Conference »Program

2022 IEEE Ocean Engineering Technology and Innovation Conference: Management and Conservation for Sustainable and Resilient Marine and Coastal Resources (OETIC) Program

	2022 IEEE Ocean Engineering Technology and Innovation Conference: Management and Conservation for Sustainable and Resilient Marine and Coastal Resources (OETIC)	
Monday, December 19		
9:00-10:00	D1P1: *Opening and Keynote Speeches*	
10:10-12:30	D1P2: *Management for Resilient Marine and Coastal Resources*	
14:00-16:30	D1R1: *Ocean Data Visualization and Information Management*	D1R2: *Underwater Acoustics Technology and Data Processing*
Tuesday, December 20		
9:00-11:25	D2P1: *Management and Conservation for Sustainable Marine and Coastal Resources*	
14:00-16:30	D2R1: *Coastal Infrastructures and Resources Management*	D2R2: *Ocean Platforms and Floating Structures Engineering Technology*

Monday, December 19

Monday, December 19 9:00 - 10:00 (Asia/Jakarta)

D1P1: Opening and Keynote Speeches

Reports from the committees Welcoming remarks by Chair of IEEE Indonesia Section, Dr. Wahyudi Hasbi Keynote Speech by President of IEEE Oceanic Engineering Society, Dr. Christopher Whitt Keynote Speech and Opening Remarks by Rector of Institut Teknologi Sepuluh Nopember (ITS), Prof. Mochamad Ashari

Monday, December 19 10:10 - 12:30 (Asia/Jakarta)

D1P2: Management for Resilient Marine and Coastal Resources

Chair: Dhany Arifianto

10:10-10:35 Dr Kaharuddin Djenod, PT PAL's Chief Executive Officer Topic: Industry 4.0 in Maritime Industry and its impact on Management of Marine and Coastal Resources: Case study of Indonesia State-Owned Enterprises in the shipbuilding sector.

10:35-11:00 Dr. Hansan Park, Co-Director of the Korea-Indonesia MTCRC (Marine Technology Cooperation Research Center) Topic: Indonesia Korea Partnership in Marine Research

11:00-11:20 Q&A session

11:20-11:45 Prof. Augy Syahailatua, IOC-UNESCO Indonesia Topic: Program NatCom IOC-UNESCO

11:45-12:10 Prof. Mohammad Heidarzadeh, University of Bath, England Title: Building tsunami resilience in East Indonesia

12:10-12:30 Q&A session

Monday, December 19 14:00 - 16:30 (Asia/Jakarta)

D1R1: Ocean Data Visualization and Information Management

Chair: Reni Sulistyowati

14:00 ***Optimal Convex Relaxation-Based Wavelet Covariance Transform for More Robust AOD-PM Characterization and Tracer Tracking of Biomass Burning over Land/Sea Boundary Regions***

Steve Chan, Ika Oktavianti and Parnmook Nopphawan

Satellite-Based (SB) Remote Sensing (R/S) column values, such as Aerosol Optical Depth (AOD), and surface values, such as Particulate Matter (PM), can be leveraged for better monitoring and tracking of the pattern of life for peatland fire-induced smoke, smog, and precipitation-generating cloud cover (a Potentially Toxic Triumvirate or PTT), which might initially move out over coastal waters, but subsequently return to coastal lands, peninsulas, as well as nearby islands with ensuing effects. In many cases, as noted by interviews with those involved with firefighting task forces, the tracking of the PTT stops at the border between land/sea. Traditionally, the amalgam of SB R/S and land surface values have been more readily available. However, the availability of Version 3 Maritime Aerosol Network (MAN) data and ship-based measurements of opportunity, such as via the Amazon procurable Microtops II Sunphotometer (MIIS), have made sea surface values more prevalent. Available Moderate Resolution Imaging Spectroradiometer (MODIS) and other SB R/S data can be combined with MIIS data for enhanced contextualization. Conjoined with the fact that aerosols from the peatland fires have been characterized, the Biomass Burning (BB) (e.g., peatland fire) tracer tracking of, among others, Levoglucosan (LG) in PM2.5 and PM1 presents an opportunity for both Post-fire Evaluation and Pre-fire Planning. Yet, a core challenge centers upon the issue that while SB R/S estimation of PM2.5 has become quite pervasive, the estimation of PM1 requires more care, such as by way of a more robust AOD-PM characterization. Contributory to this goal is AOD normalization, such as by considering Planet Boundary Layer Height (PBLH). Traditionally, this can be derived using a Wavelet Covariance Transform (WTC) (e.g., Haar) for boundary detection in the scattering ratio, and the main contribution of this paper is that of a more robust implementation of the WCT by way of an Optimal Convex Relaxation (OCR)-based approach. The ensuing enhanced AOD-PM characterization, improved AOD normalization, enhanced tracking, and more reliable contextualization might be of value-added proposition for better understanding the impact of peatland fires and improving Post-fire Evaluation and Pre-fire Planning.

