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HYPOX Kickoff meeting, Bremen 04.2009

Introduction to Partner Institutions



....HYPOX kickoff: Partner Institutions introduction

Partner 1:

MPG–MPI (Bremen, Germany)



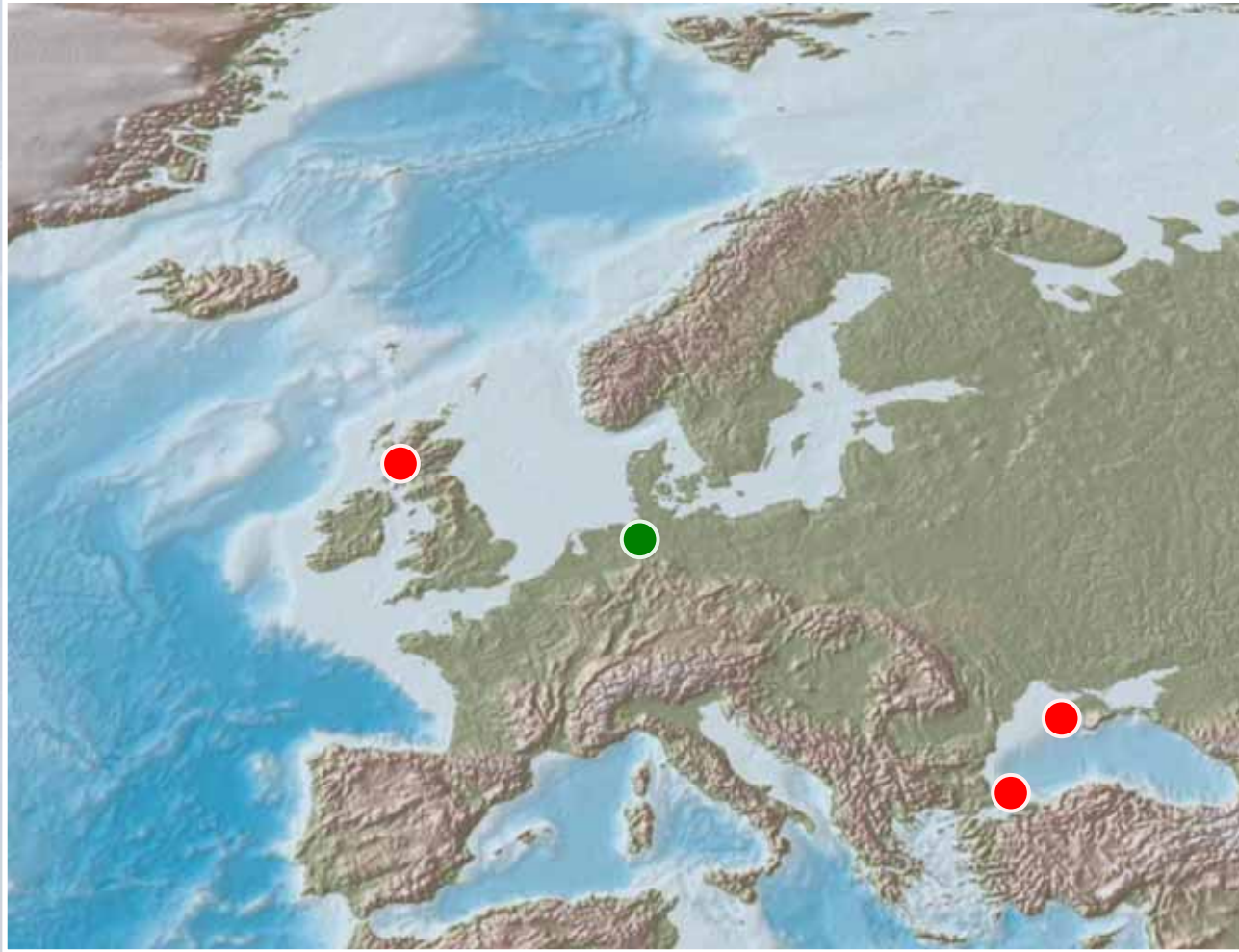
....HYPOX kickoff: MPG introduction

Max Planck Institute for marine Microbiology www.mpi.bremen.de



Image by M. Schloesser

Institute & main study sites location



Max Planck
Institute

Black Sea:
Crimea
Bosporus

Loch Etive

The Max Planck Institute in brief

- Some facts
founded in 1992, one of 76 Max-Planck-Institutes,
~ 250 coworkers >200 scientists and graduate students
- General concepts
investigating marine microbiology by combining field research on
processes with laboratory research on microorganisms
- Structure
interlinked groups covering many aspects of marine microbiology
organisms: microbiology, molecular ecology, genomic
processes & cycling: biogeochemistry, nutrient, ecophysiology
distribution & diversity: habitat, fitness



Main HYPOX project participants



Antje Boetius
Groupleader at MPI
Coord., WP8 lead



Gaute Lavik
Research associate
Nutrient cycling



Frank Wenzhöfer
Research associate
in situ experiments



Moritz Holtappels
PhD candidate
Nutrient cycling



Jan Fischer
PhD candidate
in situ experiments



Dirk de Beer
Groupleader at MPI
Microsensor studies



Marcel Kuypers
Groupleader at MPI
Nutrient cycling



Tim Ferdelman
Groupleader at MPI
Biogeo, C & S cycles



Felix Janssen
Research associate
Co-coordinator

....HYPOX kickoff: MPG introduction

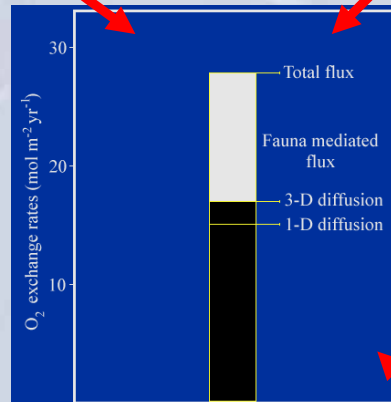
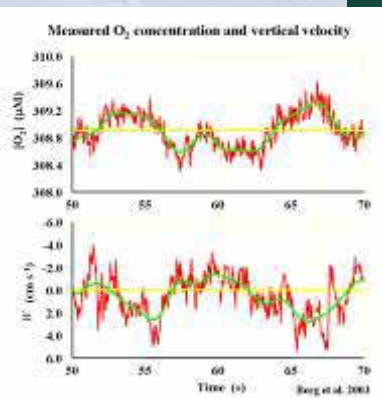
HYPOX-related tools at MPI

MPG-tasks in HYPOX

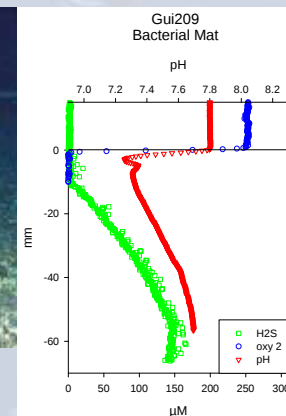
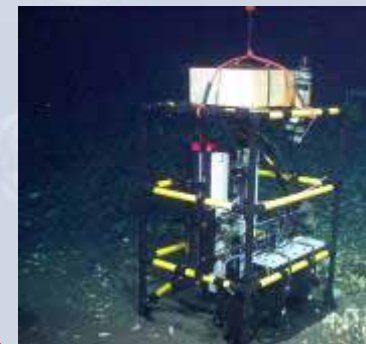


In situ approaches at MPI: examples

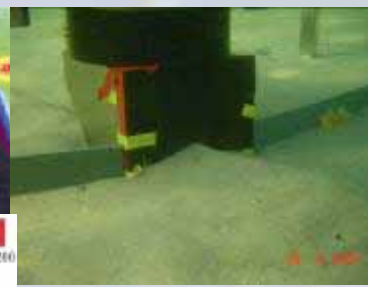
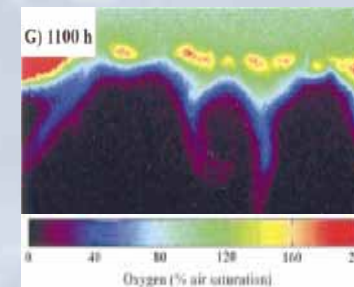
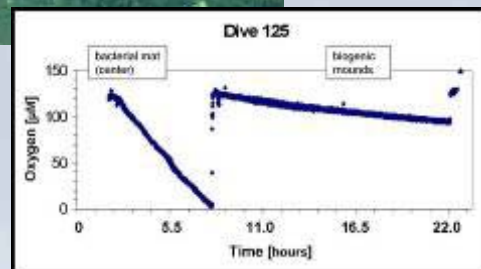
Eddy
total flux



Microprofiler
diffusive flux and
(micro-) zonation



Planar Optodes
2D-distribution over
space and time



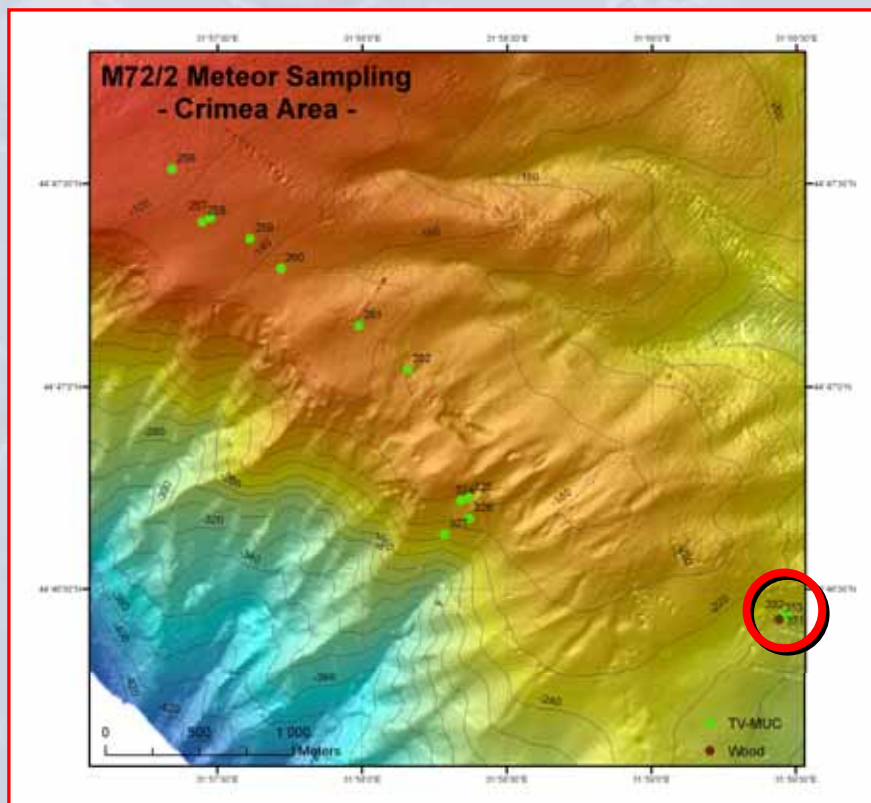
WP6&7: Sediment biogeochemistry under low/changing O_2 : Crimea & Loch Etive

- observatory installation and targeted surveys
- microbial processes and fluxes under spatially or temporally changing O_2
- autonomous instruments (profiler, chambers eddy correlation)



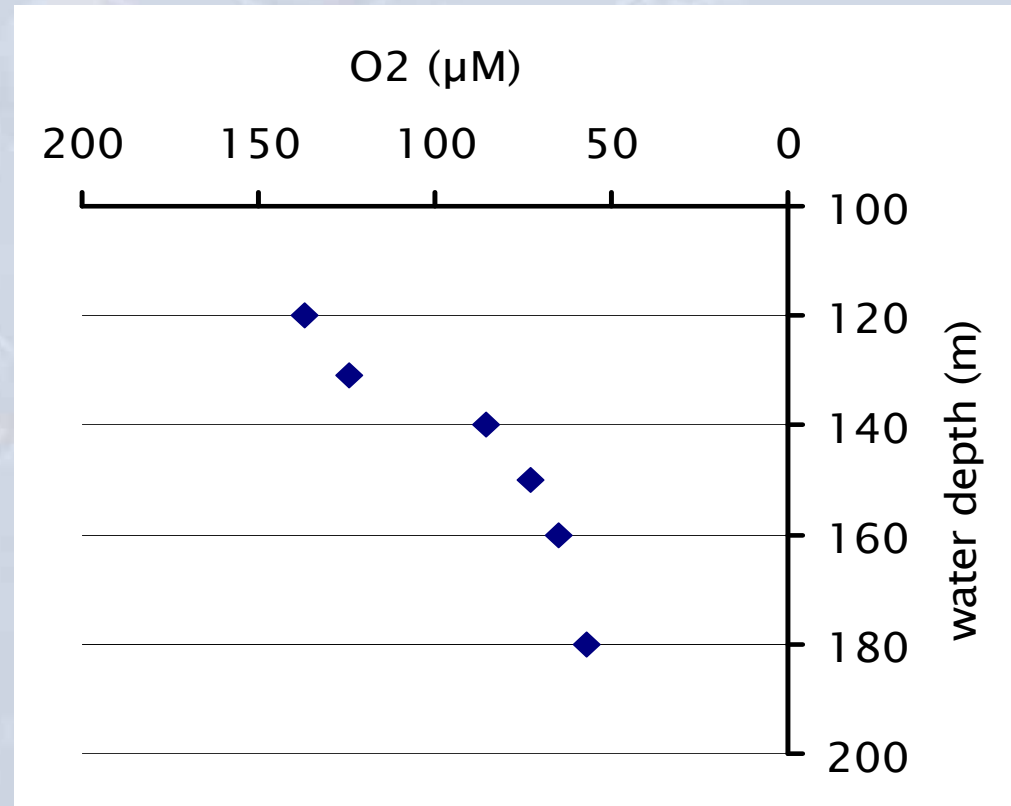
WP6&7: Sediment biogeochemistry under low/changing O₂: Crimea & Loch Etive

- observatory installation and targeted surveys
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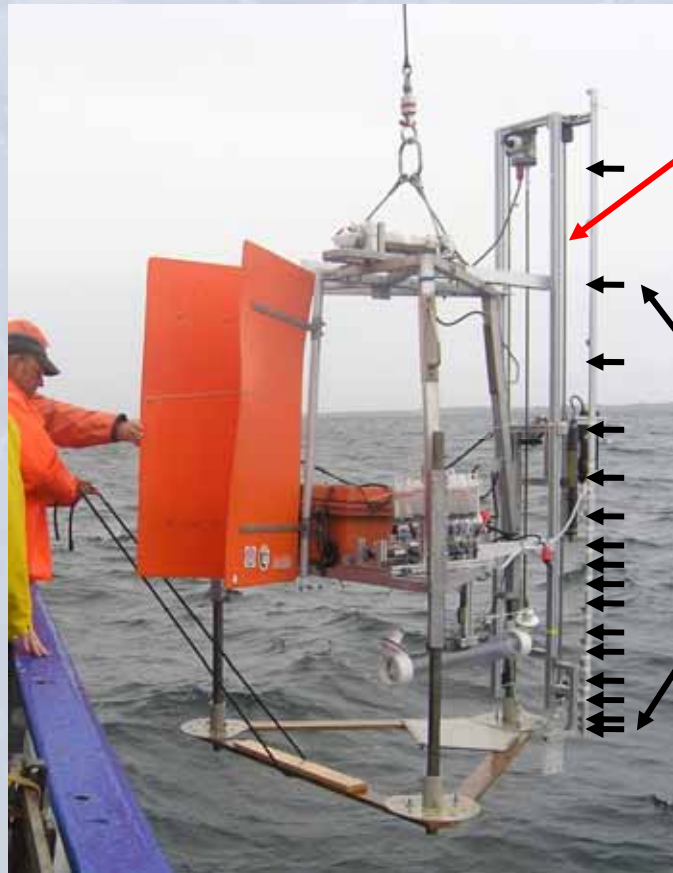
WP6&7: Sediment biogeochemistry under low/changing O₂: Crimea & Loch Etive

- observatory installation and targeted surveys
- microbial processes and fluxes under spatially or temporally changing O₂
- autonomous instruments (profiler, chambers eddy correlation)



WP6: Nutrient cycling under low/no O₂: Bosporus benthic boundary layer

- Nutrient cycling in the benthic boundary layer
- Effect of lateral intrusions of oxygenated Mediterranean waters
- Bottom water sampler & profiler

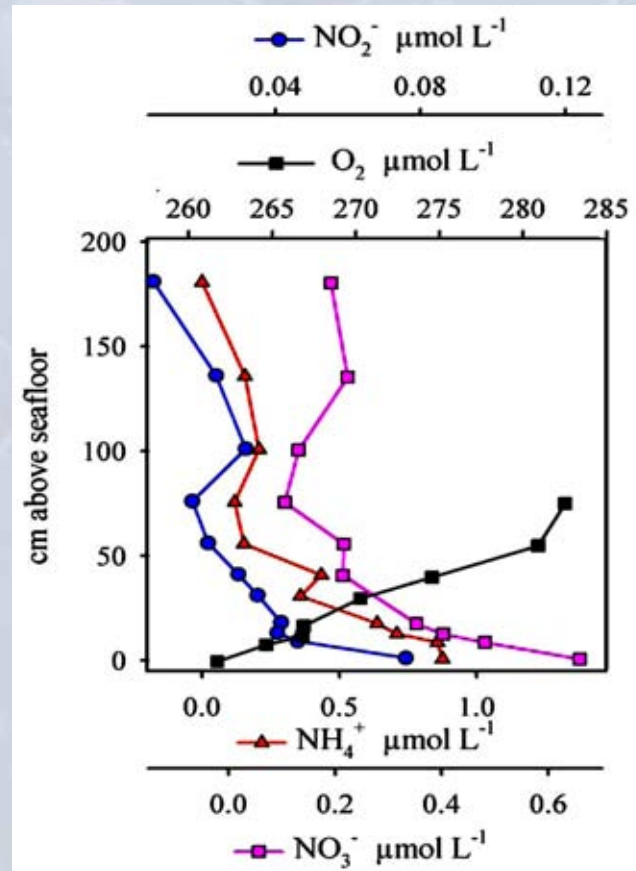


Sensor-equipped
vertical slide

Bottom water
sampler ports

WP6: Nutrient cycling under low/no O₂: Bosporus benthic boundary layer

- Nutrient cycling in the benthic boundary layer
- Effect of lateral intrusions of oxygenated Mediterranean waters
- Bottom water sampler & profiler



....HYPOX kickoff: Partner Institutions introduction

Partner 2:

AWI (Bremerhaven, Germany)



Alfred Wegener Institute for Polar and Marine Research (www.awi.de)



- Foundation established in 1980;
- Includes the Alfred Wegener Institute in Bremerhaven, the Potsdam Research Unit, the Biologische Anstalt Helgoland and the Wadden Sea Station Sylt;
- Member of the Helmholtz Association of German Research Centres (HGF);
- 90% of financing by the German Federal Ministry of Education and Research, 8% by Bremen, and each time 1% by Brandenburg and Schleswig-Holstein;
- The foundation has > 800 employees and a total budget of ~130 million Euro in 2008.

The Alfred Wegener Institute in brief

- Approaches & concepts

The AWI conducts research in the Arctic, the Antarctic and at temperate latitudes. It coordinates Polar research in Germany and provides both the necessary equipment and the essential logistic back up for polar expeditions. Recent additional research themes include North Sea Research, contributions to Marine Biological Monitoring, Marine Pollution Research, Investigation of naturally occurring marine substances and technical marine developments.

