TRAINING ON CUSTOMIZATION OF OCEAN FORECAST PRODUCTS

20-24 MAY 2024, HYDERABAD, INDIA

TRAINING OUTCOMES REPORT

CAREI SOUTH ASIA

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1. BACKGROUND

The Training on Customization of Ocean Forecast Products was held from 20th to 24th May 2024 in Hyderabad, India. This training initiative was organized collaboratively by the Indian National Center for Ocean Information Services (INCOIS) and the South Asia Hydromet Forum (SAHF)- Climate Adaptation and Resilience (CARE) for South Asia Project. The training aimed to enhance the capacity of SAHF coastal member countries, including Bangladesh, Myanmar, Maldives, and Sri Lanka, in customizing ocean forecast products to address maritime challenges effectively. The training initiative was conceived within the framework of advancing oceanographic knowledge and enhancing operational capabilities within the South Asian (SA) region. Recognizing the critical importance of oceanographic data and forecasting services, the project aimed to strengthen the capacity of National Meteorological and Hydrological Services (NMHS) professionals in utilizing advanced tools and methodologies offered by the INCOIS. This training initiative was conducted in alignment with the broader goals of the CARE Project to promote evidence-based climate-smart decision-making and enhance climate resilience in the region. Recognizing the significance of ocean forecasting in mitigating climate-related risks, the training sought to equip participants with advanced skills for customizing ocean forecast products tailored to the specific needs of SA countries. Furthermore, the training aligned with SAHF's vision of fostering regional cooperation and innovation in hydrometeorological services to address common challenges faced by SA countries.

Rationale for the Training

- The training sought to bridge the existing knowledge and product interpretation skill gaps among professionals involved in oceanographic research, monitoring, and forecasting. By providing comprehensive insights into INCOIS's operational framework, methodologies, and tools, the training aimed to empower participants with the necessary skills and expertise to effectively utilize ocean data and coastal hazard forecasting services.
- In line with the increasing demand for accurate and timely oceanographic information, the training aimed to enhance the operational capabilities of participants. By familiarizing them with state-of-the-art tools and techniques, such as data assimilation, numerical modeling, and forecast validation, the training aimed to equip participants with the expertise required to use available representative ocean forecasts and support decision-making processes.
- The training initiative also served as a platform to foster regional collaboration and knowledge exchange among NMHS professionals within the SA region with the INCOIS. By bringing together experts and practitioners from diverse backgrounds, the training facilitated the sharing of best practices, experiences, and lessons learned, thereby fostering a collaborative platform conducive to addressing common challenges and advancing mutual interests in oceanography under SAHF umbrella.
- The training was designed with a forward-looking perspective, aiming to lay the groundwork for leveraging future advancements in ocean forecasting tailored to the specific needs of each participating country through building joint project initiatives. By equipping participants with fundamental skills and knowledge, the training aimed to instil confidence and readiness to engage in more advanced training sessions focused on priority services identified by their respective countries.

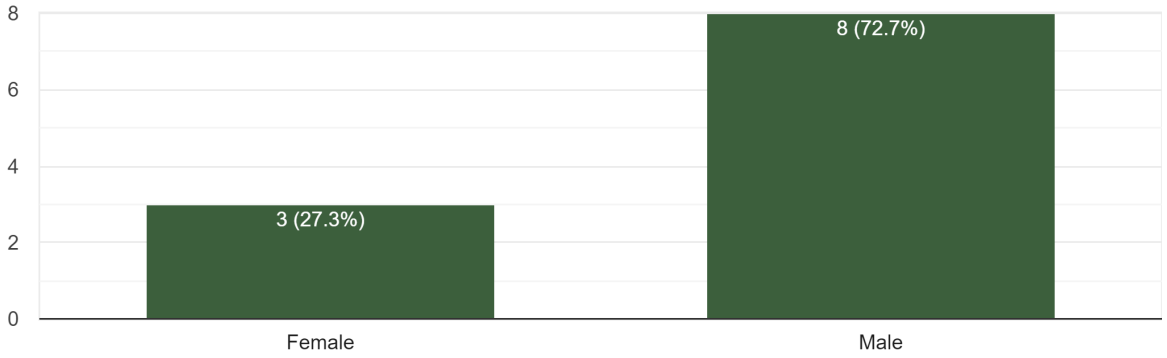
2. TRAINING OBJECTIVES

- Deepen participants' comprehension of the diverse range of ocean forecasting services provided by INCOIS, including their significance and applicability in addressing regional maritime challenges.
- Introduce participants to basic concepts and techniques of ocean data analysis and visualization, enabling them to interpret and utilize oceanographic data effectively.
- Facilitate interactions and knowledge sharing among participants to encourage collaboration and the exchange of best practices in ocean forecasting and data analysis.
- Assess the specific needs and priorities of each participating country in SA, enabling the customization of future training sessions to address these requirements effectively.

- Equip participants with fundamental skills and knowledge to prepare them for more advanced training sessions, ensuring readiness to engage with sophisticated ocean forecasting technologies and methodologies.

3. PARTICIPANTS

The training program involved 11 mid-career professionals predominantly aged between 25-40 years, with some participants in the 41-60 age group. The participants were primarily male, with a few female participants, representing NMHSs of Bangladesh, Maldives, Myanmar, and Sri Lanka.



i) Gender distribution of training participants

Knowledge and Skills Baseline
The training baseline assessment revealed a wide range of pre-training knowledge and skills among participants. While some participants demonstrated a very good understanding of concepts such as tides and tide forecasting, operational ocean forecasting systems, and general circulation modeling, others had only average or poor knowledge in more technical areas like wave modeling, oil spill advisory systems, and storm surge forecasting. Most participants rated their skills in areas such as the analysis and visualization of ocean data, customization of ocean state forecast products, and the generation of alerts as average. However, some participants exhibited lower proficiency in these skills, indicating a need for significant improvement through the training.

Attitudes and Training Expectations
Participants expressed high expectations for the training program, focusing on practical applications and hands-on experience. They anticipated the training would extend their knowledge in ocean forecasting tools and concepts, aiding in the formulation of policy and operational decisions. The need for enhanced practical skills, particularly in customizing forecast products to meet specific national requirements, was a recurring theme. Additionally, participants expected to improve their capabilities in disaster risk reduction, anticipatory preparedness measures, and collaborative efforts among regional meteorological services. The training was considered as an opportunity to gain deeper insights and directly apply new skills to their operational contexts.

The pre-training assessment highlighted the participants' diverse backgrounds and varying levels of expertise. While there were areas of strong pre-existing knowledge and skills, the need for practical, hands-on training to enhance customization and application of ocean forecasting tools was evident. Participants anticipated utilizing the training to improve their operational capabilities and foster regional collaboration, ultimately benefiting their respective NMHSs.

4. HIGHLIGHTS

SESSION 1: OVERVIEW AND ACTIVITIES OF INCOIS
Resource Person: Mr. Nagaraja Kumar, Scientist-F Division Head, OOS, INCOIS
Methodology: Lecture

This session provided an extensive overview of the INCOIS, elucidating its organizational structure and integrated approach to addressing oceanographic challenges. The Ocean Observation Network of India was highlighted, with a focus on the instruments and network utilized for comprehensive ocean monitoring. Participants were introduced to the Digital Ocean initiative, which emphasizes data accreditation, management, and dissemination, and includes INCOIS's role as an ARGO Regional Center.

The session detailed INCOIS's advanced modeling and prediction systems, covering ocean modeling, data assimilation, and validation techniques to ensure forecast accuracy. Ecosystem services were discussed, along with various Ocean State Forecast (OSF) products and services, including daily forecast parameters, warning alert services, and emergency response capabilities.

The importance of climate services was underscored, particularly the development of ocean climate indices and coastal multi-hazard vulnerability assessments. Strategies for mitigating coastal inundation and enhancing community awareness were highlighted. On an international scale, INCOIS's contributions to global services such as the Tsunami Early Warning System and the dissemination of near real-time satellite data were presented. The session concluded with an overview of INCOIS's capacity development initiatives, which have trained thousands through numerous courses.

Output:
Participants developed a comprehensive understanding of INCOIS's extensive capabilities in ocean observation and forecasting, including the Digital Ocean initiative, international collaborations, and contributions to global ocean services.

SESSION 2: INTRODUCTION TO OPERATIONAL OCEAN SERVICES
Resource Person: Mr. Nagaraja Kumar, Scientist-F Division Head, OOS, INCOIS
Methodology: Lecture

In the session introducing operational ocean services, participants gained insights into the comprehensive suite of services offered by INCOIS, setting the groundwork for a deeper exploration of Ocean State (OS) products. The discussion emphasized the imperative of bridging the gap between scientific knowledge and societal needs, focusing on tailored research efforts and operational strategies. Through lectures, participants learned about INCOIS's operational framework, including research and development, observational practices, and dissemination strategies. Key services provided by INCOIS were elucidated, encompassing ecosystem services such as Potential Fishing Zones (PFZ) Advisory Services and multi-hazard services like Tsunami Early Warning Systems. The economic and environmental benefits stemming from these operational ocean services were highlighted, emphasizing reductions in searching time and fuel consumption, as well as economic gains derived from Ocean State Forecast (OSF) products.

During interactive discussions, country-specific requirements and gaps were identified, ranging from storm surge modeling to fishery advisories and wave forecasting. Common challenges such as insufficient instrumentation and incomplete data were acknowledged, with a collective commitment to address these gaps through collaborative efforts. The session provided participants with a holistic understanding of INCOIS's operational capabilities and underscored the importance of tailored solutions to meet the diverse needs of coastal regions. Through collaboration and knowledge exchange, the stage was set for enhanced ocean forecasting capabilities and strengthened partnerships in maritime safety and environmental stewardship.

Discussion Highlights:
- Bangladesh: Emphasis on ocean modeling for marine and fishery advisories, particularly storm surge modeling.

- Sri Lanka: Focus on fishery advisories and swell wave forecasting.
- Maldives: Prioritization of swell wave forecasting and wave modeling, with defined thresholds for warnings.
- Myanmar: Requirements include wave modeling for cyclones and fishing advisory apps.

