EU-project HYPOX: some examples of monitoring activities and results obtained

Felix Janssen[1], Christoph Waldmann[2], A. Boetius[1,3]
& the HYPOX project team

[1]Max-Planck-Institute for Marine Microbiology, Bremen, DE
[2]MARUM, University Bremen, DE
[3]Alfred Wegener Institute for Polar and Marine Research, Bremerhaven, DE

SEVENTH FRAMEWORK PROGRAMME

EUROPEAN COMMISSION
European Research Area

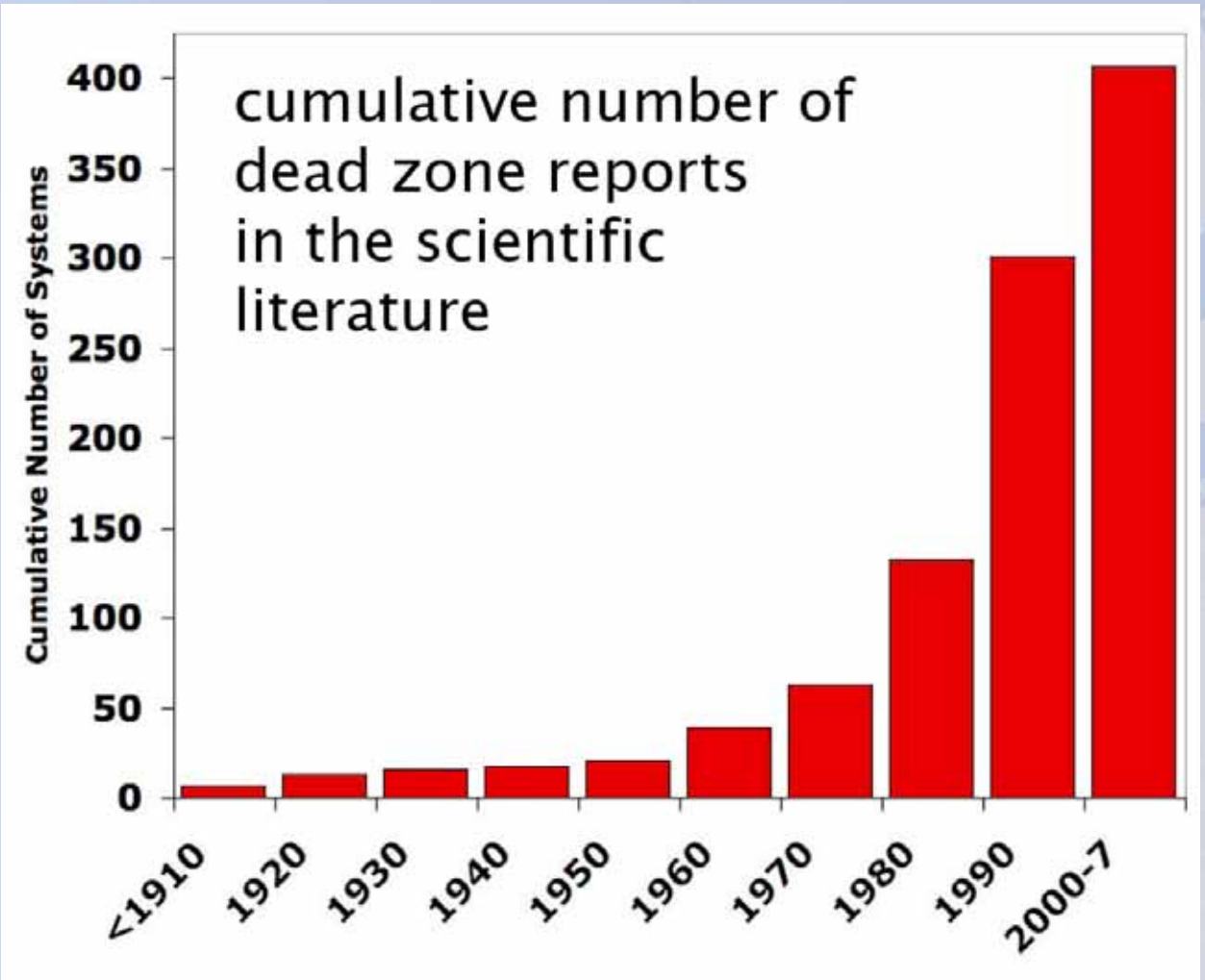
EU-project HYPOX EC grant 226213

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

‘hypoxic’: low in oxygen

Apr. 2009 – Mar. 2012

Why study hypoxia?



Diaz & Rosenberg, Science 321 (2008)

hypoxia, eutrophication & global warming

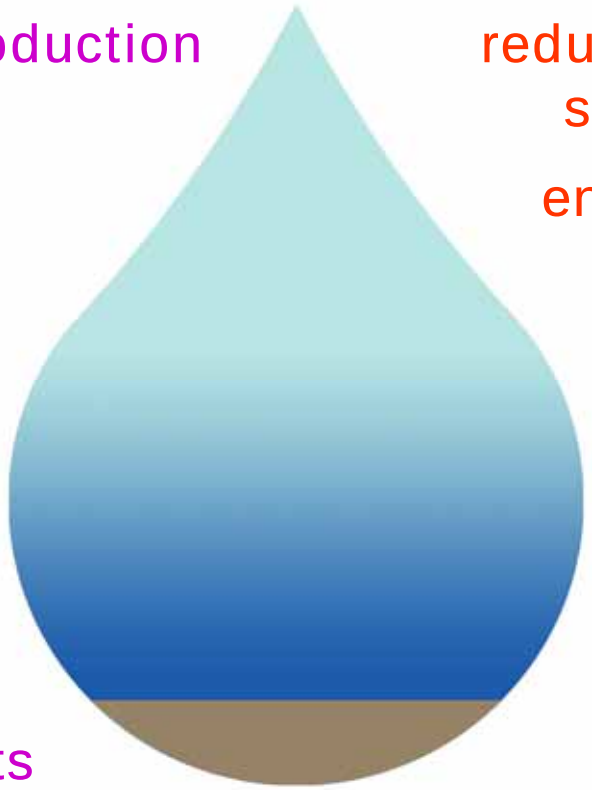
high nutrient supply

increased primary production and organic matter export

high remineralization rates and O_2 demand

anaerobic processes and release of greenhouse gases warming

nutrient release from anoxic sediments



warming of surface waters

reduced O_2 solubility and supply to deep waters

enhanced stratification and reduced vertical mixing

increased metabolic rates and O_2 demand

changes in wind fields and wind-driven mixing

HYPOX objectives

- conducting O_2 monitoring pilot studies in diverse ecosystems
- investigating fundamentals of hypoxia causes and consequences

Content *missing* in this presentation

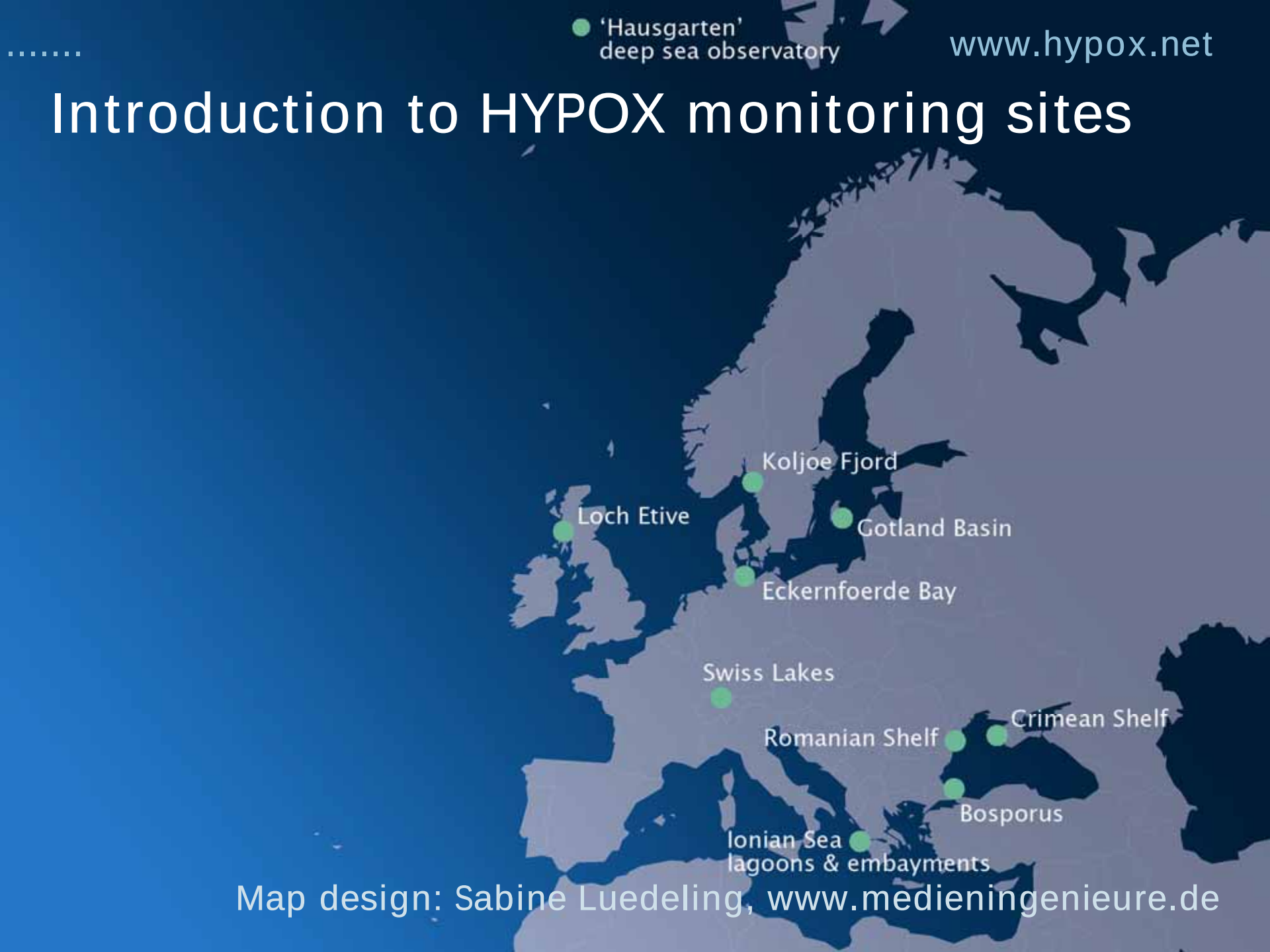
- targeted field campaigns to understand hypoxia causes and consequences
- investigations of past hypoxia (biomarkers, noble gases, sedimentary record, indicator species...)
- assessment of hypoxia impacts on ecosystems (conceptual models)
- technical developments

Instead...

- introduction to HYPOX monitoring sites
- some information on HYPOX strategies (monitoring, modeling, dissemination)