- Mission statement

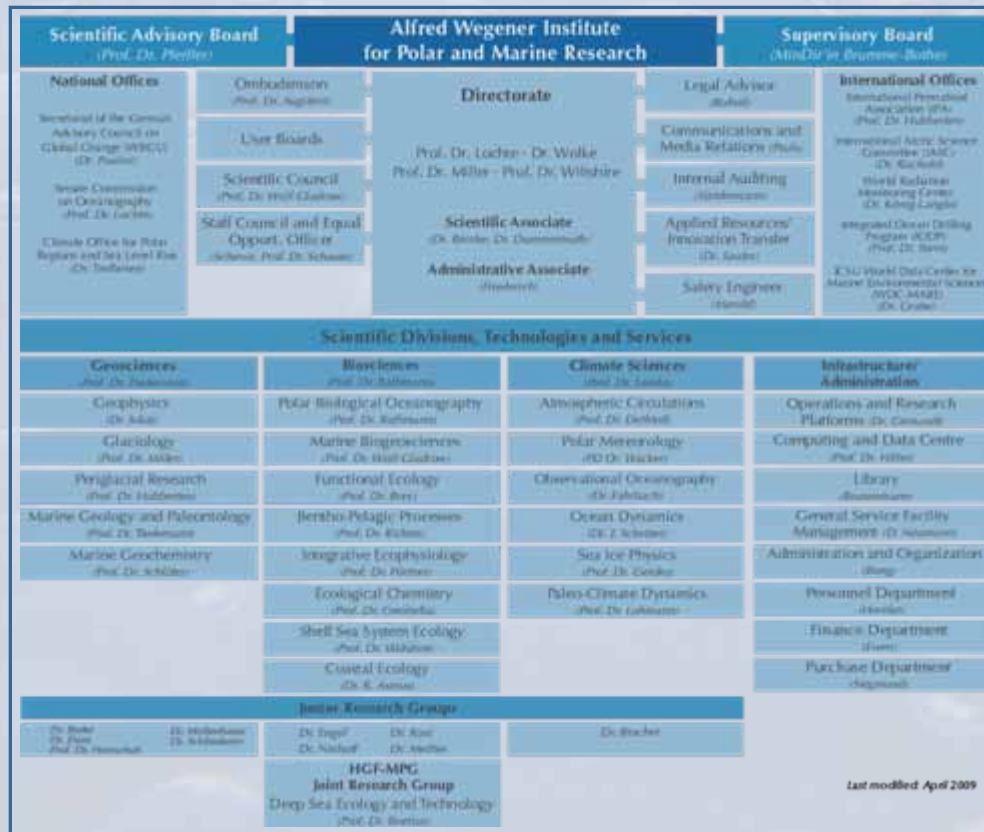
The Institute's research mission is to improve our understanding of ocean-ice-atmosphere interactions, the animal and plant kingdoms of the Arctic and Antarctic, and the evolution of the polar continents and seas. Given the major role played by these regions within the Earth's climate system, global change is a central focus of the research effort at AWI.

- HYPOX-related groups and role in HYPOX

Marine Geochemistry Group; HGF-MPI Group for Deep-Sea Ecology and Technology
> Field studies (Black Sea, Deep-sea long-term observatory HAUSGARTEN)
> WP3 lead (Existing and future impacts of hypoxia on ecosystems)



Scientific Program and Organigram



AWI is participating in the HGF research program PACES (Polar Regions and Coasts in a changing Earth System), which aims at identifying the role of processes at high latitudes on past, current and future changes of the Earth system.

Research will focus on

- the changing Arctic and Antarctic
- coasts affected and mediated by climatic and anthropogenic drivers
- lessons from the Earth's past, and
- a synthesis via the integration of the polar perspective into Earth System models.

PACES will provide insights on naturally driven Earth climate fluctuations and their anthropogenic perturbation and consequential effects and thus provides the basic scientific understanding for appropriate political decisions.

Additional info on infrastructure



- Polarstern represents the outstanding research tool of German polar research. Additional vessels are available.
- In the Arctic and Antarctic, research is conducted at research stations, some of which are manned year-round.
- Polar aircraft and underwater research facilities provide other large-scale infrastructure.
- Other infrastructure of the institute includes the libraries, various data bases and software solutions, acquired or often developed specifically for the institution.

Main project participants



Jana Friedrich
Research associate;
WP3 lead



Thomas Soltwedel
Research associate;
AWI representative

....HYPOX kickoff: Partner Institutions introduction

Partner 3:

Eawag (Kastanienbaum, Switzerland)



....HYPOX kickoff: Eawag introduction

Eawag, Swiss Federal Institute of Aquatic Science and Technology (www.eawag.ch)



The water institute of the ETH domain

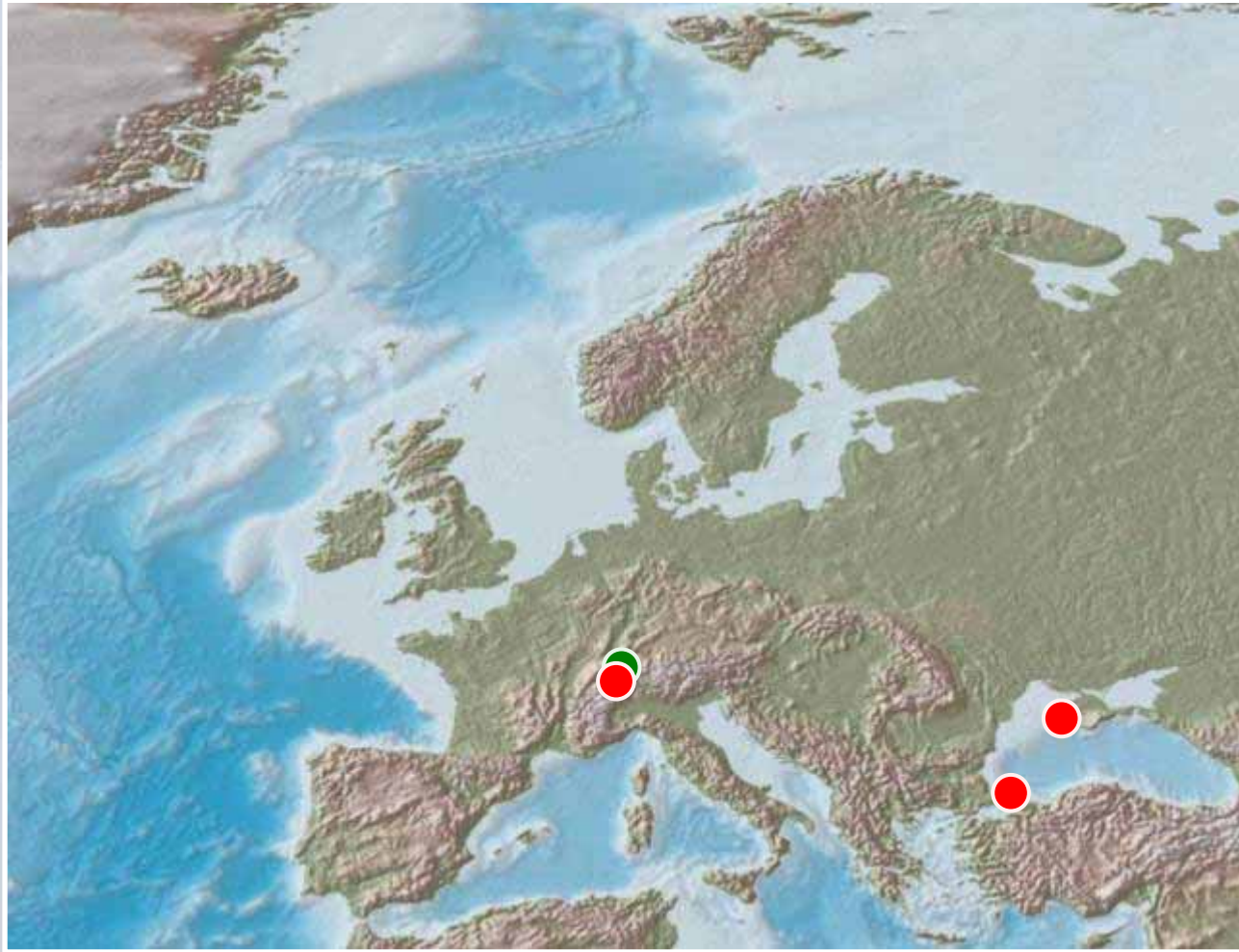


Eawag in brief

- Approaches & concepts
Combining field research and modelling to understand aquatic systems
- Methods & tools:
Geochemistry, organic geochemistry, isotope geochemistry, microsenors, engineering, ecotox, sanitation, ecology
- HYPOX–related groups and role in HYPOX
Biogeochemistry group, noble gas group
 - > Paleo oxygen estimates using noble gases, biomarkers
 - > Microsenors for oxygen, nutrients
 - > Field studies (Swiss Lakes, Black Sea, ?)

....HYPOX kickoff: Eawag introduction

Institute & main study sites location



Eawag

Swiss Lakes

(Black Sea:
Crimea
Bosporus)



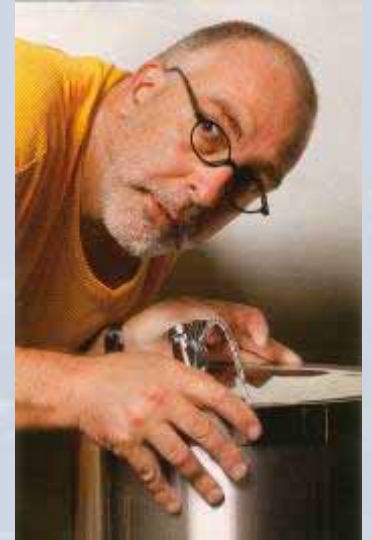
....HYPOX kickoff: Eawag introduction

Main project participants

Carsten J. Schubert
Group leader at Eawag
Coord., Hypox at Eawag
Biomarker user



Rolf Kipfer
Department Head
Noble gas chieftain



David Livingstone
Research Scientist
Long time series

Mathias Kirf
PhD candidate, sensor freak



Additional info on Institute, infrastructure, or tasks in HYPOX

Kb: Organic geochemistry laboratory
 Isotope geochemistry laboratory
 Sensor development
 Boats for sampling campaigns

DD: Dating laboratory (Pb, Cs)

ETH: Mass spectrometry laboratory
 (Noble gases)



....HYPOX kickoff: Partner Institutions introduction

Partner 4:

IBSS (Sevastopol, Ukraine)



....HYPOX kickoff: IBSS introduction

Institute of Biology of the Southern Seas

www.ibss.org.ua



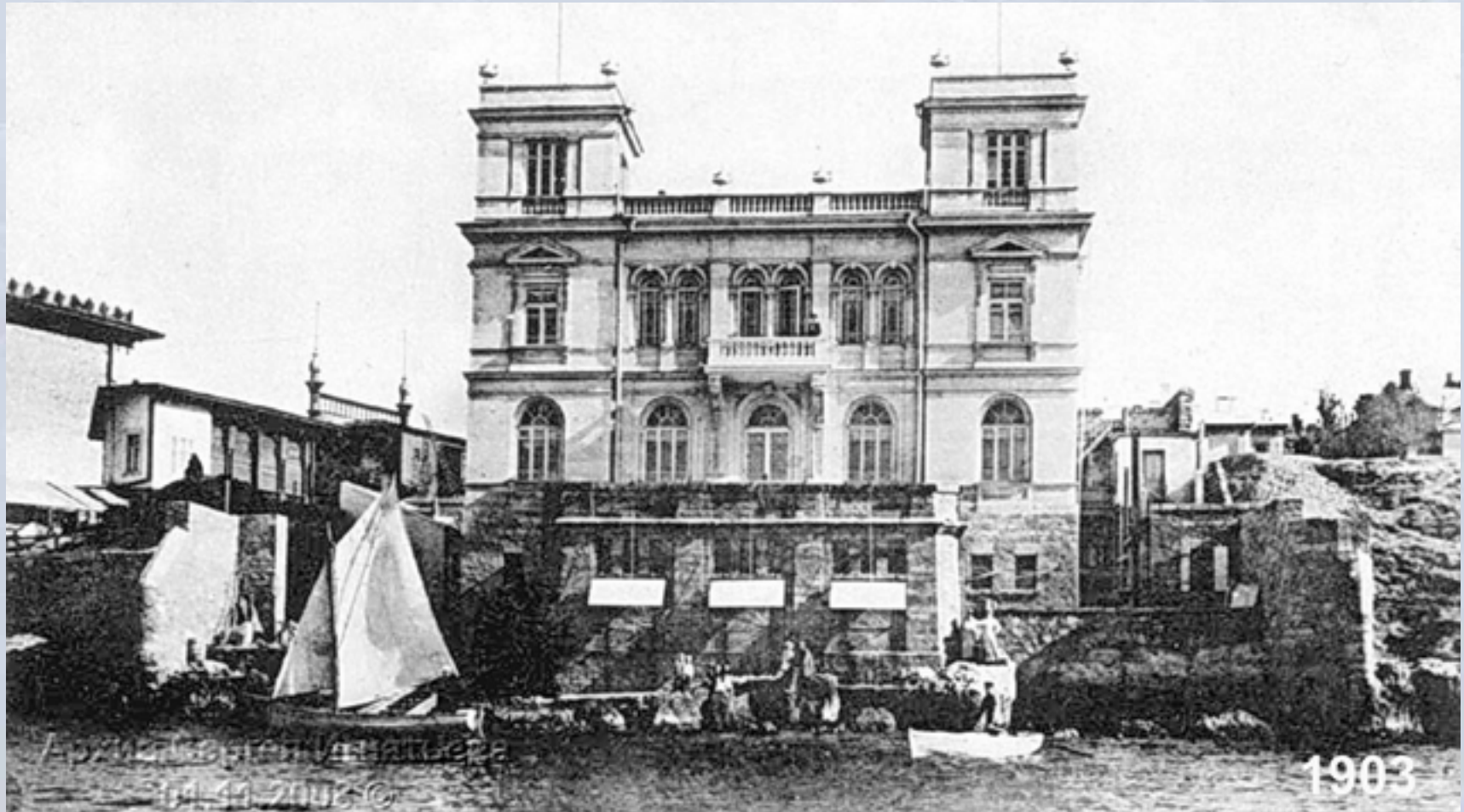
A.O. Kovalevsky Institute of Biology of the Southern Seas National Academy of Sciences of Ukraine

The A. O. Kovalevsky Institute of Biology of the Southern Seas (IBSS), National Academy of Sciences of Ukraine is one of oldest and reputable marine research centre in the world. In 1871 Biological Station, the first in Russia and the third in Europe, was founded in Sevastopol on the initiative of Nikolai N. Miklukho-Maklai, the prominent Russian explorer, and A.O. Kovalevsky, the famous scholar and the first director of the Station. Cherishing the 138-year-old classical academic traditions, the Institute of Biology of the Southern Seas increases and improves the scientific potential and welcomes international scientific co-operation. IBSS includes 13 scientific departments, RV “Professor Vodyanitskyi”, scientific library, the editorial and publishing department, the Aquarium-Museum.



....HYPOX kickoff: IBSS introduction

Sevastopol Biological Station (1903)

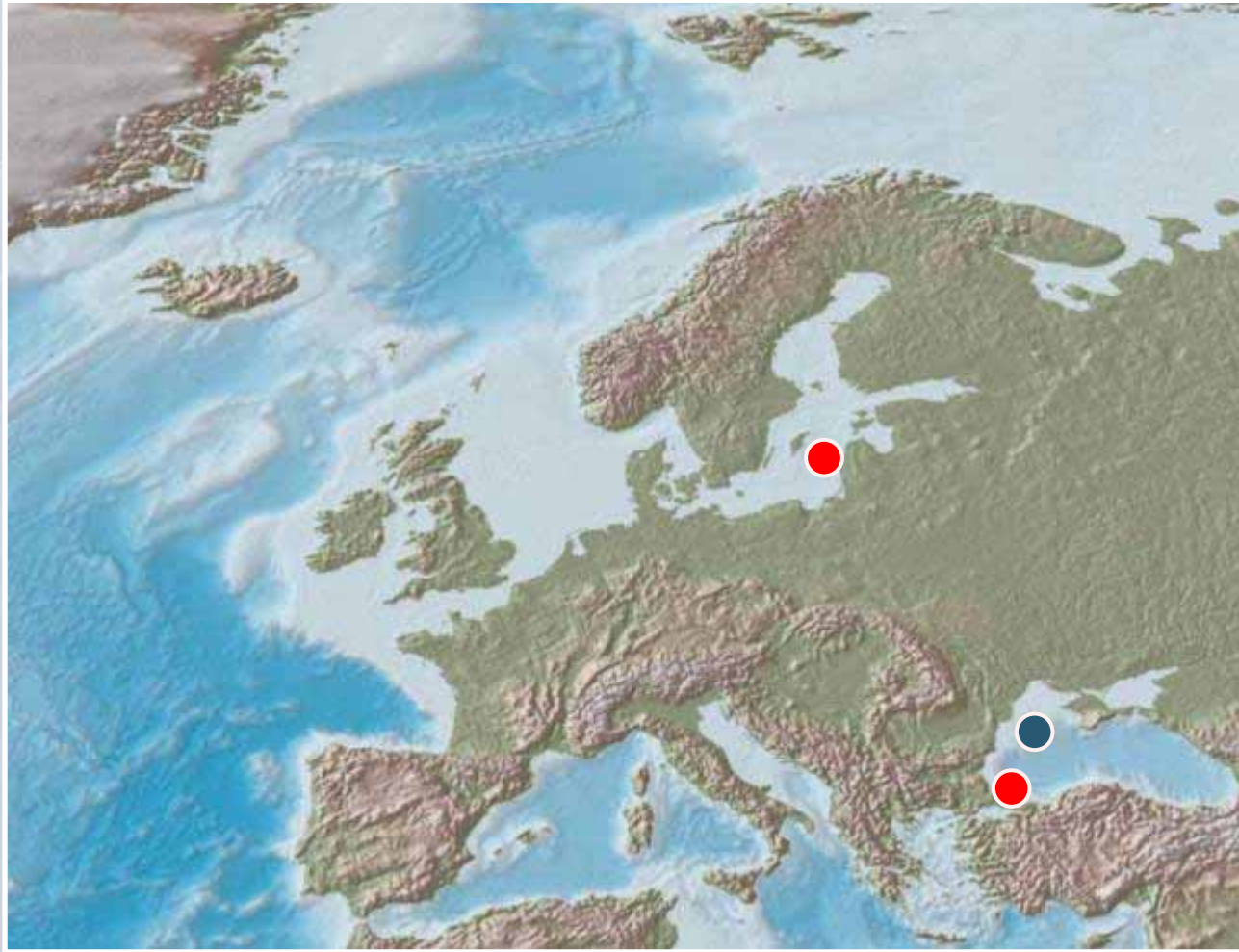


....HYPOX kickoff: IBSS introduction

- Approaches & concepts
 - > complex study of the structure and functioning of marine ecosystems in conditions of global climate change & anthropogenic impacts;
 - > integral coastal zone management;
 - > reservation of Black & Azov Seas biodiversity
 - > development of principally new methods and technical means for effective environmental control of biota & marine environment quality
- Methods & tools:
 - > from specimen to ecosystem
 - > basic physical and biogeochemical parameters in water and sediments
 - > control of quality marine environmental and assess risks for biota
 - > *in situ* and lab experiments
- Department of Benthos Ecology role in HYPOX
 - Habitat group, taxonomic group, experimental group, biogeochemistry group
 - > WP4 leader
 - > field studies (Crimea & Bosphorus, Gotland Basin)
 - > cruise lead (Black Sea)



Main study sites



Black Sea:
Crimea region
(coastal zone and
oxic/anoxic
interface)

Bosphorus

Baltic Sea:
Gotland Basin

Main HYPOX project participants



Nelli Sergeeva
Group leader at IBSS
WP4 lead



Victor Zaika
Professor
expert in ecology



Sergey Konovalov
Dr. Sci.
biogeochemistry



Maksim Gulin
PhD Research associate
experimental biology



Elena Kolesnikova
PhD Research associate
meiobenthos



Sofya Mazlumyan
PhD Research associate
modeling ecosystem



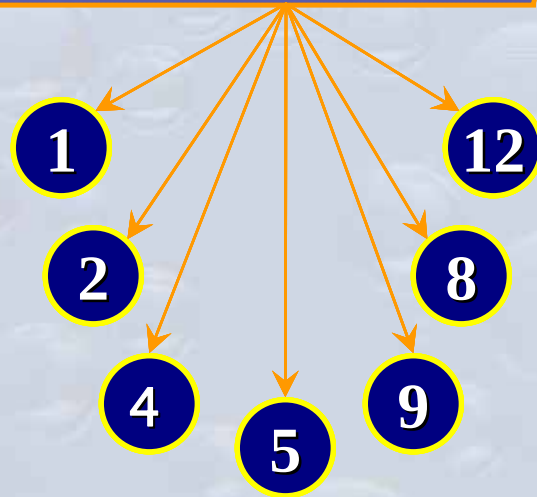
Igor Bondarev
PhD Research associate
macrobenthos



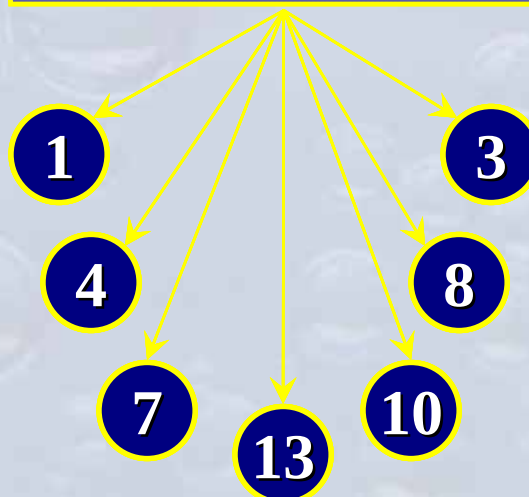
Oksana Anikeeva
Research associate
meiobenthos