14:20 *Indonesia National Oceanographic Data Center (InaNODC): Design, Function, Deployment and Maintenance*

Prabu Kresna Putra, Robby Arifandri, Muhammad Iqbal Habibie, Dionysius Bryan Sencaki, Hari Prayogi, Agustan Agustan, Lena Sumargana, Raden Muhammad Taufik Yuniantoro, Hari Priyadi and Marina Frederik

As a maritime country, Indonesia needs a reliable marine data management by improving its maritime data and information systems. The Indonesian National Oceanography Data Center (InaNODC) is a web-based system designed to archive, visualize, and share marine environmental and ecosystem data. Several prototypes of InaNODC have been successfully developed. Based on the evaluation results, InaNODC continues to be developed to be better and more perfect. Currently InaNODC has entered the final stage, namely the Deployment and Maintenance stage. This article focuses on providing a description of the current InaNODC along with its support system. InaNODC uses a microservice architecture, different from the previous version which still uses a monolithic architecture. The data standard referred to is the international marine data standard. Currently, various data are available with a data span of more than 100 years. Available marine data can be downloaded and analyzed directly, users can also share their marine data into the system. Prior to entering the deployment stage, InaNODC has been evaluated through several tests to ensure technology readiness and information security guarantees prior to launch. InaNODC has also developed various support systems to make it easier for users and administrators when using, managing and maintaining the system.

14:40 *Data Analysis and Visualization of INA-CBT Labuan Bajo System*

Amalia Irma Nurwidya, I Putu Ananta Yogiswara, I Made Astawa, Sakinah Puspa Anggraeni, Rifki Firdaus, Leli Lailatul Jannah, Lesti Setianingrum, Maratul Hamidah, Wayan Wira Yogantara, Edhi Purnomo, Michael Andreas Purwoadi, Sasono Rahardjo, Muhammad Yusha Firdaus and Tinova Pramudya

Indonesia Cable-Based Tsunameter (INA-CBT) has been successfully deployed and operating at Labuan Bajo of East Nusa Tenggara Province with one landing station (LS) and two ocean bottom units (OBUs). We present the data flow of the first time ever working CBT system in Indonesia, by dividing it into 4 major steps, i.e., data acquisition, data processing, data transmission, and data visualization. In data acquisition, bottom pressure recorder (BPR) and 3-axes accelerometer sensors acquire water level and ground shaking data to be sent to the LS. Data processing step adds a timestamp to each data and processes BPR data with a tsunami detection algorithm (TDA), while data transmission sends the data from LS to read down station (RDS). Lastly, RDS data are visualized in a web application. The data shows that the system can detect earthquake events with a time difference compared to that of Meteorological, Climatological, and Geophysical Agency (BMKG). Furthermore, the system can also predict the sea level 15 seconds in advance. However, as there is no tsunami occurs, the tsunami alert feature cannot be verified yet. At this moment, we are expecting to develop another much more suitable algorithm for the INA-CBT system in the future by utilizing all the data collected.

