

The 50th Anniversary of the International Indian Ocean Expedition

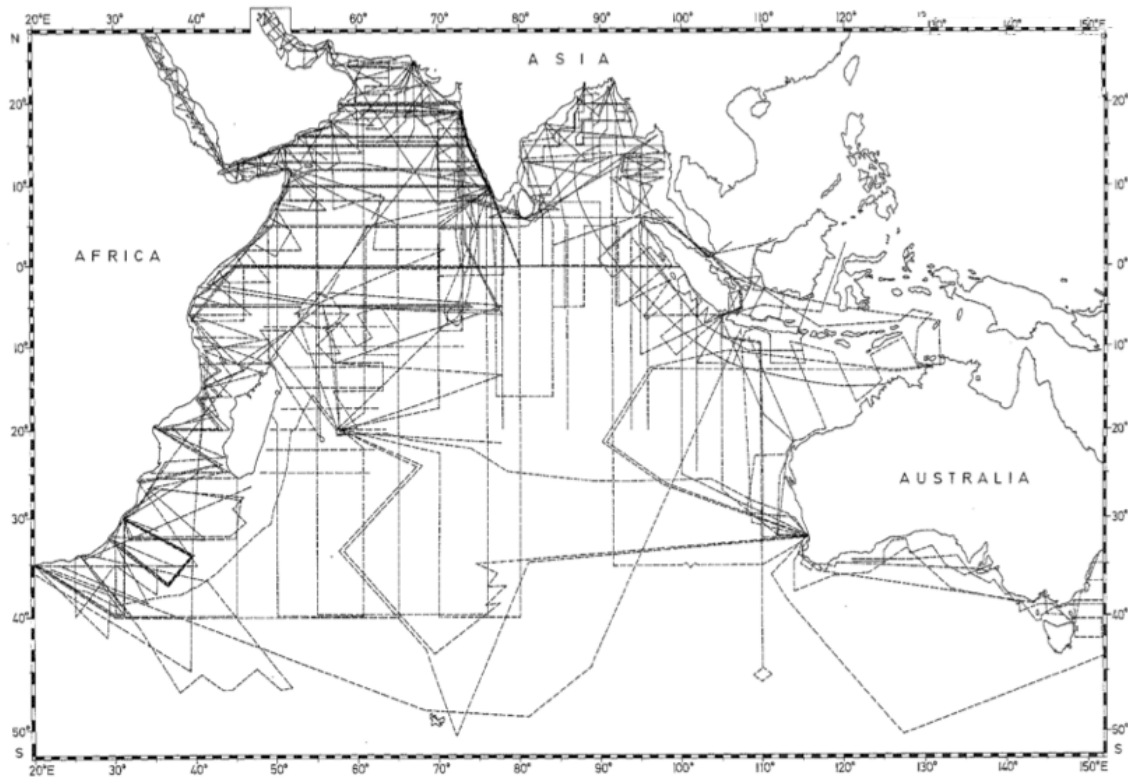
A Prospectus and Charge for an Organizing Committee

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The International Indian Ocean Expedition (IIOE) was one of the greatest international, interdisciplinary oceanographic research efforts of all time. It began in 1962 and was carried out over several years, with forty-six research vessels participating under fourteen different flags. The IIOE motivated an unprecedented number of hydrographic surveys (and repeat surveys) over the course of the expedition covering the entire Indian Ocean basin (Fig. 1). Although sampling was focused primarily on physical measurements, it was an interdisciplinary endeavor that embraced chemical oceanography, meteorology, marine biology, marine geology and geophysics. Many more countries than just the fourteen or so that ran cruises in IIOE were engaged in formative meetings and/or sample analysis.



Cruise tracks of research vessels during the International Indian Ocean Expedition. Based on information from the Office of Oceanography, UNESCO Paris

The IIOE emerged from a remarkable cascade of events. These included the International Geophysical Year of 1957-1958, which had shown the value of coordinated multinational efforts in ocean science, and the formation of Scientific Committee on Ocean Research (SCOR) dedicated to stimulating international cooperation in ocean sciences. At its first meeting in 1957 SCOR identified the Indian Ocean as the greatest unknown in the global ocean and envisioned exploration of the Indian Ocean as its first task. After years of dedicated planning and effort the IIOE emerged. It became the first project of the Intergovernmental Oceanographic Commission in 1962. It proved to be a remarkable success, providing much of the scientific foundation for our modern understanding of the Indian Ocean. Among its many legacies, the IIOE led to the establishment of India's National Institute of Oceanography (NIO) in Goa, which marked the beginning of the development of India's considerable modern day oceanographic research capacity.

In the 50 years since the IIOE two fundamental changes have taken place in ocean science. The first is the emergence of new components of the ocean observing system, most notably remote sensing and Argo floats. The second one is the emergence of ocean modeling in all its facets from short-term forecasting to seasonal prediction to climate projections. Both of these developments have revolutionized our understanding of the global oceans, including the Indian Ocean. Compared to the IIOE we now have the capacity to provide a much more integrated picture of the Indian Ocean, especially if these new technologies can be combined with targeted and well-coordinated in situ measurements.