Main trends of research at IBSS

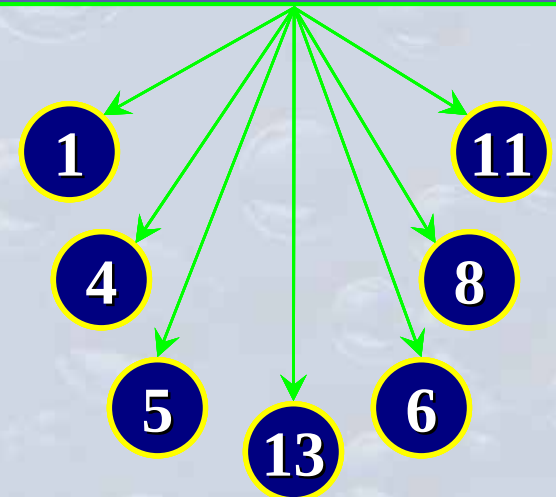
Evolution of marine and ocean ecosystems under climatic changes and impact



Conservation of Biodiversity of the Black Sea basin



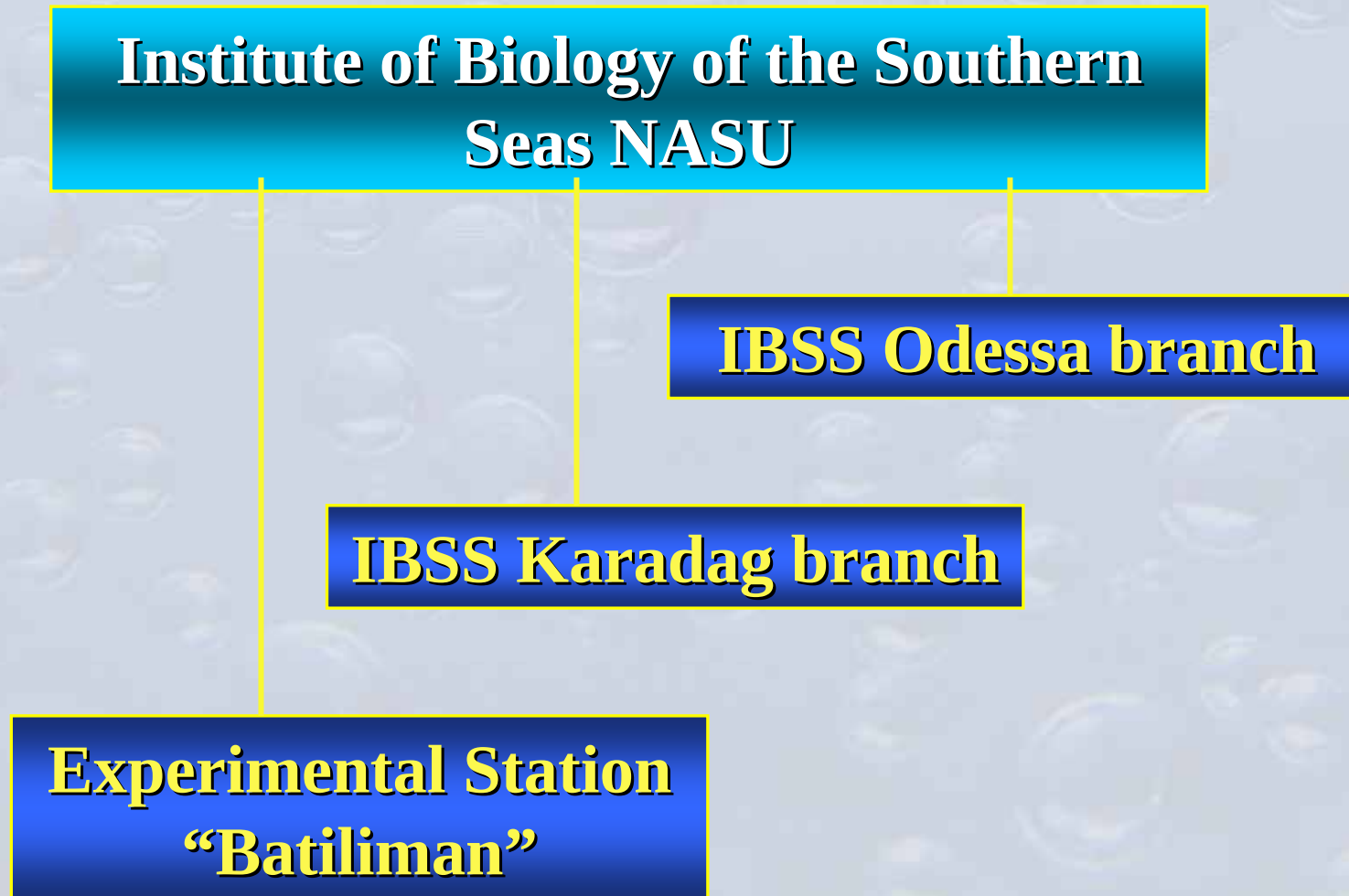
Coastal natural resources sustainable development



Departments:

1 – Physiology of Animals and Biochemistry; 2 – Functioning of Marine Ecosystems; 3 – Plankton; 4 – Benthos Ecology; 5 – Radiation and Chemical Biology; 6 – Marine Sanitary Biology; 7 – Ecological Parasitology; 8 – Ichthyology; 9 – Ecological Physiology of Algae; 10 – Mariculture and Applied Oceanology; 11 – Biophysical Ecology; 12 – Marine Pharmacology and Biological Testing; 13 – Biotechnology and Phytoresources.

IBSS structure



....HYPOX kickoff: IBSS introduction

Research Vessel „Professor Vodyanitsky”



perfectly equipped
for oceanological
research

space for up to 30
researchers

12 scientific
laboratories

IBSS international cooperation

International governmental and non-governmental organizations:

UNESCO

Intergovernmental Oceanographic Commission (IOC / UNESCO)

UNEP / UNDP / GEF

NATO

IAEA (International Atomic Energy Agency)

CIESM (International Commission for the Scientific Exploration of the Mediterranean Sea)

EU (European Union)

IOI (International Ocean Institute)

SCAR (Scientific Committee on Antarctic Research)

Cooperation with other Organizations, Agencies and Institutes:

Marine scientific institutes and centers from Russia, Bulgaria, Turkey, Romania, Georgia, United Kingdom, France, Germany, Italy, China, USA, Guinea, Greece, Israel, Poland, Malta etc.



....HYPOX kickoff: Partner Institutions introduction

Partner 5:

IFM–GEOMAR (Kiel, Germany)



....HYPOX kickoff: IFM-GEOMAR introduction

Leibniz Institute of Marine Sciences

IFM-GEOMAR, Kiel (www.ifm-geomar.de)



....HYPOX kickoff: IFM-GEOMAR introduction

IFM-GEOMAR „from the sea floor to the atmosphere“

530 employees, 330 scientists,
research is structured in 4 areas:

- Ocean Circulation and Climate
- Marine Biogeochemistry, Marine Geosystems
- Marine Ecology
- Dynamics of the Ocean Floor

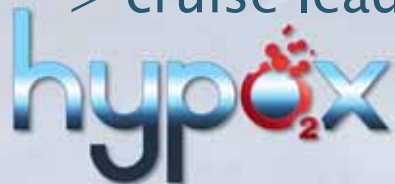
Marine Geosystems: Methods and tools
in situ technology, biogeochemical modeling,
geochemical analytical facilities, gas analysis

HYPONX-related groups and role in HYPONX

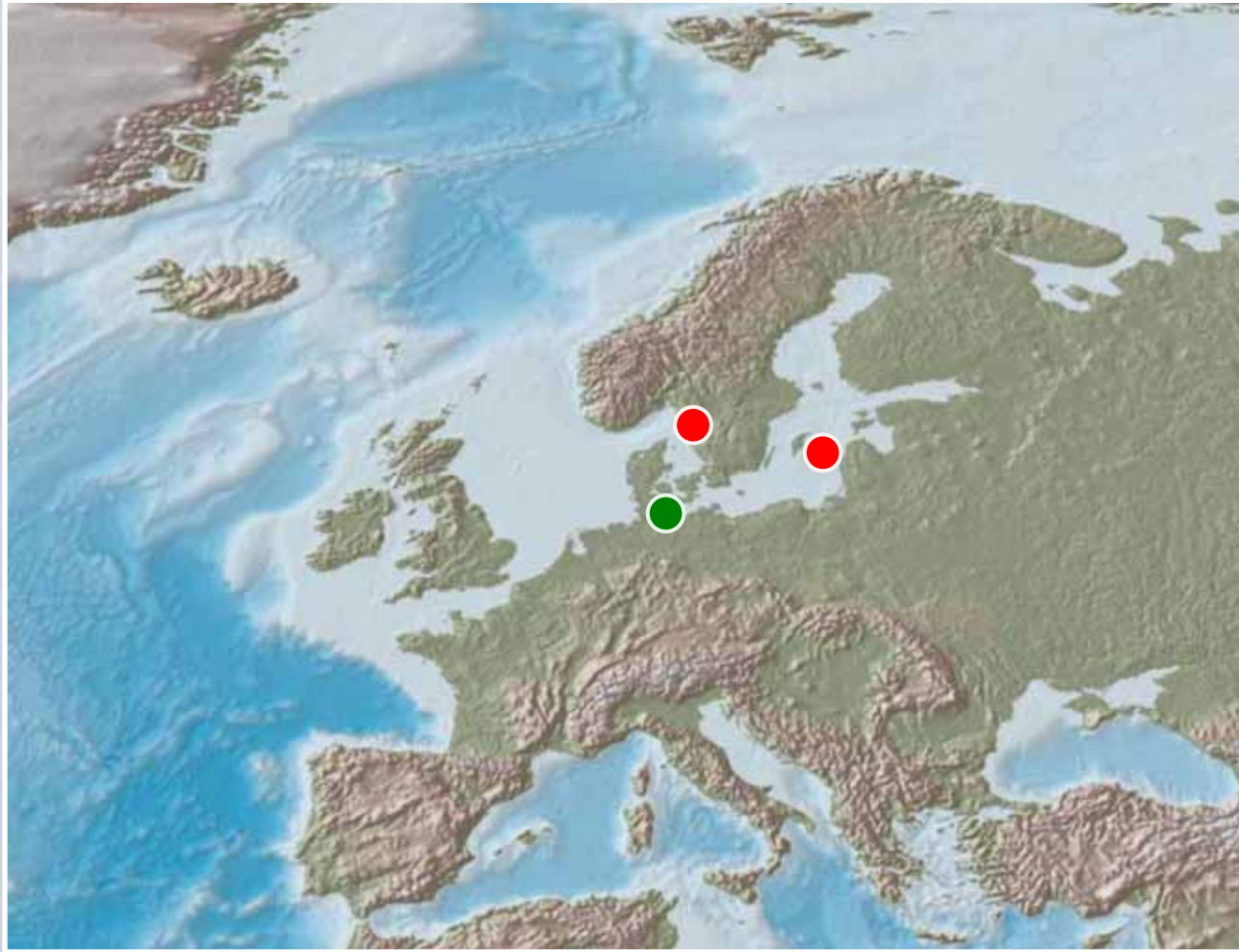
Lander and flux group, modeling group

> field studies (Gotland Basin, Koljöfjord)

> cruise lead (2 x Gotland Basin)



Institute & main study sites location



IFM-GEOMAR

Gotland Basin

Koljöfjord

Main project participants



Klaus Wallmann
Section leader
geochem. *modelling*

will
come
soon

My Madsdotter
PhD student
benthic N-cycle



Olaf Pfannkuche
Scientist, TLZ Head
in situ experiments

will
come
soon

??????
PhD student
geochem. modeling



Stefan Sommer
Scientist
in situ experiments



Andy Dale
Scientist
geochem. *modeling*

Tasks / Contributions:

In situ measurements (WP6/7), N-cycle in the benthic boundary layer (solute fluxes, response of meiobenthos to O₂ availability)

Predictive biogeochemical modeling (WP2)

Will lead two cruises to the Gotland Basin

Infrastructure:

Lander technology, in situ experimental modules, transecting profiler, geochemical lab facilities, GC/MIMS for gas analyses, research vessels



....HYPOX kickoff: Partner Institutions introduction

Partner 6:

Ifremer (Plouzane, France)



Institut français de recherche pour l'exploitation de la mer www.ifremer.fr



Created in 1984, Ifremer is a public institute of industrial and commercial nature. It is placed under the joint supervision of the ministries for Ecology, Energy, Sustainable Development and Town and Country Planning; for Higher Education and Research; for Agriculture and Fisheries.

....HYPOX kickoff: Ifremer introduction

Ifremer www.ifremer.fr



Photograph by Yann Lamour



Ifremer Institute missions in brief

- Finalized research
In the prospect of answering to social expectations (climate change effects, marine biodiversity, pollutions prevention, seafood quality...). The results are scientific knowledge and technological innovations, but also ocean observation and exploration systems.
- Oceans seas and coastal waters monitoring
In support with public policy for the environment and its resources. In the form of notices or studies reports, the results provide the information about the environment state or the evaluation of a resource and permit the expertise on sea-related questions.

....HYPOX kickoff: Ifremer introduction

Ifremer Institute missions in brief



- Development, management and open access of large research infrastructures
Fleet, calculation means, data centres, experimental facilities – which are made available to the whole National and European scientific community, as well as to private partners.



....HYPOX kickoff: Ifremer introduction

Ifremer Institute in HYPOX^{ooo}

- HYPOX-related groups and role in HYPOX

Ifremer will lead WP6 "Assessing in situ oxygen depletion in the open sea" in which it will contribute by its knowledge of the Black Sea sedimentary system from previous acquired data obtained from surveys carried out since 1997.

Ifremer will contribute to WP1 "Improving and integrating in situ observation capacities of oxygen depletion" by providing a sensor in the Black Sea area in order to perform benthic measurements with a sub sea observatory node (according to ESONET recommendations).

Ifremer will participate in water column monitoring of O₂ and associated parameters on a coastal (400m) near-eulerian profiler.



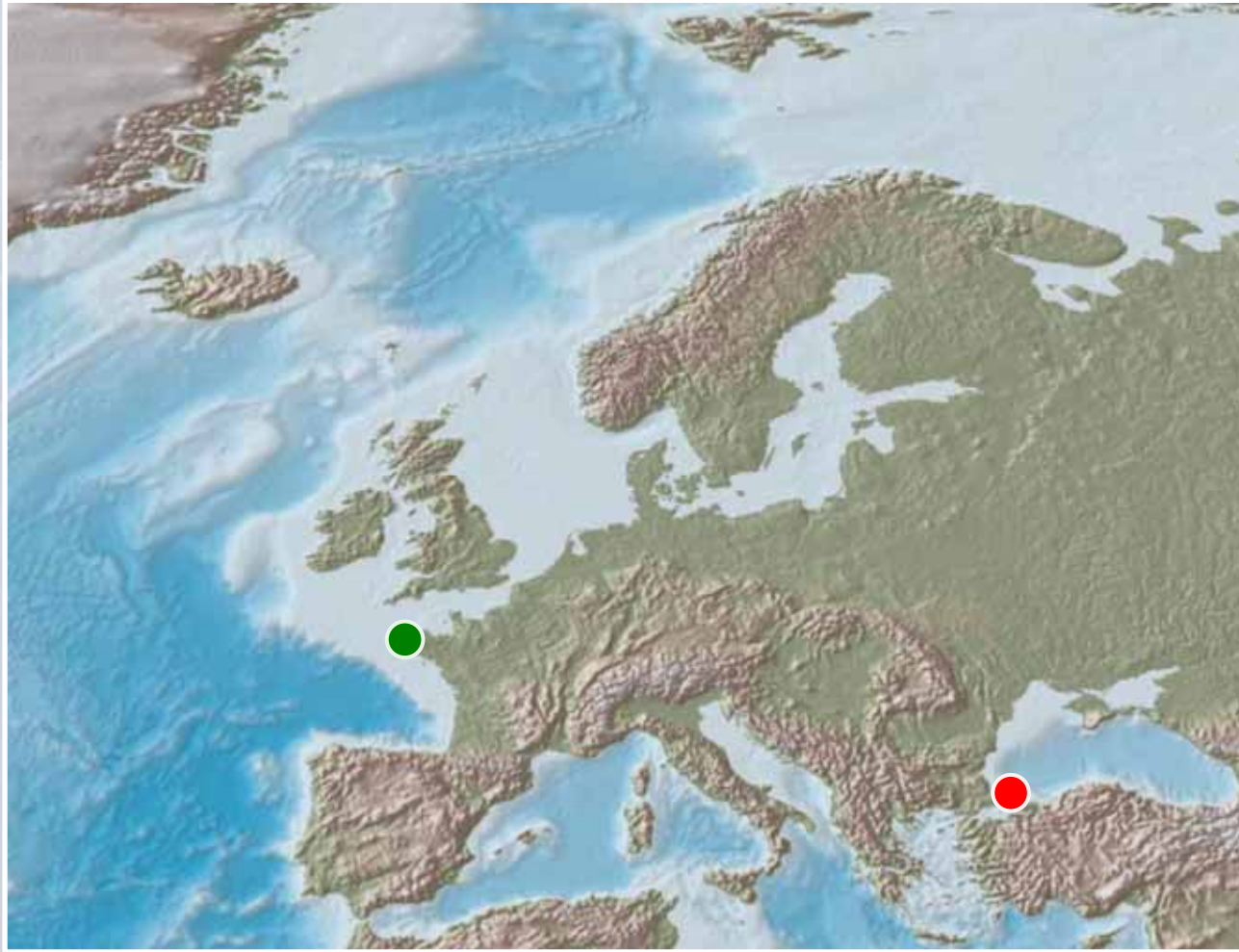
Ifremer www.ifremer.fr

- **Short partner description:** Ifremer is a public institute of industrial and commercial nature with the mission to develop basic and applied research, expertise activities and industrial and technological development actions. Ifremer has developed an important network of European and International cooperation and takes an active part in European Union studies (the European Science Foundation's Marine Board, the DG Research and DG Fisheries programs, GEOSS). Ifremer is also a member of international organizations in its field of competence (General commission for Mediterranean fishing, intergovernmental ocean research commission, the OSPAR convention, International Council for the Exploration of the Sea). Ifremer has 1,385 employees distributed among 5 main centers and 26 smaller locations along the entire coastline of France. Ifremer manages 7 research vessels (4 of them blue-ocean), a manned submersible, a remotely-operated vehicle (ROV) for deep sea explorations, AUVS, gliders, floats and buoys and a full set of test facilities.
- **Role of Ifremer in HYPOX:** Ifremer will lead WP6 "Assessing in situ oxygen depletion in the open sea" in which it will contribute knowledge of the Black Sea sedimentary system that was acquired since 1997 in numerous surveys. Ifremer will contribute to WP1 "Improving and integrating in situ observation capacities of oxygen depletion" by providing a buoy in the Black Sea area in order to perform benthic measurements with a sub sea observatory node (according to ESONET recommendations). Ifremer will also participate in water column monitoring of O₂ and associated parameters on a coastal (400m) near-eulerian profiler,



....HYPOX kickoff: Ifremer introduction

Institute & main study sites location



Ifremer

Black Sea:
Bosphorus

Main project participants



Gilles Lericolais
Group leader at
Ifremer
WP6 lead



Serge Le Reste
Underwater systems
Provor-DO – WP1



Jean-François Rolin
Underwater systems
in situ deployment
WP1



Laurent Delauney
Underwater systems
Antifouling – WP5

....HYPOX kickoff: Partner Institutions introduction

Partner 7:

INGV (Roma, Italy)



....HYPOX kickoff: INGV introduction



Istituto Nazionale di
Geofisica e Vulcanologia www.ingv.it



....HYPOX kickoff: INGV introduction



THE INSTITUTE

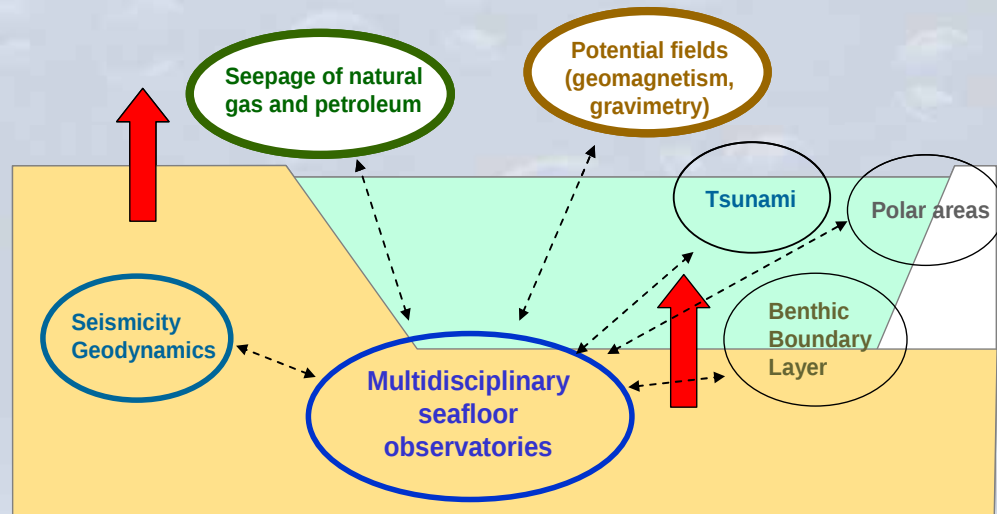
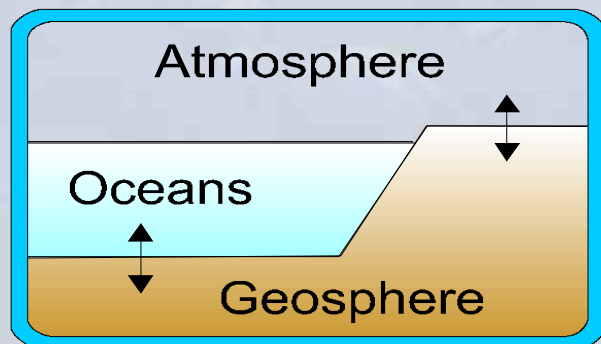
Currently the largest European body dealing with research in geophysics and volcanology, and environmental implications

research, monitoring (*technology*), surveillance (*seismicity, volcanoes*)

Headquarter in Rome; main facilities in Milano, Bologna, Pisa, Napoli, Catania, Palermo.