www.hypox.net

Introduction to HYPOX monitoring sites



Map design: Sabine Luedeling, www.medieningenieure.de

Site classification

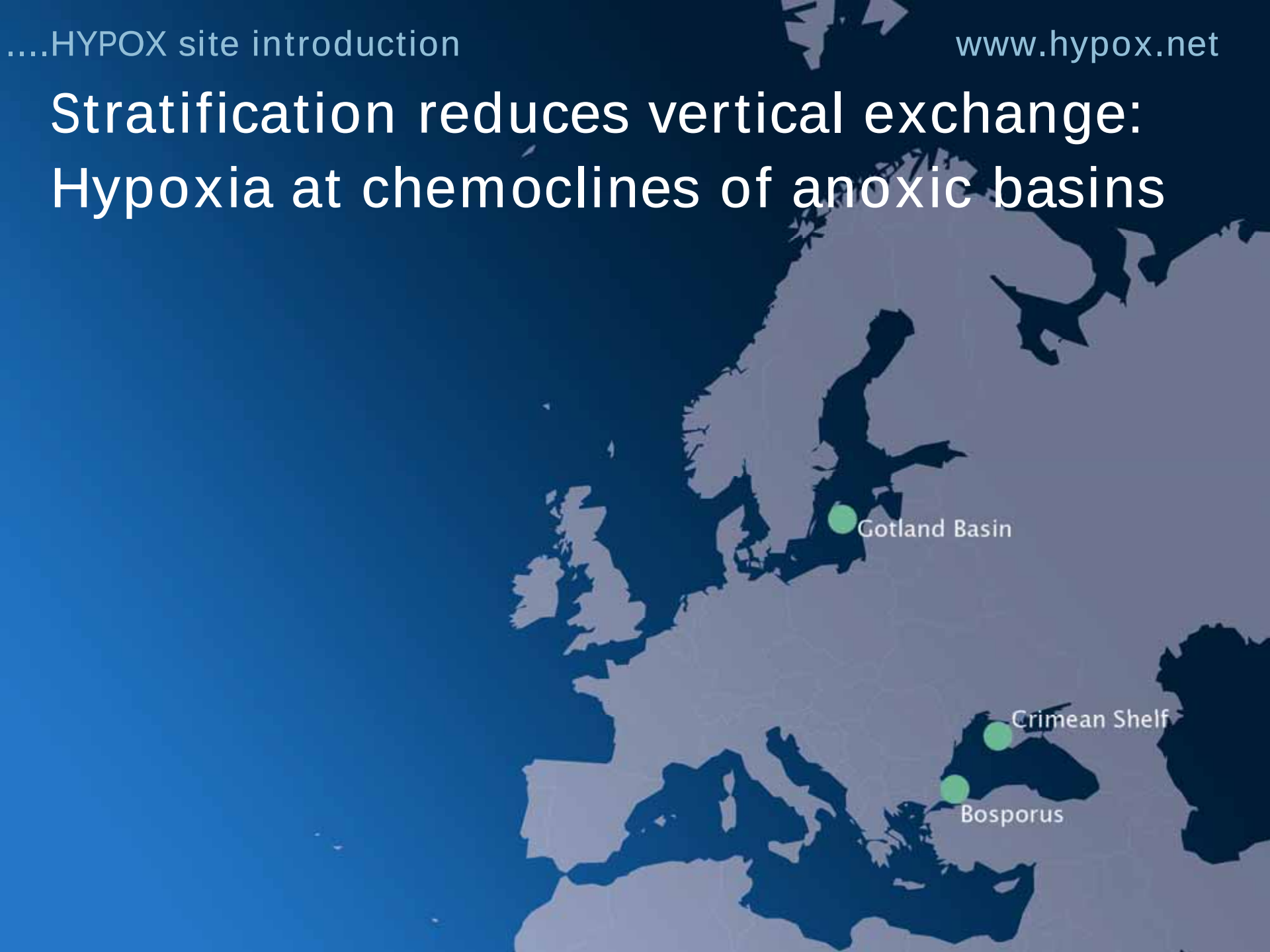
Open / coastal seas

Site classification

Land-locked waterbodies

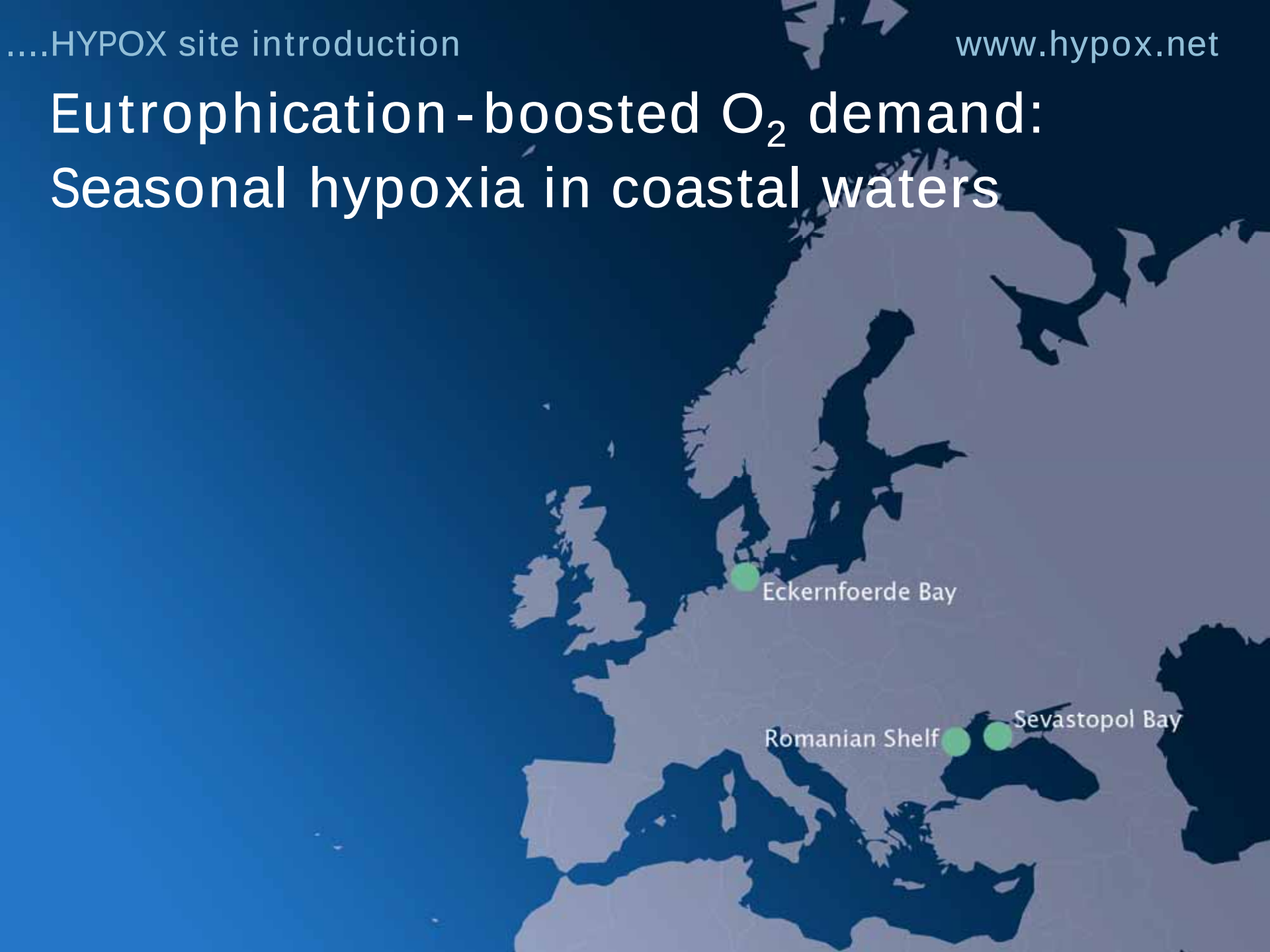
Restricted lateral exchange: Hypoxia in fjord like systems

Stratification reduces vertical exchange: Hypoxia at chemoclines of anoxic basins



Global change impacts on deep water formation and winter turnover: O_2 decline in lakes and the open ocean

Eutrophication-boosted O_2 demand: Seasonal hypoxia in coastal waters



How HYPOX works:
an overview of approaches and achievements based on examples

Adjusting monitoring strategies to site characteristics

Drifting observatories: when ship traffic and infrastructure impede moorings

photo: M. Busack

Drifting observatories: when ship traffic and infrastructure impede moorings

Black Sea

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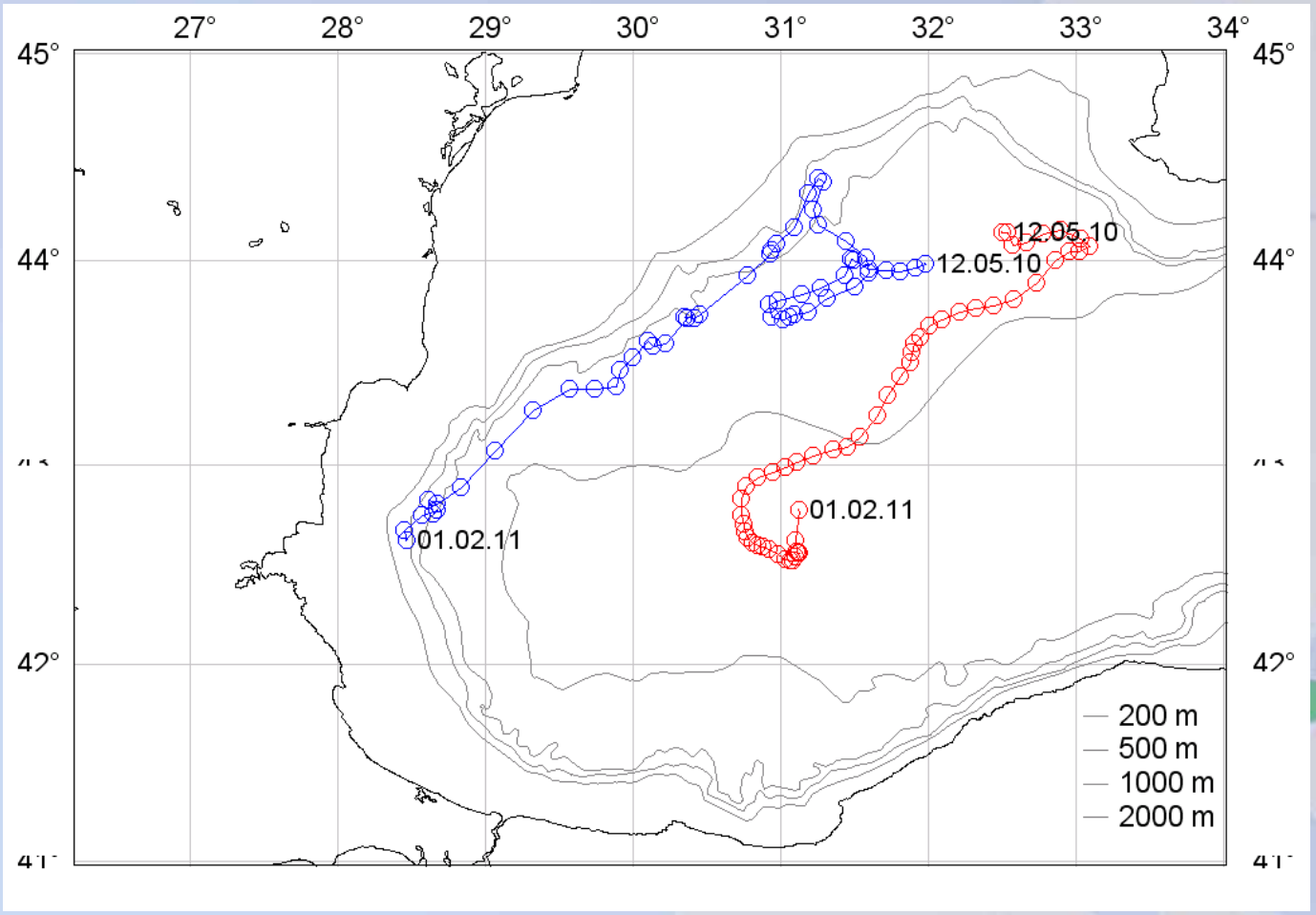
Drifting observatories: when ship traffic and infrastructure impede moorings

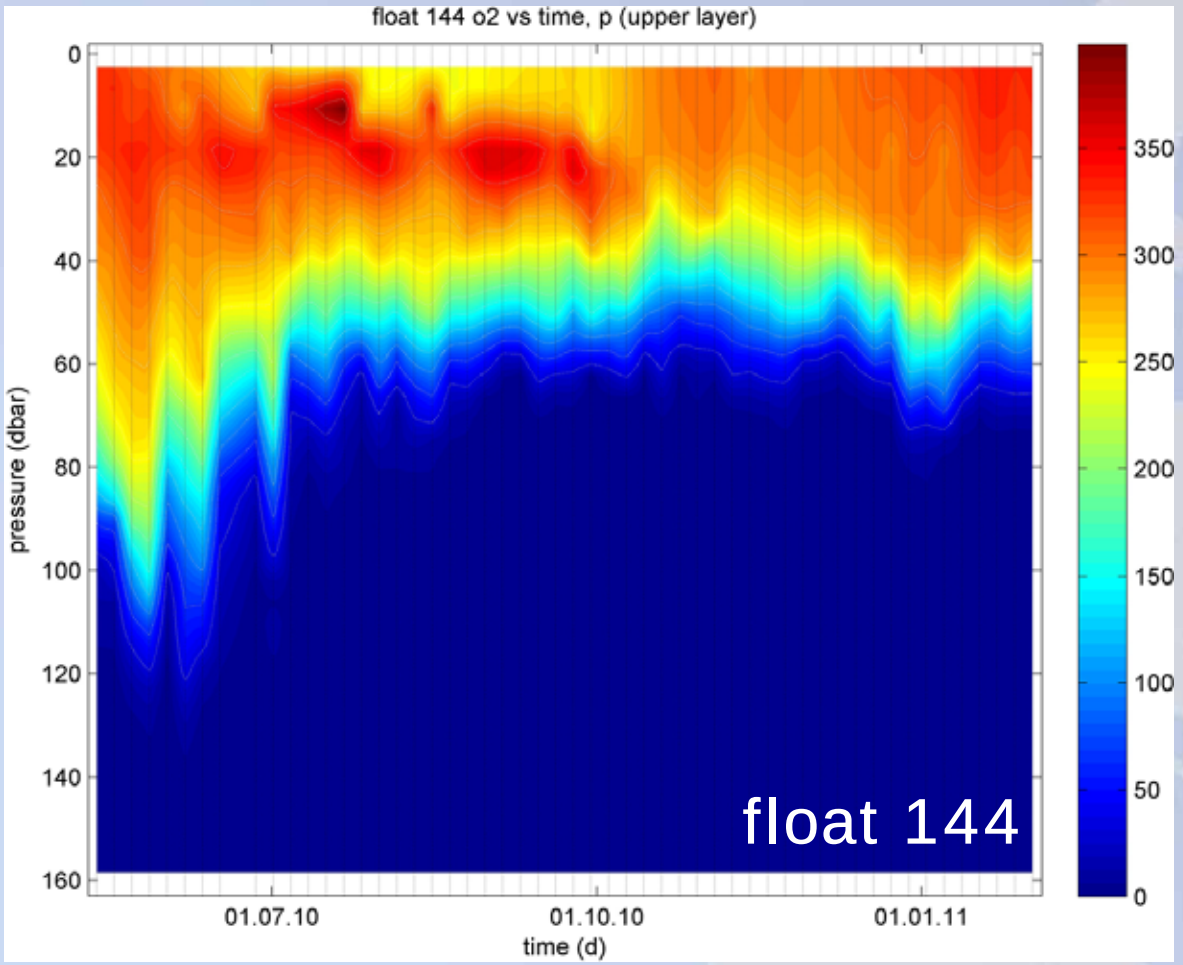
Black Sea



E. Stanev HZG & A. Boetius MPI, unpublished data

Drifting observatories: when ship traffic and infrastructure impede moorings

Black Sea



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Short / medium term moorings: during or between consecutive cruises