Outputs:
- Participants gained insights into the depth of operational ocean services provided by INCOIS, understanding their economic, environmental, and societal significance.
- Identified country-specific requirements and gaps paved the way for tailored solutions and collaboration.

SESSION 3: ESSENTIAL OCEAN VARIABLES AND NUMERICAL MODELS IN OCEAN STATE FORECASTS
Resource Person: Mr. B. Sivaiah, Project Scientist-B, INCOIS
Methodology: Lecture

The session focused on essential ocean variables and numerical models for Ocean State Forecasts (OSF), participants delved into foundational concepts crucial for effective forecasting. Through a lecture format, fundamental terminologies essential for ocean forecasting were explained, encompassing wind, waves, numerical modeling, and validation techniques. Participants gained insight into key parameters vital for accurate forecasts, including significant wave height, swell characteristics, sea surface temperature, currents, and mixed layer depth. Overall, the session provided participants with a solid understanding of foundational concepts necessary for interpreting and utilizing ocean forecast products effectively in operational contexts

Outputs:
- Participants acquired a foundational understanding of essential ocean variables and numerical models used in OSF.
- Increased comprehension of terminologies and parameters crucial for interpreting ocean forecast products.

Issues/Concerns Raised and Resolutions:
- No specific issues or concerns were mentioned during the session.

SESSION 4: COASTAL WAVE MODELLING USING SWAN AND SMALL VESSEL ADVISORY SERVICES (SVAS)
Resource Person: Dr. Sandhya K G, Scientist-E, INCOIS
Methodology: Lecture

The session covered the classification and dynamics of ocean waves, focusing on surface gravity waves, including wind sea and swells. Key aspects of wave propagation and the concept of wave spectrum were explained. The presentation delved into numerical modeling of ocean waves, with a specific focus on the SWAN (Simulating WAves Nearshore) model. It detailed the source and sink terms in wave action, the effect of wind on waves, non-linear wave-wave interactions, and wave dissipation processes.

The session also explored the processes affecting wave evolution in oceanic and coastal waters, initial and boundary conditions for SWAN, and INCOIS's SWAN configuration for coastal areas. Case studies of cyclone events illustrated the practical applications of the SWAN model. Additionally, the session introduced the Small Vessel Advisory Services (SVAS), explaining its design and development, the importance of Impact-Based Forecasting (IBF), and the verification of SVAS using real-life cases.

Outputs:
- Enhanced understanding of wave dynamics and numerical modeling techniques.
- Knowledge of the SWAN model and its applications in coastal wave forecasting.
- Insight into the development and implementation of Small Vessel Advisory Services (SVAS).
- Practical knowledge through case studies on the SWAN model's application in cyclone scenarios.

- Awareness of the importance of IBF in marine safety and advisory services.

Issues/Concerns Raised and Resolutions:

- No specific issues or concerns were mentioned during the session.

SESSION 5: INDIAN OCEAN WAVE FORECASTING SYSTEM AND MODELING USING WAVE WATCH III (WWIII)

Resource Person: Dr. Remya PG, Scientist-D, INCOIS

Methodology: Lecture

During the session participants were guided through the intricacies of modeling ocean waves. The session explored the rationale behind wave modeling, understanding what wave models predict and the processes influencing wave energy. Key components of wave growth, including wave-wave interaction, dispersion, and wave decay, were elucidated to provide a comprehensive understanding. The session highlighted essential functions of a wave model, focusing on initial conditions, forcing mechanisms, and the numerical wave model's role in predicting wave spectra. The configuration of INCOIS's WWIII for wave forecasting in Pacific islands countries was discussed, alongside considerations in setting up a wave forecasting system, such as wave characteristics and validation methods. The development of the Kallakadal Swell Surge Forecast System, which analyses oceanic conditions in the Southern Indian Ocean, was presented as a case study. Participants engaged in discussions regarding the highest achievable resolution through freeware and the importance of parameterization in wave modeling. The session provided participants with valuable insights into wave modeling processes and the application of WWIII for ocean wave forecasting. Through interactive discussions, participants deepened their understanding of model development considerations and parameterization techniques essential for accurate wave predictions.

Outputs:

- Participants gained a comprehensive understanding of wave modeling processes and the application of WWIII for ocean wave forecasting.

Issues/Concerns Raised and Resolutions:

- Concerns regarding the highest achievable resolution through freeware and parameterization in wave modeling were discussed.

SESSION 6: CONCEPTS OF DATA ASSIMILATION AND LOCAL ENSEMBLE TRANSFORM KALMAN FILTER (LETKF)

Resource Person: Dr. Arya Paul, Scientist E, INCOIS

Methodology: Lecture

In this session, participants were introduced to the fundamental concepts of data assimilation and the LETKF methodology. The lecture provided a comprehensive overview of data assimilation, starting with basic concepts such as the initial state, Gaussian distributions, and the flow chart for data assimilation processes. The session covered error characterization, including cost functions, Bayes' theorem, and the least square approach, laying the groundwork for understanding the principles of data assimilation. Key data assimilation methods were discussed, including Kalman filters, ensemble-based Kalman filters, and variational approaches like 3DVAR and 4DVAR. Practical examples, such as simple scalar problems and covariance inflation, were used to illustrate these concepts. Participants also learned about the specific application of LETKF at INCOIS and its role in ocean data assimilation, including model specification, system innovations, and ensemble spread.

Outputs:

- Enhanced understanding of basic and advanced concepts of data assimilation.
- Familiarity with data assimilation methods and their applications.
- Insight into the implementation and advantages of LETKF in ocean data assimilation.
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Issues/Concerns Raised and Resolutions:

- No specific issues or concerns were mentioned during the session.

SESSION 7: STORM SURGE FORECASTING SYSTEM
Resource Person: Dr. Siva Srinivasan K, Scientist, INCOIS
Methodology: Lecture

The session focused on the complexities of storm surge forecasting and addressed real-world problems related to structural analysis, thermal analysis, fluid dynamics, and the use of numerical methods and simulations. The lecture also covered various approaches, including experimental observations and analytical solutions, in the context of numerical modeling. The basic concepts of storm surges, storm tides, and their generation mechanisms were explained, emphasizing the importance of forecasting storm surges to prevent coastal inundation. The session highlighted factors contributing to storm surges and the evolution of storm surge early warning systems (EWS). Requirements for storm surge and inundation forecasting were discussed, including the necessity for accurate numerical models, bathymetry and topography data, cyclone track information, parametric wind formulations, high-resolution grids, and robust decision support systems (DSS). The session also covered the specific storm surge model, Advanced Circulation Model for Oceanic, Coastal, and Estuarine Waters (ADCIRC), discussing its computational efficiency and standard operating procedures (SOPs) for track generation and model launching. An overview of the INCOIS Coastal Geospatial Application was provided, along with a discussion on the integration of storm surge and tsunami forecasting under the deep ocean mission.

Outputs:
- Participants gained a comprehensive understanding of the fundamental concepts and practical approaches to storm surge forecasting.
- Enhanced knowledge of the requirements and methodologies for accurate storm surge and inundation forecasting.
- Familiarity with the ADCIRC model and its application in storm surge prediction.

Issues/Concerns Raised and Resolutions:
- No specific issues or concerns were mentioned during the session.

SESSION 8: BASICS OF TIDES AND TIDES FORECASTING
Resource Person: Dr. K Srinivas, Scientist, INCOIS
Methodology: Lecture

This session provided an in-depth exploration of the basics of tides and the methodologies used in tide forecasting. The session underscored the importance of tide forecasting for various applications, including navigation, coastal management, and storm surge prediction. Participants learned about the methods of tide measurement and the significance of studying tides in different contexts. The session introduced the fundamental building blocks of tides, explaining harmonic methods for classifying tides at specific locations. Particular attention was given to the unique characteristics of the Indian tidal situation and the role of tides in storm surge studies. The integration of tides into storm surge warning services was highlighted, along with the phenomenon of tidal bores and their implications. An overview of INCOIS's sea level networks was provided, demonstrating how these networks contribute to accurate tide and sea level monitoring. Interactions with participants included discussions on the use of tsunami buoys for tide measurements and their role in enhancing the accuracy of tide forecasts.

Outputs:
- Participants developed a foundational understanding of tide forecasting and its importance in coastal management and safety.
- Gained insights into harmonic methods for tide classification and the peculiarities of Indian tidal patterns.

Learned about the integration of tide data in storm surge and tsunami warning services.

Issues/Concerns Raised and Resolutions:
- No specific issues or concerns were mentioned during the session.

SESSION 9: BIAS CORRECTION METHODS
Resource Person: Ms. Anuradha Modi, Project Scientist, INCOIS
Methodology: Lecture

In this session, participants were introduced to bias correction methods essential for improving the accuracy of OSF and EWS. The lecture provided an overview of OSF and the role of numerical models in generating forecasts and warnings. The importance of wind generation output models and general circulation model outputs in these forecasts was emphasized, aligning with the World Meteorological Organization (WMO) guidelines on multi-hazard assessment. The session covered the concept of Impact-based Forecasting (IBF), discussing how it is used to provide specific impacts and advisories based on forecast data. The core of the lecture focused on bias correction techniques and methods for removing uncertainty from forecasts. Participants learned about the INCOIS Real-Time Automatic Weather Station (I-RAWS) and the use of wave rider buoys for data collection and validation. Information dissemination methods were also discussed, highlighting the importance of timely and accurate communication of forecast data to relevant stakeholders.

Outputs:
- Enhanced understanding of bias correction methods and their application in improving forecast accuracy.
- Familiarity with the use of numerical models for OSF and EW generation.
- Knowledge of the WMO guidelines on multi-hazard assessment and the implementation of IBF.
- Insights into the use of I-RAWS and wave rider buoys for data collection and real-time validation.

Issues/Concerns Raised and Resolutions:
- No specific issues or concerns were mentioned during the session.