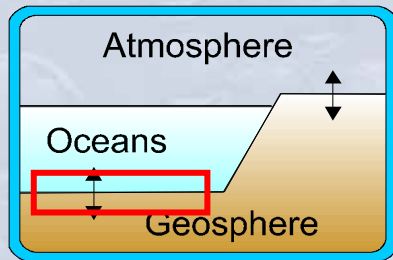


RIDGE Research Unit Geophysical-environmental processes at the geosphere-ocean-atmosphere interface

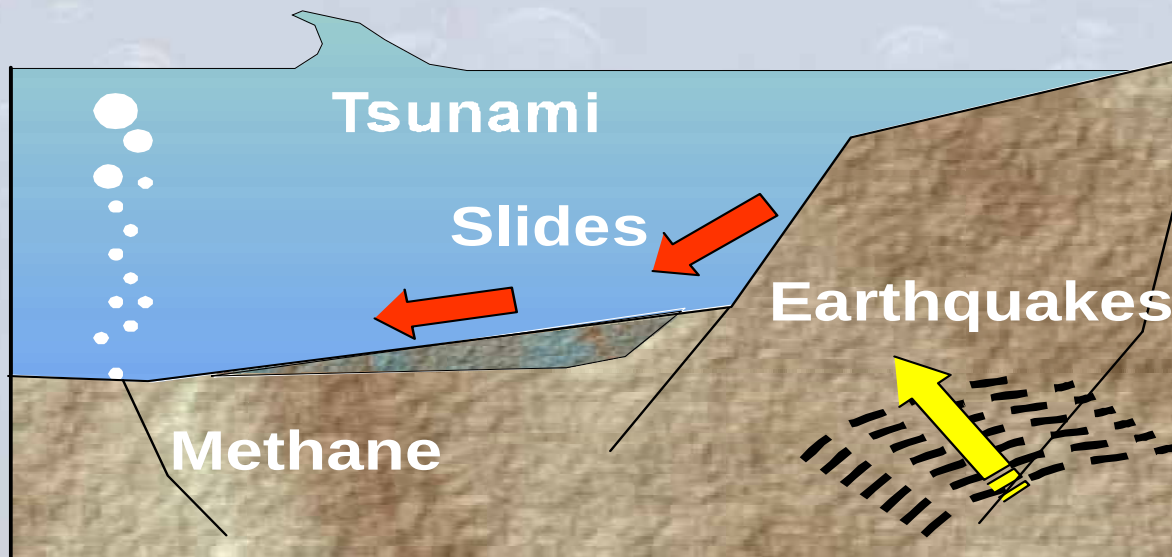


6 activities, independent or supported by innovative tools of submarine observation

Submarine monitoring of geophysical and environmental processes

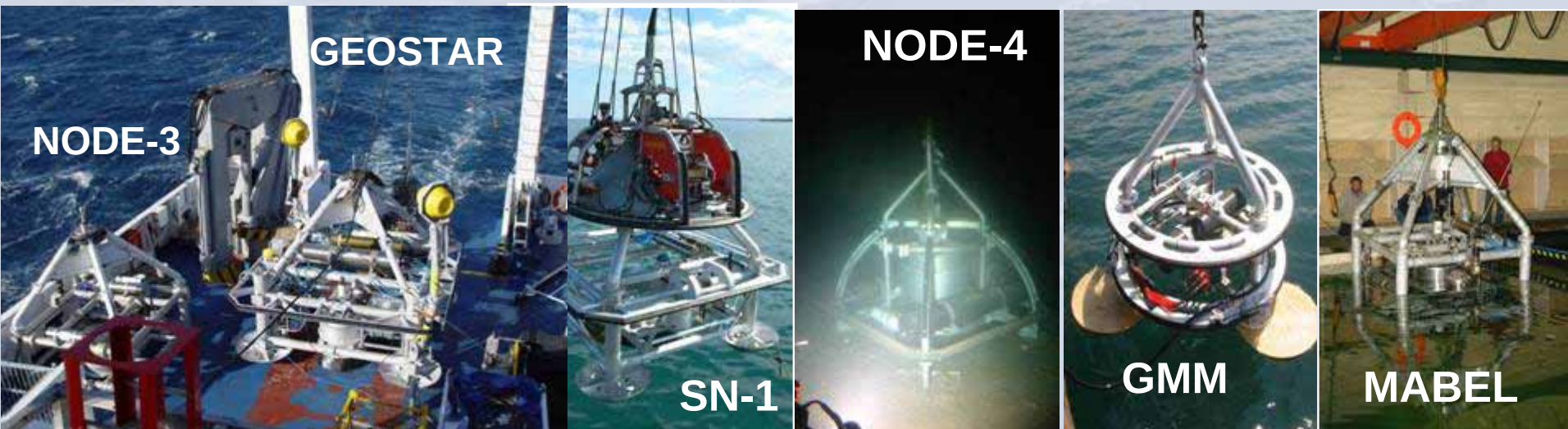


**Simultaneous monitoring of different parameters
(cause-effect links, interactions between different
systems)**



....HYPOX kickoff: INGV introduction

Endowment of a fleet of 6 Stations (GEOSTAR-class)



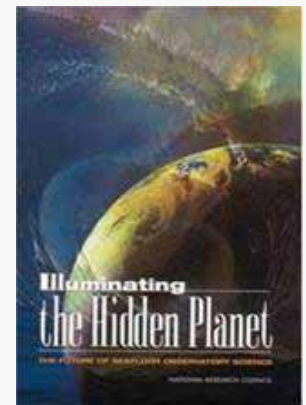
Compliant with the SEAFLOOR OBSERVATORY requirements and definition by US NSF (*Illuminating the Hidden Planet: The Future of Seafloor Observatory Science, 2000*)

MULTIDISCIPLINARITY (MULTIPARAMETRIC)

SAME TIME-REFERENCE FOR ALL SENSORS

AUTONOMOUS DATA QUALITY CHECKS

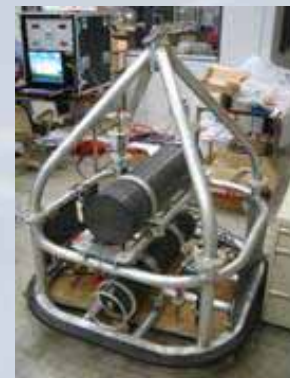
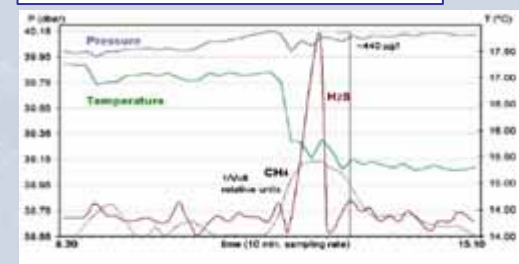
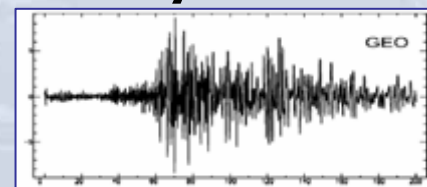
DATA COMMUNICATION



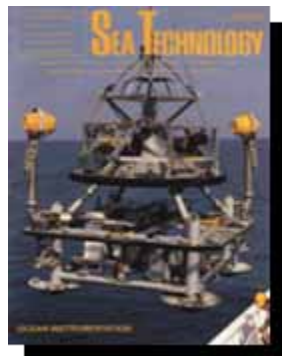
Monitoring at sea:

Scientific and technological activity

- Geophysical studies
(seismic analysis, geomagnetism, gravimetry)
- Environmental studies
(marine geochemistry, physical oceanography)
- Test of sensors
(commercial, prototypes...)
- Development of innovative sensors
(radioactivity, magnetometer)
and modules/observatories



GEOSTAR-class SEAFLOOR OBSERVATORIES Main publications



GEOPHYSICAL RESEARCH LETTERS, VOL. 32, L07303, doi:10.1029/2004GL021975, 2005

High quality seismological recordings from the SN-1 deep seafloor observatory in the Mt. Etna region

Stephen Monna, Francesco Frugoni, Caterina Montuori, Laura Beranzoli, and Paolo Favali¹

Earth Planets Space, **55**, 361–373, 2003

Mission results from the first GEOSTAR observatory (Adriatic Sea, 1998)

Laura Beranzoli¹, Thomas Braun¹, Massimo Calcarà¹, Paolo Casale¹, Angelo De Santis^{1,4}, Giuseppe D'Anna¹, Domenico Di Mauro¹, Giuseppe Etiope¹, Paolo Favali^{1,4}, Jean-Luc Fuda², Francesco Frugoni¹, Fabiano Gamben¹, Michael Maram¹, Claude Millot², Caterina Montuori¹, and Giuseppe Smriglio^{1,1*}



2009 Contents lists available at ScienceDirect

Nuclear Instruments and Methods in Physics Research A

journal homepage: www.elsevier.com/locate/nima

EMSO: European multidisciplinary seafloor observatory

Paolo Favali^{a,b,*}, Laura Beranzoli^a



Physics of the Earth and Planetary Interiors 108 (1998) 175–183

PHYSICS
OF THE EARTH
AND PLANETARY
INTERIORS

GEOSTAR: a GEophysical and Oceanographic Station for Abyssal Research

L. Beranzoli^{a,*}, A. De Santis^a, G. Etiope^a, P. Favali^a, F. Frugoni^a, G. Smriglio^a, F. Gasparoni^b, A. Marigo^b

Eos, Transactions, American Geophysical Union, Vol. 81, No. 5, February 1, 2000,

European Seafloor Observatory Offers New Possibilities for Deep-Sea Study

GEOPHYSICAL RESEARCH LETTERS, VOL. 29, NO. 19, 1898, doi:10.1029/2001GL014072, 2002

Warming, salting and origin of the Tyrrhenian Deep Water

J.-L. Fuda,¹ G. Etiope,² C. Millot,¹ P. Favali,² M. Calcarà,² G. Smriglio,² and E. Boschi²

Geo-Mar Lett

DOI 10.1007/s00367-006-0040- © Springer-Verlag 2006

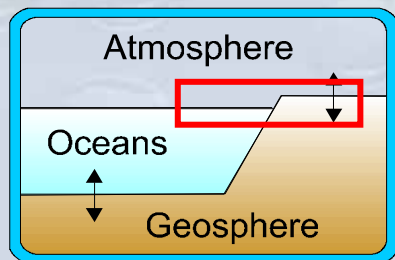
Monitoring of a methane-seeping pockmark by cabled benthic observatory (Patras Gulf, Greece)

Giuditta Marinaro • Giuseppe Etiope • Nadia Lo Bue • Paolo Favali • George Papatheodorou • Dimitris Christodoulou • Flavio Furlan • Francesco Gasparoni • George Ferentinos • Michel Masson • Jean-François Rolin

Environmental Geology (2004) **46:1053–1058**

GMM—a gas monitoring module for long-term detection of methane leakage from the seafloor

G. Marinaro • G. Etiope • F. Gasparoni • D. Calore • S. Cenedese • F. Furlan
M. Masson • F. Favali • J. Blandin



Origin, migration and emission of hydrocarbons

GAS SEEPAGE

Environment

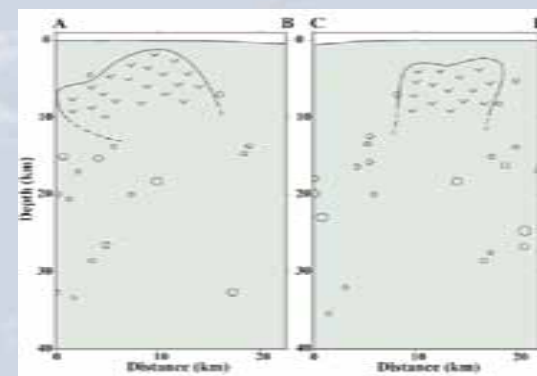
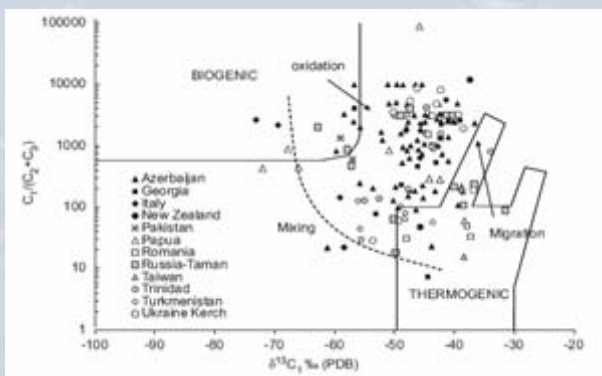
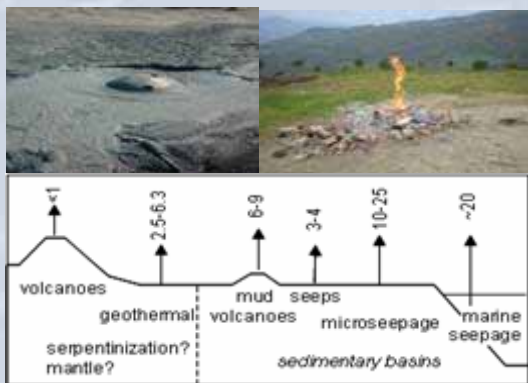
Greenhouse-gas emission
Environmental hazards

Petroleum exploration

Gas origin,
reservoir detection

Tectonics - geophysics

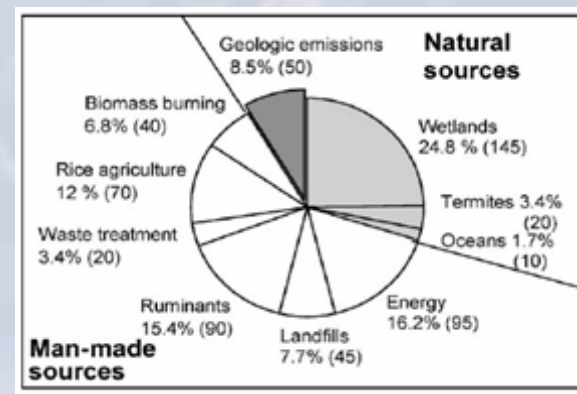
Saline tectonics
gas and seismicity



Main results:

-Geo-emissions are the 2nd natural source of CH₄

- Global and European emission estimates acknowledged by IPCC (4^o AR), US-EPA and EEA (EMEP/CORINAIR)



Chemosphere 49 (2002) 777–789

CHEMOSPHERE

Geologic emissions of methane to the atmosphere

Giuseppe Etiope ^{a,*}, Ronald W. Klusman ^b

Geology; June 2004; v. 32; no. 6; p. 465–468;

Methane emission from mud volcanoes in eastern Azerbaijan

G. Etiope Istituto Nazionale di Geofisica e Vulcanologia, Section of Roma 2, via Vigna Murata 605, Rome, Italy
A. Feyzullayev Geology Institute of Azerbaijan, National Academy of Sciences, H. Cavid pr. 29A, Baku, 370143, Azerbaijan
C.L. Baciu Babes-Bolyai University, Department of Geology, M. Kogalniceanu Strasse 1, Cluj-Napoca, Romania
A.V. Milkov BP America, Exploration and Production Technology, Houston, Texas 77079, USA

GEOPHYSICAL RESEARCH LETTERS, VOL. 35, L09307, doi:10.1029/2008GL033623, 2008



Reappraisal of the fossil methane budget and related emission from geologic sources

Giuseppe Etiope,¹ Keith R. Lassey,² Ronald W. Klusman,³ and Enzo Boschi¹



Atmospheric Environment 38 (2004) 3099–3100

ATMOSPHERIC ENVIRONMENT

www.elsevier.com/locate/atmosenv

New Directions: GEM—Geologic Emissions of Methane, the missing source in the atmospheric methane budget [☆]



Available online at www.sciencedirect.com

ScienceDirect

Global and Planetary Change 43 (2005) 79–88

GLOBAL AND PLANETARY CHANGE

www.elsevier.com/locate/gloplacha

Did geologic emissions of methane play any role in Quaternary climate change?

Giuseppe Etiope^{a,*}, Alexei V. Milkov^b, Edward Derbyshire^c



Contents lists available at ScienceDirect

Marine and Petroleum Geology

journal homepage: www.elsevier.com/locate/marpetgeo

Terrestrial methane seeps and mud volcanoes: A global perspective of gas origin

Giuseppe Etiope^{a,*}, Akper Feyzullayev^b, Calin L. Baciu^c

Environmental Geology (2004) 46:997–1002

A new estimate of global methane flux from onshore and shallow submarine mud volcanoes to the atmosphere

Giuseppe Etiope · Alexei V. Milkov



Available online at www.sciencedirect.com



ScienceDirect

Atmospheric Environment 43 (2009) 1430–1443

ATMOSPHERIC ENVIRONMENT

www.elsevier.com/locate/atmosenv

Natural emissions of methane from geological seepage in Europe

Giuseppe Etiope^{*}



Available online at www.sciencedirect.com



ScienceDirect

Journal of Volcanology and Geothermal Research 165 (2007) 76–86

Journal of Volcanology and Geothermal Research

www.elsevier.com/locate/jvolgeores

Natural emissions of methane from geothermal and volcanic sources in Europe

G. Etiope^{a,*}, T. Fridriksson^b, F. Italiano^c, W. Winiwarter^d, J. Theloke^e

23 JANUARY 2009 VOL 323 SCIENCE www.sciencemag.org

Earth's Degassing: A Missing Ethane and Propane Source

Giuseppe Etiope^{1*} and Paolo Ciccioli²

Staff working in HYPOX

Coworker name

Expertise

Giuseppe ETIOPE, Senior Researcher, Petroleum Geochemistry

Methane, HC seepage

Giuditta MARINARO, Technologist, Physics

Instruments/observatories:
test and data quality checks

Nadia LOBUE, Researcher, Natural Sciences

Physical oceanography
sensor tests and quality checks

Paolo FAVALI, Research Director, Geophysics

EMSO coordinator

Geophysical hazards
seafloor observatory network

Ludovica SARTINI, Ph.D. fellow, Marine Chemistry

Environmental monitoring
sensor tests and data quality



HYPOX objectives

“ In summary, HYPOX will develop a research platform for understanding past, present and future impacts of natural variation, global change and land use on oxygen depletion. HYPOX will gather long-term data on the oxygen status of aquatic ecosystems, and on feedbacks to the System Earth. HYPOX observatories will consist of continuous sensor systems and accompanying field studies and experiments in a wide range of European aquatic ecosystems.”