15:00 *Development of Real-Time Tsunami Early Warning System Dashboard Based on Tunami-F1 and Machine Learning in Sunda Arc, Indonesia*

Dhedy Husada Fadjar Perdana, Edwin Adi Wiguna, Amien Rusdiutomo, Ayu Novitasari Saputri, Mardi Wibowo and Wahyu Hendriyono

The majority of tsunamis in Indonesia are near-field tsunamis, therefore a quick tsunami early warning system is essential to minimize the risk. This study aimed to build a prototype of the dashboard for tsunami early warning systems that can provide tsunami prediction within the first five minutes. This prototype of the dashboard has the main function to predict the occurrence of tsunamis based on hydrodynamic modeling of wave propagation and tsunami artificial intelligence (AI) modeling which runs simultaneously when receiving earthquake data with tsunami potential. The AI model needs just a few seconds to predict tsunami heights and arrival times at affected locations, while the hydrodynamic wave propagation model needs a few minutes to complete the task. However, the results from the latter model are more accurate and complete, such as sea level elevation and the estimated time of arrival. The result of this study shows that the dashboard prototype can quickly and accurately display the results of tsunami predictions by combining the results of the two models. The results and other data are then compiled into a tsunami bulletin and distributed to competent authorities. This study is expected to be used as one of the considerations in developing a dashboard system for tsunami early warning by applying AI in addition to tsunami propagation modeling.

15:20 *An FFT-Based Method for Wave Decomposition from Wave and Tide Monitoring Using A01NYUB Sensor*

Sekar Adiningsih, Yuliah Nur Fadlilah, Rizki Taqwa Putranto, Syifa Agfanita, Salmaa Bayrus, Rossi Nur Iriani, Moses Wicaksono, Satrio Ikhtiarino, Siti Wulandari, Yustinus Adyaksa, Cendra Boskanita Petrova, Satria Ginanjar, Anindya Wirasatriya, Rikha Widiaratih, Denny Sugianto, Kunarso Kunarso and Raden Dwi Susanto

Monitoring Sea level to obtain tide and wave values using acoustic sensors has the potential to be influenced by other factors. This causes the measurement results to have noise that can affect the quality of the resulting monitoring data. This study aims to decompose the monitoring results of the

time series sea level data, to show the recorded wave variations. This study is located in Teluk Awur, Jepara, Indonesia. Sea level data was recorded for ten days using the ultrasonic sensor A01NYUB starting on November 4th, 2022 to November 13th, 2022. The results of the recording data from the A01NYUB sensor were decomposed using Fast Fourier Transform (FFT) and Continuous Wavelet Transform (CWT) based on the classification of the wave period. The results of the decomposition of sea level data from the sensor show that there are several classifications of waves with different periods. There are Ordinary Gravity Waves with a period of 15 s - 31 s and an amplitude of ~1 cm; with Infragravity Waves a period of 30 s - 5 m and an amplitude of ~8.5 cm; are Long Period Waves divided into several periods, namely period 5 m - 4 h with an amplitude of ~9.5 cm, a period of 5 m - 6 h with an amplitude of ~14 cm, a period of 15 s - 6 h with an amplitude of ~20 cm; Tide Waves with a period of 6 h - 12 h and amplitude of ~93 cm. The monitoring data also adjusted to the MSL datum. The waters of Jepara have tidal characteristics, namely tidal asymmetry. The tides in Teluk Awur are mixed tides prevailing semidiurnal. The ultrasonic sensor A01NYUB can record wave data with the lowest period which is Ordinary Gravity Waves and the highest period which is Ordinary Tide Waves.

D1R2: Underwater Acoustics Technology and Data Processing

Chair: Fiolenta Marpaung

14:00 *Performance of SCHT Sequences in Multicarrier Underwater Acoustic Communications System*

Zi-Chen Fan and Susanto Rahardja

In this paper, we apply complex spreading sequences to the underwater acoustic communications system. We derive the bit error rate (BER) expression of the multicarrier underwater acoustic communications system over Rayleigh fading channels. We compare the BER performance of the communications system with different spreading sequences including sequency-ordered complex Hadamard transform (SCHT) sequences, unified complex Hadamard transform (UCHT) sequences, and Walsh-Hadamard transform (WHT) sequences. The numerical BER simulation results show that the SCHT sequences surpass UCHT and WHT sequences in the asynchronous multicarrier underwater acoustic communications system over Rayleigh fading channels.