SESSION 10: OIL SPILL ADVISORY SYSTEMS
Resource Person: Dr. S. J. Prasad, Scientist, INCOIS
Methodology: Lecture and demonstration

This session provided an in-depth overview of INCOIS's flagship oil spill advisory service, an essential emergency aid system. The lecture began with an introduction to oil spills, covering their sources, types, and the weathering processes they undergo. The importance of a well-coordinated oil spill response mechanism and the need for an advisory system were emphasized. Participants were introduced to various types of oil spill models and the INCOIS setup for predicting and validating oil spill trajectories. Several case studies were discussed, including the Nagore beach pipeline oil spill and INCOIS's aid in oil spill response operations in neighbouring countries such as Mauritius and Sri Lanka. The session also demonstrated the use of the Online Oil Spill Advisory (OOSA) tool for the Indian coast, highlighting its functionality and applications. The role of satellite data, specifically radar data, in detecting oil spills was explained, along with the principles of oil slick detection. A demonstration of the OOSA tool provided participants with practical insights into its operation.

Outputs:
- Comprehensive understanding of the INCOIS oil spill advisory service and its emergency response capabilities.
- Familiarity with different oil spill models and the process of trajectory prediction and validation.
- Knowledge of the use of satellite data in oil spill detection and the operational aspects of the OOSA tool.

Issues/Concerns Raised and Resolutions:
- No specific issues or concerns were mentioned during the session.

SESSION 11: TSUNAMI EARLY WARNING SERVICES
Resource Person: Dr. Ajay Kumar, Scientist D, INCOIS
Methodology: Lecture and demonstration

The session covered the essential aspects of tsunami phenomena, including their causes, characteristics, and the processes of generation, propagation, and inundation. The session highlighted the devastating Indian Ocean tsunami of December 26, 2004, emphasizing the lack of awareness and preparedness as key reasons for the extensive loss of life and property. Participants were educated about the potential tsunamigenic zones in the Indian Ocean and the comprehensive risk assessment methodologies employed. The session provided an overview of the Tsunami EWS, detailing the detection methods, warning mechanisms, and dissemination processes. The components of the system, such as the seismic network, Indian tsunami buoy network, and Indian tide gauge network, were discussed in detail. The lecture and demonstration also covered the Standard Operating Procedures (SOPs) for the Indian Tsunami Early Warning System (ITEWS), the Decision Support System (DSS), and the timeline for bulletin issuance. The performance of the Indian Tsunami Early Warning Center (ITEWC) was evaluated, and the session concluded with an introduction to the UNESCO-IOC Tsunami Ready Programme, which promotes community-based tsunami preparedness and response.

Outputs:
- Enhanced understanding of tsunami causes, characteristics, and potential risks in the Indian Ocean.
- Knowledge of the components and functioning of the Tsunami Early Warning System, including detection, warning, and dissemination processes.
- Insights into the community-based preparedness initiatives under the UNESCO-IOC Tsunami Ready Programme.

Issues/Concerns Raised and Resolutions:
- No specific issues or concerns were mentioned during the session.

SESSION 12: SEARCH AND RESCUE AID TOOL (SARAT)
Resource Person: Dr. P. Vijay, Scientist D, INCOIS
Methodology: Lecture and demonstration

The session focused on the Search and Rescue Aid Tool (SARAT), another flagship application of INCOIS designed to enhance search and rescue operations. The lecture covered the fundamental principles and determinants of search and rescue (SAR) operations, explaining the various mechanisms involved in the process. A comprehensive demonstration of SARAT was provided, showcasing its integrated functionalities and validation methods. The application is tailored for both aviation and marine search and rescue missions, emphasizing its versatility and critical role in improving operational efficiency.

Outputs:
- In-depth understanding of the SARAT application and its importance in search and rescue operations.
- Knowledge of the basic forcing mechanisms and determinants crucial for SAR operations.
- Practical insights into the use and validation of SARAT for aviation and marine SAR missions.

Issues/Concerns Raised and Resolutions:
- No specific issues or concerns were mentioned during the session.

SESSION 13: MARINE FISHERY ADVISORY SERVICES
Resource Person: Ms. Naga Swetha, Project Scientist, INCOIS
Methodology: Lecture and demonstration

The session focused on Marine Fishery Advisory Services provided by INCOIS, one of the oldest services of INCOIS. The lecture highlighted the significance of these services for coastal communities, particularly focusing on the PFZ services. It discussed the challenges faced by the fishing industry and the solutions offered through remote sensing technologies. The session covered the scientific basis of PFZ, remote sensing parameters, and demonstrated the use of ArcGIS for PFZ identification, advisory generation, and dissemination to end-users. Additionally, it emphasized the customization of PFZ services for different countries and the importance of end-user engagement and awareness.

Outputs:

- Understanding of the significance and scientific basis of Marine Fishery Advisory Services, particularly PFZ.
- Practical knowledge of using remote sensing technologies for fisheries management.
- Insights into the customization and dissemination of PFZ advisories for different countries.

Issues/Concerns Raised and Resolutions:

- No specific issues or concerns were mentioned during the session.

SESSION 14: DISCOVERY AND USE OF OCEAN DATA PRODUCTS
Resource Person: Dr. T.V.S. Udaya Bhaskar, Scientist-G & Head, ODM
Methodology: Lecture

This session provided an in-depth exploration of the essential components and utilization of ocean data products. The session elucidated the crucial elements for operational oceanography, including ocean observing systems, modeling, products, services, and data management. Various observational networks such as the Indian Argo Programme, Ocean Moored Buoy Network for Northern Indian Ocean (OMNI) buoy network, and Coastal High-Frequency (HF) Radar network were discussed along with their objectives and mechanisms. The lecture also delved into satellite observations, remote sensing techniques, and platforms like the INCOIS Live Access Server and Digital Ocean. During the discussion segment, participants engaged in conversations regarding data availability, visualization, building partnerships, and customizing applications based on service priorities.

Outputs:

- Understanding of essential components and utilization of ocean data products for operational oceanography.
- Familiarity with various observational networks and platforms for data collection and management.
- Insights into building partnerships and customizing applications to meet service priorities.

Issues/Concerns Raised and Resolutions:

- No specific issues or concerns were mentioned during the session.

SESSION 15: HANDS ON SESSION: INTRODUCTION TO OCEAN DATA ANALYSIS
Resource Person: Mr. V . Chandra Sekhar, Project Scientist, INCOIS
Type of Methodology Used: Hands-on Exercise

This hands-on session introduced participants to ocean data analysis tools and techniques, focusing on the installation and use of various software packages. The session began with an overview of the Pacific Marine Environment Laboratory (PMEL) and the importance of ocean data analysis. Participants were guided through installing the Linux subsystem (WSL) and Mini Conda, essential for running data analysis software. The session then covered the installation and setup of Ferret and PyFerret, tools for oceanographic data analysis. Practical exercises included creating the necessary environment and installing dependencies, culminating in a hands-on session using Ferret to analyse ocean datasets. Through hands-on exercises, participants gained valuable experience in managing and analyzing oceanographic data, preparing them for more advanced applications in their respective fields. This

foundational knowledge is crucial for enhancing their capacity to handle complex oceanographic data and contribute effectively to their research and operational objectives.

Outputs:

- Successful installation of Linux subsystem (WSL) and Mini Conda.
- Installation and setup of Ferret for ocean data analysis.
- Practical experience in creating environments and installing software dependencies.
- Hands-on skills in using Ferret to analyse and visualize oceanographic data.

Issues/Concerns Raised and Resolutions:

- **Issue:** Technical difficulties in installing and configuring software.

Resolution: Step-by-step guidance and troubleshooting support were provided to ensure successful installation.

- **Issue:** Complexity in understanding the functionality of Ferret and PyFerret

Resolution: Detailed demonstrations and practical exercises helped clarify their usage and capabilities.

SESSION 16: HANDS-ON SESSION ON VISUALIZATION OF OCEAN DATA
Resource Person: Mr. B. Sivaiah, Project Scientist-B, INCOIS
Type Of Methodology Used: Hands-on Exercise

The hands-on session on ocean data analysis introduced participants to the Ferret software for visualizing and analysing oceanographic data. The session covered a range of plotting techniques essential for interpreting data and making it accessible to end users. Participants learned to create various types of plots, such as list plots, scatter plots, overlay plots, fill plots, contour plots, vector plots, and stick plots. They also explored multiple window views and customization options to enhance the clarity and interpretability of their data visualizations. The exercise emphasized understanding dimensions, variables, and grids within Ferret, and the practical application of these concepts in generating informative plots. Participants practiced plotting lines, scattering data (e.g., Sea Surface Temperature vs. Air Temperature), and overlaying different plot types. The session also covered the use of colour palettes, labels, and the differences between Ferret and its successor, PyFerret. A demonstration of the software provided a practical, hands-on experience, reinforcing the theoretical knowledge gained.

Outputs:

- Participants gained practical skills in using Ferret for ocean data visualization and analysis, enabling them to create detailed and informative plots.
- Enhanced ability to customize plots for better data interpretation and presentation.
- Improved understanding of the differences between Ferret and PyFerret, preparing participants to use the most appropriate tool for their needs.

Issues/Concerns Raised and Resolutions:

- **Issue:** Some participants experienced difficulties in installing and setting up the Ferret software.

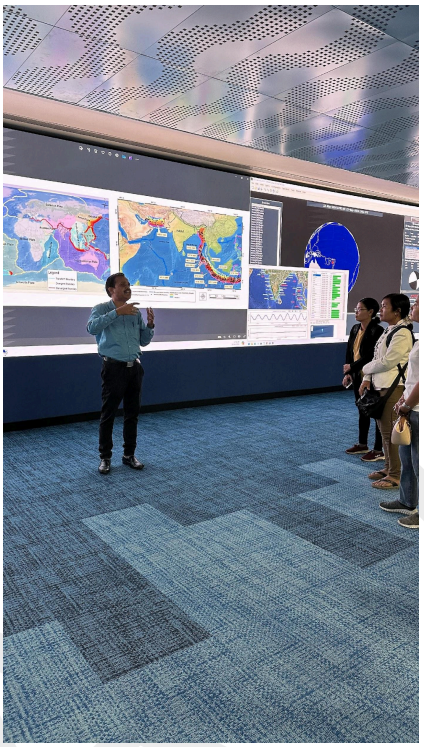
Resolution: Detailed step-by-step instructions were provided, and additional one-on-one support was offered to ensure all participants successfully installed and configured the software.

