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INFORMATION DOCUMENT

THE SECOND INTERNATIONAL INDIAN OCEAN EXPEDITION (IIOE-2)
– UPDATE ON ACTIVITIES, 2017

SUMMARY

The Second International Indian Ocean Expedition (IIOE-2) was launched under the joint leadership of UNESCO IOC, the Indian Ocean Global Ocean Observing System Regional Alliance and the Scientific Committee on Oceanic Research on 4 December 2015. Since then the underpinning governance structure for the 5 year program (2015-2020) has been established (as the IIOE-2 Steering Committee) and many research activities have commenced, with a growing number of future activities also under development.

This information document presents a summary of the activities carried out by the IIOE-2 Steering Committee and Member States since the 49th Session of the IOC Executive Council (June 2016) up to May 2017.

This document supports the oral presentation of the Executive Secretary at the IOC Assembly's 29th Session (Paris, 21-29 June, 2017).

The IIOE-2 website is the recommended source of more detailed complementary information to this Information Document: www.iioe-2.incois.gov.in. The Document also complements presentation materials prepared for the IIOE-2 Side Event of 21 June 2017, at the 29th Session of the IOC Assembly.

Background

The Second International Indian Ocean Expedition (IIOE-2) was launched in Goa, India on 4 December 2015. IIOE-2 is a major program under the auspices of the UNESCO Intergovernmental Oceanographic Commission (IOC), the Indian Ocean Global Ocean Observing System (IOGOOS) Regional Alliance and the Scientific Committee on Oceanic Research (SCOR). Over the 5 year period (2015-2020) a large number of IIOE-2 related research activities will collect new data and implement knowledge transfer activities (aligned with the IOC's Capacity Development objectives) underpinned by process studies on a range of physical, biogeochemical, biological, socio-economic and coupled climate characteristics of the Indian Ocean, spanning the open sea to coastal domains. The research and observations supported through IIOE-2 will result in an improved understanding of the ocean's physical and biological oceanography and related air-ocean climate interactions (both over short timescales and in the long-term). Enhancement of the Indian Ocean Observing System (IndOOS) is a primary objective.

The launch of IIOE-2 represented the culmination of over 4 years of international planning including the development of an IIOE-2 Science Plan under SCOR's auspices (Hood et al, 2015) and an IIOE-2 Implementation Strategy under auspices of the UNESCO IOC IIOE-2 Interim Planning Committee (2015).

The new information derived from research activities under IIOE-2 is fundamental for future sustainable development and expansion of the Indian Ocean's blue economy and of direct relevance to improved decision making in areas such as maritime services and safety, environmental management, climate monitoring and prediction, food and energy security. The program also contributes directly to UN Sustainable Development Goal 14 by building a legacy of improved understanding of the fundamental bio-physical characteristics of the Indian Ocean for translation into concrete policy decisions, operational oceanography applications and the promotion of environmental stewardship. IIOE-2 also has a strong capacity building focus in ocean science and will seek to train emerging scientists and decision makers of the next generation of ocean scientists from the region, helping to ensure that its legacy will live on for decades to come.

IIOE-2 Governance

Coincident with the launch year of IIOE-2 in 2015, India and Australia have fully established and host the two Nodes of the Joint Project Office (JPO) for IIOE-2. The Indian Node is at the Indian National Centre for Ocean Information Services, Hyderabad. The Australian Node is at the UNESCO IOC Perth Programme Office in Western Australia, also incorporating the function of IOC IIOE-2 Coordinator. The IIOE-2 Steering Committee has been fully established under the auspices of the IIOE-2 Co-Chairs (deriving from IOC, SCOR and IOGOOS) with support from the IIOE-2 Joint Project Office (JPO). Its membership is characterized by a range of entry points for Member States in order to facilitate the realization of the fundamental and applied science and related capacity development imperatives of IIOE-2. The Steering Committee met in full for the first time during 2-4 February 2017 in Perth, Western Australia, under co-hosting from the Australian IIOE-2 JPO Node and University of Western Australia and with the generous support of the Indian JPO Node and Australian and international sponsors. The first meeting was arranged to occur in an integrated fashion with * IOGOOS (13th annual meeting), IORP of IOC-GOOS/CLIVAR (13th annual meeting), SIBER of IOGOOS/IMBER (7th annual Meeting), IndOOS Resources Forum, (7th annual meeting) and the Australia-India Strategic Research Fund's Bio-Argo project alliance.

