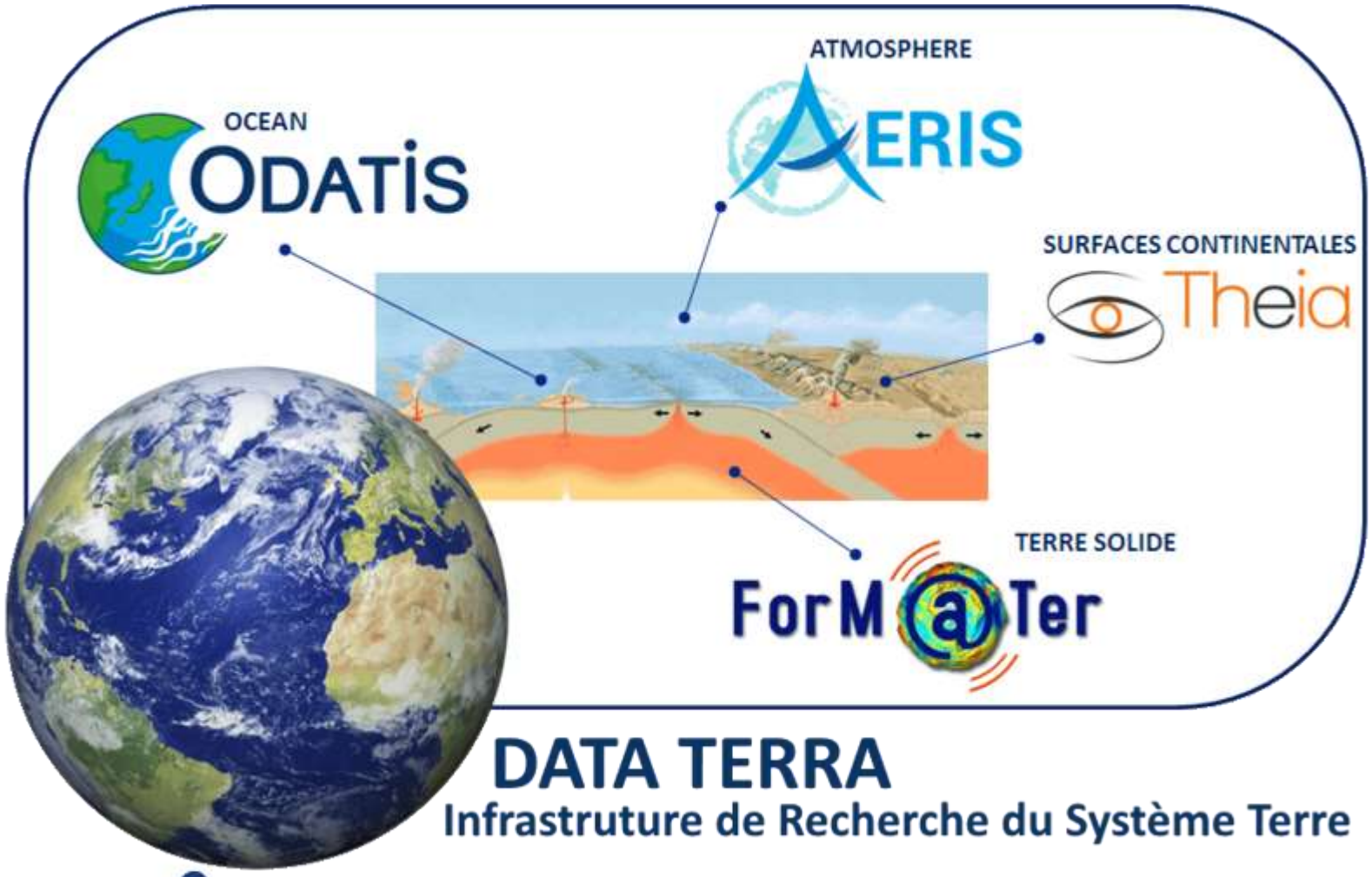
contact@odatis-ocean.fr
www.odatis-ocean.fr

ODATIS
OCEAN DATA INFORMATION AND SERVICES

CES Oxygène dissous

Véronique Garçon (LEGOS/OMP)
Sabine Schmidt (Directrice Scientifique Odatis)
Joël Sudre (Chargé Mission Odatis)