14:20 *Effects of Different Hydrophone Sensitivities on Underwater Signal Measurement in the Test Tank*

Laily Fajarwati, Hendra Adinanta, Yusron Feriadi, Endang Widjiati, Rahadian Rahadian, Chandra Permana, Arga Iman Malakani and Amilatin Rohmah

Underwater acoustic research nowadays is very much needed to achieve mastery of technology in underwater communication systems, which is at this stage there isn't much literature focus on tropical seawater such as in Indonesia. To achieve these key technologies, it is necessary to master these supporting technologies. Instrumentation in communication systems using underwater acoustics signals must be calibrated through the preparation stage before implemented in experiment done at the ocean. In this paper, underwater acoustics signals measurement results are compared two different hydrophones that have different sensitivities. The experiment was carried in the test tank of Hydrodynamic Laboratory of BRIN, in order to investigate the performances of underwater acoustic instrumentation. Based on the test, it was concluded that the hydrophone B, with sensitivity of -208dBV re 1µPa has a higher sensitivity than another hydrophone A, with sensitivity of -180dB re 1V/µPa. This is proven by the ripple in the received signal from the hydrophone A. With the frequency

variation in the transmitted sinusoidal signal, the hydrophone A has a negative correlation between the PSD and the change of the frequency with the value of 0,9947.

14:40 *Underwater Acoustic Noise Characterization in Sunda Straits Waters*

Rahadian Rahadian, Endang Widjiati, Gamantyo Hendrantoro, Dhany Arifianto and Iwan Wirawan

Communication using acoustic signals from underwater sensors to the surface is not always well received. Missing messages can occur for various reasons. Based on the oceanographic phenomenon, this can occur due to changes in the speed of sound propagation at different depths in the water, or due to underwater currents that cause signal attenuation or scattering. Judging from other natural phenomena, communication failures can be caused by noise that interferes the receiving system near the water surface. For this reason, in this study, underwater acoustic noise measurements will be carried out start a certain point in Indonesian waters. The result will determine the characteristics of noise near the water surface, which can affect underwater communication systems. The noise measured, will distinguish based on environmental conditions such as rain, wind and others that result in certain sea state conditions at sea level. The research was conducted using a surface buoy which has been installed with data recording devices from two hydrophones facing up and down. Measurements were carried out continuously for 6 days with data recording every 5 minutes interval. To determine the real time weather conditions at the research location, rainfall prediction data obtained from GSMaP (Global Satellite Mapping of Precipitation) satellite data were used. Hydrophone data analysis was carried out by applying the Fast Fourier Transform spectrum analysis method and correlated to the weather conditions at that time. The analysis is grouped into 3 parts, namely when the weather conditions are sunny, light and moderate rain.

15:00 *Efficient Image Transmission in UWA Channel*

Avik Kumar Das and Ankita Pramanik

In the quest for exploration of minerals and other resources, remote real time underwater water monitoring is gaining huge popularity. Remote monitoring of underwater expedition can be efficiently monitored from above the surface by transmission and reception of high quality images and videos. However such transmission or reception for underwater application, is extremely difficult as the communication has to be via highly lossy underwater acoustics (UWA) channel. The traditionally used orthogonal frequency-division multiplexing (OFDM) scheme for UWA communication is very lossy and the quality of the final received images or videos get highly degraded. The present work proposes a system based on 2D modulation scheme of orthogonal time frequency (OTFS) for image transmission through UWA channels. OTFS is designed by taking the best of time division multiplexing (TDM) and frequency division multiplexing (FDM) techniques. This work proves that combining OTFS waves and UWA waves, a high resolution image can be prepared for transmission. The proposed scheme can be easily extended to the cases of video transmission. In the proposed system, all the delay-Doppler diversity branches are combined in a coherent manner. The high resolution delay-Doppler separation enables OTFS to attain channel capacity with optimal performance-complexity. The proposed model gives robustness against Doppler effect and multipath channel conditions. The advantage of the proposed model over the traditionally used OFDM has been established by intensive simulation and are presented here.