**IOGOOS = Indian Ocean Global Ocean Observing System (a 'GOOS' Regional Alliance); IORP = Indian Ocean Regional Panel of IOC-GOOS and Climate and Variability (CLIVAR) of the World Climate Research Programme (WCRP); SIBER = Indian Ocean Sustained Biogeochemistry and Ecosystem Research of IOGOOS and Integrated Marine Biogeochemistry and Ecosystem Research (IMBER); IndOOS = the Indian Ocean Observing System.*

The Steering Committee is currently structured as follows (diagram taken from the IIOE-2 Implementation Strategy).

	Co-Chairs (IOGOOS, SCOR, UNESCO IOC)	
core group	<p style="text-align: center;">Strategic Executive Level</p> <p style="text-align: center;">One representative (leader) per each of the six science themes from the SCOR SPDC IIOE-2 Science Plan</p> <p style="text-align: center;">+</p> <p style="text-align: center;">One representative (leader) per each of the seven operational divisions to be established as IIOE-2 Working Groups</p> <p style="text-align: center;">+</p> <p style="text-align: center;">One representative per each major IOC regional body/committee (e.g. IOC AFRICA, IOCINDIO, IOC WESTPAC)</p>	Joint Project Office (JPO)
stakeholder group	<p style="text-align: center;">Regional Coordination Level</p> <p style="text-align: center;">One representative per each IIOE-2 ‘national committee’</p>	Leading personnel represented on Steering Committee as ex-officio
	<p style="text-align: center;">Science Delivery Level</p> <p style="text-align: center;">One representative (i.e. Principal Investigator) per each ‘major’ IIOE-2 scientific research initiative, including a representative of the Early Career Scientists Network from the Capacity Development Working Group</p>	

The IIOE-2 Steering Committee structure

Main groupings within SC: As shown, the SC comprises a ‘**core group**’, being the Strategic Executive Level (the ‘Executive’) and a broader more operationally orientated ‘**stakeholder group**’ including the respective Regional Coordination and Science Delivery levels

The Steering Committee has now been fully established, including the leadership and membership of the six Science Theme teams and seven Working Group teams that support the IIOE-2. These 13 entities are led by chairs who are also members of the ‘Strategic Executive Level’ of the Steering Committee, alongside members representing IOC WESTPAC, IOC AFRICA, IOCINDIO, the two respective JPO Nodes and the three over-arching Steering Committee Co-Chairs deriving respectively from IOC, SCOR and IOGOOS. The chairs and their team members came from a nominee pool of over 60, and that derived from 15 IOC Member States. The Steering Committee’s ‘Regional Coordination Level’, which provides places for representatives of IIOE-2 National Committees is growing in membership and, as at 3 May 2017 IIOE-2 National Committees had formed for Australia, France, Germany, Indonesia, UK, USA and South Africa . Furthermore, the Steering Committee’s ‘Science Delivery Level’, which provides membership places for representative leaders of endorsed IIOE-2 research projects/cruises, now numbers at around 20. The leader of the IIOE-2’s Early Career Scientists Network is also on the Steering Committee.

The IIOE-2 website (www.iioe-2.incois.gov.in) hosted at the India JPO Node provides the seminal reference point, with full information and associated details on the above governance structure.

