EUROPEAN COMMISSION
European Research Area

EARTH OBSERVATION

HYPOX

AT A GLANCE

Title: In situ monitoring of oxygen depletion in hypoxic ecosystems of coastal and open seas, and land-locked water bodies

Instrument: Area 6.4.1.2.,ENV.2008.4.1.2.1,FP7

Total Cost: 4.665.281 €
EC Contribution: 3.499.711 €

Duration: 36 months
Start Date: 01/04/2009

Consortium: 16 partners from 11 countries

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Project Web Site: www.hypox.net

Key Words: Oxygen depletion, climate change, in situ water cycle monitoring, GEOSS, aquatic ecosystems, marine, freshwater, global ocean observation, eutrophication, biodiversity

THE CHALLENGE

All higher aquatic life depends on oxygen. It is, thus, an alarming finding that hypoxic (low oxygen) conditions in aquatic ecosystems increase in number, duration and extent due to global warming and eutrophication. Global warming will lead to degassing of oxygen, increased stratification, reduced deep-water circulation and changes in wind patterns affecting transport and mixing. Observed and projected increases in hypoxia (e.g., exponential growth of "dead zones") are accompanied by enhanced emission of greenhouse gases, losses in biodiversity, ecosystem functions and services such as fisheries, aquaculture and tourism. These drastic threats call for strong efforts to investigate and monitor present and past hypoxia in order to understand causes and consequences, and to be able to predict future hypoxia and its impact on ecosystem functions and services.

PROJECT OBJECTIVES

A better understanding of global changes in oxygen depletion requires a global observation system continuously monitoring oxygen and associated parameters at high resolution, including the assessment of physical mixing and of the role of the seafloor in controlling the sensitivity of aquatic systems to and recovery from hypoxia. Within HYPOX, oxygen depletion and associated processes will be monitored in a broad range of aquatic systems that differ in oxygen status or sensitivity towards change: oxygen-rich open ocean with high sensitivity to global warming (Arctic), semi-enclosed basins with permanent anoxia (Black Sea, Baltic Sea) and seasonally or locally anoxic land-locked systems (fjords, lagoons, lakes). The obtained

monitoring results will be combined with information on past hypoxia and state-of-the-art numerical modelling to predict future hypoxia and its effect on aquatic ecosystems. HYPOX will further generate the necessary know-how to decide on appropriate oxygen monitoring efforts in the future.

METHODOLOGY

In situ observatories will be set up by installation of new systems and by implementing reliable sensors to existing platforms. These observatories will monitor oxygen and associated parameters (e.g., hydrodynamics, temperature, salinity, other gases) at high frequency. In addition, state-of-the art autonomous and towed equipment will be used for in situ studies and sampling of sediments and the water column during repeated surveys. Biological processes in the water column and the sediment will be studied in order to understand their role in hypoxia development and the changes in biodiversity and function when aquatic systems shift towards oxygen depletion. HYPOX will further include compilation and analysis of existing monitoring data and investigations of past hypoxia in the sedimentary record using fossils, biomarkers, and geochemical proxies. Modelling tools that couple physical and biogeochemical processes will be developed and used to predict oxygen availability in aquatic systems that are subject to global warming and eutrophication.

All project data will be kept in compliance to the standards of the Global Earth Observation System of Systems (GEOSS) and made available through a web portal run by the state-of-the-art world data centre WDC MARE (www.wdc-mare.org).

EXPECTED RESULTS

HYPOX will build capacities to monitor oxygen in aquatic systems which is an underrepresented parameter in observing and monitoring programmes. HYPOX will develop a research platform for understanding past, present and future impacts of natural variation, global change and land use on oxygen depletion and ecosystem functions and services. Scientific data will be passed on to students of aquatic and environmental sciences, citizens, and stakeholders. Obtained knowledge will be disseminated to local, regional and global organisations concerned with water and ecosystem health and management with the ultimate goal to develop tools for decision making. HYPOX will connect to the Regional Alliances of GOOS (the oceanographic component of GEOSS) and the Scientific Committee in Oceanographic Research (SCOR) working group on hypoxia. The project will contribute to the GEOSS cross cutting activities *Architecture* and *Data management* as well as to the GEOSS societal benefit areas *Water*, *Climate*, *Ecosystem* and *Biodiversity*.

PROJECT PARTNERS	
Max Planck Institute for Marine Microbiology (MPI), DE	Istanbul Technical University, Eastern Mediterranean Centre for Oceanography and Limnology (ITU-EMCOL), (Turkey) TR
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