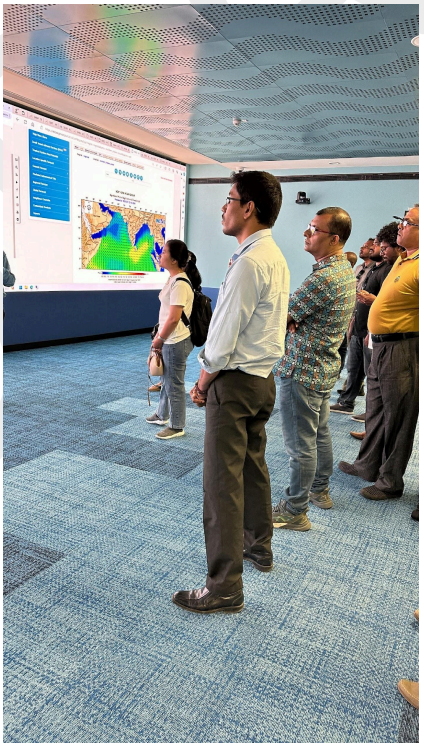
INCOIS Facilities and Lab Visits

During the training, participants had the opportunity to visit the various state-of-the-art facilities and laboratories at the INCOIS. This comprehensive visit was designed to provide an in-depth understanding of the operational capabilities and cutting-edge research conducted at INCOIS, which plays a pivotal role in marine forecasting and oceanographic services.

Outcomes

- Gained comprehensive knowledge of the operational services provided by INCOIS and their significance in marine safety and resource management.
- Understood the critical role of advanced oceanographic research and real-time data in supporting maritime operations and disaster preparedness.





ii) Participants and experts engaged in discussion during the lab visits

Issues/Concerns Raised and Resolutions:

- No specific issues or concerns were mentioned during the session.

5. OUTCOMES

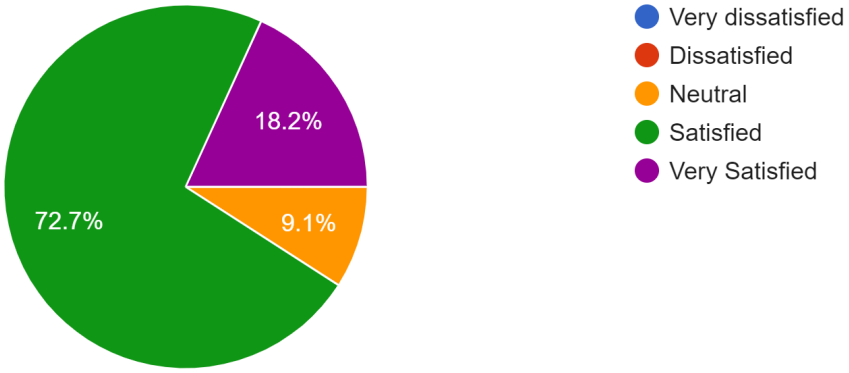
The Knowledge, Skills, and Abilities findings of the training indicate a strong overall relevance and positive impact across various domains within the coastal and marine sectors. Most respondents acknowledged the training's importance in enhancing their operational and tactical capabilities. The training addressed significant gaps in ocean information generation and application, improving the participants' knowledge and skills in accessing, utilizing, and customizing ocean datasets and forecast products. This enhancement is expected to benefit areas such as operational decision-making, disaster risk reduction, and coastal management. Participants particularly appreciated the detailed sessions on diverse topics like operational ocean services, wave forecasting, circulation modeling, and oil spill advisory systems. These sessions were rated as highly relevant and valuable, with many respondents noting that the training contributed to their ability to generate and interpret OSF products and alerts effectively

Despite the overall satisfaction with the training content and delivery, a recurring recommendation was the need for more hands-on sessions. Many participants suggested that the theoretical components were well-covered but desired additional practical exercises to reinforce their understanding and application of the concepts. Other suggestions included extending the training duration, incorporating more practical sessions alongside theoretical ones, and structuring the training into levels such as beginner and intermediate to better cater to participants' varying expertise levels. Additionally, respondents expressed high satisfaction with the trainers' clarity, conciseness, and effectiveness but indicated that the training sessions were sometimes rushed. Participants emphasized that more extended and better-balanced training would enhance their ability to apply the acquired knowledge and skills in their respective roles, particularly in customizing ocean models for specific areas and utilizing tools for search and rescue operations. The training was highly beneficial, significantly improving participants' capabilities in ocean information generation and application. However, to maximize its effectiveness, future iterations should include more hands-on exercises and a better-structured schedule to ensure a comprehensive learning experience.

Knowledge, Skills, and Abilities (KSA)

The training substantially enhanced the participants' knowledge, skills, and abilities, aligning well with the KSA baseline established prior to the program. Feedback from participants highlighted a significant improvement in their understanding of oceanographic and meteorological data, especially in areas such as operational ocean services, wave forecasting, and circulation modeling. Before the training, many participants lacked comprehensive exposure to these advanced topics. Post-training, participants reported an increased ability to generate and interpret ocean state forecast products, crucial for their roles in disaster risk reduction, coastal management, and operational decision-making. The training provided a

deeper insight into customizing ocean datasets and using forecast products effectively, bridging the initial knowledge gaps identified in the baseline assessment.



iii) Overall satisfaction of participants with the training

Learning

- The balanced of theoretical knowledge and practical application was highly valued.
- Practical exercises were particularly beneficial, helping participants apply learned concepts to real-world scenarios.
- Training improved participants' abilities in using ocean forecasting tools resulting in enhanced operational capabilities
- Interactive sessions fostered collaboration and knowledge exchange among participants, enriching their learning experience.
- The training often exceeded participants' expectations, providing valuable practical skills.

Further Training Gaps

- Additional practical exercises would reinforce learning and application of concepts.
- Offering beginner, intermediate, and advanced levels to cater to the diverse expertise levels among participants.
- A more balanced schedule would ensure thorough coverage of all topics.
- Better logistical planning would enhance the training experience by allowing participants to focus on content rather than administrative issues.

6. FEEDBACK

- Participants found the training effective in meeting its goals. They noted significant improvements in their understanding of complex ocean forecasting systems and their ability to apply this knowledge practically. The hands-on sessions were particularly beneficial, allowing participants to engage directly with the tools and techniques discussed.
- Resource persons were appreciated for their expertise and clear delivery. However, some participants suggested allocating more time for hands-on sessions and interactive discussions.
- Participants also appreciated the logistical arrangements, including the venue, schedule, and materials provided. The support and coordination were seamless, contributing to a smooth training experience.
- The training was deemed highly useful, especially in enhancing participants' practical skills. There was notable improvement in customizing ocean state forecast products and generating alerts. The knowledge gained was seen as directly applicable to their roles, particularly in disaster risk reduction and anticipatory preparedness. Participants valued the opportunity for regional collaboration and the exchange of ideas.

7. RECOMMENDATIONS

- Include extensive hands-on sessions alongside theoretical learning, with practical exercises, case studies, and real-life scenarios to help participants effectively apply concepts in their work environments.
- Expand training to cover advanced data analysis and visualization techniques using tools such as Ferret and PyFerret, equipping participants with essential skills for interpreting and utilizing oceanographic data.

Delivery:

- Adopt a blended learning approach that combines in-person and virtual training methods, accommodating diverse learning preferences and ensuring wider accessibility.
- Enhance interactive teaching methods, such as group discussions, workshops, peer-to-peer learning, and interactive simulations, to foster a collaborative learning environment.

Usefulness:

- Ensure training content is directly applicable to participants' work contexts by incorporating country-specific examples and case studies, enhancing the relevance and practical value of the training.
- Consider a modular training format, enabling participants to select sessions based on their skill levels and interests, addressing the varying levels of pre-existing knowledge among participants.
- Provide participants with access to supplementary resources, such as online tutorials, technical documentation, and peer-reviewed publications, supporting continuous learning and application of knowledge gained during the training.
- Maintain a focus on practical applications and real-world examples to demonstrate the relevance of training content to participants' operational roles.
- Offer follow-up sessions or refresher courses to reinforce and expand on the knowledge gained, providing regular updates and additional training opportunities to help maintain and advance participants' skills.

Next Steps:

- Plan and conduct follow-up training sessions through short-term attachment with INCOIS focusing on the advanced topics identified as priorities, such as PFZ, oil spill advisory systems, and more intensive hands-on sessions.
- INCOIS offered to develop customized product application programs based on the specific needs and priorities of each participating country. This could include targeted sessions on local marine conditions, specific forecasting challenges, and country-specific applications of oceanographic data for evolving thresholds for generating real time alerts with the integration of SAMUDRA Application of INCOIS.
- Explore opportunities for country-level advanced workshops focusing on customization of storm surge modeling, coastal hazard assessment, or oil spill advisory frameworks through integration of local data.
- Foster ongoing collaboration and knowledge exchange among participants through virtual forums, webinars, and professional networks, enabling continued sharing of best practices and lessons learned in ocean forecasting.
- Streamline the nomination process for the training to include participants for whom the training will be most relevant, ensuring a more targeted and effective training experience.

ANNEX 1: TRAINING AGENDA

INCOIS-RIMES Training Course on
"Customization of Ocean State Forecast Products"
during May 20-24, 2024.