Le Pôle ODATIS

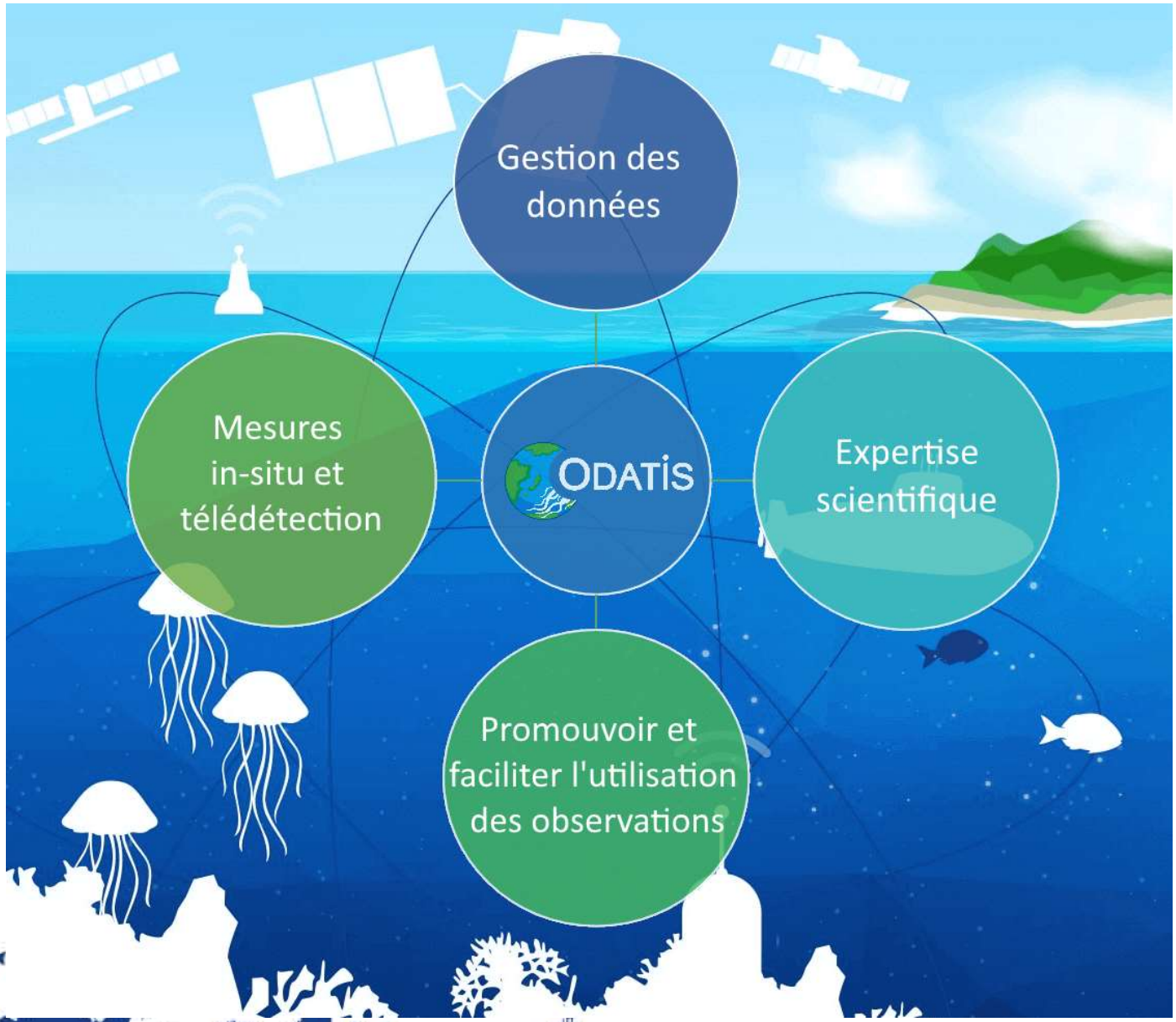


eventuellement

Les missions des Pôles

- **Diffuser et sécuriser**
  - Garantir la pérennité et faciliter la collecte des données patrimoniales
  - Faciliter l'exploitation des informations contenues dans les bases de données :
    - Interopérabilité technique et sémantique (harmonisation)
    - Portail commun (outils d'exploration, de visualisation, d'extraction, d'analyse)
- **Produire et inventer**
  - Produire des séries de données qualifiées et décrites selon les standards reconnus en vigueur (niveau 2 et +)
  - Favoriser l'utilisation combinée de données différentes (satellites, in situ, campagnes)
  - Elaborer combinant des jeux de données différents
  - S'affranchir des limites spatiales et temporelles, disciplinaires
- **Former et informer**
  - Offrir un support et de l'expertise aux utilisateurs
  - Participer à la formation scientifique, méthodologique et technique des communautés
  - Contribuer au positionnement et au rayonnement des compétences FR au niveau européen et international