We will investigate critical parameters for the prediction of trends in oxygen depletion in surface and deeper waters including

- input of oxygen by mixing with oxygen-rich water masses
- oxygen production by photosynthesis
- oxygen consumption by respiration of organic matter
- oxygen consumption by chemical and biological oxidation of reduced substances → **Gas (CH₄) seepage**
- oxygen degassing by warming
- intrusion of oxygen depleted waters

INGV role

Seepage-related hypoxia

- a) oxygen consumption by CH₄ oxidation
- b) up-welling (driven by density changes) of deep oxygen-poor water into the photic zone and surface layer

What I need and how I can get it
(scientific requirements and technical spec)

Causes and effects
(practical implications)

Data for end-users

Field studies
(Black Sea)

Field studies
(Greece)



WP No	Work package title	Type of activity*	Lead partner no	Lead partner short name	Person - months	Start month	End month
WP 1	Improving and integrating in situ observation capacities of oxygen depletion	RTD	7	INGV	62	1	36
WP 2	Modeling and prediction of short and long term factors affecting oxygen depletion in different systems	RTD	16	KNAW	108	1	36
WP 3	Existing and future impacts of hypoxia on ecosystems	RTD	2	AWI INGV	88	1	36
WP 4	Indicators of past hypoxia dynamics: improving long term records by abiotic and biotic proxies	RTD	4, 9	IBSS / ITU	100.5	1	36
WP 5	Knowledge base on oxygen depletion: Data sharing, standardization and interoperability according to GEOSS	RTD	10	Uni-HB INGV	62.5	1	36
WP 6	Assessing in situ oxygen depletion in shelf and open seas	RTD	6	IFREMER INGV	172.5	1	36
WP 7	Assessing in situ oxygen depletion in land locked water bodies	RTD	11	SAMS INGV	146	1	36
WP 8	Coordination, dissemination and outreach	RTD	1	MPG-MPIMM	81.5	1	36
		TOTAL			821		

Instrumentation

For spatial surveys

MEDUSA

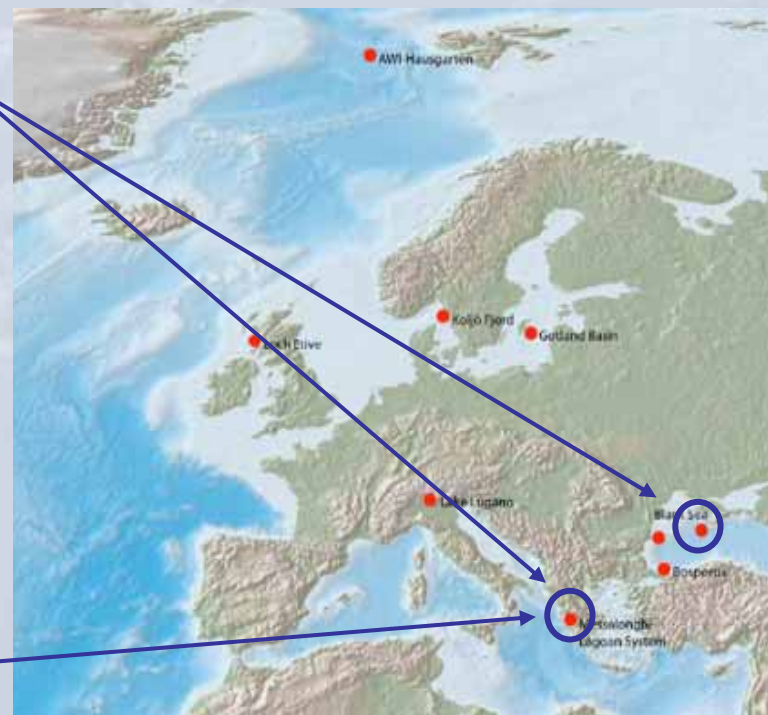
Module for Environmental
Deep-Under-Sea Analysis



For long-term monitoring

GMM

GAS MONITORING
MODULE



....HYPOX kickoff: Partner Institutions introduction

Partner 8:

IOW (Warnemuende, Germany)



....HYPOX kickoff: IOW introduction



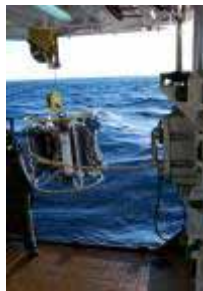
Leibniz-Institut für Ostseeforschung Warnemünde

www.io-warnemuende.de



hypox₂

The Departments



Physical Oceanography



Currents
Turbulence
Mixing processes



Marine Chemistry



Pollutants (natural and anthropogenic)
Nutrients
Carbon cycle and trace gases



Marine Biology



Marine organisms and their nutritional relations
Ecosystem function
Microbiology



Marine Geology



Sediments
Reconstruction of earlier environmental conditions

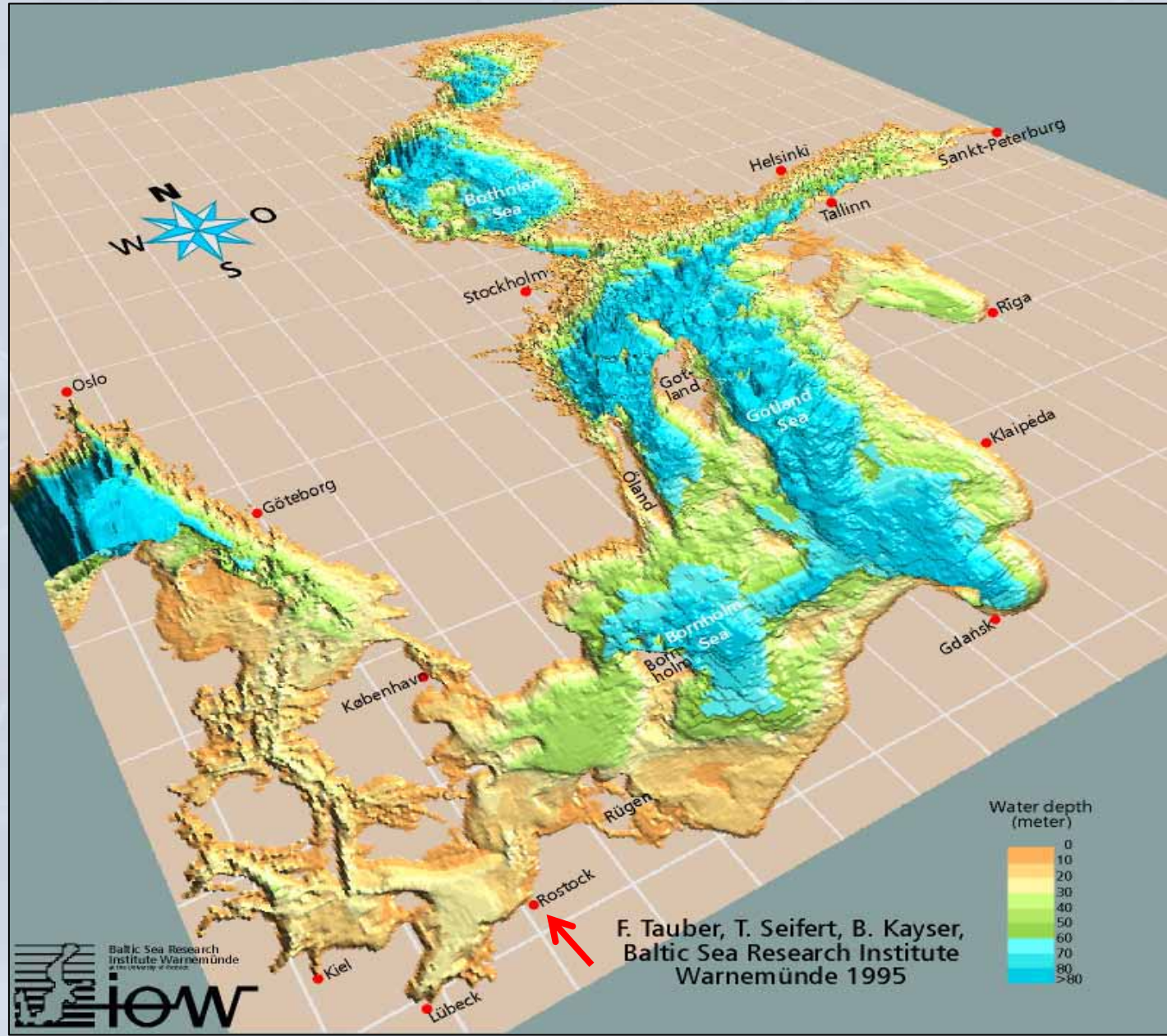
IOW in numbers

- Founded: 1992
- Staff: ~ 170
- Total budget: approx. 12,7 Mio Euro
- Third party funds: ~ 2,2 Mio Euro

....HYPOX kickoff: IOW introduction

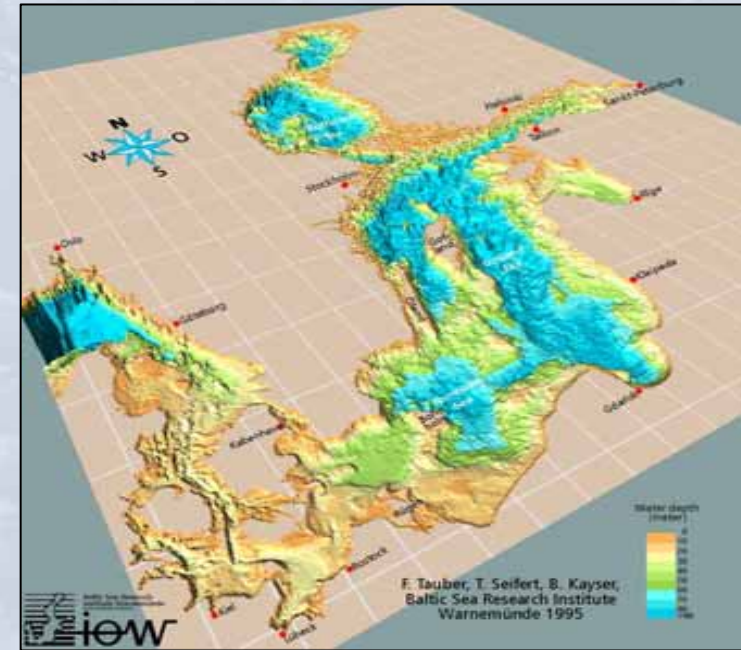


Key Research Area: The Baltic



IOW in the Baltic

- Long-term monitoring
 - > 5x per year sampling
 - > 3 MARNET stations
- Modelling capacity
 - > Advanced ecosystem model
 - > Modular turbulence solvers
- Institute's ship dedicated to the Baltic Sea
- Special instrumentation
 - > Pump-CTD
 - > Falcon ROV
- Variety of research activities through all disciplines
 - > Nutrient balance, carbonate system, trace gases
 - > Redoxcline processes (electron transfer, microbiology, mixing)
 - > Sediment flux and proxy formation ...



Main project participants

Gregor Rehder

Vice head Dept.
Marine Chemistry,
GD Instrumentation,
Trace Gases



Detlef Schulz-Bull

Head Dept. Marine
Chemistry
Particle Transformation



Ralf Prien

Scientist
Chemical sensor
development
GD Instrumentation



Siegfried Krüger

Head of Marine
Instrumentation
GD Instrumentation



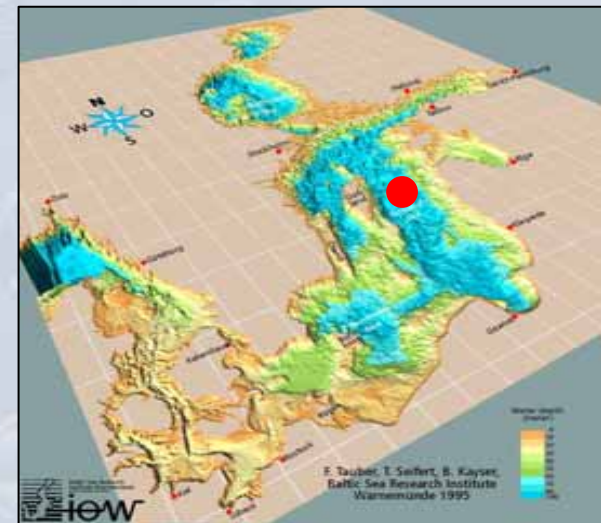
But far more people
related to the
project

....HYPOX kickoff: IOW introduction

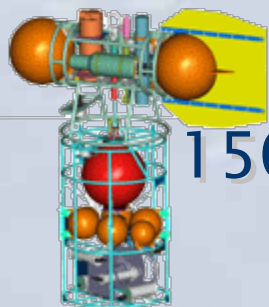
10 m

Main HYPOX activity:
Permanent profiling
station

Underwater winch



Profiler



....HYPOX kickoff: Partner Institutions introduction

Partner 9:

ITU–EMCOL (Istanbul, Turkey)





Istanbul Technical University Eastern Mediterranean Centre for Oceanography and Limnology <http://www.emcol.itu.edu.tr>

Research Areas

- Climate and environmental reconstructions
 - Palaeoceanography
 - Palaeoclimatology
 - Sea-level and coastline changes
- Geohazards:
 - Submarine earthquake studies
 - Submarine landslides studies
 - Tsunami studies





ITU-EMCOL Research Facilities

Core Analysis Lab

ITRAX XRF Core Scanner
MSCL (physical properties)

Sedimentology Lab

Lazer particle-size analyzer
Mechanical sifter
Binocular ve optical microsc.

Geochemistry Lab

TOC/TIC analyzer
Spectrophotometer
Freeze-dryer
Centrifuge



Wet-core lab

Core cutting-splitting
Core photography
Core sampling
Geomechanical analysis

Field Equipment Facility

Subbottom profiler
Platform, tripod, vinç, engine
and generator
Various corer
CTD probe
6 m boat ve engine

Core Storage Facility

Duties of ITU-EMCOL in Hypox

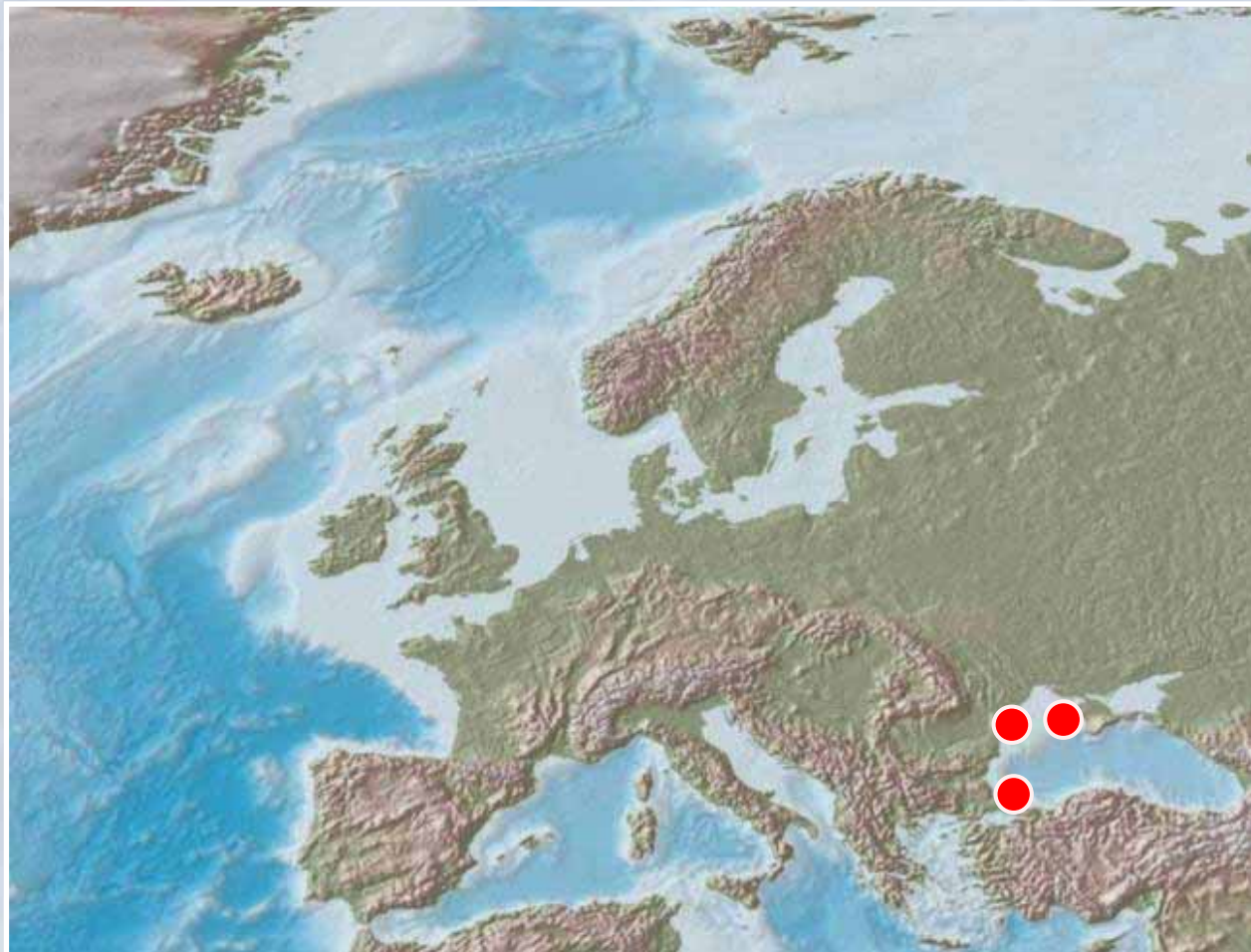
Main study sites: Bosphorus, Crimea and Romania areas of Black Sea.