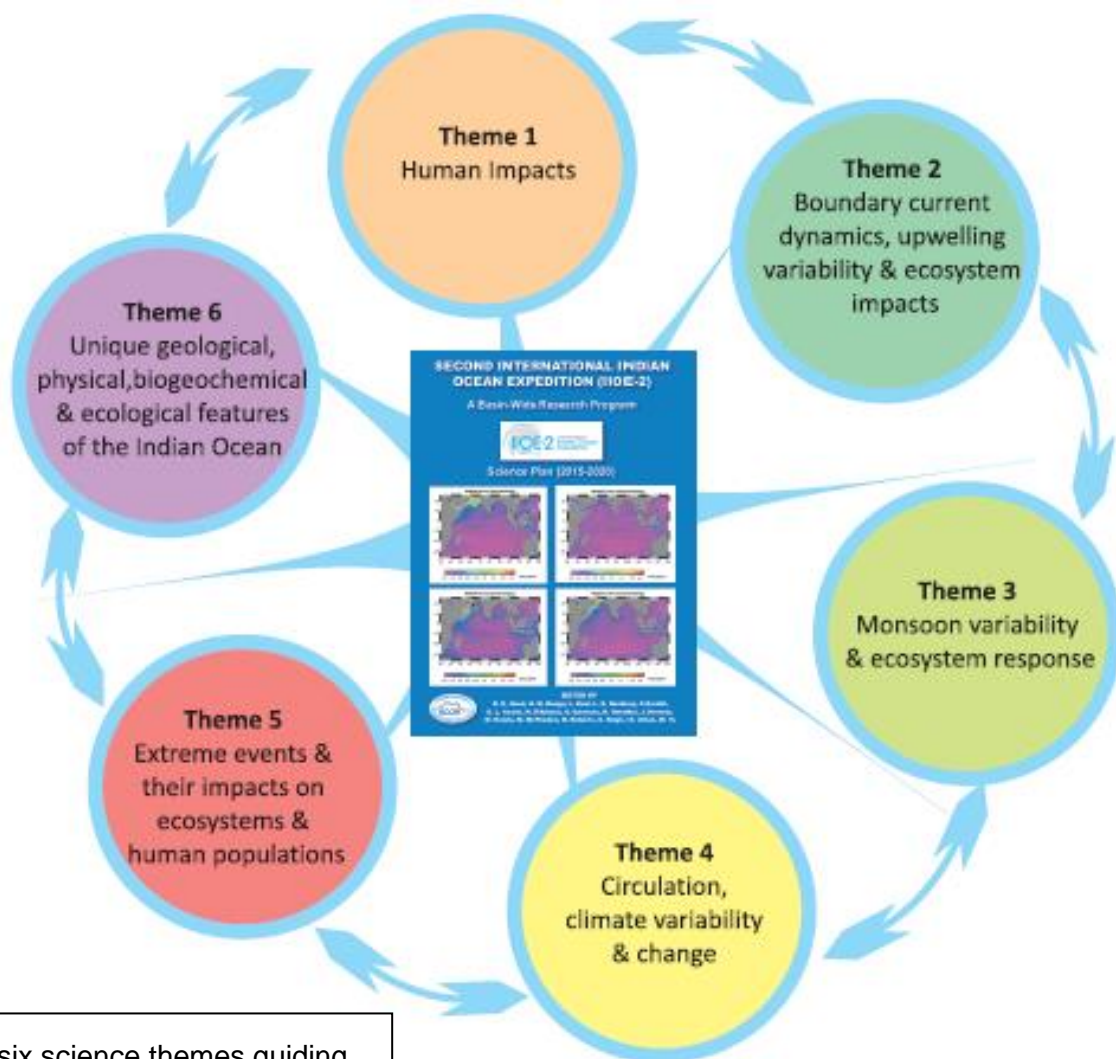
The IIOE-2 Regional Coordination Unit for Data and Information Management has been established at the Indian IIOE-2 JPO Node, as was the IIOE-2 ‘metadata portal’ and the coordination and production of the IIOE-2 newsletter *Indian Ocean Bubble – 2*.

IODE has been actively engaged at strategic and tactical levels to help address the needs of Data and Information Management for IIOE-2, with the most recent interaction having occurred through the IODE 24th Session, Malaysia, March 2017.

The IIOE-2 has also been represented institutionally and scientifically at many forums, including IOC related meetings and conferences (eg IOC Executive Council, IOC WESTPAC, IOC AFRICA, IOCINDIO), national and international scientific symposia and high level institutional/governmental alliances including, for example, the Indian Ocean Rim Association. At the UN level, IIOE-2 was profiled in a side event at the June 2017 Ocean Conference, New York.

IIOE-2 Science

The oceanic and related climatic research that is to be driven through the IIOE-2 Science Plan focusses on six over-arching themes, as shown in the figure below: human impacts/benefits; boundary current dynamics, upwelling variability and ecosystem impacts; monsoon variability and ecosystem response; circulation, climate variability and change; extreme events and their impacts on ecosystems and human populations; and unique geological, physical, biogeochemical and ecological features of the Indian Ocean.



The six science themes guiding IIOE-2 research

The resulting science pursuits of IIOE-2 stakeholders focus on issues such as predictability of the Indian Ocean’s key oceanic and coupled atmospheric phenomena, which themselves link to extremes that can have profound impacts on humans, including monsoonal effects, waves, storms, precipitation/flooding, droughts, heat waves, etc. In this context, the Indian Ocean Dipole, the Madden Julian Oscillation and coupling between sea surface features and cyclone genesis remain as exemplars of some of the basin wide features being examined under IIOE-2. The role of the Indian

Ocean in Earth cycles (oceanographic and coupled atmospheric) is also being actively considered by science stakeholders in IIOE-2, including for example the flow of energy and mass from the Pacific through the Indian Ocean and into the Atlantic and Southern oceans.