15:20 *Underwater Acoustic Location Estimation of Flight Recorder Using Onboard Ad Hoc Wireless Sensor Network*

Thomas Wiepking and Tanir Ozcelebi

Underwater Wireless Sensor Networks (UWSN) are an upcoming technology for various underwater applications, such as environment monitoring and localization of objects. An important use case for underwater object localization is finding a flight recorder (black box) after an oceanic flight crash. Current technology for finding this black box uses hydrophone-equipped vessels or autonomous underwater vehicles (AUV). However, these methods arrive too late at the crash site complicating the search process. In this article, an alternative approach to locating the sinking black box is presented utilizing an UWSN onboard the aircraft. By registering acoustic ping signals of the underwater locator beacon (ULB) of the flight recorder, the nodes in the network collaboratively track the location of the sinking black box using a Time-Difference of Arrival (TDoA) approach. Underwater nodes are used to extend network coverage to deep- ocean levels and communicate their findings by utilizing wireless acoustic modems. Simulation results show that this approach enables locating the black box with an error less than 50 meters within 25 minutes after the first ping was sent by the ULB, outperforming current vessel- or AUV-based localization approaches in time and coverage.

Tuesday, December 20

Tuesday, December 20 9:00 - 11:25 (Asia/Jakarta)

D2P1: Management and Conservation for Sustainable Marine and Coastal Resources

Chair: Wibowo Harso Nugroho

09:05-09:30 Dr. Dinar Catur Istiyanto, Senior Researcher, Hydrodynamic Technology Research Center, National Research and Innovation Agency, Indonesia Topic: Management and Conservation for Sustainable Coastal Resources

09:30-09:55 Dr Kojiro Suzuki, Director of Coastal Hydraulic Engineering Department, Port and Airport Research Institute (PARI), Japan Topic: Large scale hydraulic experiments on mangrove forest in Japan

09:55-10:15 Q&A session

10:15-10:40 Prof I Ketut Aria P. Utama, Professor of Naval Architecture, Institut Teknologi Sepuluh Nopember (ITS), Indonesia Title: Biofouling, Ship Drag, and Energy Efficiency, Overall Review for Future Vessels

10:40-11:05 Patrick Hooijmans, MSc., Senior Project Manager Ships, Team Leader Transport and Shipping, Marin, the Netherlands Title: The future of shipping: an out-of-the-box view

11:05-11:25 Q&A session

Tuesday, December 20 14:00 - 16:30 (Asia/Jakarta)

D2R1: Coastal Infrastructures and Resources Management

Chair: Marina Frederik

14:00 *Preliminary Investigation of the Mooring Line Tension of the Quad-Spar Tidal Current Power Plant Prior to Operation*

Rudi Walujo Prastianto, Sony Junianto, Nu Arini, Mukhtasor Mukhtasor, Joke Pratilastiarso and Wahyu Fadilah

Floating tidal current power plant is used to capture energy that is close to the sea surface. This technology is supported by a floating structure and mooring system. In this paper, the floating structure used is a quad-spar type. Therefore, the preliminary analysis of the mooring system was carried out to hold the quad-spar in its potential location. The configuration of the mooring system analyzed is catenary type consisting of four types of wire ropes. Analysis of the line was carried out numerically using the theory of motion of the floating structure. This numerical modeling shows that the maximum tension of mooring line 2 is greater than that of mooring line 1 with a significant difference. In addition, the maximum tension of mooring line 4 is greater than that of mooring line 3. The loads given are wave load from the direction of the quartering seas and tidal current. The results of this analysis are used as a guideline for performing maintenance on quad-spar tidal current power plant technology when operating. The guide provides the maximum tolerable tension to withstand the generator during operation.