Tasks under WP4: Study high resolution sedimentary records of redox conditions; paleoclimate and its relation to oxygen depletion

Methods:

In the Bosphorus-
Black Sea area:

- a) High resolution seismic profiling
- a) Coring along depth transects
- b) Sediment core analysis using mainly inorganic geochemical proxies



EMCOL Core Analysis Laboratory

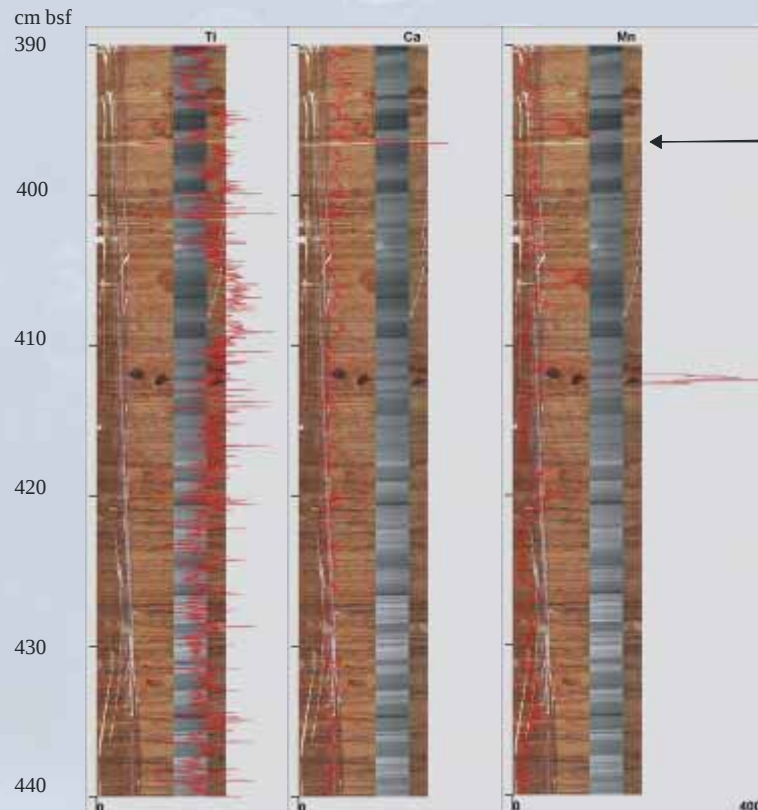
Itrax XRF Core Scanner

- XRF Micro-analysis (200 μm) for multi-element
- geochemical analysis
- X-ray radiography (20 μm)
- Digital colour imaging



PALEOCLIMATE RECORDS IN SEDIMENT CORES

Black Sea Core SL12, Section 5



↑
Coccolith Unit

←
First occurrence of
Emiliana Huxleyi
(2720 $\pm$ 160 a BP;
Jones & Gagnon, 1994)

Sapropel Unit
(8000-1635 a BP)

Main project participants



Namık Çağatay
Group Leader
Geochemistry



Ümmühan Sancar
Paleoceanography,
paleoclimate



Dursun Acar
Engineer: coring and
Coring & core analysis



Temel Oğuz
Physical oceanography
Biogeochemical modelling



Sena Akçer
Micropaleontology
Benthic foraminifera



Umut B. Ülgen
Paleo-limnology,
Core analysis

....HYPOX kickoff: Partner Institutions introduction

Partner 10:

Uni-HB (Bremen, Germany)



....HYPOX kickoff: Uni-HB introduction

MARUM– Center of Marine Environmental Sciences at Bremen University

(www.marum.de)



MARUM in brief

- MARUM comprises the DFG research center and the cluster of excellence "The Ocean in the Earth System"
- Contributing institutions– AWI, MPI, Senckenberg, ZMT
- MARUM–UniHB consists of several research groups at the University of Bremen, Department of Geosciences
- About 200 employees mainly involved in Marine Geosciences
- PANGAEA and MARUM technology group ~30 people



MARUM in brief

- MARUM focuses on six research areas:
 - Ocean and Climate,
 - Biogeochemical Processes,
 - Sedimentation Processes,
 - Coastal Dynamics and Human Impacts,
 - and
 - Seepage of Fluid and Gas
 - Hydrothermal Vents

Project-relevant facilities

Support and services

- Data centre PANGAEA
- Testing facilities for underwater equipment (pressure vessel, water basin)
- Electronic lab– design and test

MARUM/Uni-HB tasks in HYPOX

- contribution to the technical implementation, interoperability, standardization and quality assurance issues
- contribution to GEOSS related issues
- lead of WP5– Knowledge base on oxygen depletion: Data sharing, standardization and interoperability according to GEOSS

Main project participants

Michael Diepenbroek

Data management,
GEOSS



Gerrit Meinecke

Technology



Christoph Waldmann

Technology,
GEOSS



....HYPOX kickoff: Partner Institutions introduction

Partner 11:

SAMS (Oban, Great Britain)



....HYPOX kickoff: SAMS introduction

Scottish Association for Marine Science

www.sams.ac.uk



SCOTTISH
ASSOCIATION
for MARINE
SCIENCE

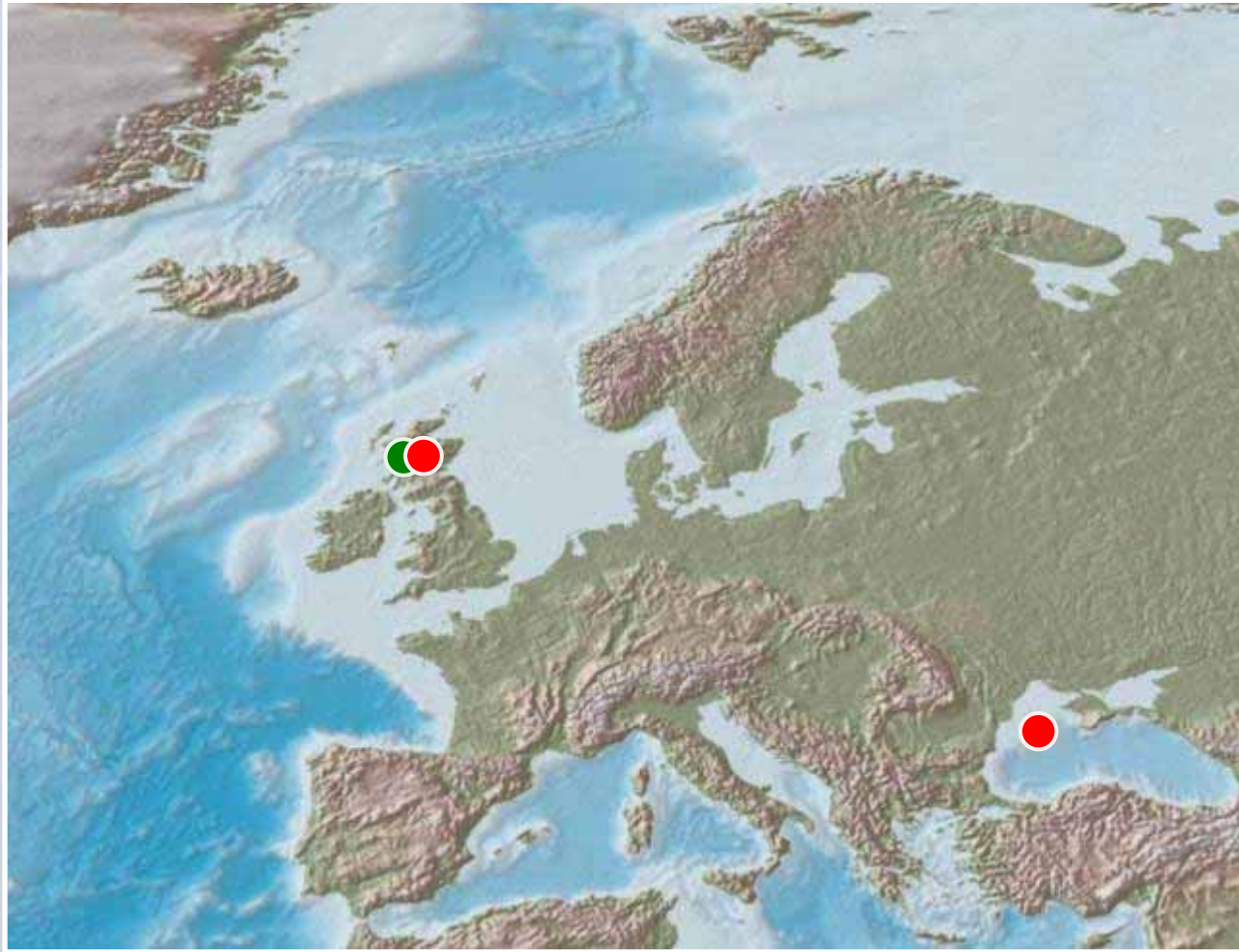
SAMS in brief



- Approaches and concepts
Combining field observations with computer modeling of sal-temp-oxygen distribution in Loch Etive; prediction of timing and frequency of renewal events and duration of hypoxia based on IPCC scenarios; effects on benthic biogeochemistry
- Methods & tools
In situ observatory, remote sensing, benthic landers, macro & microsensors, hydrodynamical model (POLCOMS) & box model
- HYPOX-related departments and role in HYPOX
Biogeochemistry, Physics & Technology
 - > WP7-lead
 - > establishment of permanent observatory in Loch Etive
 - > field studies (Loch Etive & Black Sea)
 - > modeling of sal-temp-oxygen distribution in Loch Etive



Institute & main study sites location

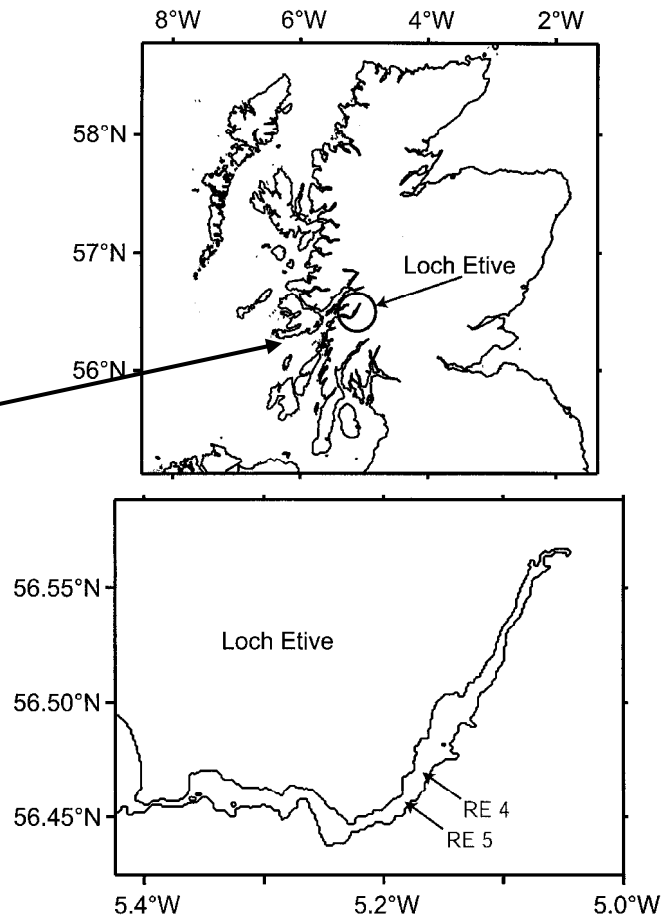
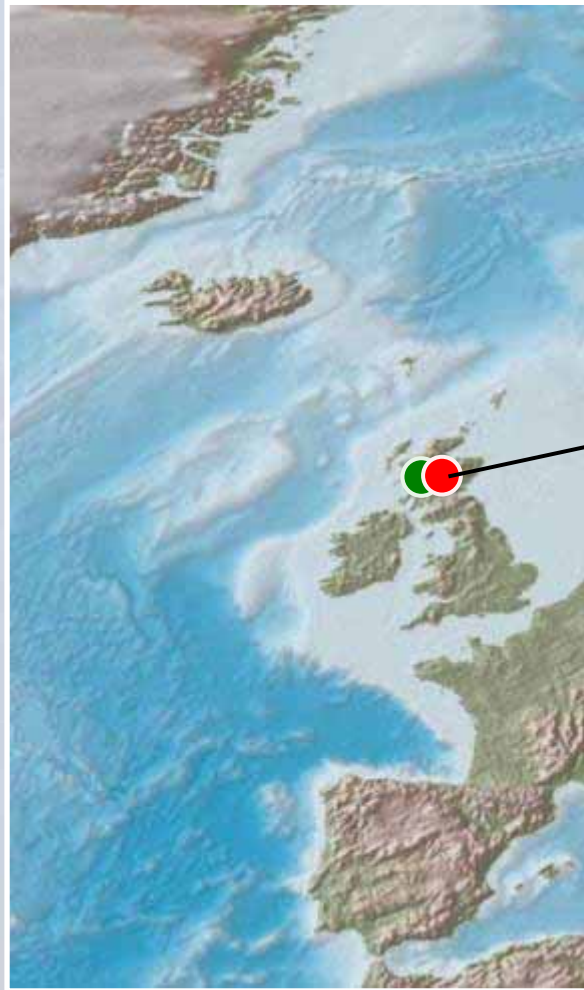


SAMS

Loch Etive

Black Sea

Institute & main study sites location



SAMS

Loch Etive

Black Sea

SAMS main project participants



Prof. Ronnie Glud
Groupleader
Microsensor & landers



Dr. Henrik Stahl
Research Associate
In situ measurements,
lead WP 7



Dr. Mark Inall
Head of department
Physics, sea ice &
technology



Dr. Dimtry Aleynik
Research associate
Physics, modeling



Dr. Keith Jackson
Dept. Groupleader
Marine technology



John Bass
Engineer
Marine technology

SAMS infrastructure

- 2 research vessels
- Mechanical & electronics workshops
- New aquarium facilities
- Modern analytical & wet labs
- Benthic lander centre
- Microsensor laboratory
- Diving facility
- Conference & meeting rooms
- Various sampling gear
- Library
- Etc....



SAMS tasks in HYPOX:

- WP 1 – scientific requirements, technical specification & strategy and recommendations for Etive observatory (T1.1–1.3)
- WP 2 – modelling of O₂ dynamics in Loch Etive (T2.4)
- WP 3 – input to existing and future impacts of hypoxia on ecosystems (T3.1–3.3; T3.5–3.7)
- WP 5 – data management & standardization (T5.1–5.4)
- **WP 7 – implementation and operation of Etive observatory (T7.1–7.3)**
- WP 8 – dissemination and outreach of findings (T8.4–8.5)



....HYPOX kickoff: Partner Institutions introduction

Partner 12:

UGOT (Goeteborg, Sweden)



....HYPOX kickoff: *UGOT* introduction

University of Gothenburg www.gu.se

Dept. of Chemistry www.chem.gu.se and

Dept. of Earth Sciences www.gvc.gu.se

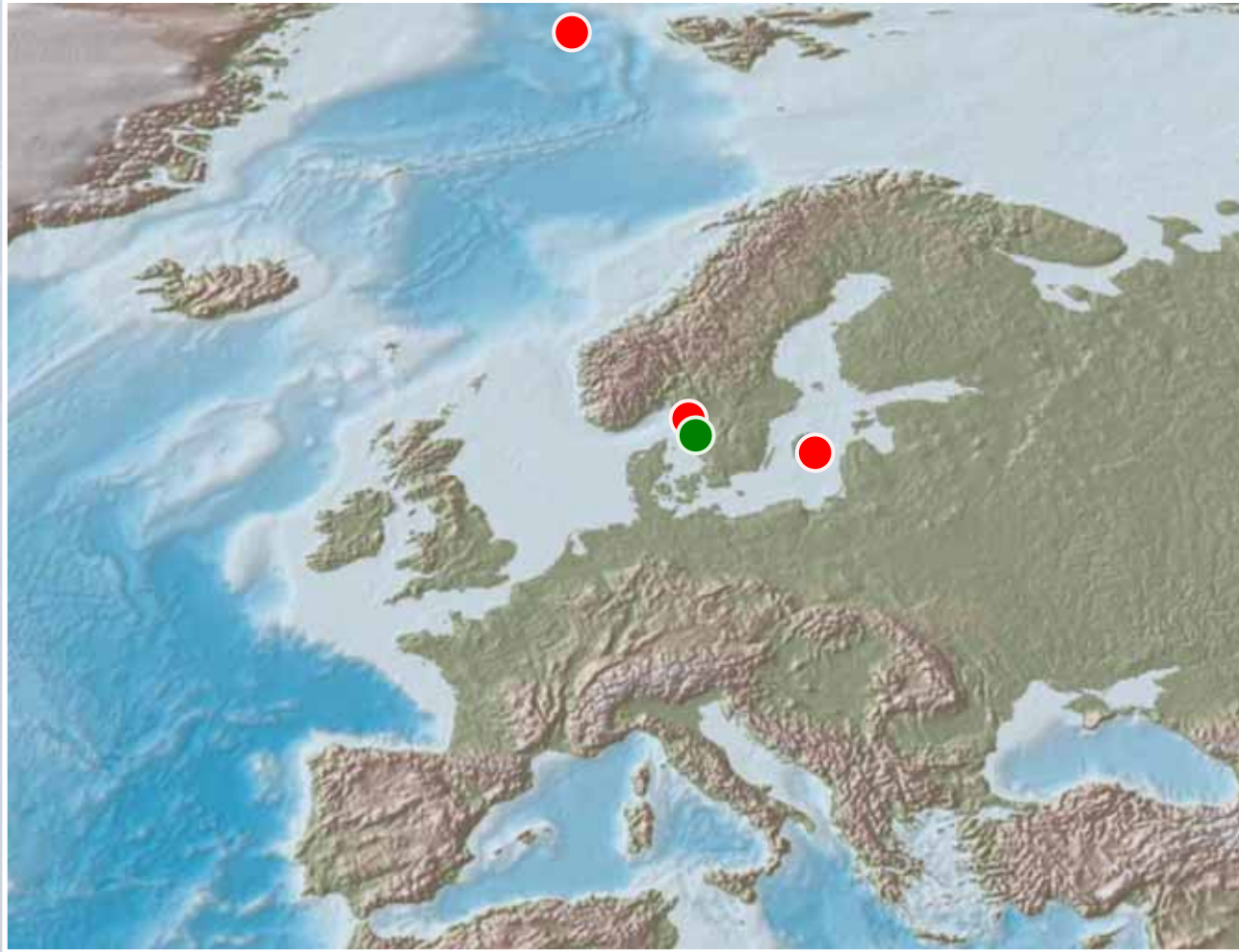


The University of Gothenburg in brief

- Approaches & concepts
Combining field research / measurements on processes and distributions in sediment and water with modeling
- Methods & tools:
From in-situ studies using benthic landers, planar optodes and LT moorings (T, S, and O₂ in surface water; O₂ and currents in bottom water) to coupled modeling; From biogeochemistry to physical oceanography
- HYPOX-related groups and role in HYPOX
Benthic biogeochemistry group, Marine Systems Analysis group
 - > Field studies (Koljö Fjord, Gotland Basin, Hausgarten / Fram Strait)
 - > 1-D process-based physical-biogeochemical modeling
 - > Field site study lead (Koljö Fjord)
 - > Cruise lead (Koljö Fjord, Gotland Basin)



Institute & main study sites location



University of
Gothenburg

Koljö Fjord

Gotland Basin

AWI-Hausgarten

....HYPOX kickoff: *UGOT* introduction

Main project participants

Per Hall, Chemistry

Group leader at UGOT, Professor
Lead HYPOX scientist at UGOT

Anders Stigebrandt, Earth Sciences

Group leader at UGOT, Professor
Modeling; Phys–biogeochem
comp.

Anders Tengberg, Chemistry

Associate professor
Benthic lander work; WC moorings

Postdoc NN, Earth Sciences

Together with Stigebrandt
Process–based modeling
Water column field
campaigns

Madeleine Nilsson,
Chemistry

Ph. D. student
Benthic C dynamics
Organic carbon budget

Mikhail Kononets, Chemistry

Ph. D. student
Benthic lander work
Vertical BW O₂ gradients
Benthic O₂ dynamics



....HYPOX kickoff: Partner Institutions introduction

Partner 13:

UPAT (Patras, Greece)



....HYPOX kickoff: UPAT introduction

Department of Geology

University of Patras

Laboratory of Marine Geology &
Physical Oceanography (M.G.P.O)

www.gaiaocean.geology.upatras.gr/marine_geology



....HYPOX kickoff: UPAT introduction

The Laboratory of Marine Geology & Physical Oceanography (M.G.P.O) in brief (1 / 2)

The aims of the Laboratory:

to train undergraduate and postgraduate students in Marine Sciences

to carry out fundamental research in the fields of Marine Geology, Physical Oceanography, Palaeoclimatology/Palaeoceanography and Oceanographical Archaeology

to offer high quality scientific and engineering service and consultation to Governmental Agencies, Local Authorities and Private Industry

(harbors, pipelines, u/w power and telecommunication cables, e.t.c)

HYPOX-related groups and role in HYPOX

I.N.G.V

> field studies (Amvrakikos Gulf, Aetoliko Lagoon, Katakolo bay-WP7) and WP1,WP4

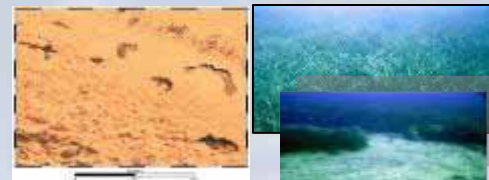
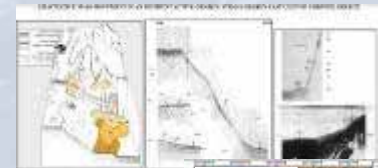
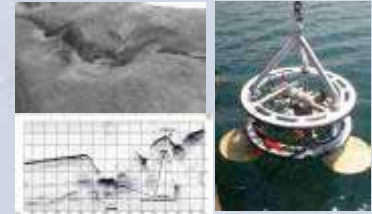


