., (2021). Is the Indian monsoon rainfall linked to the Southern Ocean sea ice conditions? *Weather and Climate Extremes*, 34, 100377 (**IF: 7.761**).

- Anilkumar, N., **Jena, B.**, JV George., P. Sabu., S. Kshitija., M Ravichandran., (2021). Recent Freshening, Warming, and Contraction of the Antarctic Bottom Water in the Indian Sector of the Southern Ocean. *Frontiers In Marine Science* 8, DOI: 10.3389/fmars.2021.730630 (IF: 5.247).
- Anilkumar, N., Ravichandran, M., **Jena, B.**, (2020). Indian Scientific Expeditions to the Southern Ocean: Comprehensive surveys to understand atmospheric, physical, and biogeochemical processes. *Deep-Sea Research-II*, <https://doi.org/10.1016/j.dsr2.2020.104860> (IF: 2.887).
- Mishra, R.K., Naik, R.K., Vankara, V., **Jena, B.**, AnilKumar, N., Soares, M., Sarkar, A., et al., (2020). Phytoplankton biomass and community composition in the frontal zones of Southern Ocean. *Deep-Sea Research-II*, <https://doi.org/10.1016/j.dsr2.2020.104799> (IF: 2.887).
- Turner, J., Guarino, M. V., Arnatt, J., **Jena, B.**, Marshall, G., Phillips, T. et al., (2020). Recent decrease of summer sea ice in the Weddell Sea, Antarctica. *Geophysical Research Letters*, 47, e2020GL087127. <https://doi.org/10.1029/2020GL087127>. (IF: 5.576).
- **Jena, B.**, Anilkumar, N., (2020). Satellite observations of unprecedented phytoplankton blooms in the Maud Rise Polynya, Southern Ocean. *The Cryosphere*, 14, 1385-1358. <https://doi.org/10.5194/tc-14-1385-2020> (IF: 5.805).
- **Jena, B.**, Ravichandran, M., & Turner, J. (2019). Recent reoccurrence of large open-ocean polynya on the Maud Rise seamount. *Geophysical Research Letters*, 46, 4320–4329. <https://doi.org/10.1029/2018GL081482> (IF: 5.576).
- **Jena, B.**, Kumar, A., Ravichandran, M., Kern, S (2018) Mechanism of sea-ice expansion in the Indian Ocean sector of Antarctica: Insights from satellite observation and model reanalysis. *PLOS ONE* 13 (10): e0203222. <https://doi.org/10.1371/journal.pone.0203222>. (IF: 3.752).
- **Jena, B.**, (2018). Phytoplankton blooms in the Southern Ocean: Through satellite observations. *Geography and You*. <https://www.geographyandyou.com/phytoplankton-blooms-in-the-southern-ocean-through-satellite-observations/>
- Tripathy, S.C., **Jena, B.**, (2019). Iron-Stimulated Phytoplankton Blooms in the Southern Ocean: a Brief Review. *Remote Sensing of Earth System Sciences (Springer)*, 2, 64–77 (2019). <https://doi.org/10.1007/s41976-019-00012-y>.
- **Jena, B** (2017), Effect of phytoplankton pigment composition and packaging on the retrieval of chlorophyll-a concentration from satellite observations in the Indian sector of Southern Ocean. *International Journal of Remote sensing (Taylor & Francis)*, 38 (13), 3763-3784, ISSN: 1366-5901, doi: 10.1080/01431161.2017 (IF: 3.531).
- Shetye, S., **Jena, B.**, Mohan, R., (2017), Dynamics of sea-ice biogeochemistry in the coastal Antarctica during transition from summer to winter. *Geoscience Frontiers (Elsevier)*, 8 (3), 507-516. ISSN: 1674-9871, doi: <http://dx.doi.org/10.1016/j.gsf.2016.05.002> (IF: 7.483).
- Mishra, R.K., **Jena, B.**, Anilkumar, N., Sinha, R.K., (2017). Shifting of phytoplankton community in the frontal regions of Indian Ocean sector of the Southern Ocean using in situ and satellite data. *Journal of Applied Remote Sensing (SPIE)*, 11 (1), doi: 10.1117/1.JRS.11.016019. (IF: 1.568).