14:20 *Application of Multibeam Data for the Identification of a Possible Free Span on a Subsea Pipeline*

Yudo Haryadi, Muhamad Irfan, Djunaedi Muljawan and Sri Ardhyastuti

Free span on a submarine pipe is a pipe condition in one segment that is not attached to the surface of the seabed, that pipe is floating and not supported either by seabed sediment or by a structure. This condition can occur after some periods since the subsea pipeline installation activity is completed. The free span conditions can be seen from marine mapping surveys using underwater acoustic equipment, such as side scan sonar and multibeam echosounder. Both data can be used for the identification of the possibility of free span on subsea pipelines. Side scan sonar with its tow-fish can produce an image that shows clearly the free span condition of the pipeline because of its ability to get as close to the object as possible. This method is the best, but there is a risk of losing tow-fish due to being too close to the seabed which is easily exposed to seabed objects, both on the seabed and floating. Multibeam echosounder can produce a good image for early identification of free spans with low risk. Multibeam data has very accurate geometric values for calculating the length and height of the free span, as well as analyzing the potential for seabed depression or scouring in the vicinity. This study discusses the deepening of multibeam data to identify potential free spans in subsea pipelines.

14:40 *Two-Phase Modelling of Pipeline Scouring in OpenFOAM*

Novan Tofany and Arnida L Latifah

Scouring is a crucial concern for design, operational, and a submarine pipeline maintenance because it can lead to pipeline failure. This study presents a two-phase flow model developed in OpenFOAM for simulating early stages of scour induced by current. The model couples the dynamics of fluid and sediment phases based on the Reynolds-Averaged Navier Stokes (RANS) equations combined with a two-phase k − ε model and rheology-based constitutive models to compute fluid and sediment stresses, respectively. The model validation against experimental data show favorable results for the flow and bed profile around the pipeline. The detailed fluid-particle interactions around the pipe are

examined to understand the driving mechanisms of scour, which can be beneficial for deciding countermeasure methods of the scouring in the early stages.

D2R2: Ocean Platforms and Floating Structures Engineering Technology

Chair: Endang Widjiati

14:00 *Precise Vessels Positioning in a Coastal Zone*

Igor Borisovich Shirokov

The design and the operation of the system for vessel positioning control in a coastal zone is considered in the paper. The system is oriented on unmanned vessels primary, and the vessel positioning and moving are implemented automatically. For vessel positioning the phase method for distance determination is used, what ensures the highest accuracy among entire family of radio engineering systems. The homodyne signal conversion is used for main information parameter obtaining. Such an approach ensures the simplest system design at the saving of high metrological features.

14:20 *Designing AIS Link Based on Software Defined Radio for LEO Satellites*

Habib Idmouida

The Automatic Identification System (AIS) was developed by the International Maritime Organisation (IMO) in order to improve the safety of navigation. However, AIS devices allow identification of vessels in the vicinity within a limited range (15-20 nautical miles). Therefore, a space-based AIS system is used nowadays as a relay to shore stations with a higher range of detection. In this paper, an AIS radio link design based on software defined radio between vessels in Moroccan territorial sea and a specific ground station in Rabat is proposed. The AIS data is received by satellite via a highly integrated software defined radio (SDR) over very high frequency (VHF) channels and downloaded to the ground station via an S-band transceiver as a data communication subsystem. This paper focuses on the preliminary process of designing an optimum link for the space-based AIS system.

14:40 *Finite Element Analysis for Structural Strength of High-Density Polyethylene Material on Midship Boat Structure*

Dony Setyawan, Aries Sulisetyono, Wasis Dwi Aryawan and Rizky Chandra Ariesta

FRP is mostly used for small boats in Indonesia, however its use has been forbidden since 2000 due to the presence of non-biodegradable elements that could affect the environment. It is crucial to the shipbuilding industry's problem-solving efforts that suitable materials with the same strength and environmental friendliness be located. This work proposed the design of a boat structure built of HDPE material and analyzed the strength of the midship structure using the finite element method. Therefore, testing the HDPE material was necessary to validate the data on the material's properties utilized as input for the numerical analysis. The examination findings illustrated the durability of the HDPE boat structure used for the platform of a small boat.