Date	Time	Program
20 May 2024	10:00 – 10:30	Welcome address, Group photo with Director, GD, DHs & faculties
	10:30 – 11:30	Overview and Activities of INCOIS – **Dr. T. M. Balakrishnan Nair**
	11:00 – 11:30	Tea Break
	11:30 – 13:00	Introduction to Operational Ocean Services provided by INCOIS – M**r. Nagaraja Kumar**
	13:00 – 14:00	Lunch Break

	14:00 – 15:30	Essential Ocean Variables and Numerical Models in OSF – **Mr. B. Sivaiah**
	15.30 – 16:00	Tea Break
	16:00 – 17:30	"Coastal wave modeling using SWAN and Small Vessel Advisory Services" – **Dr. Sandhya KG**
21 May 2024	10:00 – 11:30	Indian Ocean Wave Forecasting System and Modeling Waves using Wave Watch III – **Dr. Remya PG**
	11:00 – 11:30	Tea Break
	11:30 – 13:00	Concepts of Data Assimilation and LETKF – **Dr. Arya Paul**
	13:00 – 14:00	Lunch Break
	14:00 – 15:30	Storm surge forecasting system – **Dr. Siva Srinivas**
	15.30 – 16:00	Tea Break
	16:00 – 17:30	Basics of tides and tide forecasting – **Dr. K. Srinivas**

22 May 2024	10:00 – 11:30	Bias correction methods for operational ocean forecasting- **Ms. Anuradha**
	11:00 – 11:30	Tea Break
	11:30 – 13:00	Oil Spill Advisory System – **Dr. S. J. Prasad**
	13:00 – 14:00	Lunch Break
	14:00 – 15:30	Search and Rescue aid tool – (Method and Demonstration) – **Dr. P. Vijay**
	15.30 – 16:00	Tea Break
	16:00 – 17:30	Discovery and use of Ocean Data Products provided by INCOIS – **Dr. T.V.S. Udaya Bhaskar**
23 May 2024	10:00 – 11:30	Tsunami Early Warning Services – **Dr. B. Ajay Kumar**
	11:00 – 11:30	Tea Break
	11:30 – 13:00	Marine fishery advisory services – **Ms. Naga Swetha**
	13:00 – 14:00	Lunch Break
	14:00 – 15:30	Explanation of components of INCOIS OSF and products – **Dr. B. Ajay Kumar**

	15.30 – 16:00	Tea Break
	16:00 – 17:30	Hands-on session on introduction to ocean data analysis – **Mr. V . Chandra Sekhar**
24 May 2024	10:00 – 11:30	Hands-on session on visualization of ocean data – **Mr. B. Sivaiah**
	11:00 – 11:30	Tea Break
	11:30 – 13:00	Hands-on session on customization of OSF products and Alerts generation– **Mr. V. Chandra Sekhar & Mr. B. Sivaiah**
	13:00 – 14:00	Lunch Break
	14:00 – 15:30	Discussions and a way forward Valedictory session –
	15.30 – 16:00	Tea Break
	16:00 – 17:30	INCOIS facilities and lab visits

ANNEX 2: PARTICIPANTS LIST

S NO.	NAME	INSTITUTION	DESIGNATION	GENDER	CONTACT DETAILS
1.	Ahmed Nazeer	Maldives Meteorological Service	Assistant Meteorologist	Male	ahmed.nazeer@met.gov.mv
2.	Chaminda De Silva	Department of Meteorology	Meteorologist	Male	chamdesilva@gmail.com
3.	Hnin Wut Yee	Department of Meteorology and Hydrology	Staff Officer	Female	hninyeye@gmail.com

4.	J W Karunaratna	Department of Meteorology Sri Lanka	Meteorologist	Male	jeewankaru1@gmail.com
5.	K M Salahuddin	Ministry of Defence Bangladesh	Deputy Secretary	Male	monsalhmed@gmail.com
6.	Malith Fernando	Department of Meteorology	Meteorologist	Male	rmpfernando@gmail.com
7.	Mohamed Imadulla	Maldives Meteorological Service	Meteorological Technician	Male	mohamed@met.gov.mv
8.	Mohamed Shahudh	Maldives Meteorological Service	Meteorologist	Male	mohamed.shahudh@met.gov.mv
9.	Shwe Yee Nwe	Department of Meteorology and Hydrology	Staff Officer	Female	shweyeenwe@gmail.com
10.	Suman Saha	Bangladesh Meteorological Department	Assistant Meteorologist	Male	mars0742@gmail.com
11.	Tin Mar Hyat	Department of Meteorology and Hydrology	Deputy Director	Female	tmarhtay@gmail.com

ANNEX 3: TRAINING NOTE

Background:

In the realm of ocean forecasting, South Asian (SA) countries—Bangladesh, Myanmar, Maldives, and Sri Lanka—are taking a proactive stance to elevate their capabilities in addressing maritime challenges. These nations are driven by a collective recognition of the dynamic complexities within the maritime environment, prompting them to focus on tailored solutions, effective data use, and ongoing technical advancement**. The Training on Customization of Ocean Forecast Products** facilitated by the Indian National Center for Ocean Information Services (INCOIS) and the South Asia Hydromet Forum (SAHF) , will serve as a pivotal collaboration, bringing together the collective aspirations of SAHF costal member countries to become adept in the complexities of marine forecasting. In addressing the training needs for ocean forecast product customization in SA countries, distinct requirements have emerged from Bangladesh, Myanmar, Maldives, and Sri Lanka[1]:

In Bangladesh, the primary objective is the implementation of marine forecasting for the Bay of Bengal. Training needs encompass basic marine meteorology to bolster capacity, with a specific focus on Ocean State Forecast Services. This includes training on sea state, significant wave height forecasting, storm surge predictions, and determining tropical cyclone heat potential. Additionally, training on ocean wave and storm surge models is deemed essential for generating effective ocean information advisories. Myanmar, on the other hand, aims to enhance the capabilities of its marine service under the Department of Meteorology and Hydrology (DMH). The identified training needs include storm surge modeling and wave modeling using open-source software. Utilization of Numerical Weather Prediction (NWP) products for forecasting wind speed, direction, and significant wave height is crucial. The training program also emphasizes the application of scatterometers and altimeters for marine forecasting, along with the extraction of forecast data from INCOIS products, particularly focusing on network Common Data Form (NetCDF) format. A potential component includes buoy installation training if time permits. In the Maldives, the training focus centers on building expertise in accessing and interpreting INCOIS model data. This involves scripting using Python or Grid Analysis and Display System (GrADS) for post-processing and interpreting data. Additionally, training is needed for tidal and swell waves surge application, specifically tailored for Impact-based Forecasting (IBF). Understanding locally observed tidal data and other atmospheric data is identified as a critical component of the training. Sri Lanka's training needs are driven by the goal of strengthening the ability to address fishermen's inquiries and improve forecast products. This includes understanding sea currents, high wind, and high waves for fishermen's safety, along with the identification of rough sea conditions. Training is required for improving forecast products to cater to specific needs such as surfing conditions and the identification of potential fishery areas. Moreover, a key emphasis is placed on developing location-specific forecasts for ports and harbours and establishing an emergency online oil spill advisory system based on past experiences.

Training Overview:

Lead by INCOIS, renowned for its expertise in oceanography and state-of-the-art forecasting technologies, the forthcoming training program aims to address the common themes and shared requirements identified across Bangladesh, Myanmar, Maldives, and Sri Lanka. By harnessing the experiences of these diverse coastal countries, the training endeavours to empower meteorological professionals with the tools and insights necessary to customize ocean forecast products effectively. Against the backdrop of challenges such as staffing shortages, need for technical knowledge enhancement, and the utilization of available data sources, the training is significant for fostering collaboration and skill development. It aligns with the region's vision to fortify its resilience against maritime uncertainties, paving the way for more accurate, tailored, and impactful ocean forecasting. The training is anticipated to elevate the collective understanding of ocean forecasting intricacies and foster enduring partnerships that transcend geographic boundaries.

Taking place at INCOIS facility in Hyderabad, India, the one-week training program is specifically tailored for three operational staff from each participating nation. This focused structure ensures

[1] Identified based on inputs from NMHSs in Bangladesh, Maldives, Myanmar and Sri Lanka on country specific requirements for the training

an immersive and impactful learning experience, directly addressing the needs of operational staff engaged in ocean forecast customization.

Expected Outcomes:

- Obtaining advanced skills for customizing ocean forecast products, resulting in more accurate and tailored predictions for specific regional needs
- Building a collective pool of expertise in ocean forecasting through shared insights, experiences, and best practices.
- Proficiency in extracting, processing, and interpreting data for improved forecasting accuracy.
- Addressing challenges related to the utilization of available data sources.
- Development of the capability to tailor forecast products to specific regional needs.
- Contributing to more impactful forecasting, particularly in addressing challenges specific to each country's maritime environment.

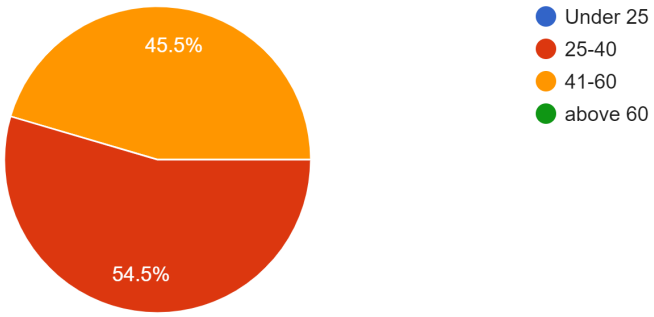
By tackling common challenges and fostering collaboration, the training will pave the way for impactful and tailored ocean forecasting in the SA region. The training program will set the stage for effectively addressing maritime challenges with precision and collaboration in the future.

