INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION
(of UNESCO)

Forty-first Session of the Executive Council
UNESCO, Paris, 24 June–1st July 2008

Roger Revelle Memorial lectures, 2008

Thursday 26 June 2008, UNESCO Headquarters, Paris

IMPACT OF CLIMATE CHANGE ON THE MARINE ENVIRONMENT

PRESENTATION AND ABSTRACTS

Lecturers:

Nadia Pinardi
Associate Professor at the Laboratorio di Simulazioni Numeriche del Clima e degli Ecosistemi Marini, Italy (SINCEM), will address “Operational oceanography: the present system and the future challenges”.

Cecilie Mauritzen
Director, Climate Division at the Norwegian Meteorological Institute will address "Arctic Observations: meeting the needs of operational ocean forecasting, climate monitoring and all timescales in between".

Robert J. Nicholls
Professor of Coastal Engineering at the School of Civil Engineering and the Environment, Southampton, United Kingdom, will address “Adaptation frameworks for climate change and sea-level rise impacts on the coastal zone”.

Moderator:

Keith Alverson
Chief, Ocean Observation and Services Section

The Operational Oceanographic Service for sustainable development and management of marine resources: a unified approach

Nadia Pinardi
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Nadia Pinardi holds a Ph.D. in Physical Oceanography from Harvard University, MA, US, and she is now associate professor of Oceanography at Bologna University, Italy. Her interests range from ocean numerical modelling to data assimilation, numerical modelling of the marine ecosystem and physical-biological interactions. She has written more than eighty papers in peer reviewed journals on a wide range of subjects. The last topic of her research is the understanding of uncertainties in ocean field estimation and ensemble forecasting with distributed computing networks.
She has coordinated from the middle nineties the development and implementation of the Mediterranean Operational Oceanography Network which is now the European service for ocean monitoring and forecasting. She is a member of the European Environment Agency Scientific Steering Committee and of the European Research Council for Earth Sciences. She was awarded European Geophysical Union (EGU) Fridtjof Nansen Medal 2007 for Oceanography.

Abstract
Operational oceanography nowadays embraces the frontier research for ocean monitoring and forecasting, as operational meteorology did in the fifties and it is continuing to do today. From the nineties, the availability of reliable and real time satellite and in situ data together with advanced hydrodynamics numerical models has allowed the development of a system that monitors in an integrated way the ocean variability and forecasts into the future.

The present day monitoring and forecasting systems for the ocean were designed in a prototypical way in the eighties in limited areas of the ocean, where it was possible to collect synoptic data sets for model initialization purposes. The advent of satellite altimetry, accurate reconstruction of Sea Surface Temperature from satellites, autonomous vehicles for the collection of in situ data started the development of a global approach to operational oceanography that was coordinated by the Unesco-IOC GOOS program in the past fifteen years.

Today operational oceanography systems make available and deliver a set of basic, generic services based upon common-denominator ocean state variables that are required to help meet the needs for information of those responsible for marine environment management and protection, civil and military security at sea, monitoring of climate variability and change. It is the science based approach to the needs for ocean information from our society, organised as a meteorological office for the marine environment.

The initial Operational Oceanographic Service (OOS) is being designed at high resolution because oceans are dominated by mesoscales but also because the users are near the coasts where high resolution is needed to describe the processes. The OOS in fact has designed and implemented a scheme that refines the resolution and the processes going from the open ocean areas to the coasts. The development of modelling techniques for nested and nesting models, two-way

coupling between models and multi-model approaches has progressed very rapidly in the recent years and these research results form the basis for the OOS.

Another crucial advancement in knowledge that has positively impacted out capability to develop the initial OOS is the development of data assimilation tools to estimate as accurately as possible the initial state of the ocean. Data assimilation in oceanography is challenging because of the model high resolution that makes the flow very nonlinear and the coastal constraint that modifies the correlation between state variables. Data assimilation methods are now used for marine biogeochemical models and data, they are used to quantify uncertainty in the forecasts.

Applications based upon the generic products of the OOS range from real time emergency management at sea to respond to oil spills, ecosystem modelling for the best estimation and forecast of primary producers biomass, planning of investments based on realistic scenarios of land based pollution sources.

The future issues in operational oceanography concentrate on the integration of waves and currents, climate extension of the predictions, uncertainty estimation with ensemble methods, applications for maritime transport safety, ecosystem management, sustainable fisheries and integrated coastal zone management

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Arctic Observations: meeting the needs of operational ocean forecasting, climate monitoring and all the timescales in between… "

Cecilie Mauritzen

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Cecilie Mauritzen is an oceanographer who specializes in large-scale ocean circulation and its role in earth's climate. She got her Master's degree at the University of Bergen and her PhD is from MIT in Boston (formally: the Massachusetts Institute Technology/Woods Hole Institution Joint Program in Oceanography), and she has since worked as an oceanographer in the USA, in France, and since 2002: at the Norwegian Meteorological Institute.

She was a lead author of the IPCC Fourth Assessment report, which was published in 2007. Since its publication she has involved herself actively in communicating the climate issue to the lay public. Scientifically, she is presently leading or involved in four international Arctic projects during the International Polar Year.

Abstract

Arctic ocean and ice observation will be discussed in the context of meeting the needs for precise and accurate climate monitoring, and at the same time: fast (real-time) transfer for initializing operational forecasting. A range of monitoring activities in the Arctic during the International Polar Year will be presented, as well as their initial usage. Some experiences gained from 100+ years of atmospheric climatological data quality control and banking will be discussed.

Impacts and Responses to Sea-Level Rise

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Abstract

Sea-level rise is widely seen as a major threat to low-lying coastal areas around the globe. What is not always appreciated is that large populations already live below high tide, including, for example, 10 million people in the Netherlands and 4 million people in Japan. Globally, more than 200 million people live in areas at risk of coastal flooding. Many of these exposed populations depend on artificial flood defences and drainage – Hurricane 'Katrina' reminds us of what happens if those defences fail. While it is widely accepted that sea-level rise is a threat, the actual consequences of sea-level rise remain uncertain and contested. Pessimists tend to focus on possible high rises in sea-level and events like 'Katrina', and view our ability to adapt as being limited; they see an alarming future, with widespread human displacement from coastal areas. Optimists tend to focus on lower rises in sea-level, stress humanity's ability to adapt (as exemplified by the Dutch and the Japanese) and wonder what all the fuss is about. This talk will focus on understanding the threat and the different views of its importance. It includes consideration of the impacts of rising sea-level on coastal areas, as well as the types of responses that might be implemented. These are divided into 'mitigation' (reducing greenhouse gas emissions and hence climate change, via climate policy) and 'adaptation' (reducing the impacts of sea-level rise via coastal management policy). The talk will emphasise that understanding the impacts of sea-level rise crosses many disciplines and embraces natural sciences, social science and engineering.