- Mishra, R.K., **Jena, B.**, Anilkumar, N., Krishna NR, Bhaskar, P.V., (2017). Variability of chlorophyll-a and diatoms in the frontal ecosystem of Indian Ocean sector of the Southern Ocean. *Polish Polar Research*, 38 (3), 375-392, ISSN: 2081-8262, doi: 10.1515/popore-2017-0014 (**IF: 0.900**).
- Sasmal, S. K., **Jena, B.**, (2016), Monitoring of ocean environmental changes under influence of cyclonic system: Utilization of SARAL and contemporary satellite observations. *Remote Sensing Applications: Society and Environment (Elsevier)*. ISSN: 2352-9385, doi: 10.1016/j.rsase.2016.10.003.
- **Jena, B.**, Kurian, P.J., Kumar, A (2016), Morphology of submarine channel-levee systems in the eastern Bay of Bengal near Andaman region. *Journal of Coastal Conservation (Springer)*, 20 (3), 211–220, ISSN: 1874-7841, doi:10.1007/s11852-016-0431-2 (**IF: 2.098**).
- **Jena, B** (2016), Satellite remote sensing of Island mass effect on the sub-Antarctic Kerguelen Plateau, Southern Ocean. *Frontiers of Earth Science (Springer)*, 10 (3), 479–486. ISSN: 2095-0209, doi: 10.1007/s11707-016-0561-8 (**IF: 2.273**).
- Shetye, S., Mohan, R., Patil, S., **Jena, B.**, Chacko, R., George, J.V., Noronha, S., Singh, N., Priya, L., Sudhakar, M. (2015), Oceanic pCO<sub>2</sub> in the Indian sector of the Southern Ocean during the austral summer–winter transition phase. *Deep-Sea Research-II (Elsevier)*, 118, 250–260. ISSN: 0967-0645, doi: <http://dx.doi.org/10.1016/j.dsr2.2015.05.017> (**IF: 2.887**).
- Shetye, S., Sudhakar, M., Mohan, R., **Jena, B.**, (2014), Contrasting Productivity and Redox Potential in Arabian Sea and Bay of Bengal. *Journal of Earth Science, (Springer)*, 25 (2), 366–370. ISSN: 1867-111X, doi: 10.1007/s12583-014-0415-9 (**IF: 2.433**).
- Shetye, S., Sudhakar, M., **Jena, B.**, Mohan, R. (2013), Occurrence of Nitrogen Fixing Cyanobacterium *Trichodesmium* under Elevated pCO<sub>2</sub> Conditions in the Western Bay of Bengal. *International Journal of Oceanography (Hindawi)*, ArticleID-350465, 8pages, ISSN: 1687-9406, doi: <http://dx.doi.org/10.1155/2013/350465>.
- Rajendran, C. P., Andrade, V., Jaishri, S, Kurian, J., **Jena, B.**, (2013), Constraining large earthquakes along the Andaman trench using deepwater turbidites: prospects and challenges. *Current Science*, 104 (10), 1300-1307. ISSN: 0011-3891 (**IF: 1.169**).
- Kumar, A., **Jena, B.**, Vinaya, M.S., Jayappa, K.S., Narayana, A.C., Bhat, G.H., (2012), Regionally tuned algorithm to study the seasonal variation of suspended sediment concentration using IRS-P4 Ocean Colour Monitor data. *The Egyptian Journal of Remote Sensing and Space Sciences (Elsevier)*, 15, 67–81. ISSN: 1110-9823, doi: <http://dx.doi.org/10.1016/j.ejrs.2012.05.003> (**IF: 6.393**).
- **Jena, B.**, Sahu, S., Kumar, A., Swain, D., (2013), Observation of oligotrophic gyre variability in the south Indian Ocean: Environmental forcing and biological response. *Deep-Sea Research-I (Elsevier)*, 80, 1-10. ISSN: 0967-0637, doi: 10.1016/j.dsr.2013.06.002 (**IF: 3.101**).
- **Jena, B.**, Kurian, P.J., Swain, D., Tyagi, A., Ravindra, R., (2012), Prediction of bathymetry from satellite altimeter based gravity in the Arabian Sea: Mapping of two unnamed deep seamounts. *International Journal of Applied Earth Observation and Geoinformation (Elsevier)*, 16, 1–4. ISSN: 0303-2434, doi: 10.1016/j.jag.2011.11.008 (**IF: 7.672**).
- **Jena, B.**, Swain, D., Kumar, A., (2012), Investigation of the biophysical processes over the oligotrophic waters of South Indian Ocean subtropical gyre triggered by cyclone Edzani. *International Journal of Applied Earth Observation and Geoinformation (Elsevier)*, 18, 49–56. ISSN: 0303-2434, doi: 10.1016/j.jag.2012.01.006 (**IF: 7.672**).

