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INFORMATION DOCUMENT

**WMO-IOC-ICSU WORLD CLIMATE RESEARCH PROGRAMME (WCRP):
YEAR 2012 REPORT**

Summary. This report provides a brief update on main ocean-related WCRP activities since the time of IOC 26th Assembly in 2011 (IOC/INF-1285).



WCRP organized the very successful Open Science Conference entitled “Climate Research in Service to Society” that was held in Denver, USA, in October 2011 and attracted over 1900 scientists and stakeholders, many of them oceanographers, from 86 countries. An important message from speakers at the conference was the need for actionable science. The WCRP oversight body, the Joint Scientific Committee, met briefly just after the conference and identified the following scientific and programmatic priorities to be addressed in order for WCRP to meet this requirement in the next decade: (1) prediction of the Earth System bridging the physical climate system with biogeochemistry, the social sciences, and human dimensions; (2) making use of the opportunity, provided by new satellite observations, to make a quantum leap in understanding of clouds and aerosols and their contributions to climate sensitivity; (3) skilful climate information on regional scales, embodying the so-called “seamless prediction” paradigm; (4) quantifying uncertainty in climate predictions; (5) predicting how natural modes of climate variability will modify the “forced” anthropogenic component of climate change over the coming years to decades; (6) determining the predictability of polar climate, especially given the potential opening of the Arctic and international negotiations regarding increased commercial traffic for shipping and extraction of natural resources; (7) understanding the causes of extreme events, and enabling attribution studies in near real-time; (8) improve predictions and assessments of future sea-level variability and change on regional scales, which will require knowledge of not only cryospheric and thermosteric contributions but also how gyre circulations, storm tracks, and tidal amplitudes will change; and (9) training and empowering the next generation of climate scientists from all regions of the world.

Capacity building is high priority for WCRP; recently WCRP sponsored a meeting in Jakarta aimed at developing an effective monitoring programme for the Indonesian Throughflow that brought together scientists from around the world with Indonesian oceanographers from a half dozen different concerned institutions to develop a joint plan to monitor and improve our understanding of this critical link between the Pacific and Indian Oceans. WCRP CLIVAR’s American Monsoons project regularly organizes training workshops on different aspects of climate, including the role of ocean observations in climate research. WCRP is sponsoring a series of workshops in regions around the world to train scientists and practitioners in the use of regional climate model outputs under the auspices of its CORDEX project (see further discussion below).

Ocean observations continue to be an important focus of WCRP projects. New measuring techniques such as gliders and integrated physical and biogeochemical sensors are continuously being tested and refined in WCRP international field programmes. For instance, the New Guinea Coastal Undercurrent and its variation has been a major gap in ENSO diagnosis and the link between extra-tropics and tropics. CLIVAR is now addressing this gap through the use of ocean gliders. These autonomous instruments provide a relatively inexpensive means to produce time series measurements. Ultimately it is expected that this sort of instrument will become part of a sustained ocean climate observing system. WCRP works closely with GOOS through the Ocean Observations Panel for Climate to design such a system.

The utility of ocean measurements is continuously being enhanced through the efforts inter alia of the WCRP CLIVAR Global Synthesis and Observations Panel (GSOP) that is working to create the best possible syntheses of in situ ocean observations, satellite measurements and model outputs. Such ocean synthesis products are needed to understand sea-level changes in the context of climate change and variability and to measure changes in the meridional overturning circulation that could lead to rapid climate change. They also form the basis for assimilation of ocean observations into climate prediction systems, and, in particular, those to be used for decadal prediction. Synthesis products that include information about carbon will help us to understand and monitor the role of the ocean as a carbon sink. This effort, coordinated by WCRP and involving representatives from all the major modelling centres around the world, will provide key information about the state of the ocean to a wide range of users, including climate prediction centres (through the Global Framework for Climate Service), commercial entities interested in exploiting ocean resources and policy makers anxious to know the fate of the world’s carbon.

Multi-decadal ocean warming and acidification have impacts on marine ecosystems with severe socio-economic consequences. Given the value of ocean ecosystems to human health and welfare, it is important to understand the links between ocean and climate variability, and marine physical processes and their impact on marine ecosystems. The OceanObs09 Conference, of which WCRP was a sponsor jointly with IOC, highlighted the urgent need to fully integrate physical, chemical and biological observations in the ocean observing system. The IOC/CLIVAR Indian Ocean Panel is pioneering the implementation of such integrated measurements on the Indian Ocean equatorial buoy array. The WCRP CLIVAR project is working with its sister IGBP projects and, in particular, IMBER, to develop a scientific strategy that will enhance our ability to study the ocean in a holistic sense. The 2012 session of the CLIVAR Scientific Steering Group will be held jointly with the Scientific Steering Committee of IMBER. WCRP is a co-sponsor of the Symposium on “Effects of climate change on the world’s oceans” in Yeosu, Korea, a forum that will provide an excellent opportunity for ocean scientists from all disciplines around the world to meet and coordinate their efforts.

WCRP is pursuing a vigorous modelling programme designed to improve our ability to understand and predict phenomena that are of relevance to society, such as anthropogenic climate change, the rates of sea-level rise and its causes and seasonal to decadal climate signal like the El Nino/Southern Oscillation (ENSO), the Indian Ocean Dipole and monsoons. The effects of these phenomena are felt locally, and in response to the growing requirement for regional climate information, the WCRP has initiated the Coordinated Regional Downscaling Experiment (CORDEX). This project involves scientists and stakeholders in each region of the world and has a large capacity building component. WCRP will be working with IOC to make use of CORDEX regional products for the Transboundary Water Assessment Project (discussed elsewhere in this document) and has entered into discussions with the UNESCO concerning their utility in assessing the impact of climate change on World Heritage Sites.

Significant advances are taking place in the research on, and assessment of, sea-level variability and change, an area of joint interest for WCRP and IOC. It has become possible to obtain, for the first time, evaluations of various factors contributing to the sea-level rise in the second half of the 20th century that sum up to values that are very close to those observed *in situ* and by satellite. The most recent results concern the role of terrestrial water storage and its use in the global water balance. It is possible to state that the instrumentally-observed changes in sea level can now be quantitatively explained by the modern climate science. The updated assessment of the expected global mean sea level in the 21st century will be reported in 2013 through the report of the Working Group 1 in the Intergovernmental Panel on Climate Change Fifth Assessment Report. WCRP is also focussing international research on the study of regional variations in sea-level change which are very significant and therefore important for coastal zone management.

In conclusion, WCRP and IOC have many shared interests and mutual benefits. WCRP values IOC’s sponsorship and looks forward to IOC’s continued contribution to the Joint Climate Research Fund that makes possible the activities discussed above.

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