....HYPOX kickoff: UPAT introduction

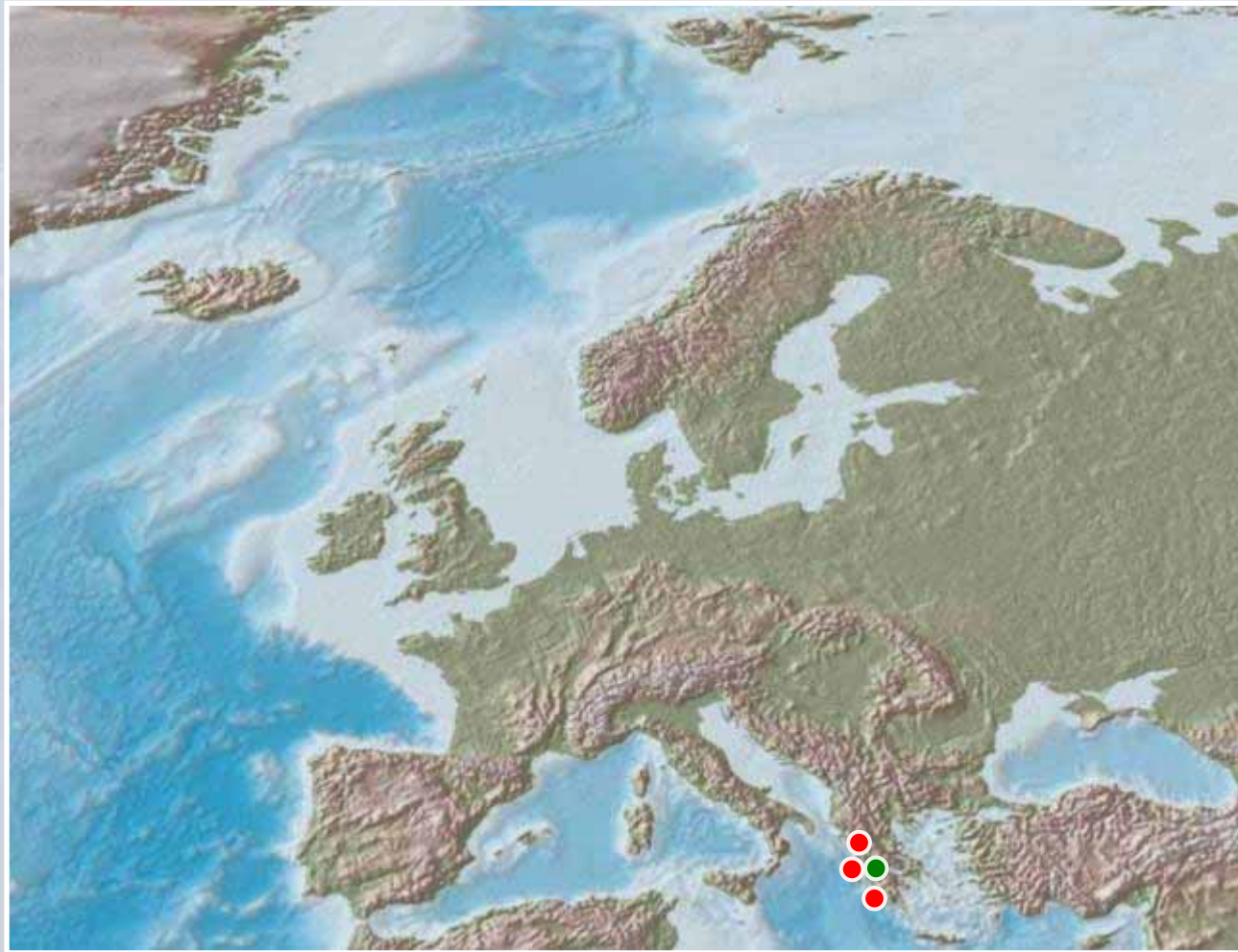
The Laboratory of Marine Geology & Physical Oceanography (M.G.P.O) in brief (2/2)

The Laboratory has been involved in a wide range of scientific topics:

- from gas charged sediments to pockmarks monitoring
- from submarine landslides to submarine faults and tsunamis
- from heavy metals and NORM/Cs in marine sediments to marine litter
- from palaeoceanography to reconstruction of coastal and underwater archaeological sites
- Habitat mapping from *Posidonia oceanica* to coralline algae formations



Institute & main study sites location



Laboratory of Marine
Geology & Physical
Oceanography
(UPAT)

Amvrakikos Gulf

Aetoliko Lagoon

Katakolo Bay

Main project participants

George Papatheodorou
HYPOX scientist in
charge



George Ferentinos
HYPOX member



Maria Geraga
HYPOX member



....HYPOX kickoff: UPAT introduction Infrastructure (1 / 4)



3.5 kHz ORE Pinger
with 4 and 9
transducers



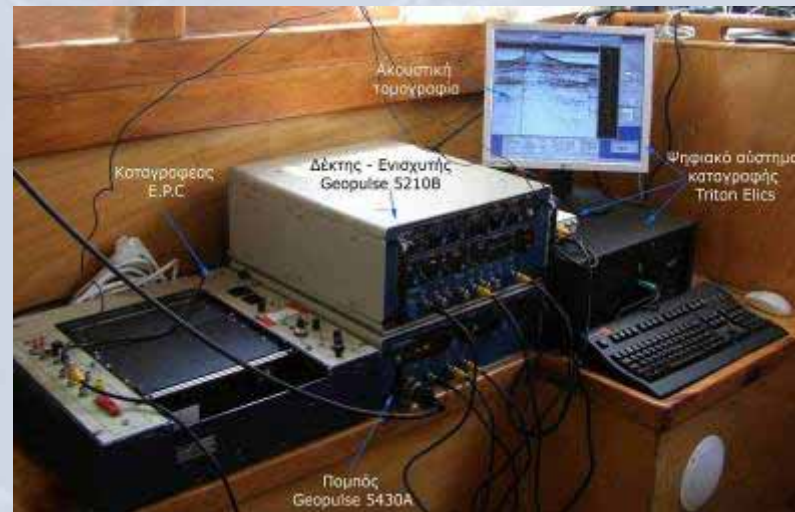
S.I.G. Hydrophones:
1 channel, 4 cells.
1 channel, 8 cells
2 channels, 4, 8, 12 cells



S.I.G. Sparker
2000A και 2000B
Geopulse Receiver
Triton Elics Digital
Acquisition system

SUBBOTOM PROFILER

3.5kHz Pinger, O.R.E.–Geopulse
SPARKER (SIG Sparker System 2000AB)



Geopulse Transceiver/Receiver Triton Elics Digital
Acquisition system

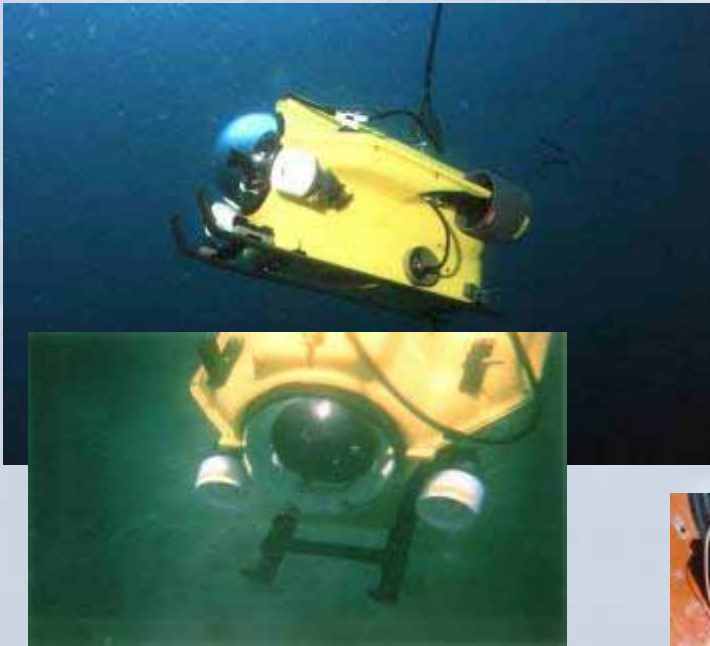


....HYPOX kickoff: UPAT introduction

Infrastructure (2 / 4)

REMOTE OPERATED VEHICLE
Benthos MKII (R.O.V)

Operational depth 300 m



SIDE SCAN SONAR EG&G
272TD towfish Edgetech 4100-
P digital recording unit



MARINE MAGNETOMETER

Overhouse type

SeaSPY (Marine Magnetics)



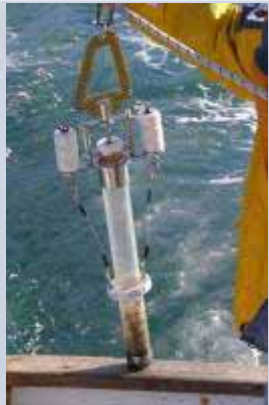
....HYPOX kickoff: UPAT introduction Infrastructure (3/4)



Benthos Gravity Corer



Box Corer



KC Kajak Corer



Day-Grab



Van-Veen Grab



Multi-parameter seawater sensors
YSI 600XL



Multi-parameter seawater sensor and current meter
Aanderaa RCM9 MK II.



Multi-parameter seawater sensors
Insitu troll 9500



Water Sampler
HydroBios



Methane Sensor METS
Franatech

....HYPOX kickoff: UPAT introduction Infrastructure (4/4)

Sieves



particle size analyzer
(MasterSizer 2000)



Perkin Elmer 3100 Atomic
Absorption Spectrometer



ICP-MS Perkin Elmer



Microwave digestion MLS 1200 mega



Microscope sediments
analysis



shear box

....HYPOX kickoff: Partner Institutions introduction

Partner 14:

GKSS (Geesthacht, Germany)



Helmholtz Association of German Research Centres

Institute for Coastal Research

Operational Systems

*Radar Hydrography
Remote Sensing
Coastal Oceanographic
Measurement Systems
In situ Measurements
Ecosystem Modelling
Marine Bioanalytical
Chemistry*

Systems Analysis and Modelling

*Coastal Climate
Regional Atmospheric Modelling
Modelling for the Assessment of Coastal Systems
Data Analysis and Data Assimilation
Palaeoclimatology
Environmental Chemistry
Human Dimension of Coastal Areas*

Data Analysis and Data Assimilation (KSD)

*Remote Sensing
SAR*

*Numerical Modeling
Wind waves*

Circulation

*Biogeochemistry and
SPM transport*

Data Assimilation

European Projects in KSD

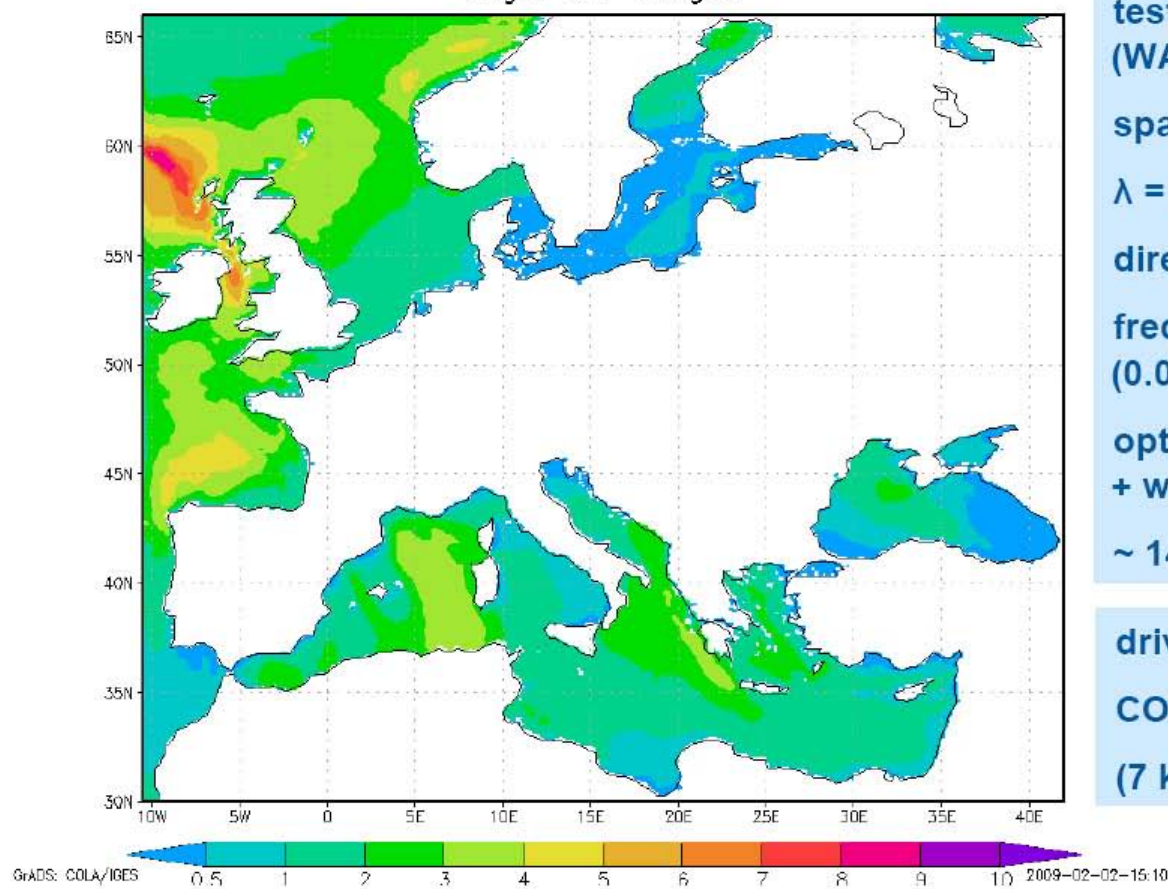
WASP	The Wadden Sea Project	MAST I	1991-1993
RACC	Regionalization of Anthropogenic Climate Change Simulations	MAST I	1993-1996
MTCF	Medium Term Climatic Variability	MAST II	1993-1996
NEPTUNE	An Integrated Approach for Determining NW European Coastal Extremes	MAST II	1994-1996
EROS 2000	Interaction between the River Danube and the north-western Black Sea: Pilot Phase.	Climate and Environment	1994-1996
WASA	Waves and Storms in the North Atlantic	Climate and Environment	1994-1997
EROS 21	Biogeochemical Interactions between the Danube River and the North-western Black Sea	Climate and Environment	1996-1999
VENTIL	Ventilation of Black Sea anoxic waters	INCO-COPERNICUS	1996-2000
EuroROSE	European Radar Ocean Sensing	MAST III	1998-2001
PIONEER	Modelling of transport of Nutrients including data assimilation	MAST III	1998-2001
PROMISE	PRe-Operational Modelling In the Seas of Europe	MAST III	1998-2001

European Projects in KSD-2000s

ARAL-KUM	Desertification in the Aral Sea Region : a Study of the Natural and Anthropogenic Impacts	INCO-COPERNICUS	2000-2003
MaxWave	Rogue waves - Forecast and impact on marine structures	FP 5 Environment	2000-2003
Searoutes	Advanced Decision Support for Shiprouting based on Full-scale Ship-specific Responses as well as Improved Sea and Weather Forecasts including Synoptic, High Precision and Realtime Satellite Data	FP 5 Transport	2000-2003
Hipocas	Hindcast of Dynamic Processes of the Ocean and Coastal Areas of Europe	FP 5 Environment	2000-2003
DANUBS	Nutrient management in the Danube basin and its impact on the Black Sea	FP 5 Environment	2001-2005
ASSEMBLAGE	ASSEsMent of the BLAck sea sedimentary system since the last Glacial Extreme	FP 5 Environment	2003-2006
ADOPT	Advanced decision support system for ship design, operation and training	FP 6 Transport	2005-2009
SAFEDOR	Design, operation and regulation for safety of ships	FP 6 Transport	2005-2009
SESAME	Assessing and Modelling Ecosystem changes	FP 6 Environment	2006-2010
ECOOP	European COastal-shelf sea OPerational monitoring and forecasting system	FP 6 Environment	2006-2009
YEOS	Yellow Sea observation, forecasting and information system	FP 6 Global Change	2007-2009
HYPOX	In situ monitoring of oxygen depletion in hypoxic ecosystems of coastal and open seas, and land-locked water bodies	FP 7 Environment	2009-2012

Future DWD regional wave model

Sig.Wave Height



testrun: 20090122 00 UTC
(WAM Cycle 4.5.1_MPI)

spatial resolution:

$\lambda = 0.1^\circ$, $\varphi = 0.05^\circ$

directions : 24 (15°)

frequencies : 30
(0.04177 - 0.66264 Hz)

options : depth refraction
+ wave breaking

~ 140.000 active gridpoints

driving wind fields :

COSMO-EU

(7 km spatial resolution)

North Sea-Baltic Sea

$\Delta\lambda=\Delta\phi= 3$ min, Time step = 30 s

2 open boundaries (S and N)

German Bight

$\Delta\lambda=\Delta\phi= 1$ km, Time step = 10 s

2 open boundaries (W and N)

Wadden Sea

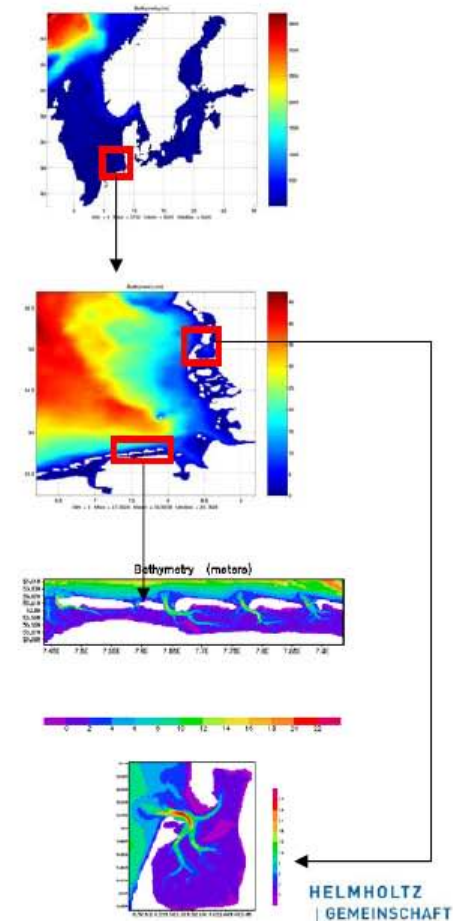
$\Delta\lambda=\Delta\phi= 200$ km, Time step = 3 s

3 open boundaries (W, N and E)

Sylt-Römö

$\Delta\lambda=\Delta\phi= 200$ km, Time step = 3 s

3 open boundaries (W, N and E)





....HYPOX kickoff: GKSS introduction

wissen
schafft
nutzen

COSYNA

GKSS
FORSCHUNGSZENTRUM

Netcdf Viewer - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://134.106.81.124/webNetcdf/

Google

Search

Bookmarks

PageRank

Check

Translate

AutoLink

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Send to

Settings

<<	<	Nov 2008				>	>>
Sun	Mon	Tue	Wed	Thu	Fri	Sat	
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30							

☒ Show flow velocity

☐ Regenerate image

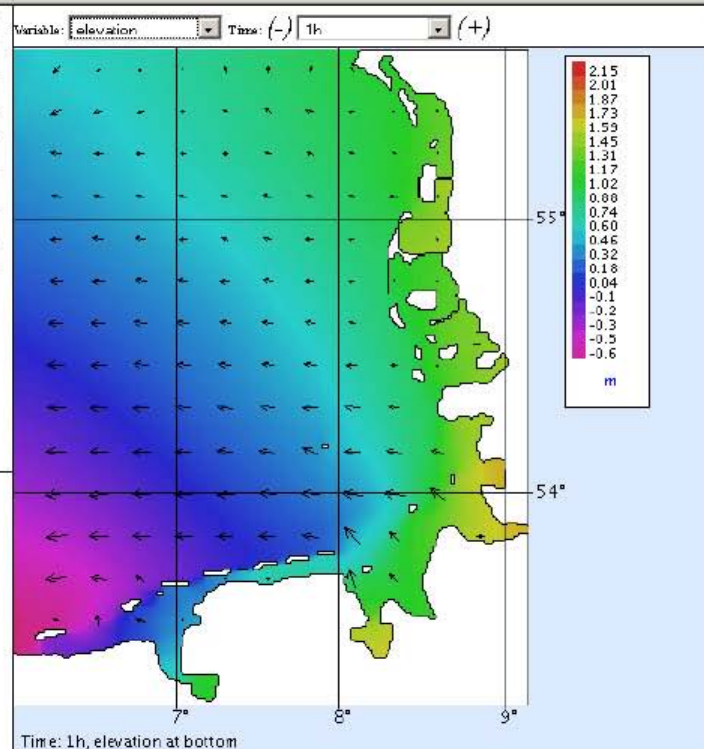
☒ Scale image



Download shown data as:

Datefile (Netcdf)

Download



<http://134.106.81.124/webNetcdf>

Satellite Data Assimilation into a Suspended Particulate Matter Transport Model

Mikhail Dobrynin, Heinz Günther and Gerhard Gayer

Institute for Coastal Research

GKSS Research Center

Germany

Processes included in the model:

Pro-
scharft
nutzen



Water column

Transport with ocean currents

Mixing due to waves and currents

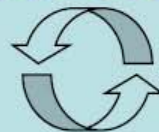
Sinking



21 Water layers

5-10 m

Water column



Seabed

Sedimentation

Resuspension

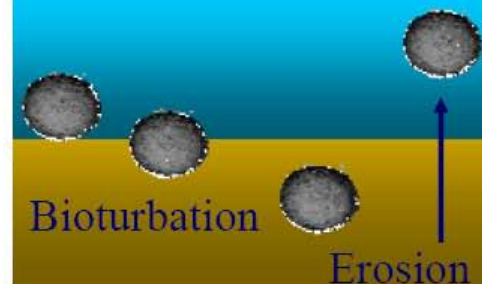


Resuspension

Seabed

Bioturbation

Erosion



Erosion

21 Seabed layers

0.5-1.0 mm

Modeled seasonal mean surface SPM concentration:

schaft
nutzen



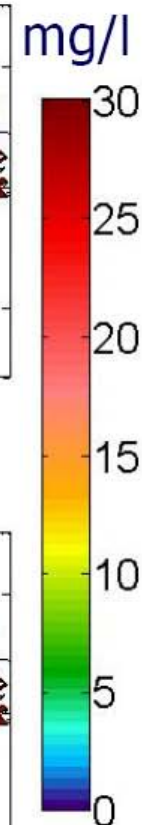
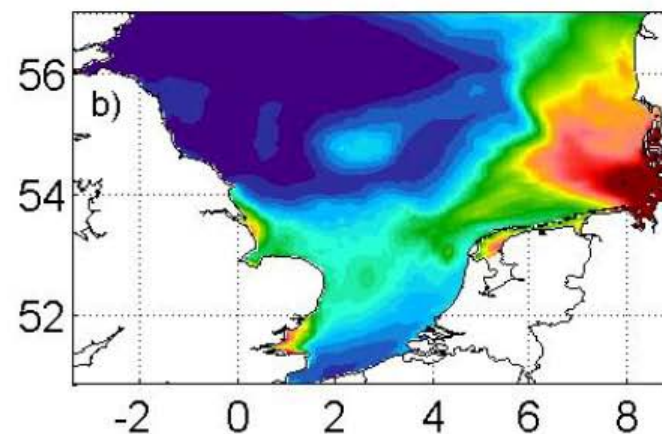
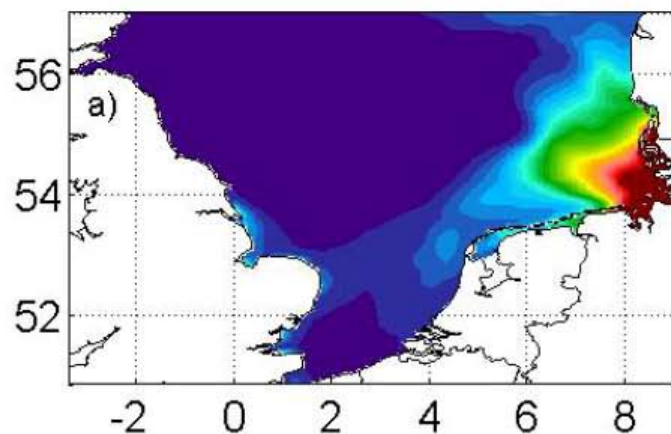
15 April-15 October 2003

15 October – 15 April 2003

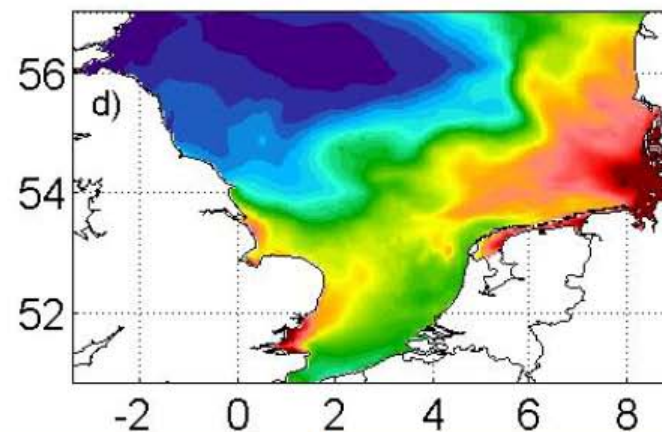
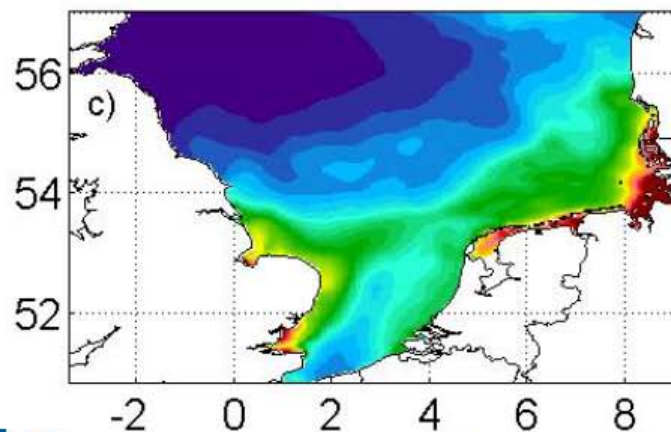
calm season

Without assimilation

stormy season



MERIS data assimilation (Optimum Interpolation)



BLACK SEA OCEANOGRAPHY

Understanding **BLACK SEA DYNAMICS**

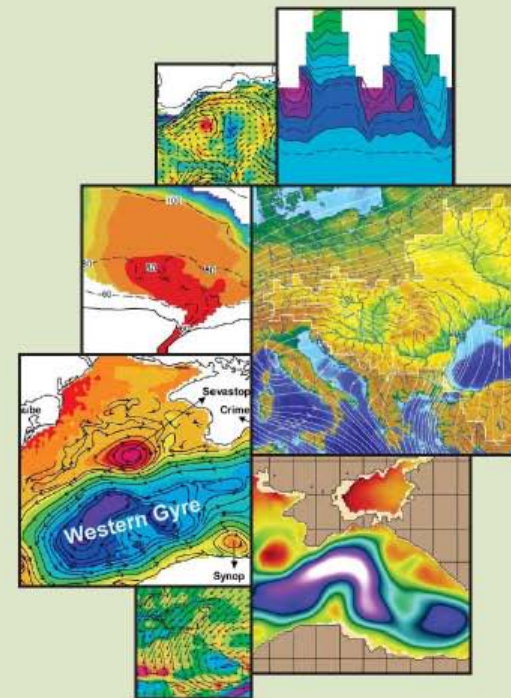
An Overview of Recent Numerical Modeling

BY EMIL V. STANEV

The importance of the Black Sea extends far beyond its regional role as a mixing body where Mediterranean water is diluted. This sea's marine environment acts as a small-scale laboratory for investigating processes that are common to different areas of the world's oceans. In particular, research on deep ventilation could facilitate understanding of similar controlling processes in the paleocean when the ocean's conveyor belt was shallower. Because water and salt balances are easily controllable and the scales are smaller than in the global ocean, this basin is a useful test region for developing models, which can then be applied to larger scales. Moreover, studying outputs from numerical models is an important complement to sparse observations and extends our knowledge. The major purpose of this paper is to demonstrate this possibility, using Black Sea physical oceanography examples based on numerical modeling results.

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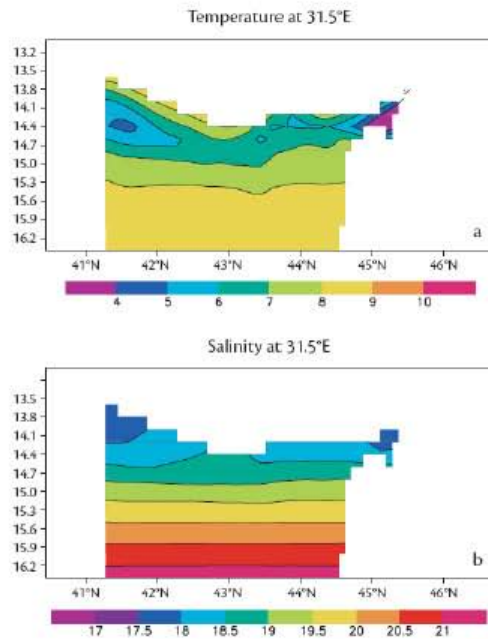


Figure 6. Meridional cross sections of simulated (a) temperature and (b) salinity in density coordinates at 31.5°E during April 1991. The simulations have been done with the 5-minute-resolution Black Sea Modular Ocean Model (MOM), its setup, forcing, and other technical details are described by Stanev and Staneva (2001) and Stanev et al. (2005). The upper panel represents the CIL. The larger 'depth' of CIL in the interior Black Sea seen in isopycnal coordinates is due to upwelling (causing shallower isopycnals). The bottom panel demonstrates that below $\sigma_t = 15.5$ (density layer in kg/m³) stratification is entirely dependent on salinity, and isohalines coincide with the isopycnals.

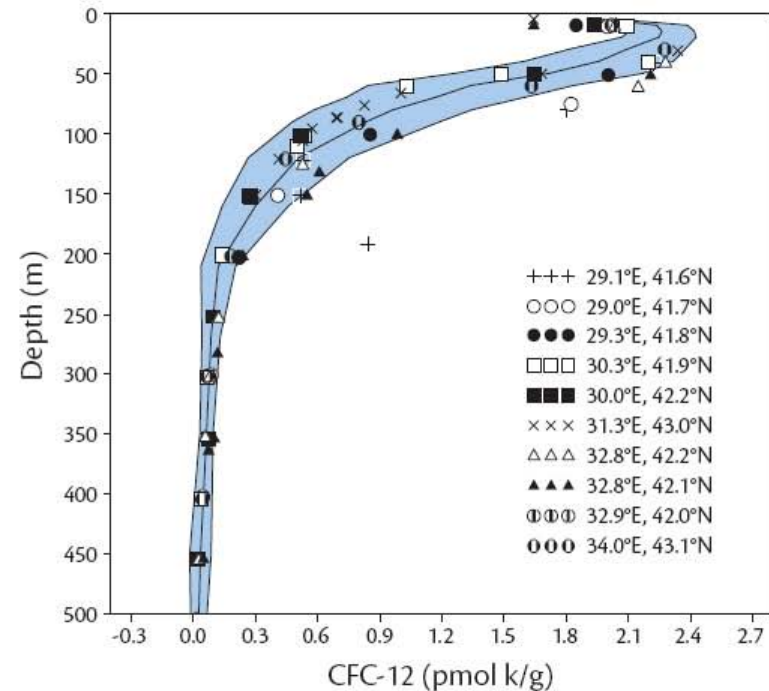


Figure 7. CFCs are passive tracers giving a valuable information about pathways of water masses (Stanev et al., 2004). Here, we show vertical profiles of CFC-12 in the Black Sea (area mean and one standard deviation) as simulated by the Black Sea Modular Ocean Model (MOM). The accuracy of simulations in replicating the penetration of surface signals is supported by comparisons with field observations. Data from the R/V *Knorr* 1988 cruise (for more details see Stanev et al., 2004) are plotted by symbols. The legend gives the correspondence between symbols and station numbers. The outlier at 200 m is from measurements very close to the strait, thus, this value is higher, displaying deep ventilation by the buoyant plume.

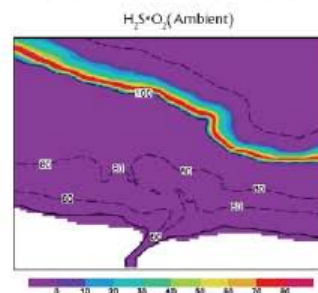
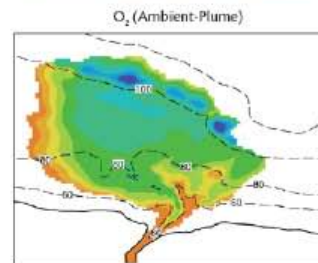
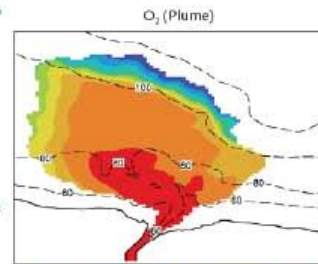
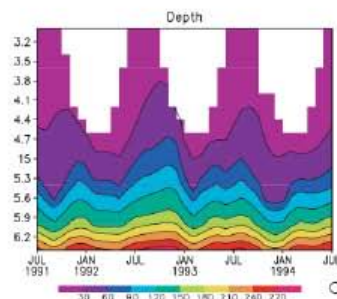
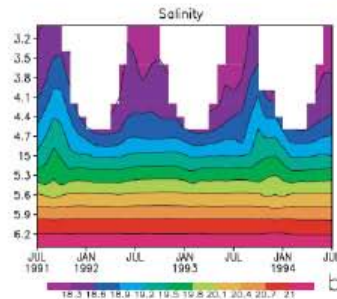
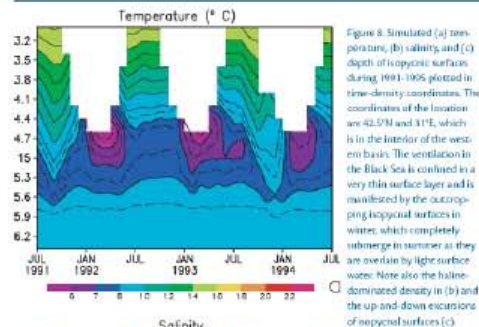


Figure 11. Stanev et al. (2002) developed a reduced gravity model for the buoyant plume originating from the Bosporus Strait with 600 m horizontal resolution. Unlike the case shown in the Box 1, Figure 10, the bottom layer moves and the surface layer is immobile. Simulation of the motionless ambient fluid (including chemical tracers) is possible from observations. The model is coupled with a simple chemical model simulating the reaction of H_2S by O_2 . The upper panel gives the distribution O_2 in the plume, and the middle panel shows the difference between O_2 in the ambient fluid and plume. The bottom panel gives an idea about the projection of the subsurface on the bottom represented the product between H_2S and O_2 (low values are due to dilution of H_2S in surface layers, or O_2 in deep layers). The narrow strip follows a depth of ~ 12 m, which is approximately the depth of sulfide crust in the open sea (Konnaveer et al., 2003). As seen in the upper and middle panels, the plume reaches a depth of ~ 250 m, plotted also extends between 28.8°E and 29.5°E and 41.1°N and 41.6°N. Depth contours down to 100 m are plotted with dashed lines with a contour interval of 20 m; the last dashed line is isobath 500 m.

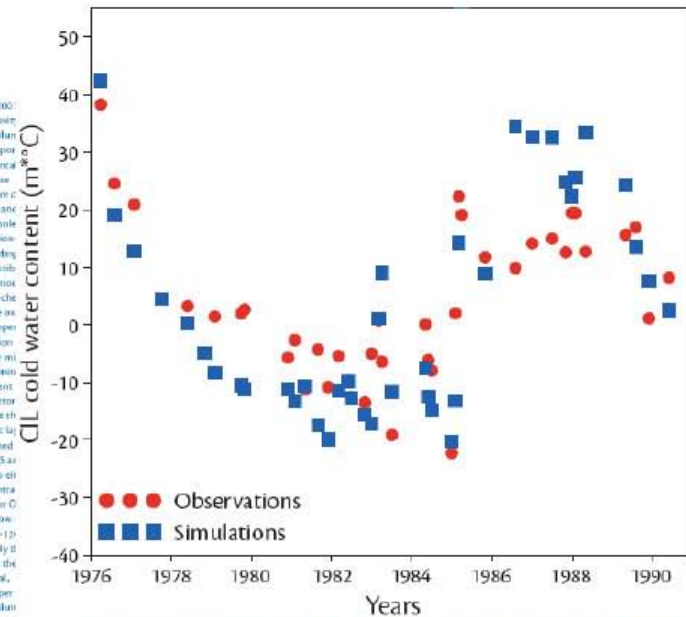


Figure 12. Temporal variability of the cold water content between isopycnal levels $\sigma_t = 14.4$ and 15.6 . Observations and simulations with the Black Sea Modular Ocean Model (MOM) are shown. This variability is triggered by large-scale atmospheric forcing (Stanev and Penava, 2002; Oguz, paper 2, this issue).

....HYPOX kickoff: Partner Institutions introduction

Partner 15:

GeoEcoMar (Constanta, Romania)



HYPOX kickoff: GeoEcoMar introduction

National Institute for Marine Geology and Geoecology www.geoecomar.ro



Bucharest Headquarters



Constanta Branch



GeoEcoMar scientific activity & objectives

■ Geological, geophysical, sedimentological, biogeochemical and ecological studies of marine, fluvial and deltaic environments:

■ Geological–geophysical and ecological mapping of the Romanian shelf and other marine areas.

■ Investigation of geological structure and evolution of the marine, fluvial and deltaic environments and their mineral resources.

■ Assessment of the macro–geosystem Danube River–Danube Delta–Black Sea.

Institute & main study site location



GeoEcoMar

Black Sea:
North-Western
Shelf

Facilities Relevant for the Project

- Research Vessel “*Mare Nigrum*”, 3000 t displacement, 81.94 m length, 13.60 m width, 5.20 m draught;
- Fluvial and shallow marine Research Vessel “*Istros*”, 176.5 t displacement, 31.81 m length, 6.8 m width, 0.8 m medium draught;
- Multibeam hydrographic system – Sea Beam 1050D – ELAC Nautik GmbH
- CTD Sea Bird SBE 25 with 12 five liters bottles
Rosette SBE 32
Sensors: Conductivity, pressure, temperature, oxygen, pH-Eh, chlorophyll *a*, *beam attenuation*
- Multicorer Mark II – 400
- ROV Vector M5

R/V “*Mare Nigrum*”



- Total area ~ 200 m²
- Computer network
- Air conditioning
- Sea and freshwater
- 380 V, 220 V &
- 24 V electric power

Fluvial R/V “*Istros*”



House boat laboratory “*Halmyris*”



Main Project participants



Marian-Traian Gomoiu
Groupleader at
GeoEcoMar *Biology*



Adrian Teaca
Scientist
Biology – benthos



Dan Secrieru
Senior scientist
*Inorganic
geochemistry*



Mihaela Muresan
Assistant Scientist
Biology – Zooplankton



Gheorghe Oaie
General Director
Sedimentology



Priscila Opreanu
Senior scientist
Microfauna



Tatiana Begun
Scientist
Biology – Benthos



Sorin Balan
Senior scientist
Geochemistry, CTD

GeoEcoMar tasks in HYPOX

- WP 3 – GeoEcoMar will identify and analyze the main drivers of oxygen depletion, investigate the influence of oxygen depletion on the benthic and pelagic biota and analyze related regime shifts of ecosystems
- WP 4 – GeoEcoMar will provide historical data from its databases and from the Romanian literature
- WP 6 – GeoEcoMar will provide offshore observations by ship, CTD measurements and bottom sampling for the assessment of the ecological state in the oxic/anoxic interface of the northwestern Black Sea shelf study
- WP 7 – GeoEcoMar will periodically assess the ecological state of benthic communities in shallow areas affected by red tides and hypoxia



....HYPOX kickoff: Partner Institutions introduction

Partner 16:

NIOO-KNAW (Yerseke, Netherlands)



....HYPOX kickoff: NIOO-KNAW introduction

Netherlands Institute of Ecology

www.nioo.knaw.nl



Netherlands Institute of Ecology

- NIOO is part of the KNAW
(Royal Netherlands Academy of Arts and Sciences)
- NIOO comprises three centres (Limnology, Terrestrial Ecology and Estuarine and Marine Ecology)
- Centre for Estuarine and Marine Ecology in Yerseke focuses on basic and strategic ecological research at the interface of land-ocean and ecology and biogeochemistry
- 85 persons in Yerseke of which ~ 10 tenured scientific staff
- Department of Ecosystems Studies is HYPOX partner



Department of Ecosystem Studies

- Faculty

Carlo Heip, Karline Soetaert, Filip Meysman and Jack Middelburg

- Real work

2 technicians, 6 postdocs, 10 PhD students, ++

- Research at interface of ecology and biogeochemistry

- Biogeochemistry of estuarine and coastal ecosystems
- Animal-sediment interactions
- Elucidation of coastal and benthic food webs
- Marine biodiversity and ecosystem functioning

- Modeling of sediment biogeochemistry, bioturbation/diffusion and benthic pelagic coupling

- Stable isotope approaches to unravel ecosystem functioning



Main project participants



Tom Cox

Research associate, Ecosystem Models, engineering background, data-assimilation



Filip Meysman

Staff scientist, Theory and modeling biogeochemistry & ecology, marine biology and engineering background



Karline Soetaert (will not attend)

Staff scientist, Ecological modeling, data-assimilation, computer science and marine biology, meiofauna



Jack Middelburg

Head of Department, Biogeochemist, observational, experimental and modeling research on all types of ecosystems, geochemistry background



Role of NIOO in HYPOX

- Link to SCOR WG 128 on Hypoxia
- Leader and contributor to WP2 on modeling and prediction of oxygen levels and their effect on ecosystems functioning
- Contributes to WP 3, 4, 5 and 8
- Responsible for couple of deliverables (D2.5; D2.8; D3.4)
- Non-linear response of coupled biogeochemical systems and coupled benthic–pelagic system
- Are happy to contribute to experimental work with deliberate tracer techniques (biomarker & isotope techniques to link identify with activity)