Le Pôle ODATIS



Le Pôle ODATIS

Comité directeur (CD)
Représentants des 6 partenaires:
CNES, CNRS-INSU, Ifremer, IRD, SHOM, U. Marines

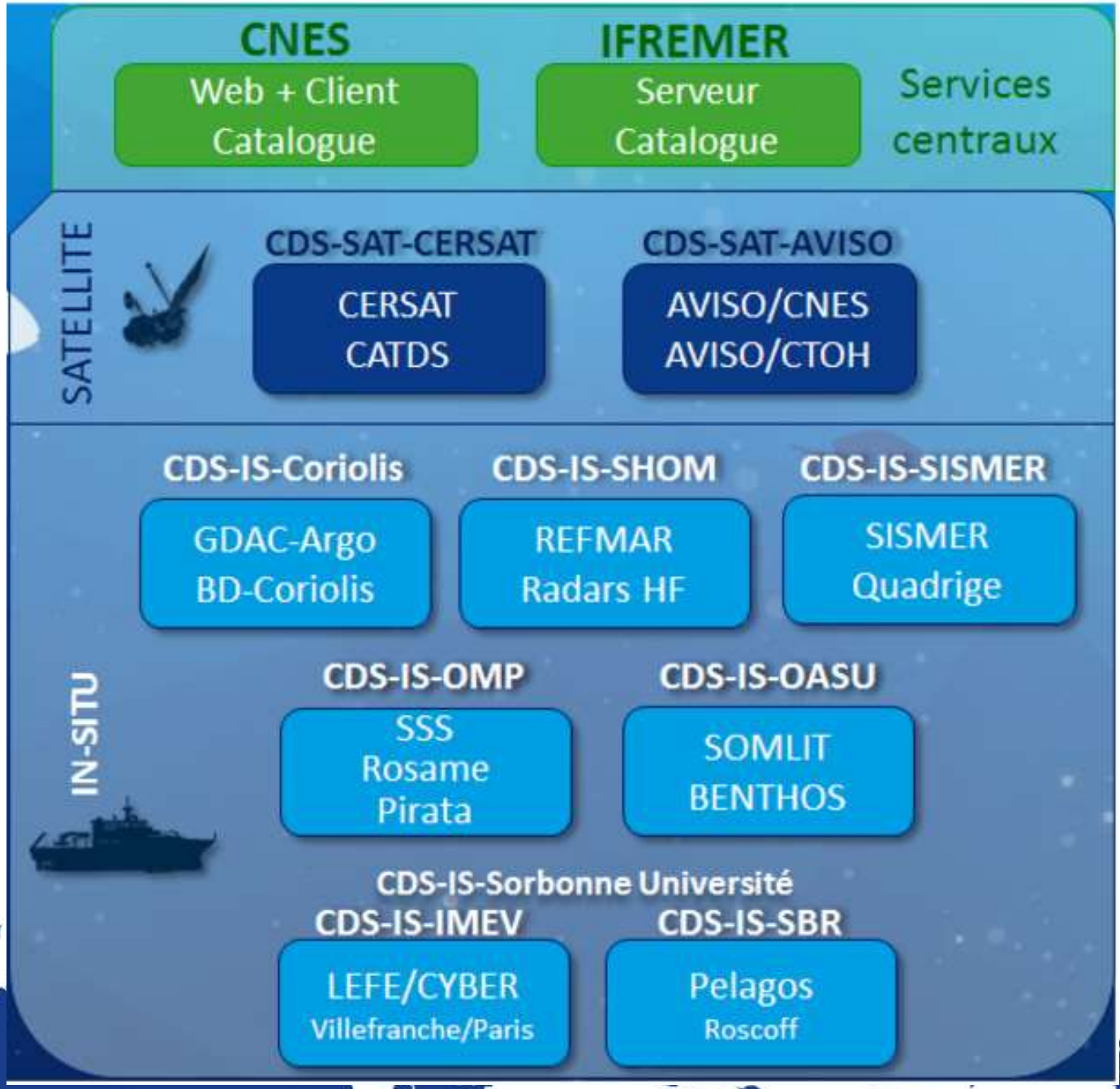
Bureau exécutif

Equipe de direction
Direction: G.Maudire
Direction technique: G.Dibarboure
Président du conseil scientifique: S.Schmidt
Chargés de mission ad-hoc