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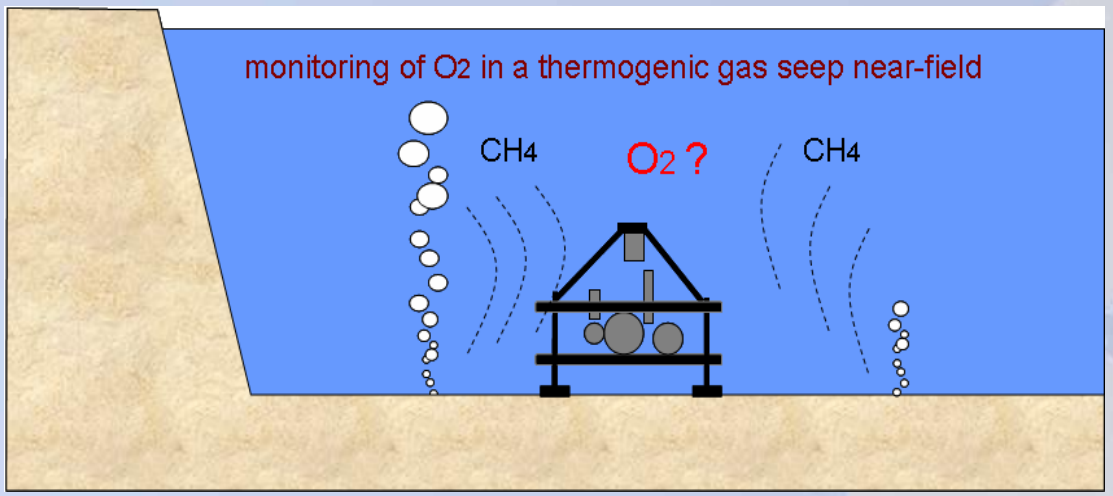
Example: Katakolo Bay, Greece

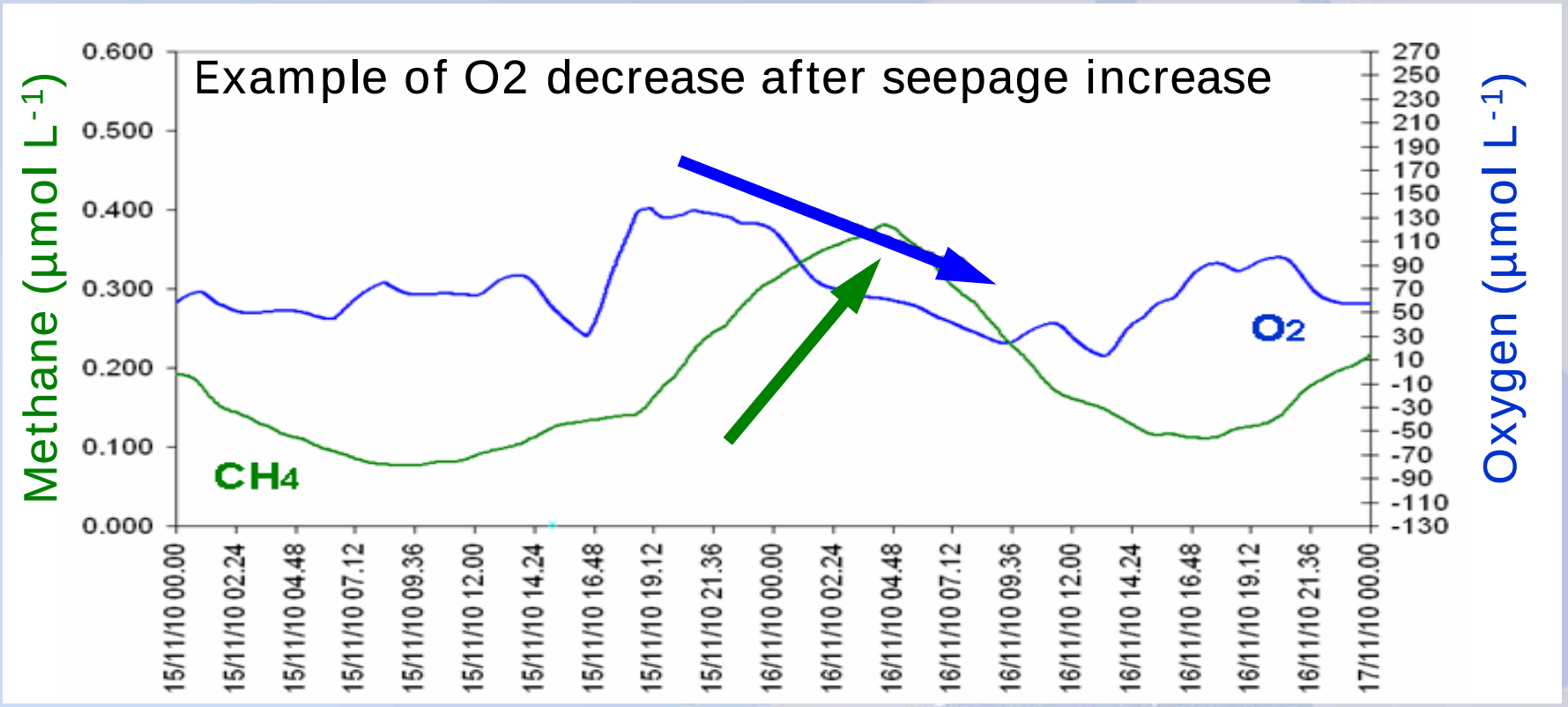


Romanian Shelf
Crimean Shelf
Ionian Sea
lagoons & embayments

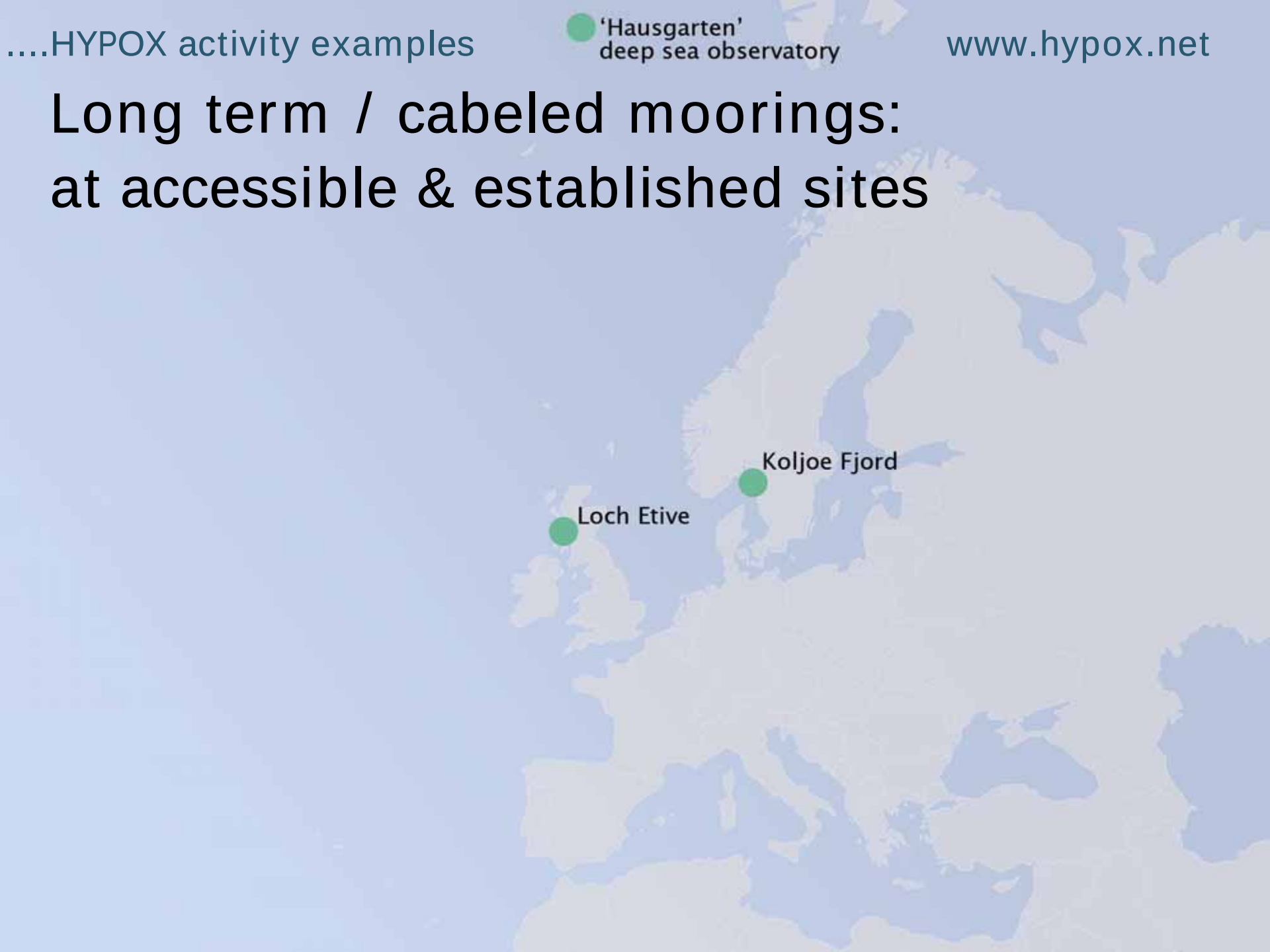
Image & photograph courtesy of G. Etiope & G. Marinaro INGV

Short / medium term moorings: during or between consecutive cruises

Example: Katakolo Bay, Greece



G. Etiope & G. Marinaro INGV, unpublished data



Long term / cabeled moorings: at accessible & established sites

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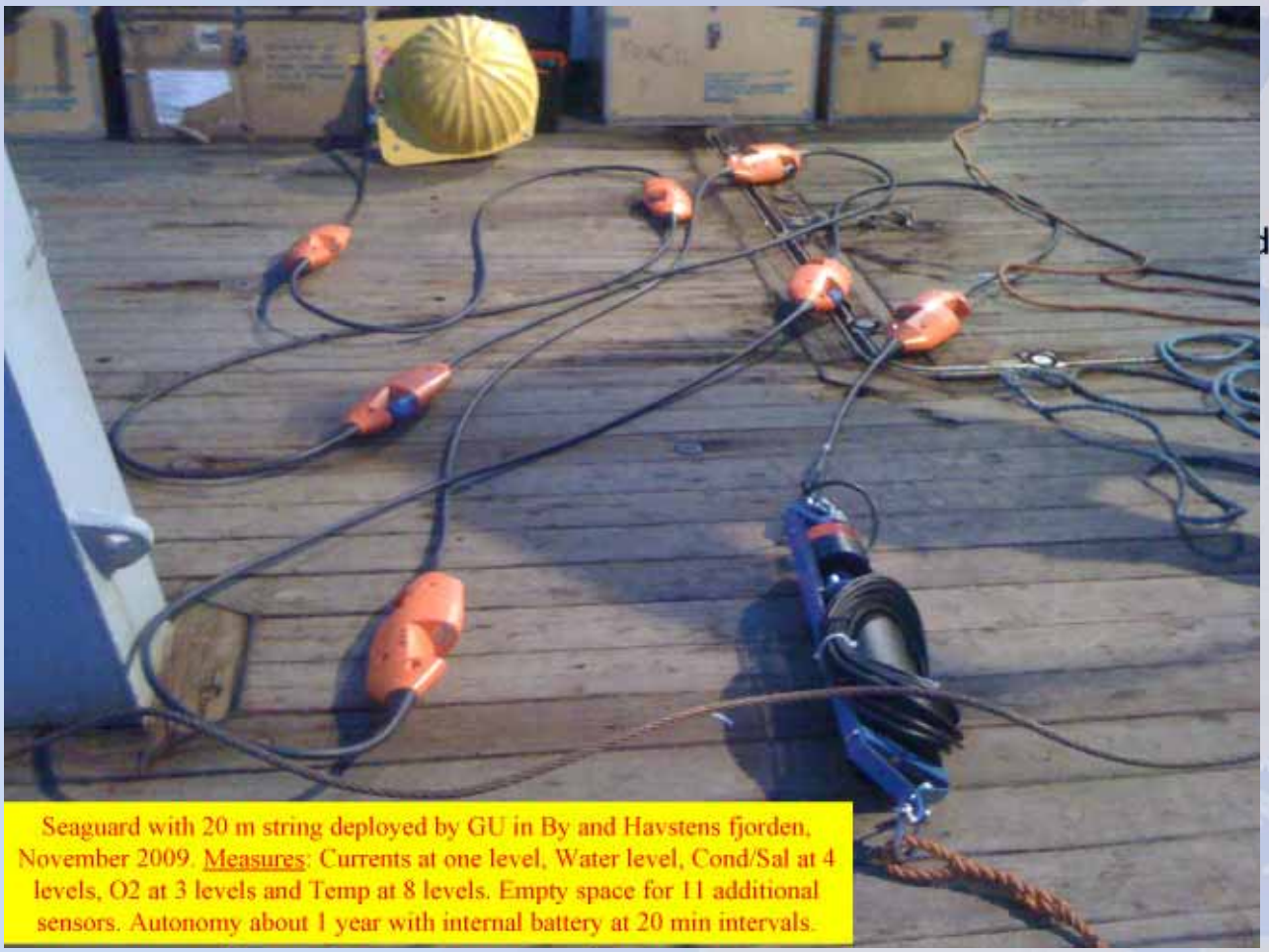
Example: Havstensfjord near Koljoe Fjord



Seaguard with 20 m string deployed by GU in By and Havstens fjorden, November 2009. Measures: Currents at one level, Water level, Cond/Sal at 4 levels, O2 at 3 levels and Temp at 8 levels. Empty space for 11 additional sensors. Autonomy about 1 year with internal battery at 20 min intervals.