The number of major research initiatives, bringing together stakeholders from multiple countries, continues to evolve in a positive collegial fashion. These involve some of the formative early topics of the Eastern Indian Ocean Upwelling Research Initiative (EIOURI) and Western counterpart (WIOURI) and consolidations of research projects aligned with IIOE-2 through science alliances such as IORP and SIBER under IOGOOS, IOC-GOOS, CLIVAR and IMBER. As shown in the table below, there are now 20 endorsed research projects (including cruises, coded as EP) and activities (coded as EA) under the IIOE-2, with more known to be committed or likely under the auspices of a growing number of national commitments (see www.iioe-2.incois.gov.in).

Month & Year of Endorsement	Endorsement Number	Projects	Principal Investigator (PI)	Country
May 2017	IIOE2-EP19	<u>GO-SHIP OBSERVATION OF SECTIONS I8N AND I7S BY R/V MIRAI</u>	Katsuro Katsumata (Japan)	Japan
May, 2017	IIOE2-EP18	<u>IMPACT OF CLIMATE VARIABILITY ON THE INDIAN OCEAN: ROLE OF GELATINOUS ZOOPLANKTON STRUCTURING FOOD WEB STRUCTURE AND COMMUNITY ASSEMBLAGES</u>	Bijoy Nandan Sivasankaran (India)	India
May, 2017	IIOE2-EP17	<u>REAL-TIME METEOROLOGICAL AND OCEANOGRAPHIC DATA COLLECTION USING MOORED BUOY NETWORK IN INDIAN SEAS (OON-INDIA)</u>	R. Venkatesan (India)	India
March, 2017	IIOE2-EP16	<u>BIOGEOCHEMISTRY OF TRACE ELEMENTS AND ISOTOPES IN THE INDIAN OCEAN (GEOTRACES-INDIA)</u>	Sunil K. Singh, India	India
March, 2017	IIOE2-EP15	<u>EQUATORIAL CURRENTS AND UNDERCURRENT IN THE INDIAN OCEAN</u>	Victor Neiman, Russia	Russia
March, 2017	IIOE2-EP14	<u>GEOLOGY AND GEOPHYSICS OF THE EASTERN INDIAN OCEAN (GEODYNAMICS, TECTONICS AND EVOLUTION OF UNIQUE INTRAPLATE FEATURES)</u>	Oleg Levchenko, Russia	Russia
February, 2017	IIOE2-EP13	<u>EASTERN INDIAN OCEAN UPWELLING RESEARCH INITIATIVE (EIOURI)</u>	Weidong Yu, China	Multinational
February, 2017	IIOE2-EP12	<u>DUST STIMULATED NITROGEN FIXATION IN THE ARABIAN SEA- AN ASSESSMENT OF HNLC REGION HYPOTHESIS (DUSTNIF)</u>	Arvind Singh, India	India
January, 2017	IIOE2-EP11	<u>INTERNATIONAL BUOY</u>	Shaun Dolk,	Multinational

Month & Year of Endorsement	Endorsement Number	Projects	Principal Investigator (PI)	Country
		<u>PROGRAMME FOR THE INDIAN OCEAN (IBPIO)</u>	USA	
December, 2016	IIOE2-EP10	<u>UNDERSTANDING THE UPWELLING SYSTEM AND OXYGEN MINIMUM ZONE PROCESSES IN THE NORTHERN INDIAN OCEAN: PAST, PRESENT AND FUTURE</u>	Hermann Bange, Germany	Germany
November, 2016	IIOE2-EP09	<u>BIOGEOCHEMICAL CYCLING AND HYPOXIA IN THE BAY OF BENGAL COASTAL ZONE; THE ROLE OF SEDIMENT DISCHARGE (HYBOB)</u>	Greg Cowie, UK	UK-USA
October, 2016	IIOE2-EP08	<u>THE CHALLENGER OCEAN GLIDER MISSION: INDIAN OCEAN</u>	Charitha Pattiaratchi, Australia	Australia-USA
October, 2016	IIOE2-EP07	<u>BIOGEOCHEMISTRY-ATMOSPHERE PROCESSES IN THE BAY OF BENGAL: A CONTRIBUTION TO IIOE-2 (BIOCAT-IIOE2)</u>	Hermann Bange, Germany	Germany
September, 2016	IIOE2-EP06	<u>A COUPLED BIO-PHYSICAL, ECOSYSTEM-SCALE, EXAMINATION OF AUSTRALIA'S INTERNATIONAL INDIAN OCEAN EXPEDITION 110°E LINE</u>	Lynnath Beckley, Australia	Australia-USA
September, 2016	IIOE2-EP05	<u>PELAGIC ECOSYSTEM PROCESSES, NITROGEN SOURCES AND SOUTHERN BLUEFIN TUNA LARVAL ECOLOGY IN THE INDO-AUSTRALIAN BASIN</u>	Lynnath Beckley, Australia	Australia-USA
August, 2016	IIOE2-EP04	<u>WESTERN INDIAN OCEAN UPWELLING RESEARCH INITIATIVE (WIOURI)</u>	Michael Roberts, UK-South Africa	Multinational
February, 2016	IIOE2-EP03	<u>RESEARCH MOORED ARRAY FOR AFRICAN-ASIAN-AUSTRALIAN MONSOON ANALYSIS AND PREDICTION (RAMA)</u>	Ravichandran, India	India-USA
January, 2016	IIOE2-EP02	<u>AIR-SEA INTERACTIONS IN THE NORTHERN INDIAN OCEAN: REGIONAL INITIATIVE (ASIRI)</u>	Ravichandran, India	India-USA
December, 2015	IIOE2-EP01	<u>FIRST SCIENTIFIC CRUISE UNDER IIOE-2</u>	Vinayachandran, India	Multinational
March, 2016	IIOE2-EA01	<u>THE SOCIO-ECONOMIC BENEFITS OF THE SECOND INTERNATIONAL INDIAN OCEAN</u>	Rashid Sumaila, Canada	Canada