Représentants techniques des centres de données et de services

Conseil scientifique
Président:
S.Schmidt
22 membres

Le Pôle ODATIS



Le Pôle ODATIS

Observations « individuelles »

Initiatives locales, régionales, ... Résultats associés à une publication

Dépôt / Publication
- Obtention d'un DOI (Landing page)
- Conservation long terme

Suivi des dépôts
Importation

Traitements multi-sources
- Satellite / In-situ
- Constitution/ harmonisation de séries temporelles
- ...

Utilisateurs de l'ensemble des services :
- Accès par DOI,
- Requêtage,
- Visualisation
- Téléchargement
- Accès direct
- Soumission de traitement

Observation structurée

Programmes nationaux, européens et internationaux (SNO, IR et TGIR d'observation, ...) Missions satellites (segments sols)

Centres de Données et de Services
- Curation des données d'observation
- Traitement des observations (en routine)
- Mise à disposition des données

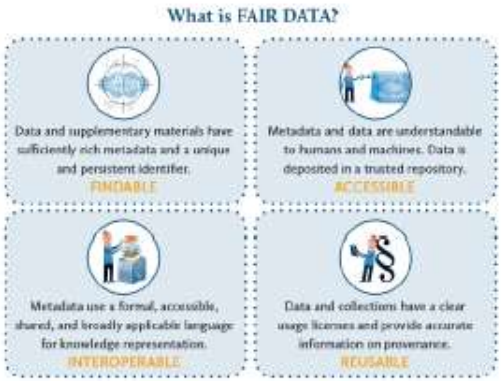
Services avancés de diffusion
- « Cache technique »
- Assemblage multi-source
- Subsetting
- Co-visualisations

Services communs (de base)
- Authentification / Autorisation des utilisateurs, sécurisation
- Catalogue(s)
- Serveurs de référentiels : vocabulaires communs (ontologies), fonds géographiques, ...
- Suivi des usages (analyses des logs des services, bibliométrie)

En fait cela détaille pour odatis

Les services Odatis

- **Pour les producteurs des données (en cours)**
  - Support technique (formats, harmonisation, transferts ...)
  - Pérennisation des données
  - Attribution de DOI