Photo: P. Hall, UGOT

Long term / cabeled moorings: at accessible & established sites

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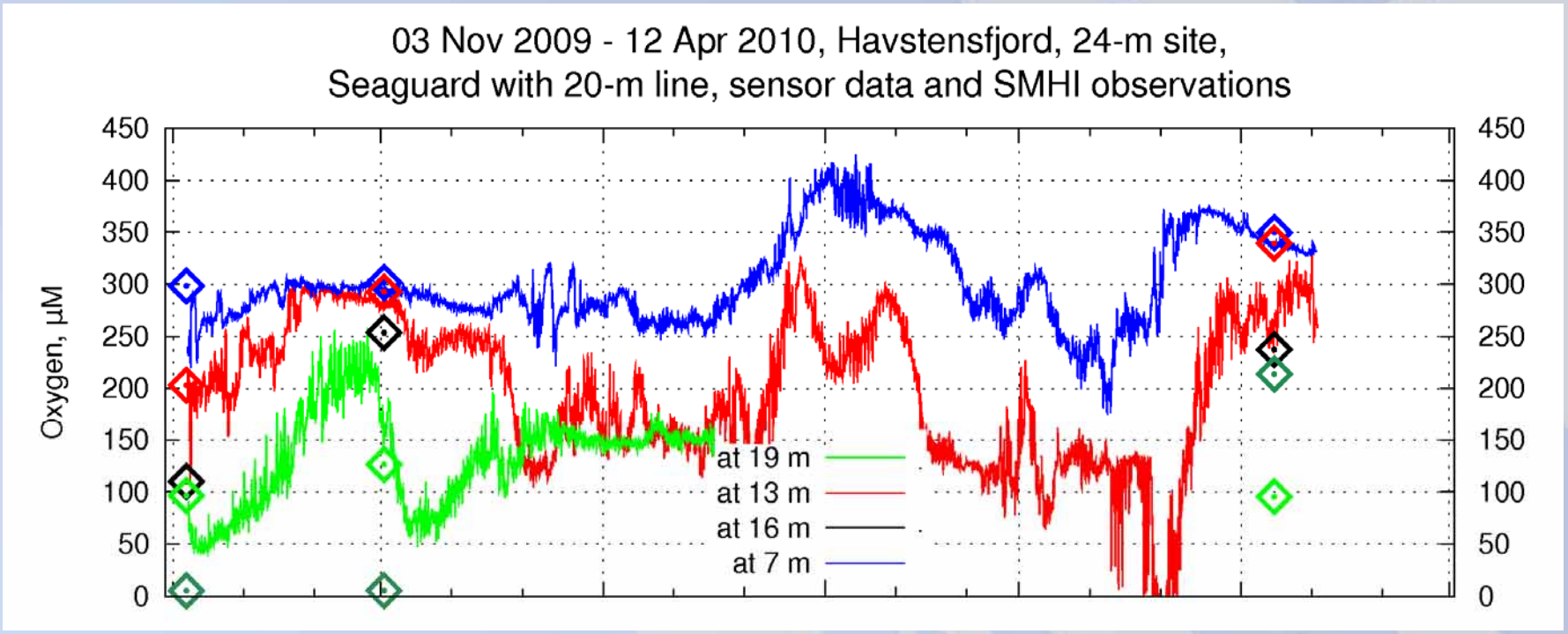
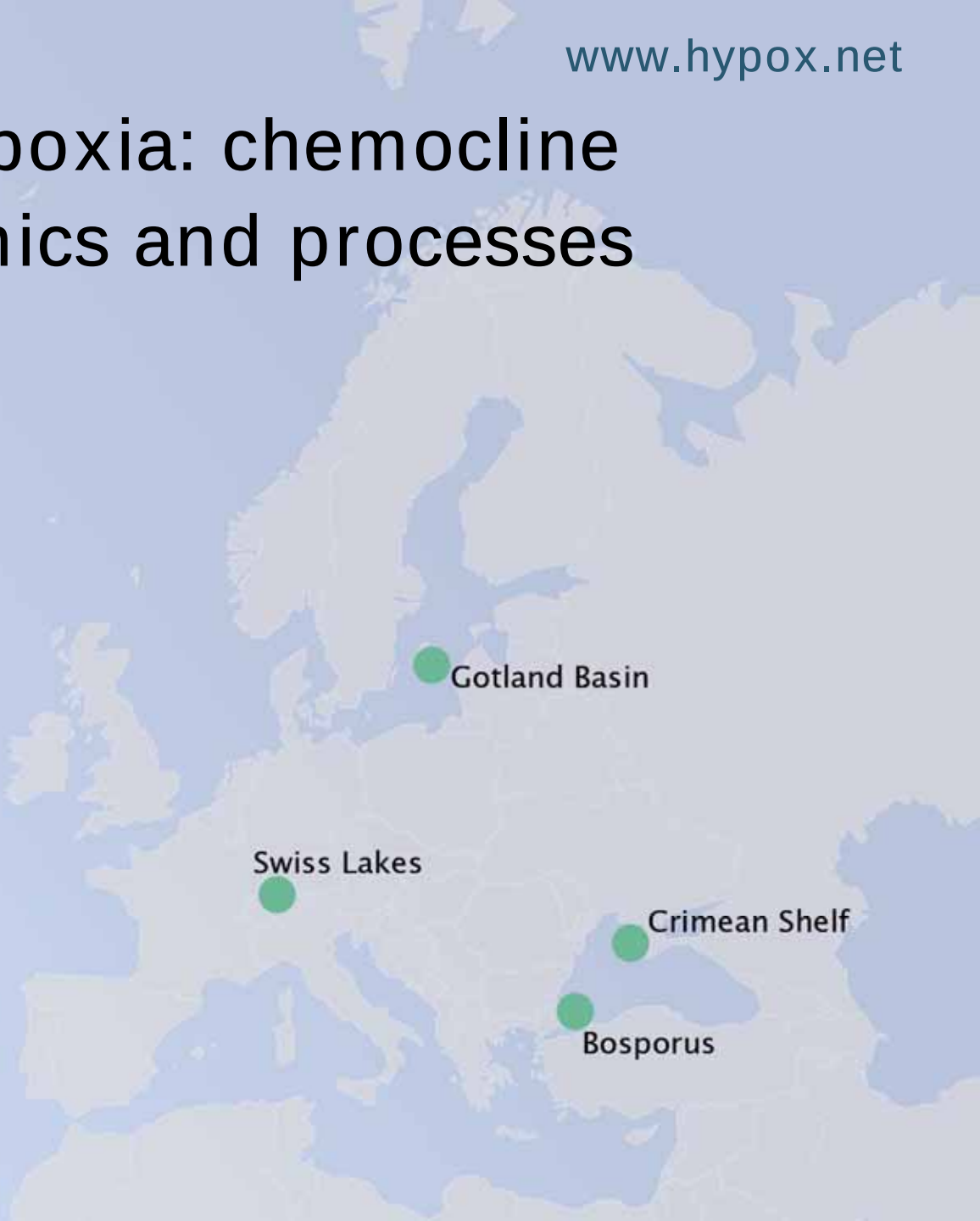


P. Hall, M. Kononets, A. Tengberg, UGOT, unpublished data

Covering different aspects of hypoxia causes and consequences

Watercolumn hypoxia: chemocline structure, dynamics and processes



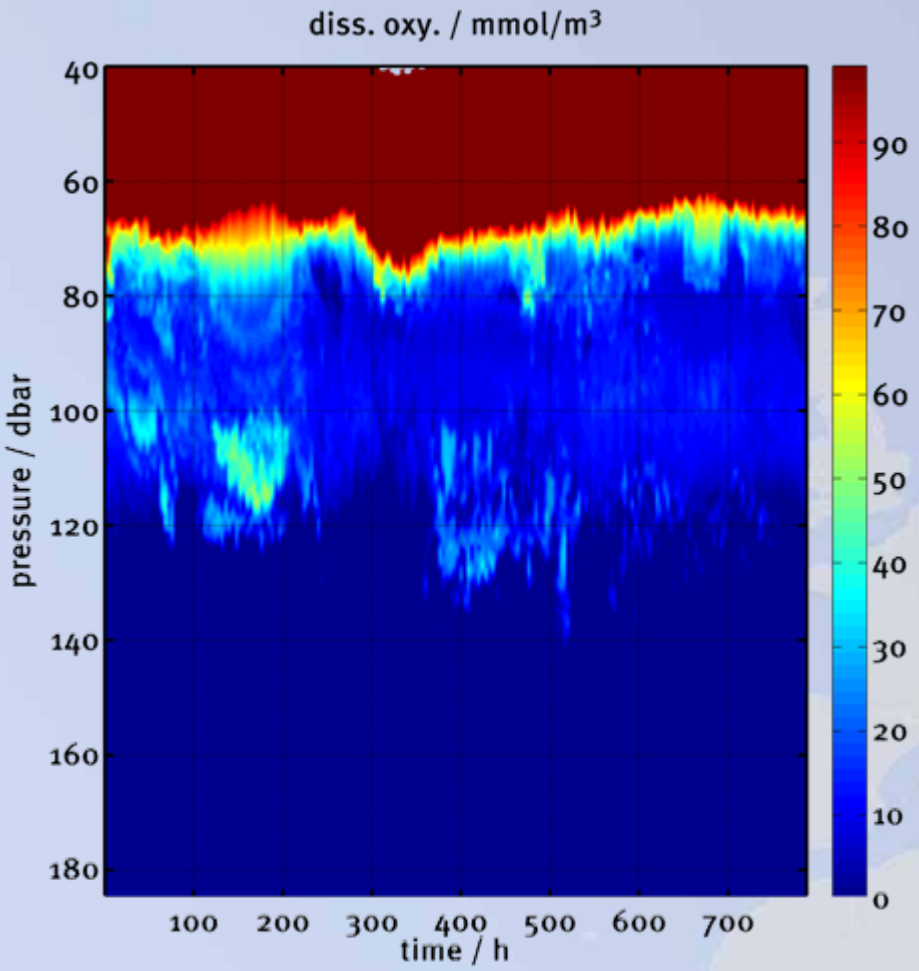
Watercolumn hypoxia: chemocline structure, dynamics and processes

Example: Gotland Basin

photo: R. Prien

Watercolumn hypoxia: chemocline structure, dynamics and processes

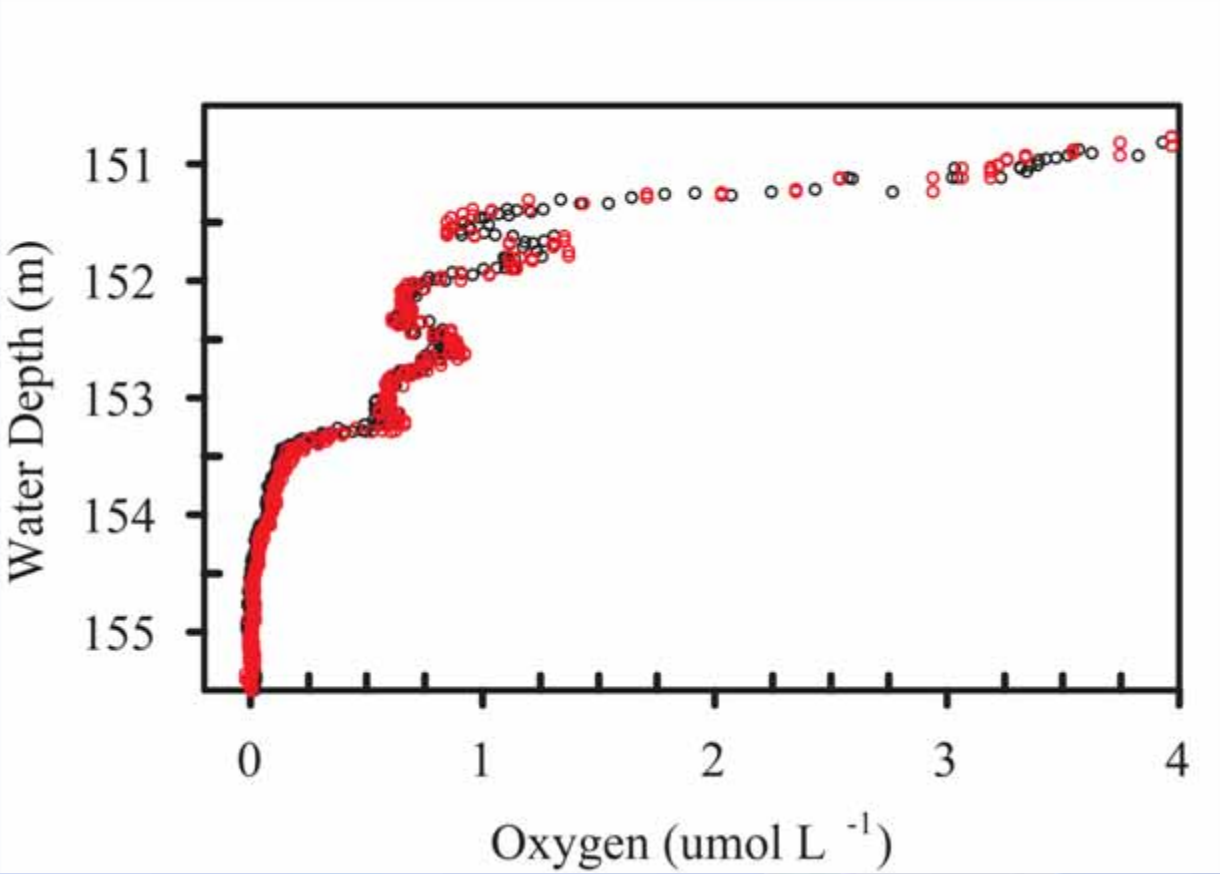
Example: Gotland Basin



R. Prien, IOW, unpublished data

Watercolumn hypoxia: chemocline structure, dynamics and processes

Example: Lake Zug, Switzerland

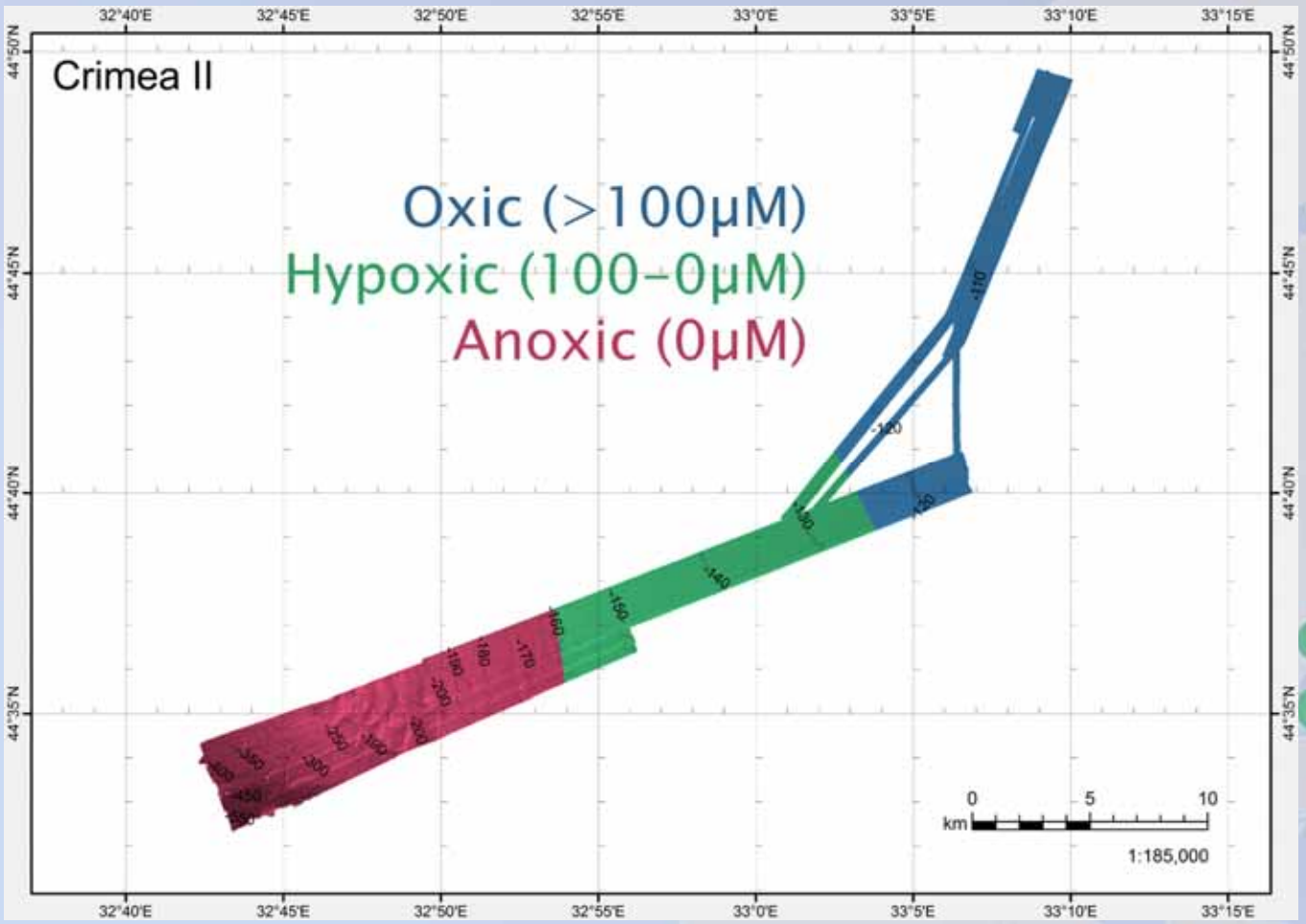


High resolution oxygen profile, M. Kirf Eawag, unpublished data

Bottom water hypoxia: oxygen dynamics & benthic community response

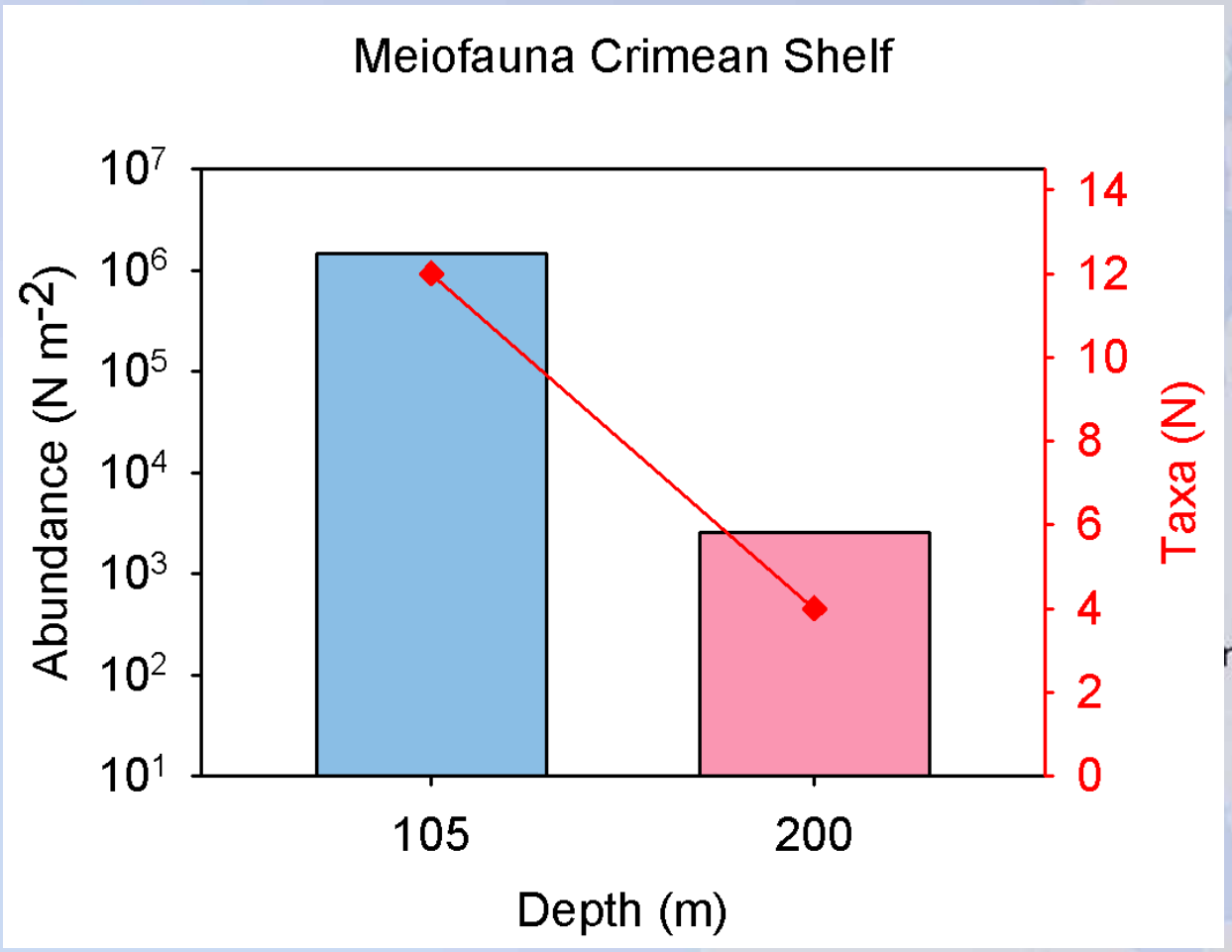
Bottom water hypoxia: oxygen dynamics & benthic community response

Example: Crimean Shelf

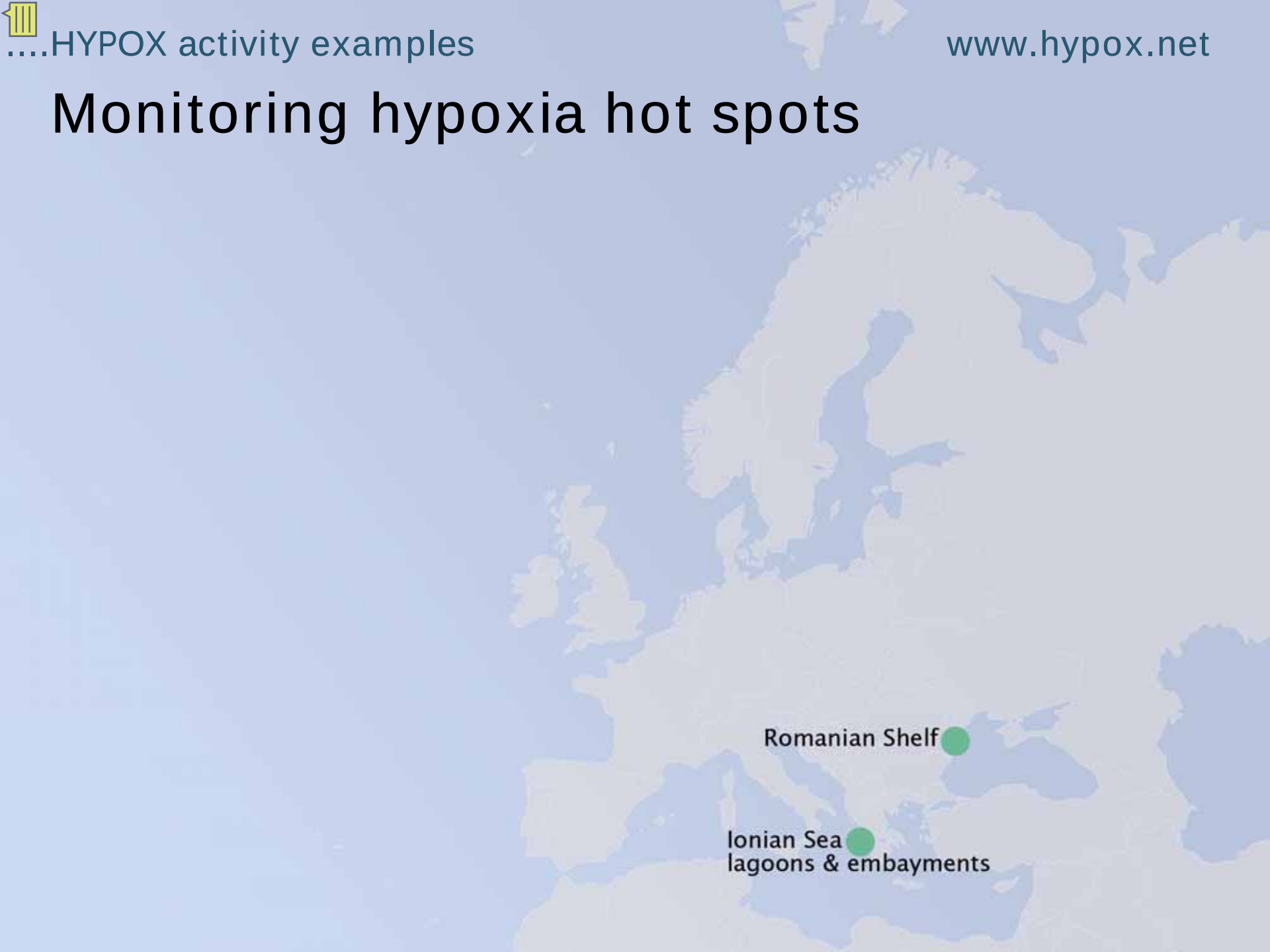


Bottom water hypoxia: oxygen dynamics & benthic community response

Example: Crimean Shelf

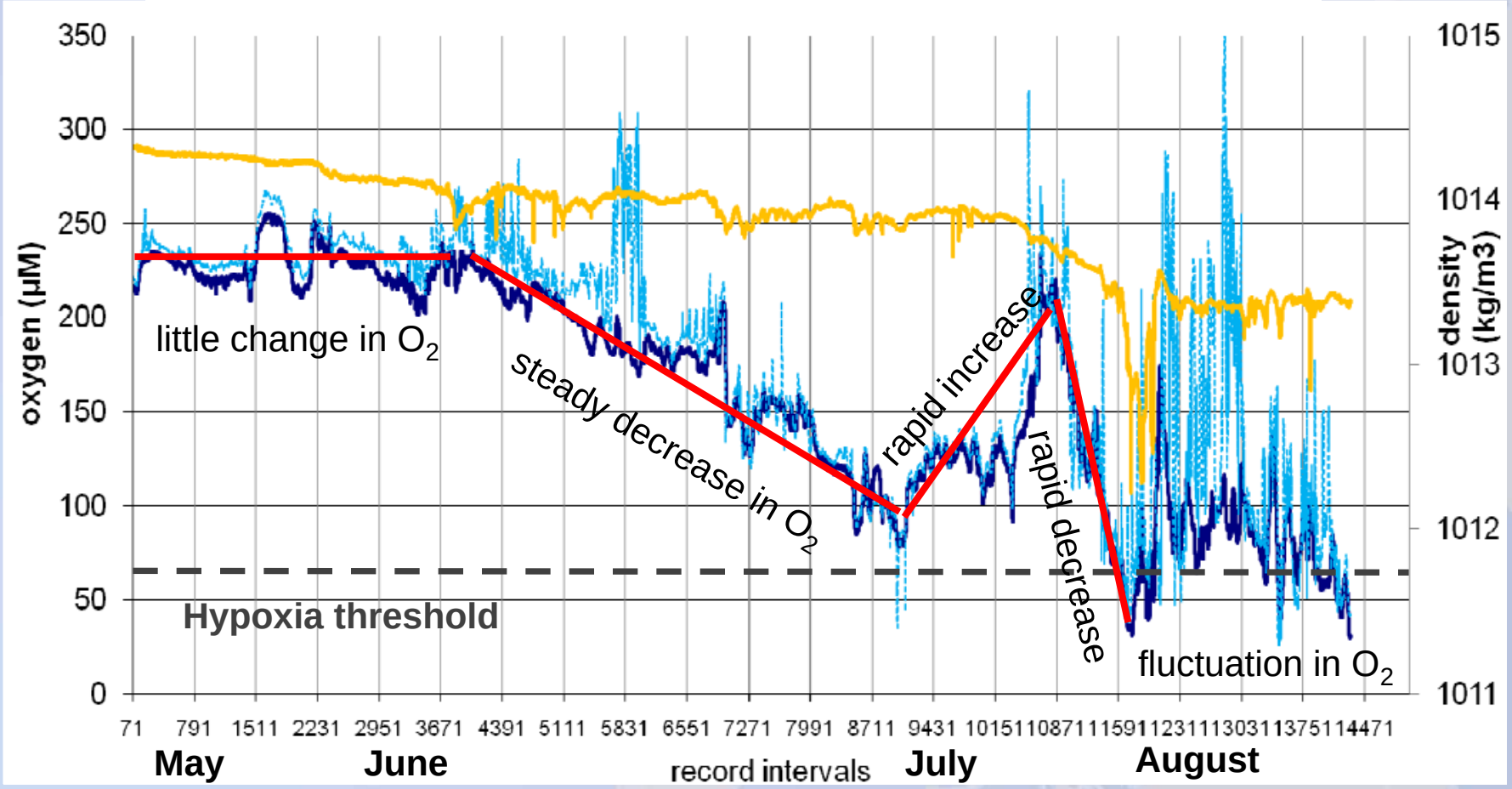


Monitoring hypoxia hot spots



Monitoring hypoxia hot spots

Example: Romanian Shelf



J. Friedrich AWI, unpublished data

Monitoring hypoxia hot spots

Example: Romanian Shelf

Photo A. Teaca, GeoEcoMar

'Hausgarten' deep sea observatory

Modeling in HYPOX: hypoxia development and ecosystem response

Numerical models: turning observations into predictions & generalizations

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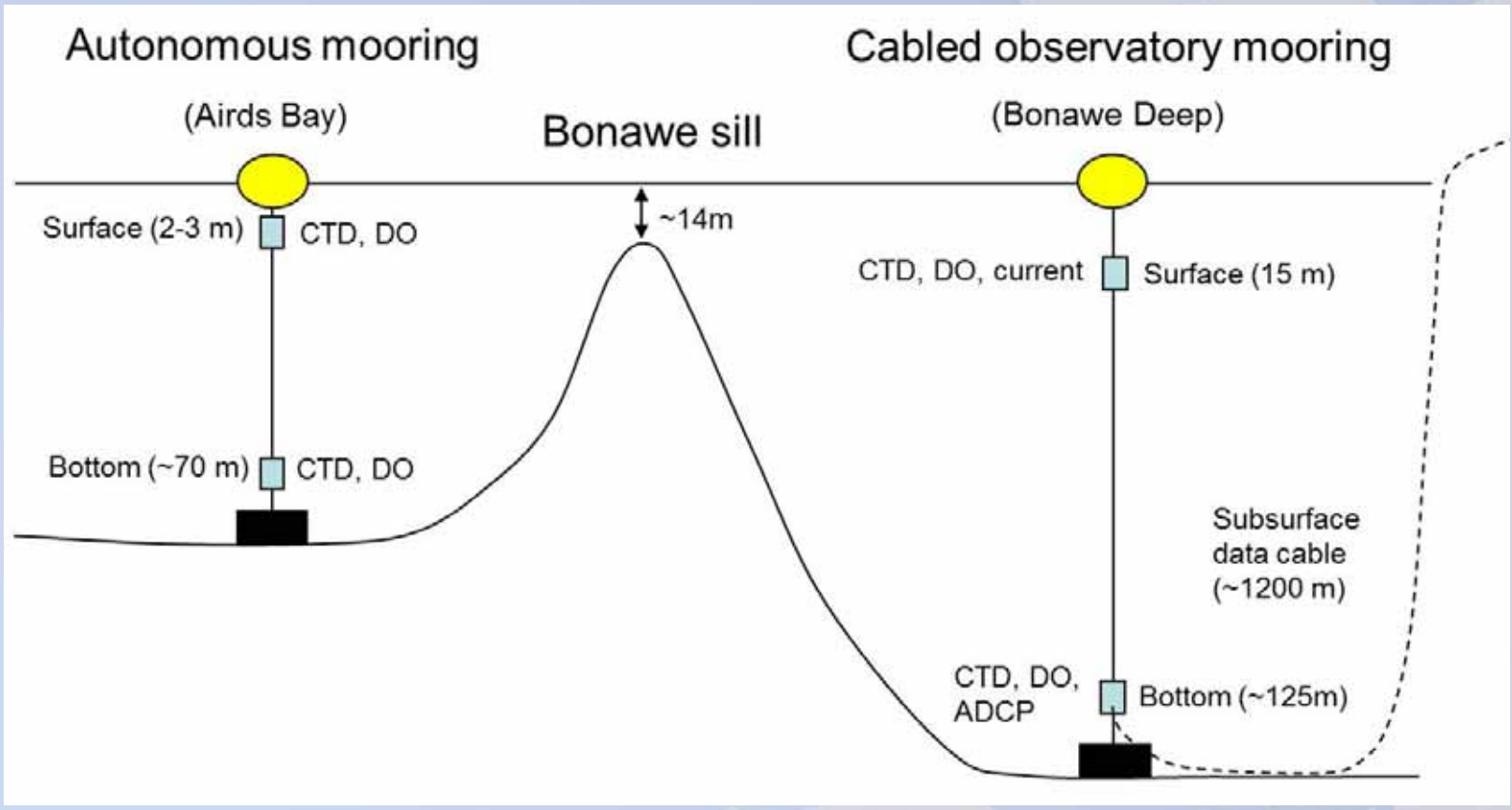
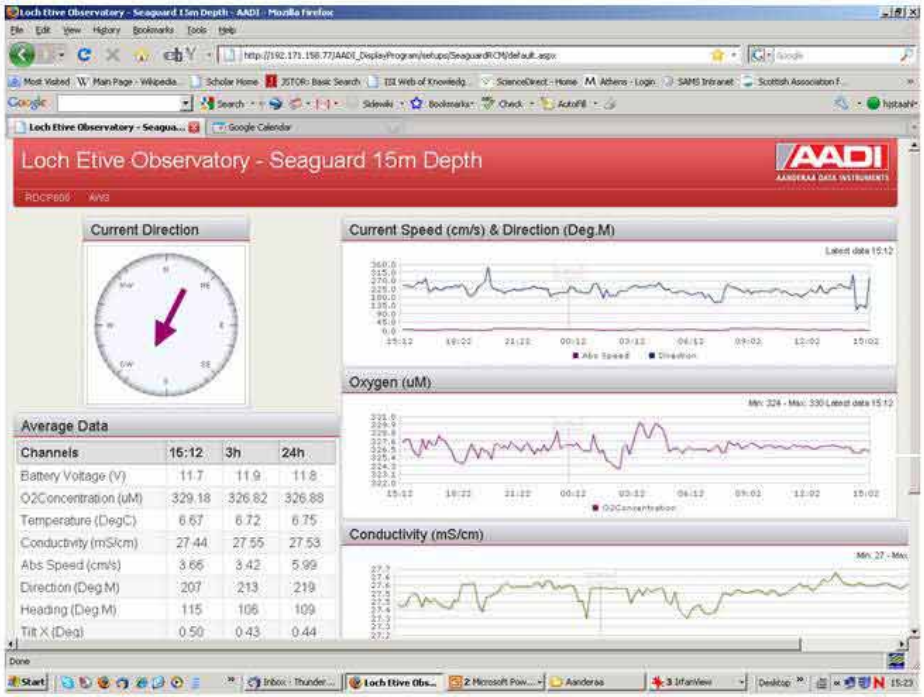
Example: Loch Etive (observatory)

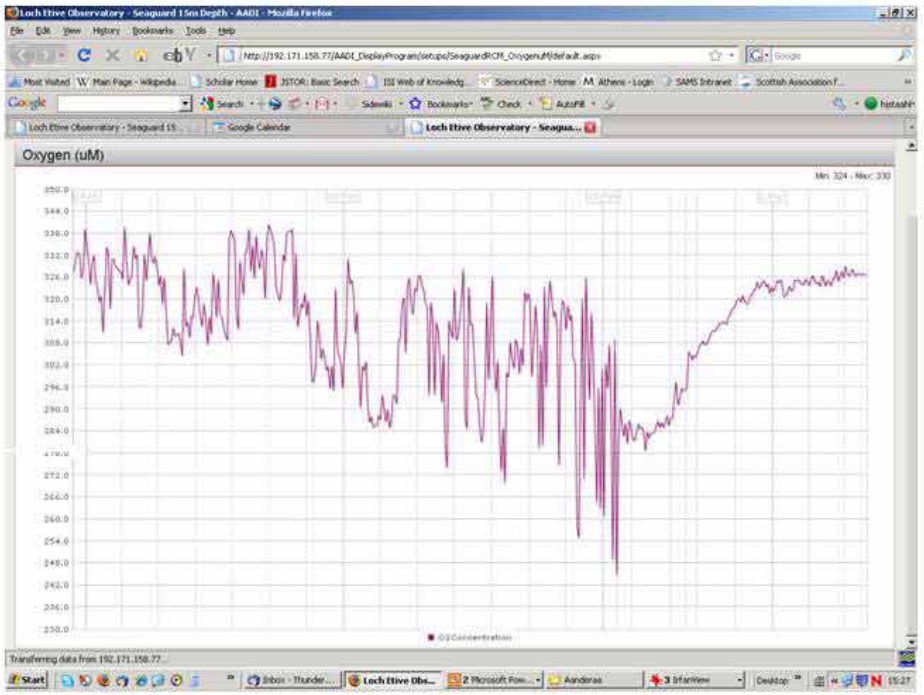


Schematic: H. Stahl, SAMS

Numerical models: turning observations into predictions & generalizations

Example: Loch Etive (observations)

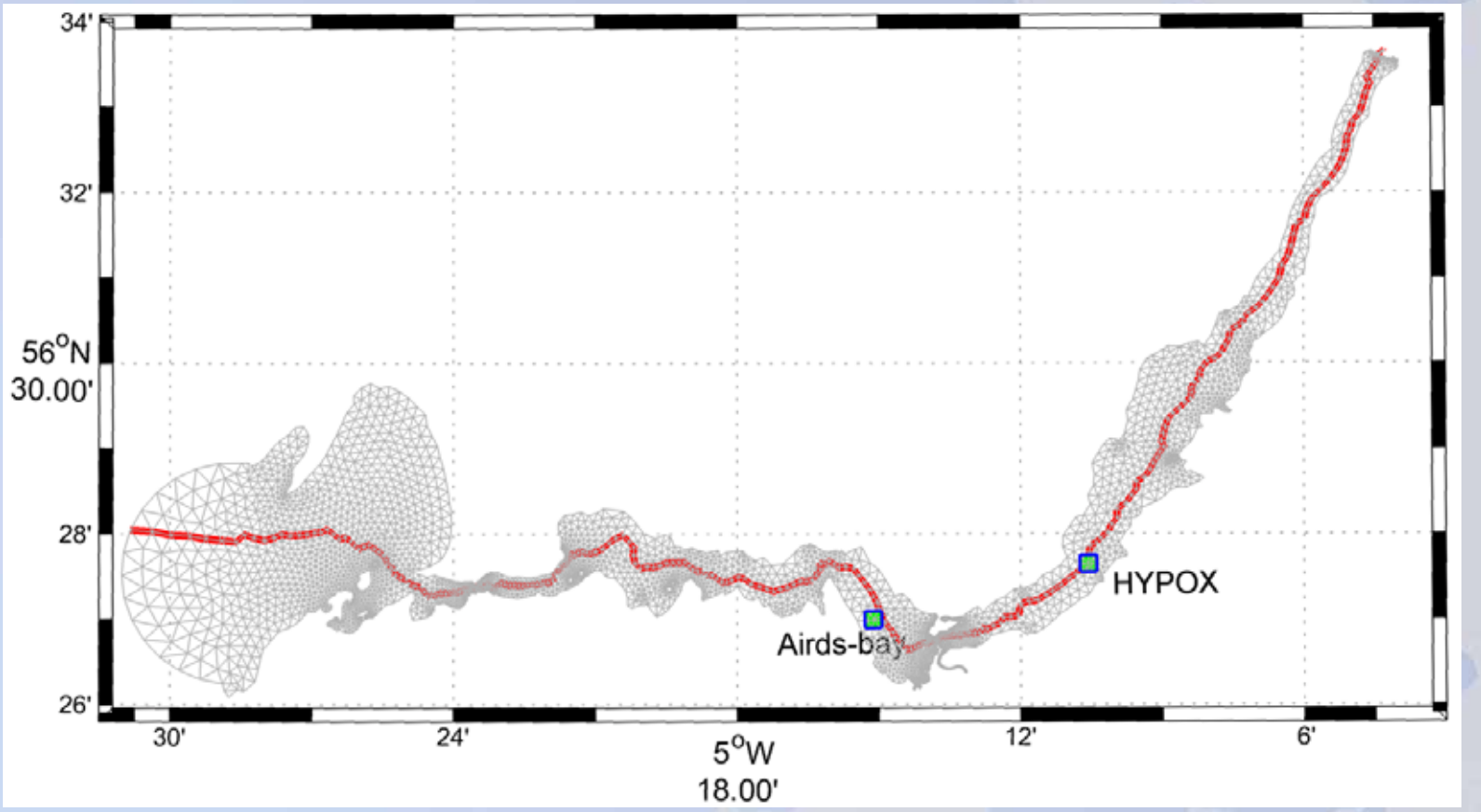




Loch Etive Cabled Observatory online data, courtesy of H. Stahl, SAMS

Numerical models: turning observations into predictions & generalizations

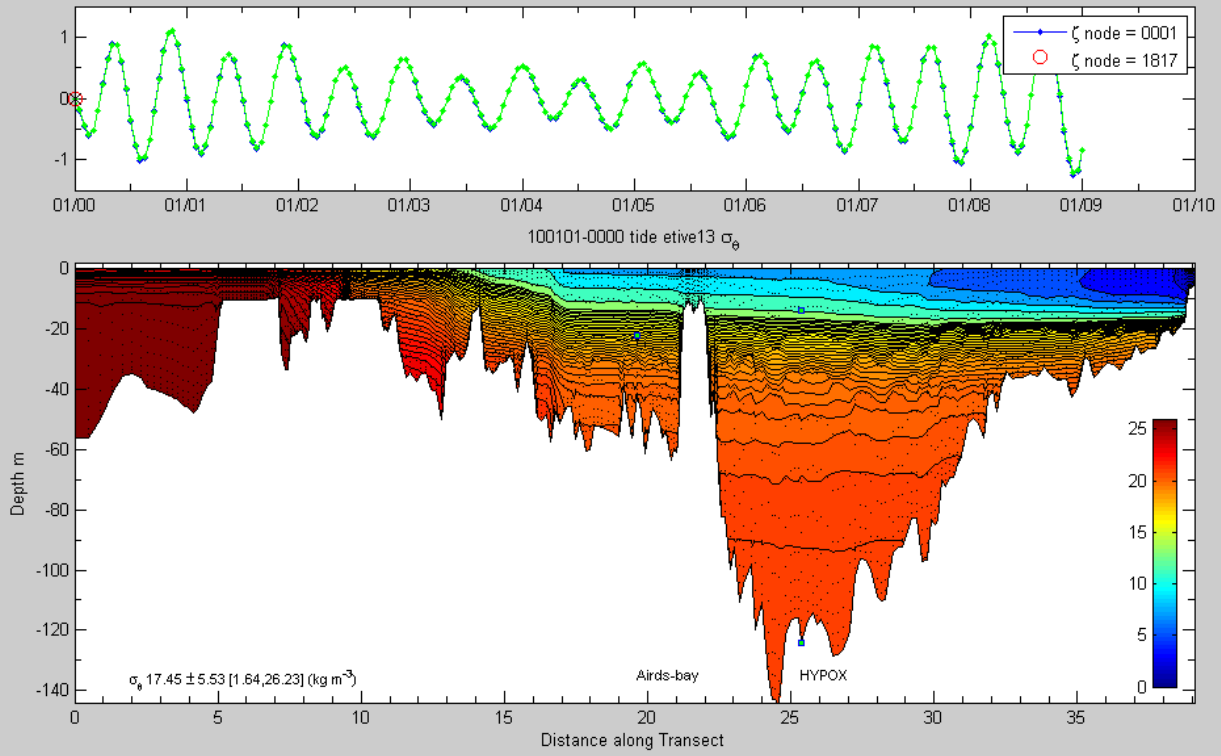
Example: Loch Etive (modeling domain)



Graph: Dmitry Aleynik, SAMS

Numerical models: turning observations into predictions & generalizations

Example: Loch Etive (modeling results)



FVCOM run with unstructured grid. Courtesy of D. Aleynik, SAMS

Conceptual models: ecosystem response to hypoxia

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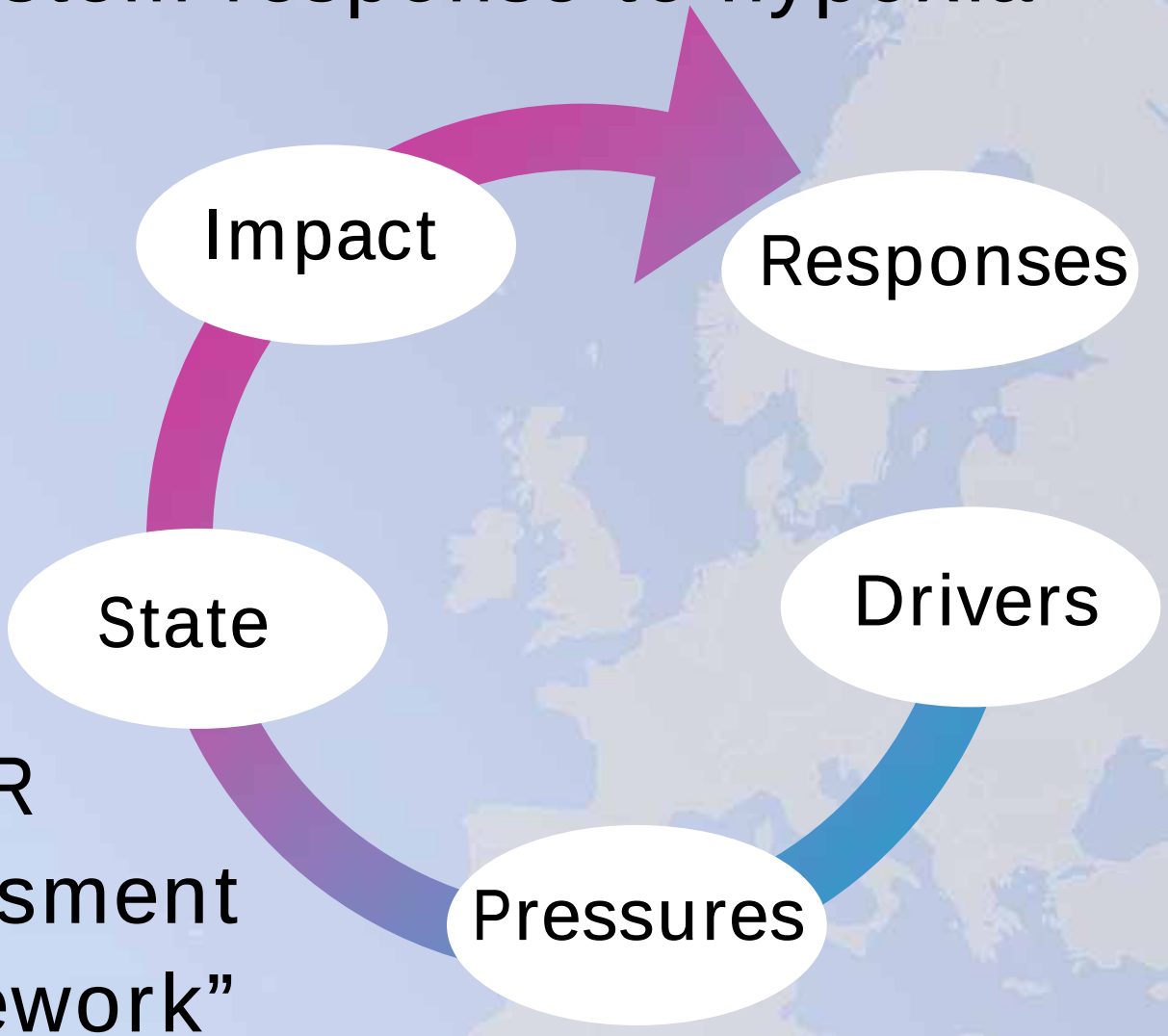
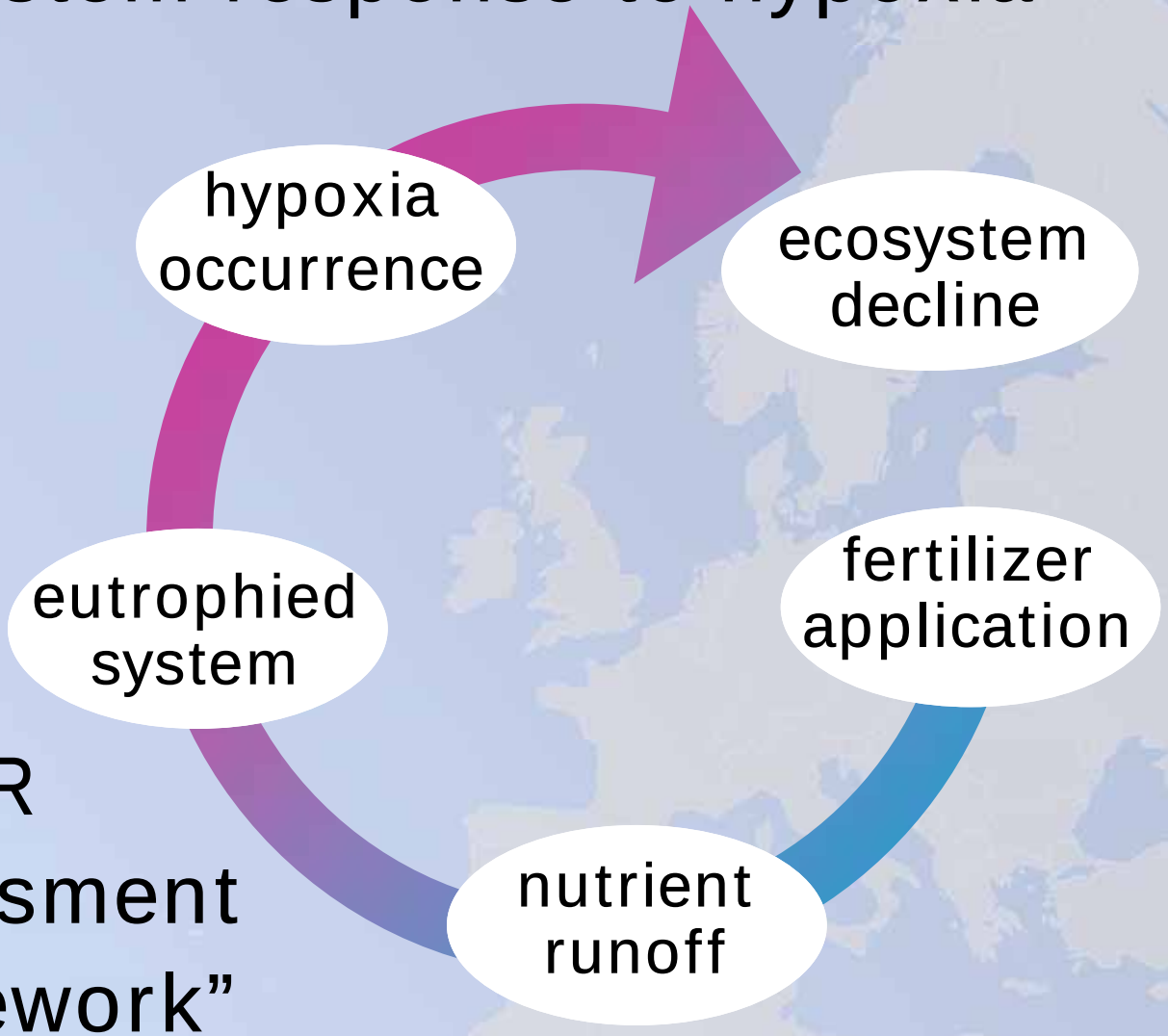


"DPSIR assessment framework"

Scheme: J. Friedrich, AWI

Conceptual models: ecosystem response to hypoxia



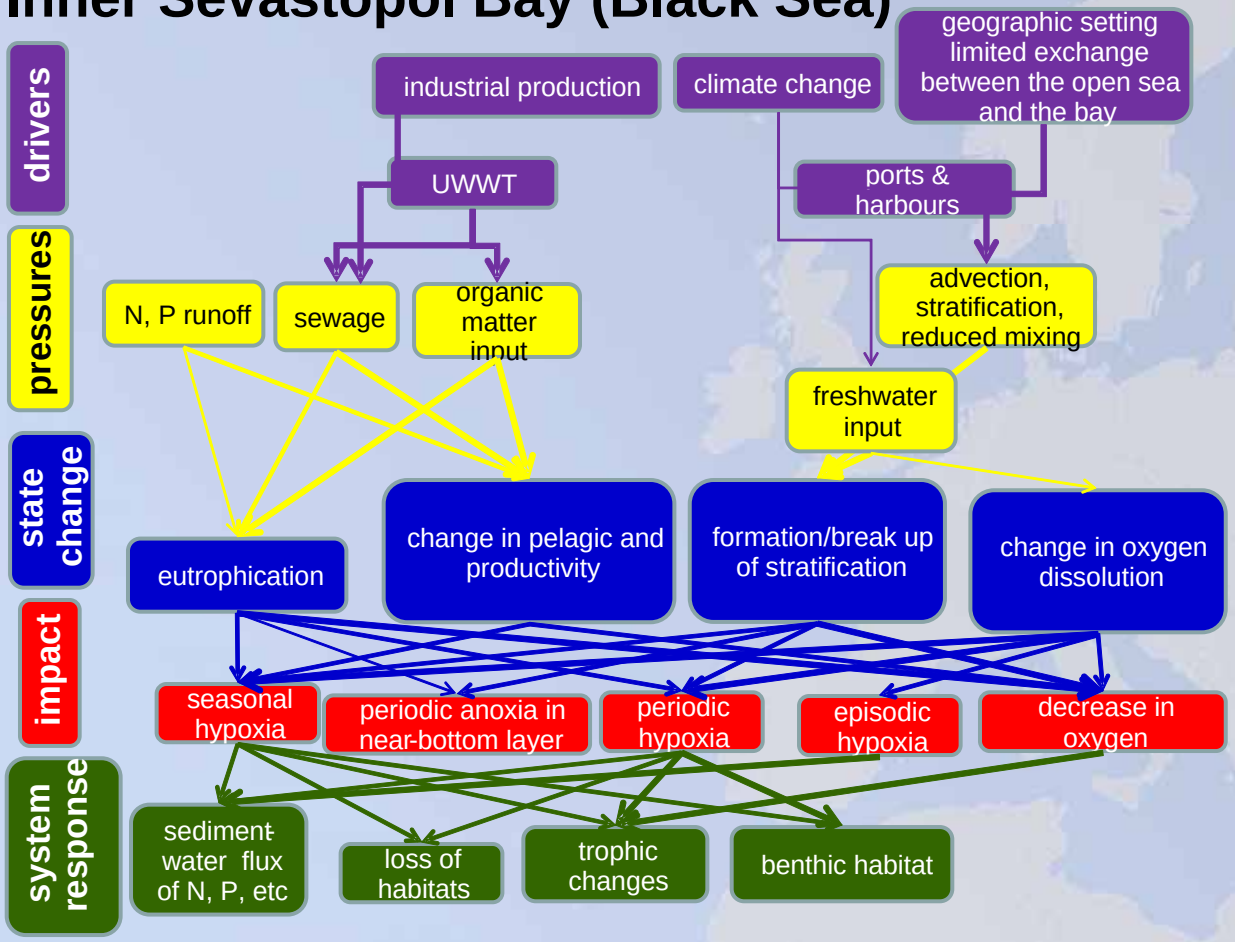
"DPSIR assessment framework"

Scheme: J. Friedrich, AWI

Conceptual models: ecosystem response to hypoxia

Example: Sevastopol Bay

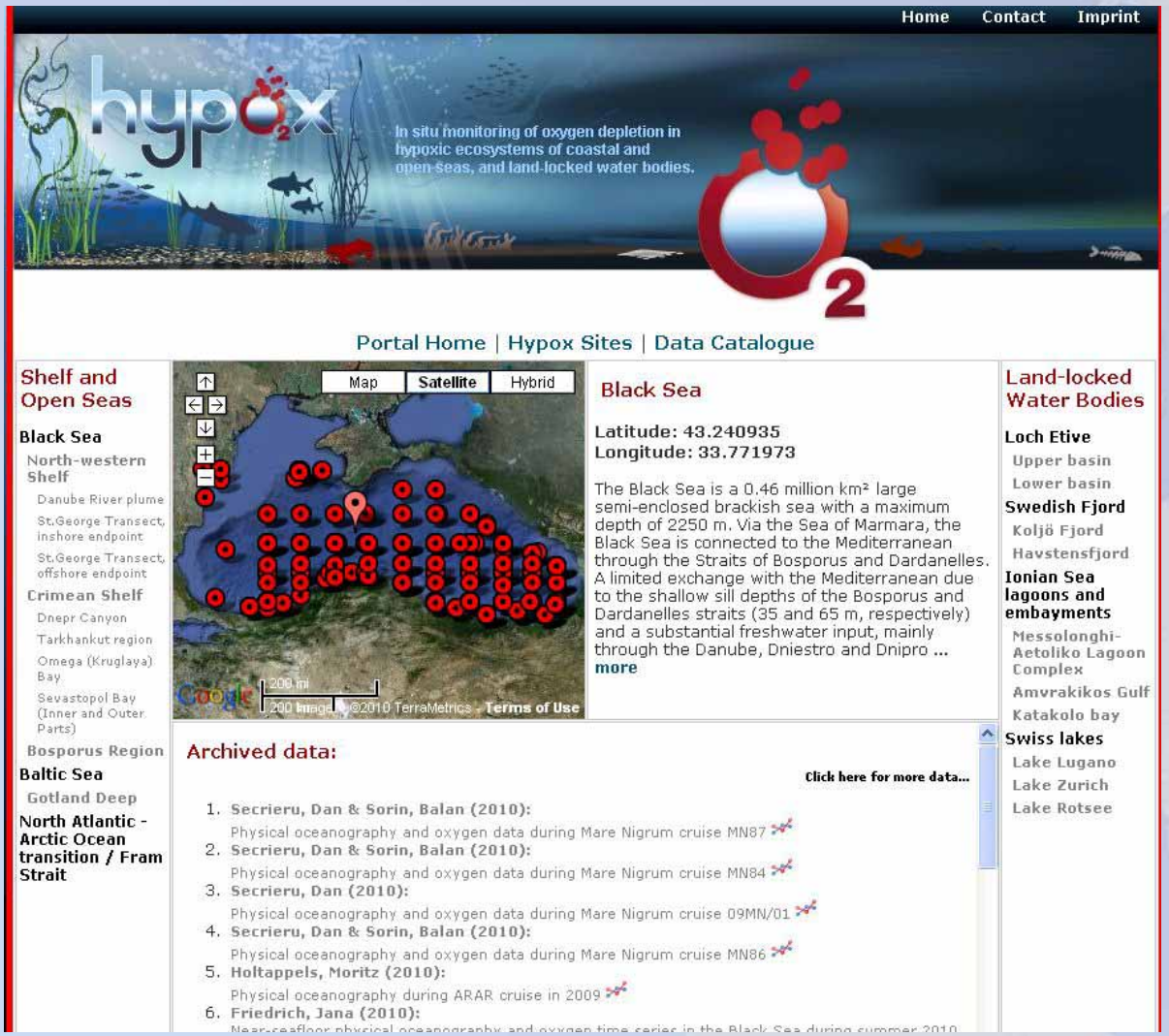
Inner Sevastopol Bay (Black Sea)



Dissemination of results

Open access archiving: data publishing network “Pangaea” (www.pangaea.de)

improved usability and advanced options: hypox data portal (www.hypox.net)



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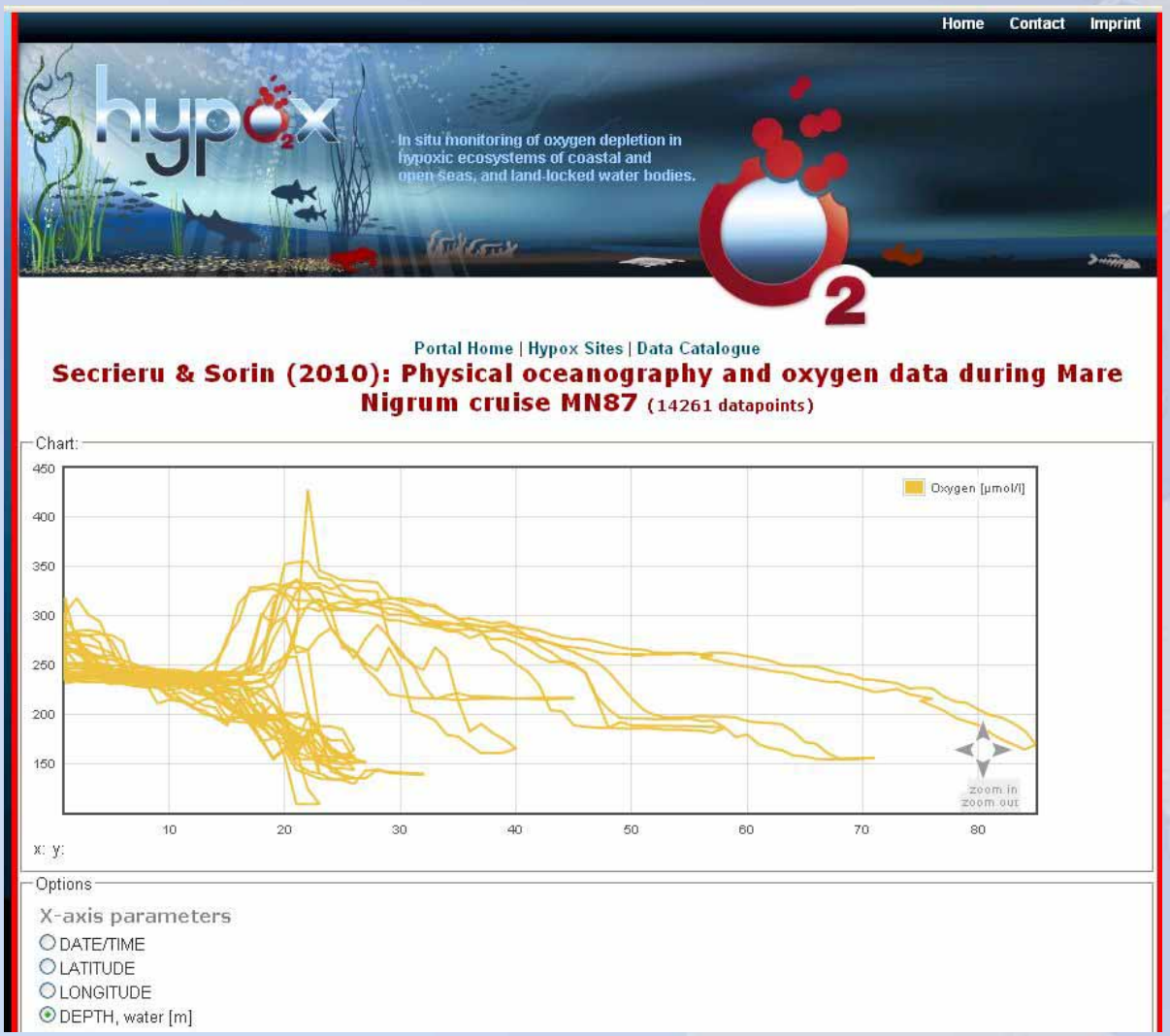

Adding to the global system of systems: implementation in GEOSS

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GROUP ON EARTH OBSERVATIONS

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GEOSS Registry Publication Portal

GEOSS Service Instance Details

Service Basic Information		
	Component Id:	urn:uuid:3549bbf7-0e82-429b-b6c7-af67e1b043f8 (Click to see Component details)
	Service Id:	urn:uuid:5e3ce24e-4434-4781-bd8e-be7a22dfa652
	Name:	HYPOX GEORSS
	Abbreviation:	HYPOX GEORSS
	Description:	HYPOX GEORSS: New data from the HYPOX Project: Presentation of oxygen monitoring data recorded in freshwater and oceans
	Information URL:	www.hypox.net
	Interface URL:	http://www.pangaea.de/tools/latest-datasets.rss?q=project%3Ahypox
Service Contact Information		
	Contact Name:	Robert Huber
	Contact Email:	rhuber@wdc-mare.org
Service Time Period of Information Content		
	Begin Date:	Indefinite Start
	End Date:	Ongoing
Referenced GEOSS Supportive Standards or Speical Arrangements		
	Supportive Information:	Data Format
1.	Special Arrangement (click to view details):	Geospatial extensions for RSS and Atom
	Supportive Information:	Communications and Telecommunications
2.	Standard (click to view details):	Hypertext Transfer Protocol (HTTP), Version 1.1

Date and Time of Last Update

2010-05-26T15:05:26Z

Approval Status

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EC grant 226213