- **Jena, B.**, Rao, M. V., Sahu, S., Sahu, B. K., (2011), A comparative assessment of IRS-P4 (MSMR) derived sea surface temperature and sea surface wind speed over the north Indian Ocean. *International Journal of Remote sensing (Taylor & Francis)*, 32 (24), 9879-9891, ISSN: 1366-5901, doi: 10.1080/01431161.2011.562932 (**IF: 3.531**).
- **Jena, B.**, Swain, D., Tyagi, A., (2010), Application of artificial neural networks for sea surface wind speed retrieval from IRS-P4 (MSMR) brightness temperature. *IEEE Geoscience and Remote Sensing Letters, IEEE (GSRL)*, 7 (3), 567-571, ISSN: 1545-598X, doi:10.1109/LGRS.2010.2041632 (**IF: 5.343**).
- **Jena, B.**, Rao, M.V., Sahu, B. K., (2006), TRMM derived sea surface temperature in the wake of a cyclonic storm over the central Bay of Bengal. *International Journal of Remote sensing (Taylor & Francis)*, 27 (14), ISSN: 1366-5901, 3065–3072, doi: 10.1080/01431160600589187 (**IF: 3.531**).
- **Jena, B.**, S. K. Sasmal, M. V. Rao, M. M. Ali (2006), Inter comparison of NOAA-AVHRR and IRS-P4 (MSMR) derived Sea Surface Temperatures: Possibility of blending two observations. *International Journal of Remote sensing (Taylor & Francis)*, 27 (15), 3123–3130, ISSN: 1366-5901, doi: 10.1080/01431160600580608 (**IF: 3.531**).
- Choudhury, S. B., **Jena, B.**, M. V. Rao, K. H. Rao, V. S. Somvanshi, D. K. Gulati and S. K. Sahu (2007), Validation of integrated potential fishing zone forecast using satellite based chlorophyll and sea surface temperature along the east coast of India. *International Journal of Remote sensing (Taylor & Francis)*, 28 (12), 2683 – 2693, ISSN: 1366-5901, doi: 10.1080/01431160600987878 (**IF: 3.531**).
- **Jena, B.**, Sudarshana, R., Chaudhary, S. B., (2003), A study on spatial distribution of water quality parameters around the Sagar Island, Sunderbans. *J. Nature Env. and pollu. Tech.*, 2 (3), 329-332, ISSN: 0972-6268.
- **Jena, B.**, Sudarshana, R., Chaudhary, S. B., (2003), An environmental inventory of Sagar Island using IRS-1C LISS-III data. *J. Nature Env. and pollu. Tech.*, Vol.2 (4), 405-409, ISSN: 0972-6268.

## Editorial Board

- Guest Editor, Deep-Sea Research-II (Elsevier)
- Associate Editor, Remote Sensing in Earth System Sciences (Springer)
- Journal of Water Resources and Ocean Science.

## Awards/Honours

- Received Ministry of Earth Science (Government of India) Award: Merit Scientist for the year 2020 for outstanding contribution in the field of Polar Science and Technology.
- Fellowship awarded by National Remote Sensing Centre, ISRO, during 2001-2005.

## Scientific expeditions for National/International programmes

2010: Dy. Chief Scientist in Akademik Boris Petrov for Indian EEZ survey and mapping.

2010: Chief Scientist in ORV Sagar Kanya (SK 273) for Indian EEZ survey and mapping.

2010: Chief Scientist in ORV SK 275 for Indian EEZ survey and mapping.

2011: Chief Scientist in ORV SK 286 for Indian EEZ survey and mapping.

2012: Chief Scientist in ORV SK 292 for Indian EEZ survey and mapping.

2012: Chief Scientist in ORV SK 299 for hydrothermal studies.

2012: Chief Scientist in Akademik Nikolay Strakhov for hydrothermal studies.

2015: Member of the 34<sup>th</sup> Indian Scientific Expedition to Antarctica.

2020: Member of the 11<sup>th</sup> Indian Scientific Expedition to Southern Ocean.