The time frame of 2012-2015 marks the 50th Anniversary of the IIOE and the 50th Anniversary of NIO. Coincidentally, this window also marks the 10-year anniversaries of the respective establishments of the Indian Ocean GOOS (IOGOOS) Regional Alliance and the GOOS/CLIVAR Indian Ocean Panel (IOP), and the mid-term of the 10-year Sustained Indian Ocean Biogeochemistry and Ecosystem Research (SIBER) program (under IOGOOS and IMBER). It will also mark the 5-year anniversary of the establishment of the Indian Ocean Observing System Resources Forum (IRF) under IOGOOS, which engages the leadership of operational divisions of some of the world's most significant institutions involved in ocean observations in the Indian Ocean. These four dedicated Indian Ocean programs for research planning and support have developed a remarkable degree of international and interdisciplinary synergy for fundamental and applied coupled ocean-climate research through CLIVAR, IMBER and GOOS. Interestingly, SIBER was established partly due to the modern-day recognition that the Indian Ocean remains under-sampled, particularly in terms of biogeochemical and ecological observations, and is an area that would singularly benefit from sustained ocean observations under a framework that marries physical (e.g., through IOP) and biogeochemical (e.g., through SIBER) research. In addition, several major research programs in the Indian Ocean are on-going (e.g., the GEOTRACES Program and WOCE repeat survey lines), are being initiated (e.g., Japan's Mirai Bay of Bengal Beam Cruise and others) or are in the planning stages (e.g., the IOP/SIBER/IOGOOS Eastern Equatorial Upwelling Initiative, see task 5 below) during the 2012-2015 time frame and beyond. Thus, it appears that 50 years later a cascade and alignment of events are once again conspiring to motivate multidisciplinary exploration of the Indian Ocean.

We propose to form a sub-committee (calling it the IIOE-2 Reference Group or IIOE-2 RG for short) to undertake the task of energizing and harnessing a collaborative community and motivating and organizing necessary workshops, meetings and scientific research in celebration of the 50th Anniversary of the IIOE. We envision that this committee will be composed of at least the chairs of the IOP, SIBER and IOGOOS programs, and also include

key representatives from Indian Ocean rim countries and international programs such as the IRF, SCOR, UNESCO IOC, JCOMM, POGO, and IAPSO. Relevant broader membership is to be encouraged.

A presentation of these ideas (i.e., to motivate IIOE-2 activities and form a Reference Group) to the recent meetings of IOGOOS, IOP, SIBER and IRF in Cape Town, South Africa (October 2012) was met with great interest from this IO community. It was agreed that IOGOOS should champion the IIOE-2 concept on behalf of its broad regional and international constituency. IOGOOS was enthusiastic to take a lead role in catalyzing its constituency to support and engage in the prospective IIOE-2 initiative. It sought the support of SIBER (through its Co-Chair, Dr. Raleigh Hood) and the IOC (through Dr. Nick D'Adamo of its regional programme support office in Perth, Australia) to coordinate the development of a prospectus for an IIOE-2.

The IIOE-2 RG will be specifically tasked to undertake the following:

- 1) Review the IIOE history, scientific motivation and outcomes with a view toward identifying scientific questions that are still unanswered that should be pursued as part of the 50th Anniversary effort.
- 2) Review the scientific results of later major programs in the region such as WOCE and research supported by sustained observation under GOOS.
- 3) Identify new, compelling scientific questions that have emerged since the IIOE that could be addressed by research expeditions and sustained observation as part of a 50th Anniversary IIOE-2.
- 4) Assess ongoing and planned research activities in the Indian Ocean in the 2015 to 2020 time frame, with the goal of embracing and helping to organize these activities as part of a larger coordinated 50th Anniversary research initiative.
- 5) Motivate and coordinate IIOE repeat line work that can help address the scientific questions identified under tasks 1 to 3 (note that at least one ship time request proposal to do repeat line work in the eastern IO has already been submitted in Australia).
- 6) Help organize and define (through the formation of a sub-committee and workshop activities) a science plan and implementation strategy, and also an international participant list, for a new international, interdisciplinary research program in the Indian Ocean. (It has been suggested that this initiative might focus on upwelling in the eastern equatorial region. However, the focus and spatial scope of this initiative remains to be precisely defined.)
- 7) Motivate the organization of a 50th Anniversary Open Science Conference celebrating the 50th Anniversary of the IIOE and India's NIO, the 10-year anniversary of the establishment of the IOGOOS and IOP programs, the mid-term of the SIBER program and the 5 year anniversary of the IRF program in support of the Indian Ocean Observing System. This particular event would also signal and promote the initiation of the IIOE-2.

We envision this IIOE-2 as a 5-year expedition and effort beginning in approximately 2015 with an Open Science Conference and continuing through to 2020, culminating with a second Open Science Conference. This second conference would be convened in the same

spirit as the conference that was convened at the end of the IIOE, which was aimed at building research capacity in India and led to the establishment of the NIO.

An important challenge for the IIOE-2 RG will be to identify key gaps in our understanding of the Indian Ocean, which will be crucial for justifying ship time for research expeditions and repeat lines in times of tight budgets and economic constraints. One key rationale for IIOE-2 might be to observe the Indian Ocean where neither satellites nor Argo provide data, e.g., in the deep ocean and to some extent along the boundary currents. It should also be emphasized that the IIOE-2 is not intended to redirect funding away from existing programs and long-term measurement campaigns. Rather, the goal will be to integrate, leverage and augment these as part of an expedition that is focused on the Indian Ocean.

A tentative time frame has been set for convening the first meeting of the IIOE-2 Reference Group, i.e., in mid- to late-March of 2013. It will require that RG members, as much as is possible, support their own participation, however potential funding to support engagement has been identified.

We propose to convene this meeting at a central location to facilitate convergence of members at minimal cost. One option might be the United Nations Conference Center in Bangkok, Thailand. Locations in India are also under consideration.