ANNEX 4: PRE-TRAINING ASSESSMENT RESULTS

RESPONDENT INFORMATION

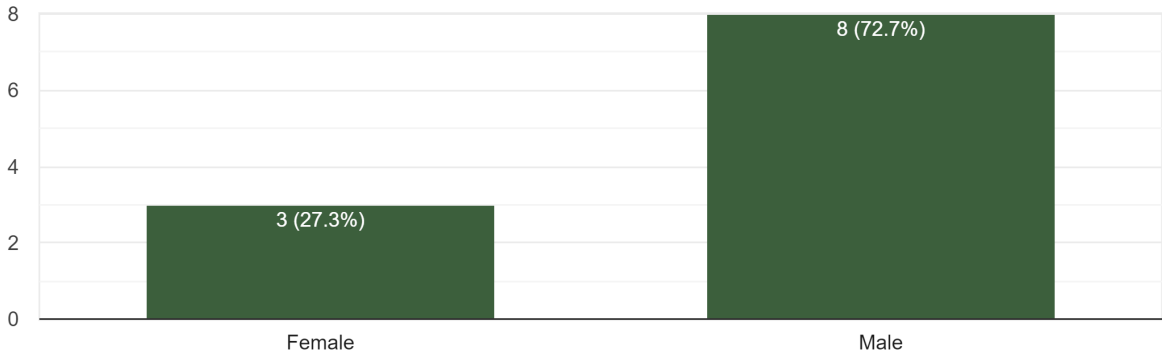
Age group

11 responses



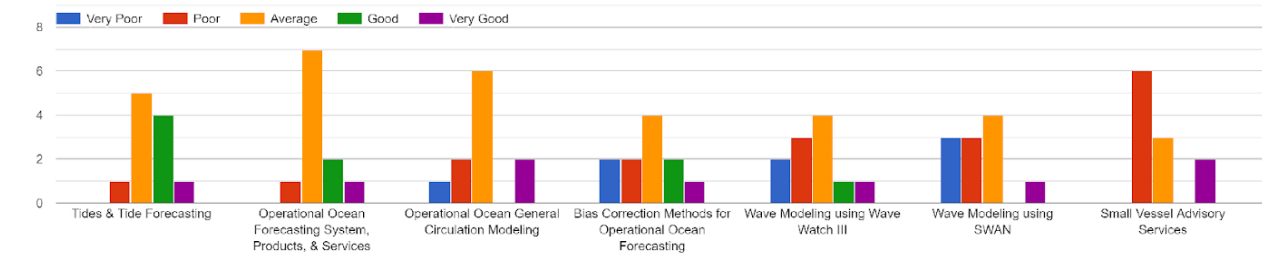
Gender

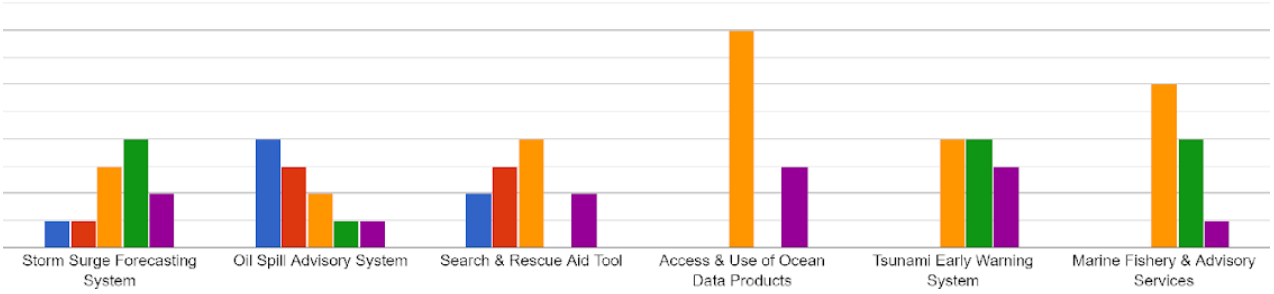
11 responses



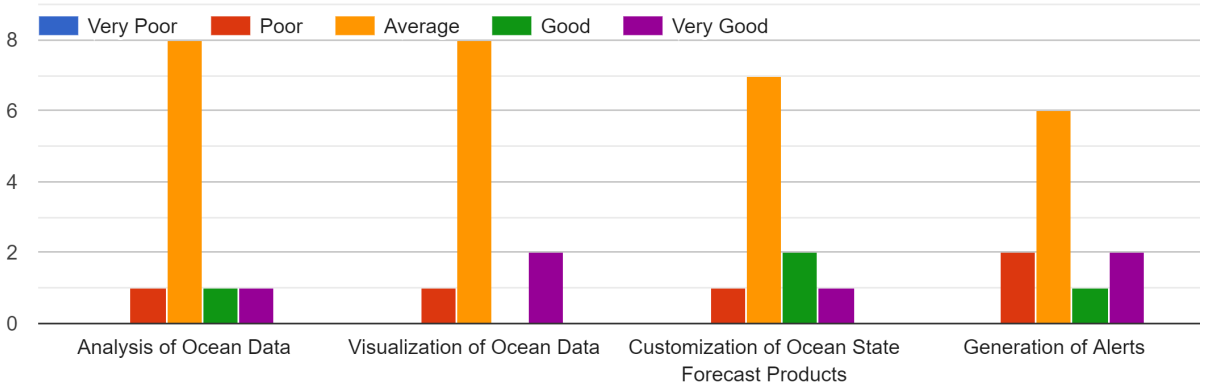
KNOWLEDGE

Please rate your understanding of the following concepts before the training:





Please rate your skill level before the training:



ATTITUDE

How can this training help you in your work?

11 responses

- Formulation of policy
- It would extend my knowledge in ocean forecasting
- Understand ocean forecast and customize to my country and forecasting procedure
- More knowledge about INCOIS products and how to customise it to my country needs
- We can get a lot of information and knowledge of Ocean information and forecast.

- This training will help me to catch many knowledge and hang-on exercise to apply in our operational work.
- This training will help me to catch many knowledge and hang-on exercise to apply in our operational work.
- More Hands on session on modelling and validation
- Knowledge and skills of understanding and modifying ocean forecasts products would help me to develop the accuracy of forecasting at the home institute.
- It will be helpful to understand ocean state variabilities and provide a better service to navel and fishing communities.
- Currently we use ocean forecast product for our forecast. After this training w would like to introduce more valuable forecast products for out stake holders.

What are your expectations from this training?

11 responses

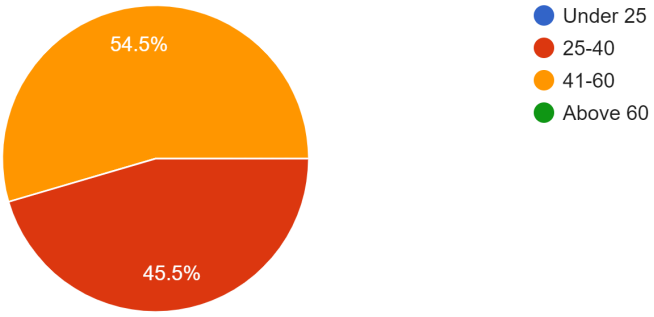
- Enhancing knowledge
- Learn and get familiar with I ocean forecasting tools by INCOIS
- Understand swell wave forecast and forecast for fishermen
- More information about swell forecast
- We hope very good opportunity to generate our own ocean and storm surge forecast for our Country.
- I hope from this training to get much knowledge, technology and hang-on exercise as well as the customized software for our country.
- I hope this training get much knowledge, technology and hang-on exercise as well as the customized software for our country.
- To increase capacity building on customization of several ocean information services like marine fishery services, small vessel advisories, tsunami early warnings and ocean data analysis with modelling.
- To understand the concepts behind Ocean modeling and impacts of the various forecast products given by the OFS.
- To enhance my knowledge in ocean weather and have a good collaboration with INCOIS to enhance our forecasting capacity.
- Learn on how customize ocean forecast products. How to set thresholds for products. Surf forecasting for surfers, etc.

ANNEX 5: PARTICIPANTS SATISFACTION SURVEY RESULTS

RESPONDENT INFORMATION

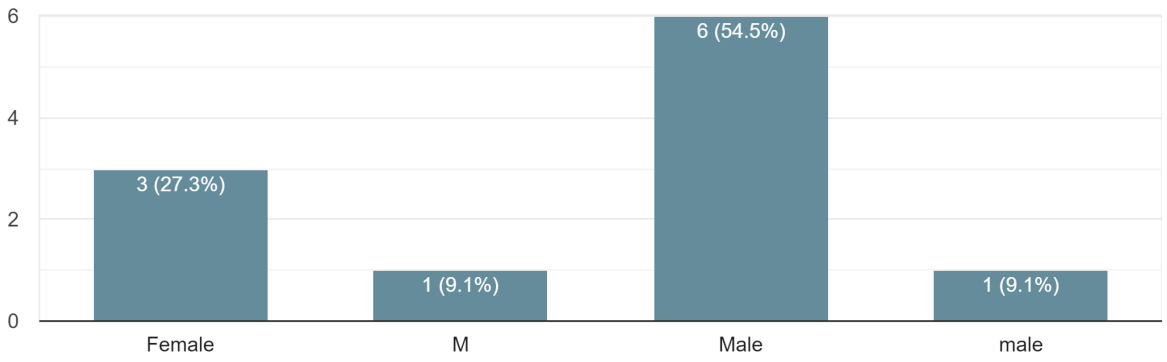
Age group

11 responses



Gender

11 responses

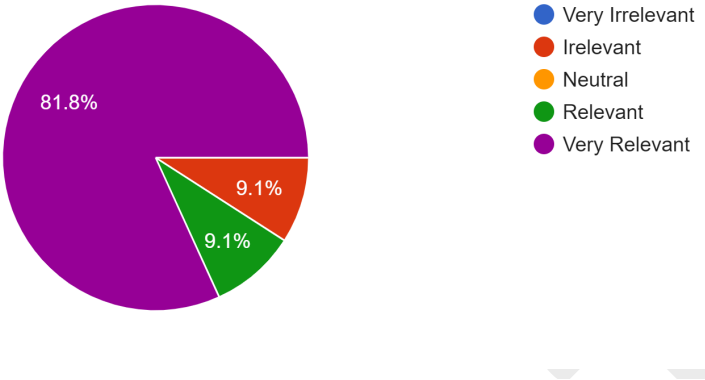


RELEVANCE

How relevant is this training in your work/institution?

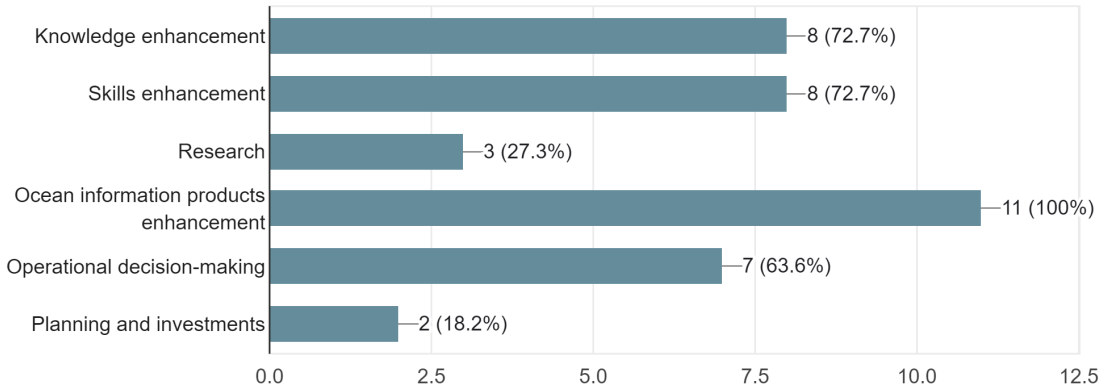
How relevant is this training in your work/institution?

11 responses



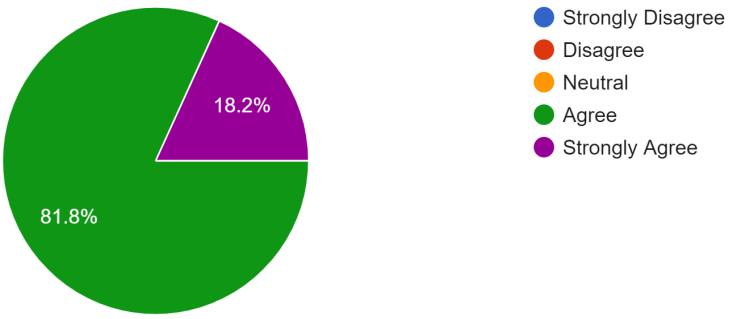
Please identify specific areas where the training might be relevant

11 responses



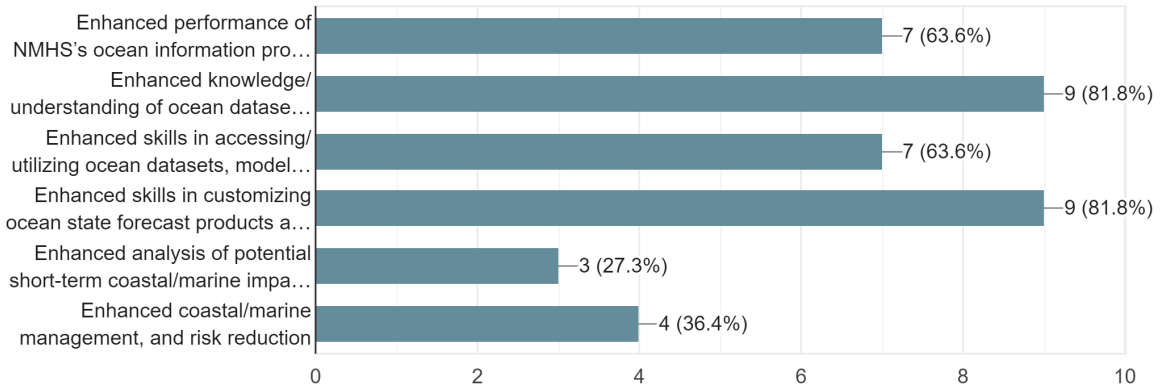
This training has addressed gaps in ocean information generation and application in operational and tactical plans and decisions in the coastal/marine sector.

11 responses

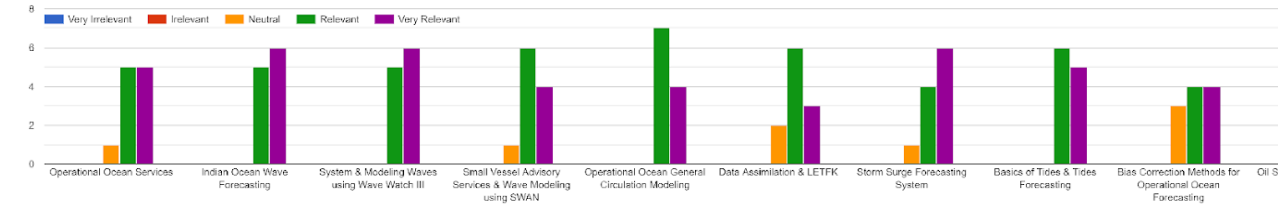


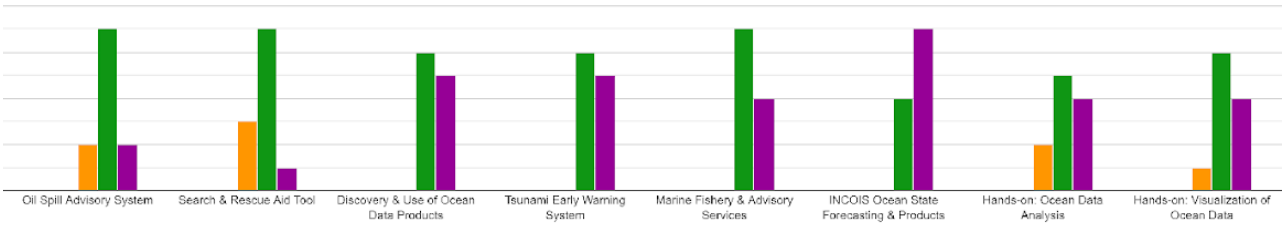
Please identify areas where the training has made/might have an impact

11 responses



How relevant are the following training sessions?

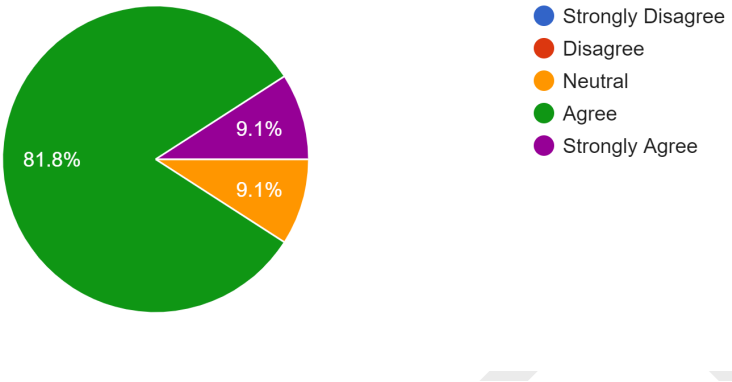




COHERENCE

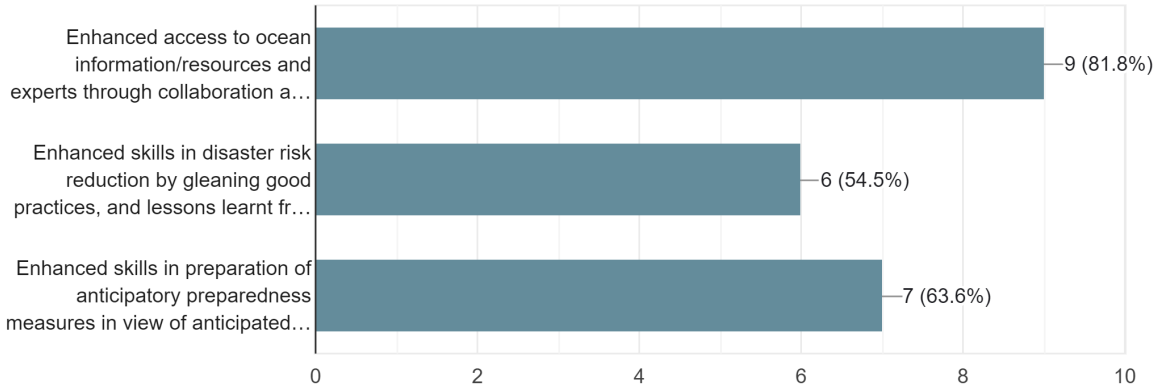
This training is complementing/contributing to other programs, projects, and activities vis-à-vis ocean information generation and application in plans and decisions.

11 responses



Please specify how the training is complementing or contributing to other initiatives

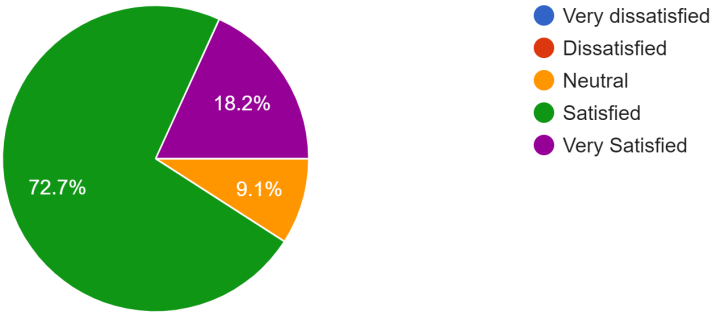
11 responses



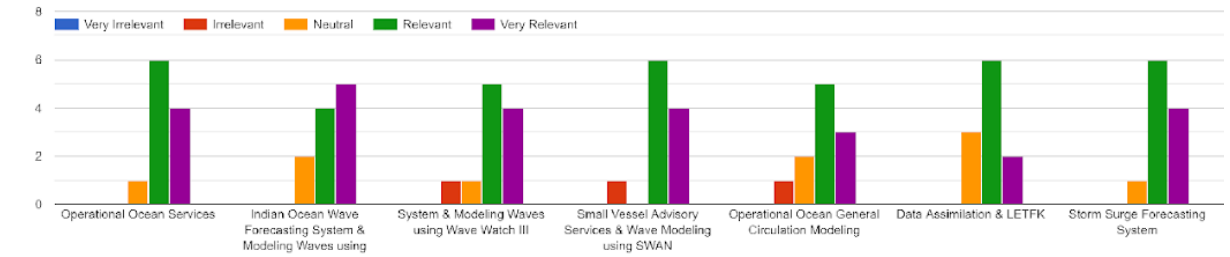
EFFECTIVENESS

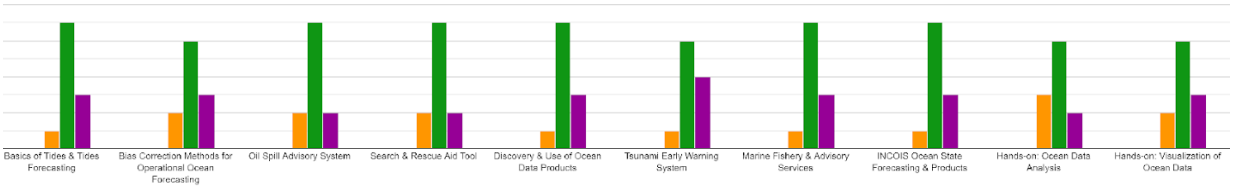
Overall, how satisfied are you with this training?