Month & Year of Endorsement	Endorsement Number	Projects	Principal Investigator (PI)	Country
		<u>EXPEDITION: A STUDY PROPOSAL</u>		

IIOE-2 is contributing to GOOS by continuing the pursuit of completing the Indian Ocean Observing System (IndOOS) as originally planned through the IORP of IOC-GOOS/CLIVAR and as will now be further enhanced under the IIOE-2 science framework. In this regard, it is also contextual to note that the IORP has undertaken to coordinate a review (during 2017/18) of IndOOS, complementary to the recent review that was undertaken for the Tropical Ocean Observing System (TPOS).

Another major focus of the IIOE-2 continues to be the transfer of knowledge and Capacity Development (CD), as expressed in the IIOE-2 Implementation Strategy (IPC, 2015). This is an explicit focus of the IIOE-2 Capacity Development Working Group, which includes an emphasis on aspiring and emerging young stakeholders through an IIOE-2 Early Career Scientists Network (ECSN). In the CD context, important collaboration also continued with the IODE component of the IOC Capacity Development programme, both through the related IOC Oostende Office and IODE stakeholders. As previously highlighted, the early cruises of the IIOE-2 implemented from the very inception of the IIOE-2 provided explicit opportunities for people, including from developing countries, to participate in tangible ways onboard and in the science of IIOE-2 research cruises. Much more needs to be done in this regard and so the objective continues to be strongly encouraged and facilitated by the Steering Committee through its oversight and assessment of IIOE-2 research initiatives (including those with cruises) The ECSN is active and the engagement in IIOE-2 of IOCINDIO, IOCAFRICA and WESTPAC continues to emphasize and facilitate the transfer of knowledge and capacity throughout their respective constituencies.

Some of the key challenges facing the IIOE-2 network center on impediments to ‘working together’ and ‘sharing data’ in sovereign (EEZ) zones, and of course resourcing of good relevant scientific project ideas. The issue of sustaining observations in the Indian Ocean (including under the IndOOS framework) remains a critical one, as it does generically for GOOS world-wide. A lack of sufficient underpinning seed funding to help those from scientifically and economically less advanced countries engage in and take advantage of the opportunities that abound to integrate within IIOE-2 research initiatives (including cruises) remains an impediment. Finally, a challenge remains in maintaining support beyond current tenures of sponsorship for the Joint Project Office Nodes in order to enable them to continue to play a facilitating and supporting role for not only the Steering Committee and its many elements, but also for the full IIOE-2 constituency at operational and strategic levels. Member States are urged to consider these issues and respond to the best of their capacities to resolve them, for the mutual benefits that can be unlocked via IIOE-2 for the IOC constituency as an integrated whole.

In terms of ensuring IIOE-2 continues to provide the most effective and optimal benefit to its broad constituency, the Steering Committee continues to be self-reaffirmed of the need for regular communications, with those being as much as is possible of the direct face to face nature. This remains as a necessary complement to the ever-growing modes of e-communications. This applies internally within the Steering Committee and also externally in regards to engagement with science applicators and beneficiaries of the science (i.e. the end users). It also applies to the objective of facilitating maximal engagement of those less able to travel ‘to’ relevant forums when those forums are not in their own regions or localities. This also concerns those who have the time and interest and approval to engage in research initiatives outside of their own localities, but that do not have the material travel and incidental support to present themselves at ports of embarkations of cruises, science planning meetings, secondments etc. Underpinning sponsorship for funding to enable these objectives to be realized is a critically important perennial requirement.