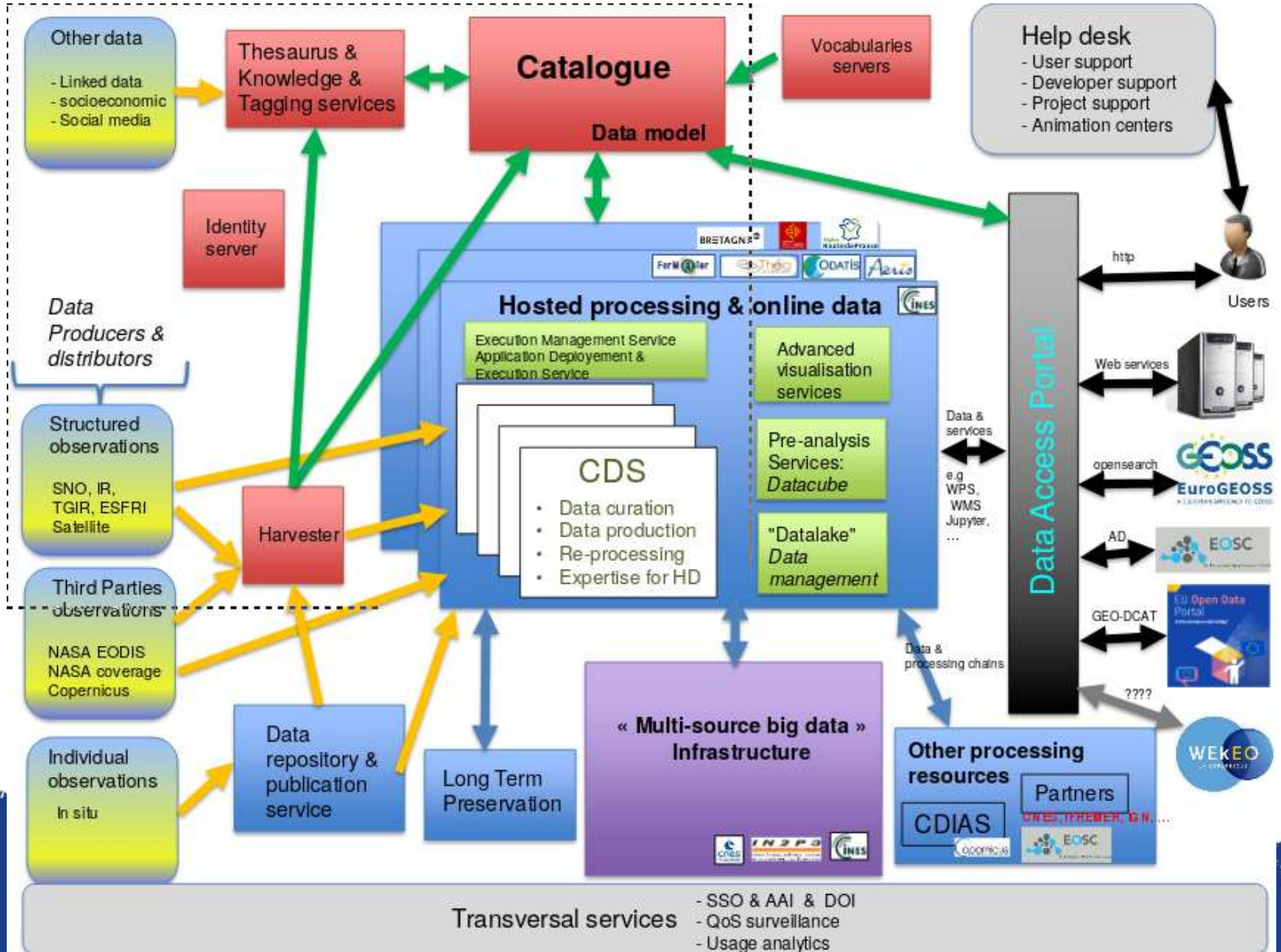


- **Pour les utilisateurs des données marines**
  - Portail : point d'accès aux jeux de données
    - **Découverte** : Catalogue des données et des services associés
    - **Visualisation**
    - **Accès aux données**

- **Vers une harmonisation technique et des procédures pour faciliter l'utilisation**
  - Interopérabilité technique et sémantique
    - ➔ adoption de protocoles, formats, référentiels communs
      ex : métadonnées ISO19115 (version 3), CSW (ou OAI/PMH), WMS, OpenDAP, ...
    - ➔ un atelier technique interpôle et un atelier Odatis
  - Respect des dispositions nationales et européennes pour l'accès aux données de la recherche (recherche éthique et transparente, ...)

Un projet déposé à l'ANR Flash mai 2019

Le Pôle ODATIS dans IR DATA TERRA



Les CES du Pôle ODATIS

- promouvoir et de valoriser des **méthodes de traitement et des produits innovants** d'observation spatiale, aéroportée ou in-situ de l'Océan et de ses interfaces (atmosphère, littoral et sous-sol sous-marin) avec les autres pôles de données

- **regroupements d'acteurs publics ou privés** menant des travaux de recherche ou développant des méthodes innovantes de mobilisation des données d'observation

- capables **d'assurer la réalisation de prototype de produits à valeur ajoutée**, ou l'opération de ces **prototypes pour produire des données spécifiques sur des problématiques Océan** (littorales, côtières ou hauturières), autour de champs thématiques (processus physiques, chimiques et biologiques, écosystèmes, échanges océan/atmosphère, approches globales, exploitation raisonnée des ressources, …) pour répondre aux défis sociétaux et environnementaux de notre époque.

Le CES Oxygène dissous

Initiative conjointe de l'action LEFE/CYBER
Inscrit dans l'effort international du réseau IOC-UNESCO GO_2NE et de IOCCP

Objectifs:

- **Réunir les acteurs** des sciences de l'océan, qui s'intéressent à l'oxygène dissous
- **Elaborer une plateforme** en accès ouvert sur les données océaniques de concentration en **oxygène dissous collectées par toute la communauté française,**
- Regrouper l'ensemble des données quelque soit l'approche mise en œuvre: BGC-Argo, flotteur-profileurs, mouillage, données expérimentales, interface eau-sédiment, etc.
- Inventorier les données existantes et de développer un cahier des charges pour la mise en place d'un produit synthétique des données, incluant un contrôle qualité,
- Mettre en place un DMP pour les données Oxygène dissous.