## Research/Project Experience

- **Project 7:** Variability of remote sensing reflectance of the waters around Antarctic continent—implications to retrieval of chlorophyll-a from an optical sensor for studying biogeochemical cycle in the high latitude waters. **Role:** Principal Investigator. Participated in scientific expedition to Antarctica.
- **Project 6:** Hydrothermal mineralization study in the Indian Ocean. **Role:** Chief Scientist for carrying out scientific operations for exploration of seafloor massive hydrothermal sulfide ore deposits in the Central Indian Ridge and South-west Indian Ridge.
- **Project 5:** Swath bathymetric multibeam survey and mapping of the exclusive economic zone of India. **Role:** Chief Scientist for cruise/survey planning, data acquisition, processing, quality evaluation, map preparation and interpretation of seabed morphology/ Bathymetry retrieval from satellite altimeter.
- **Project 4:** Development of marine geo-scientific database (MGSDB) at NCPOR. **Role:** Overall coordination.
- **Project 3:** Generation of Ocean color and mixed layer primary production climatic atlas over the North Indian Ocean using IRS-P4 (OCM) data. **Role:** Processed entire mission record of IRS-P4 OCM-1 for chlorophyll-a and ocean primary production atlas generation.
- **Project 2:** Synergistic study of AVHRR SST and IRS-P4 OCM chlorophyll for generation of integrated PFZ forecast. **Role:** Cruise participation for collection of in-situ bio-optical data, evaluation of bio-optical models, development of algorithms for retrieval of biophysical parameters from satellite data.
- **Project 1:** Retrieval and validation of geophysical parameters from IRS-P4 (MSMR) for studying climatic anomalies of the north Indian Ocean. **Role:** Development of algorithms for retrieval and validation of SST and wind from IRS-P4 (MSMR).

## Innovative content of work done

- The largest and most prolonged polynya (Maud Rise, Southern Ocean) since the 1970s appeared in 2017. The formation was due to the combined influence of the seamount, cyclonic ocean eddies, negative wind stress curl, and the large-scale anomalous atmospheric circulation.

- Entire mission records of multiple ocean-color satellite observations indicated unprecedented phytoplankton blooms in the Maud Rise, with the carbon fixation rates reached up to  $415.08 \text{ mg C m}^{-2} \text{ day}^{-1}$ . The bloom appearance leads it to a site of sink of atmospheric  $\text{CO}_2$  through biological pumping.
- The sea-ice expansion in Antarctica was due to significant strengthening of the westerly wind that induced northward transport of the low saline and cold water, accompanied with the upper ocean cooling through an overall loss of net heat flux.
- Record decrease of sea-ice/multi-year ice in the Weddell Sea was linked to both mechanical forcing and thermodynamic processes.
- Characterized the South Indian Ocean oligotrophic gyre (SOG) and detected its expansion. More than 80% of the SOG region is warming significantly under circumstance of overall gain of net heat flux.
- Carried out Indian EEZ survey and reported the morphology of seamounts and submarine channels.
- Worked as a Chief Scientist in various expeditions and carried out scientific operations for acquisition of geophysical, geological, and oceanographic parameters in the Central-Indian-Ridge & Southwest-Indian-Ridge. The outputs were used to file the India's application to International Seabed Authority (ISBA) for grant of license to explore hydrothermal sulfide deposits.
- Global and regional optimized algorithms applied to satellite observations over the Southern Ocean underestimates Chl-a upto a factor of 2.9; significantly when *in-situ* values exceeded  $\sim 0.3 \text{ mg/m}^3$ . Diagnosed causes of uncertainties w.r.t phytoplankton pigment composition and packaging.
- Development of Marine Geo-scientific Database (MGSDb) at NCPOR.

### Recognised Ph.D guide

- Mangalore University
- Bharathidasan University
- Pune University

### Other important contributions

- (a) Research guidance : 02 (Ph. D pursuing), 26 (M. Sc/M. Tech completed)
- (b) Acted as reviewer for : 11 Journals
- (c) Total no. of field/sea-going days for in-situ data collection : ~540 days (Participated in various cruises onboard MV Ivan Papanin, ORV-Sagar Kanya, Akademik Boris Petrov, Sagar Poorvi, Sagar Paschim, SA Agulhas).
- (d) Coordinated two sessions in National Conference on Polar Sciences, one session in "36th IGC: A Unique Opportunity for advancement in Geo-sciences", three sessions in International Indian Ocean Science Conference (IIOSC) 2022. A session convener in SCAR 2022.
- (e) Member of various committees on: Procurement of scientific instruments, Recruitment of Research Scientist, Tender committee meetings.

### Software Skills\*

Programming skills : IDL, EML Scripting, CDO, GRADS.  
Image Processing/GIS : ArcGIS, ERDAS Imagine, ENVI, SeaDas, CARIS HIPS/SIPS,  
Fledermaus.  
Statistical packages : GRADS, ODV, Statistica, Minitab, SPSS, Surfer, Grapher, Tecplot

*\* Excellent experience in sea-ice, thermal & ocean color data analysis.*

Place: Vaso-da-gama, Goa, India

(Dr. Babula Jena)

Date: