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FINAL REPORT

Sustained capacity building among early-career researchers towards climate resilience by effective ocean monitoring through satellite remote sensing

CBA2020-08SY-Idris

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material contained herein. The use of geographic names, boundaries and related data on maps, and in lists and tables within this publication are not warranted to be error-free, nor do they imply any endorsement by APN.

1. Summary

To support development in the maritime field, one needs technology capable of monitoring the oceans, marginal seas, and coastal areas thoroughly and systematically, including through remote sensing (RS) from space. Remote Sensing technology, along with in situ measurements, is essential for monitoring marine natural resources & for assessing climate and human impacts in coastal areas, e.g., monitoring coral reefs & marine utilization planning for various sectors of the economy such as tourism, for example. It is also crucial for monitoring and studying climate variability and change, biodiversity and ecosystems, and changes in the atmospheric, marine, and coastal domains.

This project develops the capacity among early career scientists in developing countries through several initiatives. First is the virtual capacity building development (CBD) program on the Massive Open Online Course (MOOC) platform that has been successfully delivered twice in 2021 and 2022 during the pandemic Covid-19 and the movement control order (MCO) era. There were 13 modules presented on the pre-recorded videos plus, a student-mentorship program to foster active interactions between our experts and participants. The MOOC wins a silver award during the International University Carnival on E-Learning (IUCEL) 2021. Second is the physical CBD program held in December 2022 in Malaysia. The CBD comprises four (4) days of tutorial capacity building at Universiti Teknologi Malaysia, and two (2) days of conference meetings at KSL Hotel and Resort Johor Bahru. The recipients of the physical CDB are selective and priority is given to the alumni of the MOOCs to strengthen their knowledge, practical exercise, and social interactions among peers and instructors.

The physical CBD is based on five (5) dimensions; science (10%), application (26%), student-mentorship project (25%), project presentation (10%), and field excursion (28%). The domain of student project clusters focuses on different aspects of climate resilience including the climate-ocean, ocean colour and habitat modelling, sea level rise, and shoreline changes. Social aspects have been taken seriously into account in the CBD model. In addition to the field excursion at the mid-week end, common lodging and meals for instructors and students enhance the interactions.

Among the lesson learnt during the Pandemic Covid-19 pause is the opportunity for global knowledge exchange without a physical boundary. Through a hybrid model of CBD, most of the fundamental lectures, basic practices, and individual projects are provided through the online MOOC platform, while the complicated practical, social interactions and group projects are emphasized during the physical CBD.

2. Objectives

The conference reviews and discusses the state of ocean remote sensing and help scientists and students involved in ocean-atmosphere studies using remote sensing techniques to benefit from interactions with experts participating from all over the globe. The conference also

provides an opportunity to showcase research work that furthers understanding of the Earth's environmental processes such as climate variability, the effects of the El Nino Southern Oscillation (ENSO), oceanic hazards such as tsunamis, tropical and extra-tropical cyclones, sea level rise, and other climate change effects and the effects of pollution carried out using remote sensing techniques from various satellite missions. Thus, it provides a forum to exchange knowledge about the applications of ocean remote sensing for societal benefits. A student tutorial held prior to the conference aims to give students detailed practical examples of remote sensing techniques used for monitoring the ocean-atmosphere system for research and operations, and the ability to develop networks with other students and senior scientists.

3. Outputs, Outcomes and Impacts

Outputs	Outcomes	Impacts
Completion of MOOC tutorial 2021 and 2022, and physical tutorial/conference in 2022	Improved student's understanding and practical examples of remote sensing techniques for monitoring ocean-atmosphere for research and operations	-Connect openly on a global scale, with global learners. -Improved quality of life in individuals with flexible learning and lifelong learners.
Published Pre-Conference Proceedings (Volume 1 and 2), Abstract Book, and/or Paper in the International Journal of Remote Sensing Special Issue	Enabled students' interaction and exchange ideas about ocean remote sensing and climate change	Improving world understanding of the field related to ocean remote sensing and climate change

4. Key facts/figures

-12 ECS, 18 ECS, and 9 ECS from the APN developing nations are trained in during MOOC in 2021, 2022, and physical CBD in 2022, respectively.
-13 instructors from 8 different countries across continents including the United States, United Kingdom, Europe and Asia involved in the CBD program.

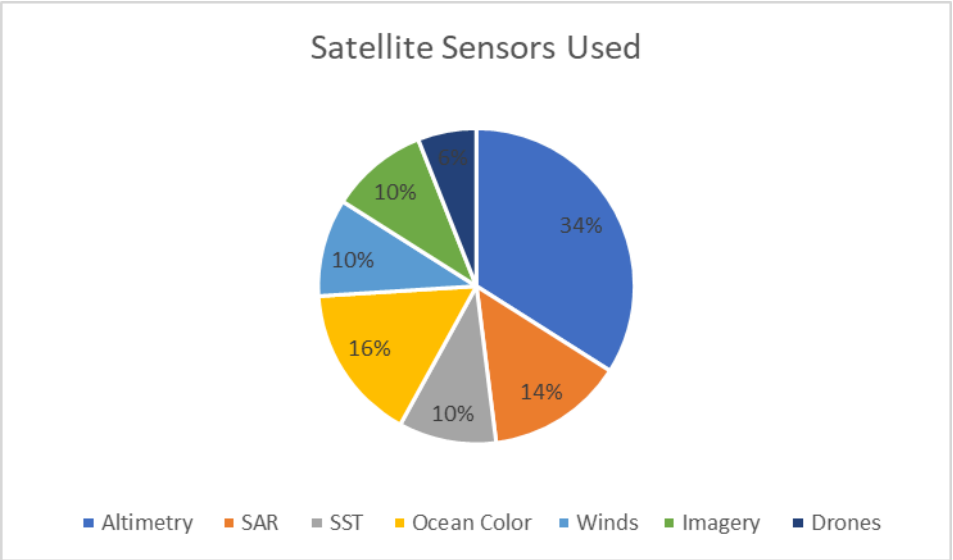

Figure 1 The satellite sensors applied in the ocean remote sensing studies

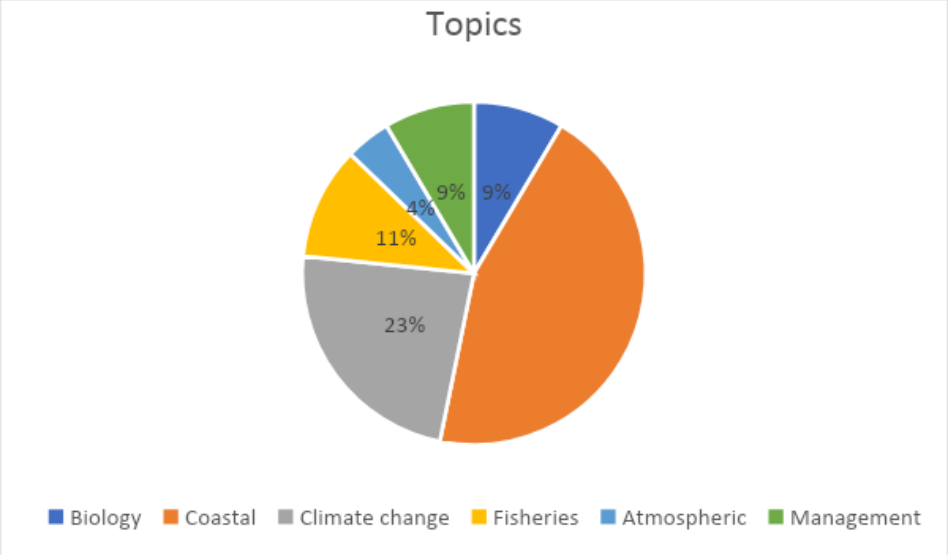

Figure 2 The cluster of topics addressed during the conference in December 2022

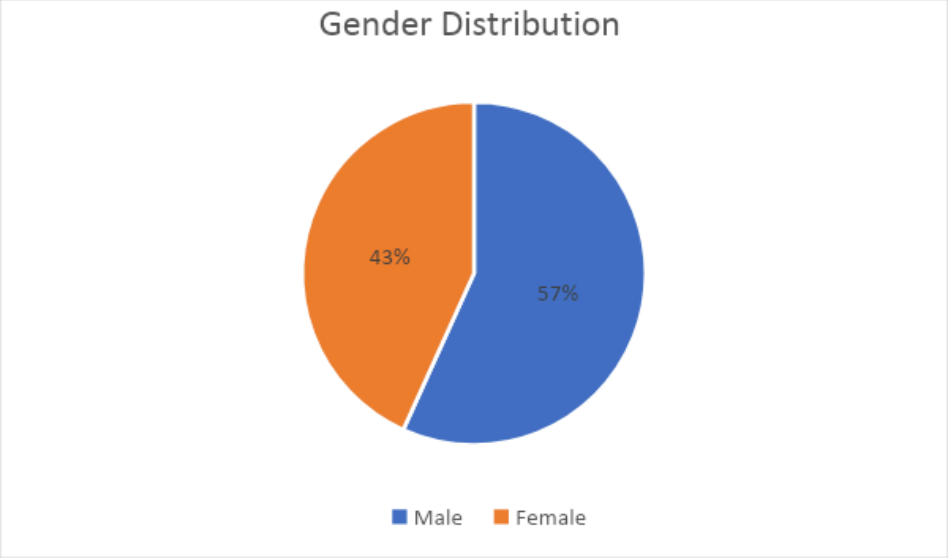

Figure 3 Gender distributions of attendees presenting topics during the hybrid conference in December 2022

5. Publications

1. Publication of Abstract Book and Pre-conference proceedings Volume 1 (June 2021). (Attached in Appendix 1 and Appendix 2).
2. N. Yusof, N. H. Idris, N. Darwin, K. D. Kanniah, N. Kumar and G. Levy, "Interactive Distance Learning for Virtual Capacity Building Development Intra-Pandemic Experiences: A Case of Mooc UTM-PORSEC," IGARSS 2022 - 2022 IEEE International Geoscience and Remote Sensing Symposium, 2022, pp. 4619-4622, doi: 10.1109/IGARSS46834.2022.9883929. (Appendix 3)
3. Publication of Conference proceedings Volume 2 (incoming)
4. International Journal of Remote Sensing (PORSEC Special Issue). Now open call for papers until February 28, 2023. Expected print publication date: December 2023. https://think.taylorandfrancis.com/special_issues/pan-ocean-remote-sensing/?utm_source=TFO&utm_medium=cms&utm_campaign=JPG15743

6. Media reports, videos and other digital content