11 responses

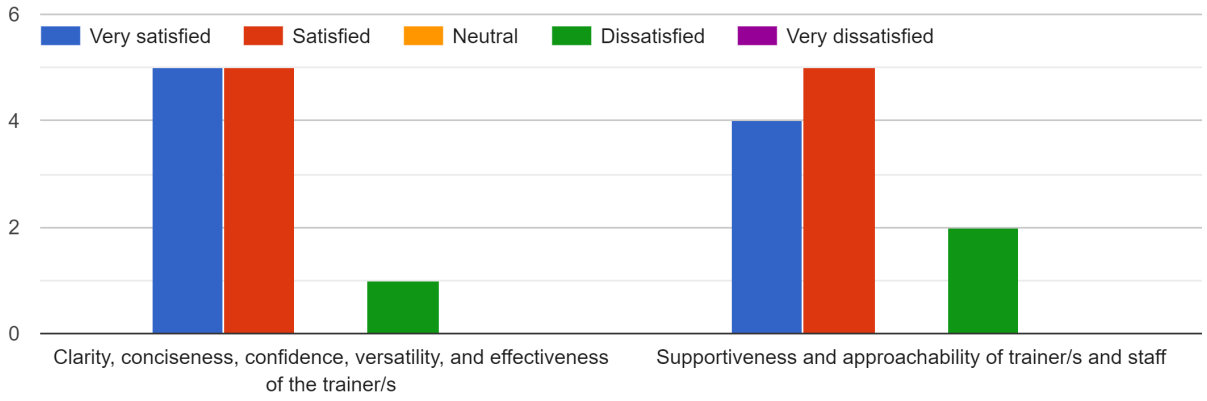


How satisfied are you with the training sessions/hands-on exercises (e.g., clarity, conciseness, timeliness, and effectiveness of the training content and materials)?

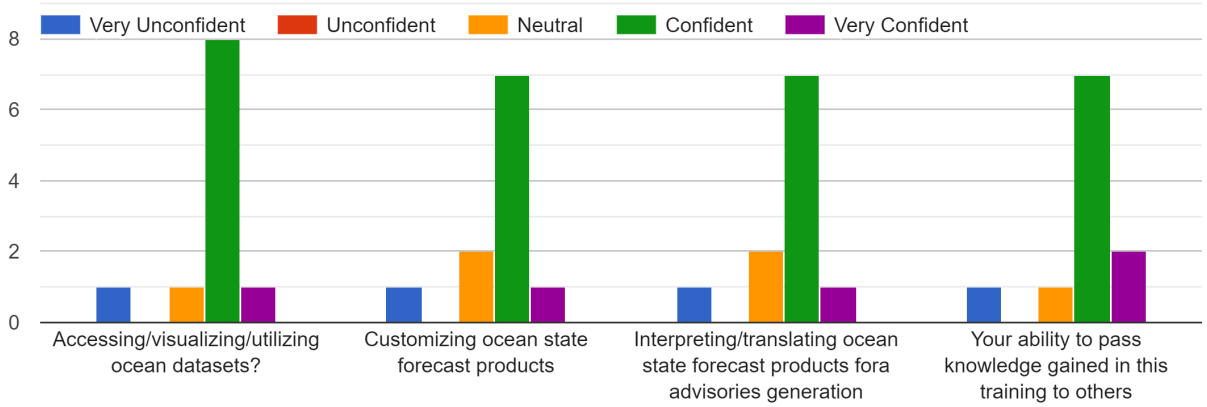




How satisfied are you with the delivery of the training sessions/hands-on exercise?

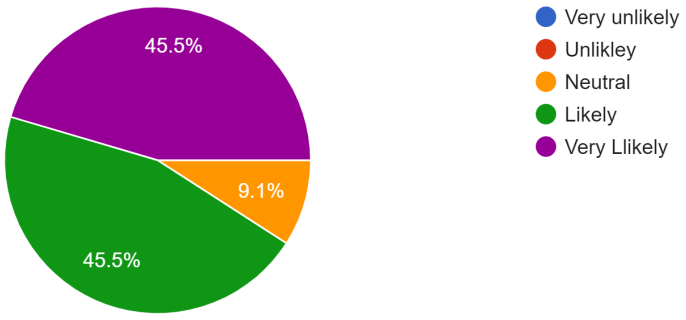


How confident are you in:



How likely are you to apply knowledge/skills gained (i.e., customization/translation of ocean state forecast products for generating advisories) to your work after this training?

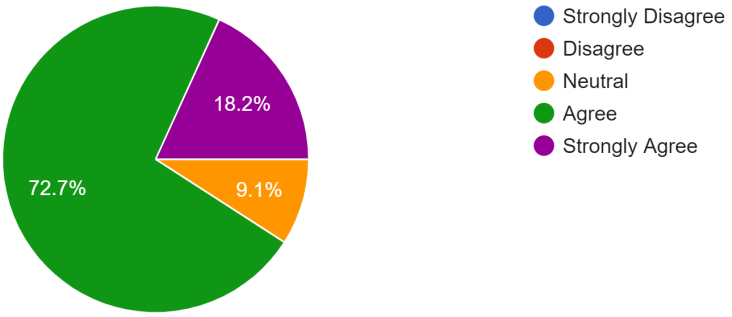
11 responses



EFFICIENCY

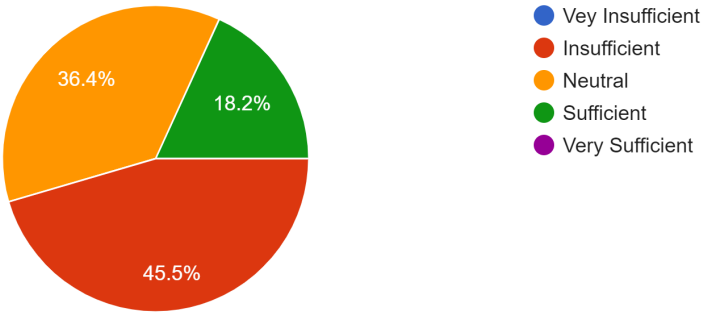
This training is well-planned (e.g. schedule, agenda, topics, presenter).

11 responses



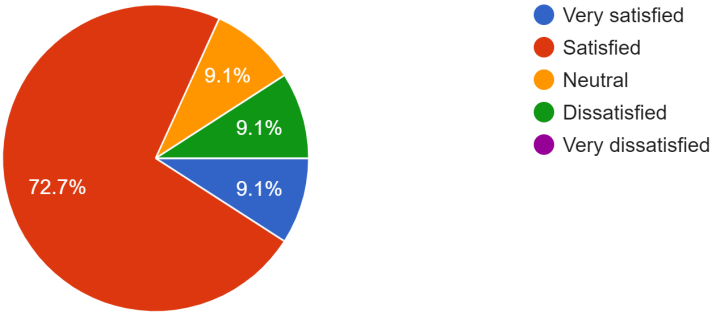
Was the length of training sessions sufficient?

11 responses



How satisfied are you with the coordination of this training (e.g., communications, venue, equipment, logistics, support)?

11 responses



LESSONS LEARNT AND RECOMMENDATIONS

What went well? What areas need improvement?

11 responses

- The course was excellent.
- We need more practical and hand-on session
- Overall, the training was good.

- Training content and overall training went well. coordination could be improved a little better.
- Oceanography theory went well while not having enough time for hands on.
- Theoretical background from resource persons is very good. Most of them explained very well. As a beginner in this field, I earned a very good knowledge. But I am unsatisfied about hands on exercise because we need more time to practice and understand the processes.
- As per the title of the training more hands on exercise need to be done
- All the training sessions were well. The time duration for the hands-on session should be extended and the learnings from the practical sessions can be applied for the respective country which will increase confidence in using ocean data provided by INCOIS.
- Although we need theoretical background, we need more practical experience. Therefore, we should include more practical sections.
- Although we need theoretical background, but we need more practical experience. Therefore, we should include more practical sections.
- All the lecturers are very good in explained. But the training period is short.

What insights/opportunities have you gained from this training that you can apply in your work?

11 responses

- Holistic approach to Ocean
- We will share and TOT in Office.
- Everything taught in the training is applicable to my work
- Issue marine weather warnings and better understanding on where to find ocean products of INCOIS.
- Ocean model data availability at INCOIS and how much the accuracy they have.
- I can use some of them in my work. From my side I got (in theoretical background) sound knowledge about some areas.
- There is high possibility to make available fishery zone information to the fishermen. And oil spill advisories can be issued. Overall knowledge gathered in this training is highly useful for the daily work as a meteorologist.
- storm surge warnings, search and rescue tool, tsunami early warning and others
- We have a meteorological background, so we have a lot of knowledge relevant to the OSF. We found a link where we can download ocean observation data, allowing us to conduct further research. We can share this knowledge and the forecast link within our department.
- We have a meteorological background. So, we have a lot of knowledge relevant to the OSF. We found a link where we can download the ocean observation data, allowing us to conduct further research. We can share this knowledge and the forecast link within our department.
- Learn to customise ocean models for my area. And also lean to use tools for search lost people or boats

What recommendations can be made for enhancing subsequent trainings?

11 responses

- -need more training periods. -need more practical aspects alongside parallel theory.
- Course contents are good, trainers are okay but need more time. It was a little bit rush in every session. Besides more practical sessions may include. Overall training part was really good but other parts needs to rethink as International standard.
- We need to generate the wave and storm surge model for our specific areas.
- More hands on session.
- More hands on training. split trainings into levels like beginner and intermediate so time can be utilized faster
- A dedicated technical session for a customization of ocean data products is required as I think. Since most of the time during this program went on recognizing the products that are available at INCOIS.
- # Need at least two weeks training. # More hands on exercises as I mention before. # I suggest, in the morning theoretical explanation and in the afternoon practical session on that theory
- In some lectures repetition could be observed. Prctical hands on exercises and lecture sessions should be balanced since those practices can be applied easily to the work. Thank you very much for giving us this opportunity.
- A post graduate diploma degree course on ocean state forecasting and customization can be introduced.
- Include more practical sessions with theory.