- https://news.utm.my/2021/04/tropicalmap-research-group-led-international-capacity-building-development-program-on-ocean-remote-sensing-towards-climate-resilience/
- https://nf-pogo-alumni.org/opportunities/training/040122-1/
- https://www.ecopdecade.org/event/tuition-fee-waiver-for-massive-open-online-course-mooc-on-ocean-remote-sensing-for-climate-resilience-due-january-15-2022/

7. Pull quotes

- The global community has stopped due to the COVID-19 pandemic, but this has inspired a renewed interest in flexible and live long learning in professional education (Nurul Hazrina Idris)

8. Acknowledgments

We appreciate the Universiti Teknologi Malaysia and Pan Ocean Remote Sensing Association (PORSEC) for organizing the CBD program. Also, thanks to the Asia-Pacific Network for Global Change Research (Award Ref: CBA2020-08SY-Idris) and the co-sponsors: the Committee of Space Research (COSPAR), the Scientific Committee on Oceanic Research (SCOR), the Indian National Centre for Ocean Information Services (INCOIS), and Malaysia Convention and Exhibition Bureau (MyCEB) for providing the co-support funding for the capacity building development program.

9. Appendices

Appendix 1: Abstract Book

Appendix 2: Pre-conference proceedings Volume 1

Appendix 3: Conference paper IEEE

Appendix 4: Certificate of Award (silver awards during the IUCEL 2021)