Mardi 2 juillet 2019

10H30 café de bienvenue

Matin 11h -13h
Bienvenue et Introduction (Sabine Schmidt, EPOC, ODATIS, Véronique Garçon (LEGOS, CES-O2) et Joël Sudre (LEGOS, ODATIS) (10 min)

Objectifs du workshop, résultats attendus et logistique,
Contexte international (Sabine Schmidt, EPOC, ODATIS; Véronique Garçon (LEGOS, CES-O2),
Joël Sudre (LEGOS, ODATIS, CES-O2)

Discussion de groupe (10 min)

Qu'existe-t-il? (1h)

Virginie Thierry, (BGC-ARGO-O_2) IFREMER, LOPS
Virginie Racapé, IFREMER, LOPS
Laurent Coppola, LOV, CNAP, SOMLIT Med Sea
Sabine Schmidt, EPOC, CNRS, estuaires Loire et Gironde
Catherine Schmechtig (BGC-ARGO-O_2, LEFE-CYBER) CNRS
Sylvain Rigaud (Université de Nimes)
Dominique Lefevre (IODA), MIO, CNRS, SOMLIT Med sea
Nicolas Savoye (Somlit) EPOC
Christophe Rabouille CEA, LSC, pro-delta du Rhone
Bruno Deflandre, EPOC
Nathalie Sennechaël (LOCEAN)
Anne Daniel, IFREMER
Aurelien Paulmier, LEGOS, IRD, OMZs calibration --→ cet après midi car au Mexique

Exemple de démarches
L'initiative SOCAT
Nathalie Lefèvre (LOCEAN, IRD) (10 min)

JERICO : Livre blanc sur les mesures de l'oxygène dissous
Laurent Coppola (LOV, CNAP) (10min)

Repas : 13h – 14h

Séparation en groupes de travail et identification des questions communes pour les capteurs O_2 sur CTD, sur mouillages fixes/séries temporelles, capteurs O_2 sur BGC-ARGO, gliders et wavegliders.
Chaque sous-groupe travaillera en parallèle mais les participants doivent être libres de circuler entre les sous-groupes. Sur la base de chaque capteur/technique utilisés pour l'échantillonnage et la mesure, chaque sous-groupe devra investiguer comment :

-Implémenter des contrôles qualité automatiques standardisés sur l'ensemble du jeu de données,
-Définir des contrôles qualité/corrections spécifiques à chaque type de capteur/technique utilisés pour l'échantillonnage et la mesure et ensemble des métadonnées nécessaires pour mener ces contrôles,
-Implémenter les contrôles qualité recommandés et construire le jeu de référence des données oxygène,
-Mettre à jour le marquage des données.

Une attention spéciale sera portée aux régions océaniques à très faible oxygène qui requièrent une validation adaptée et spécifique pour les titrations Winkler comme pour les capteurs d'oxygène.

Session 1 : Capteurs O_2 sur les CTD et calibration avec les mesures Winkler
Session 2: Capteurs O_2 sur les mouillages fixes/observatoires de fond
Session 3: Capteurs O_2 sur les profileurs BGC-ARGO, sur les gliders et wavegliders et calibrations in situ en air
Session 4 : Gliders/wavegliders/ tout véhicule/plateforme autonome
Session 5 : Observations O_2 en estuaires et océan côtier

Closure 18H

Mercredi 3 Juillet 2019

Courts rapports des discussions par sous-groupe de la veille après-midi

***Matin* 9h00 – 12h00**
Poursuite des discussions, élaboration de recommandations et rédaction du rapport de synthèse pour chaque sous-groupe : ***Session 1, Session 2, Session 3, Session 4, et Session 5.***

Repas : 12h – 13h

Après- midi 13h -17h30
Rapports de chaque sous-groupe en session plénière et discussion générale.

Elaboration d'un cahier des charges et de tâches en vue de la création d'une base de données nationales d'oxygène dissous océanique, et identification de responsables et de contributeurs par tâches.

Fin du workshop 17h30

« Si on ne peut respirer, rien d'autre n'a d'importance »

La santé des océans c'est la santé du système Terre et c'est notre santé

La désoxygénation des océans

Assemblée Nationale- Commission des Affaires Etrangères- MI Mers et Océans

Véronique Garçon

LEGOS

cnrs

GO$_2$NE

Global Ocean Oxygen NEtwork

United Nations Educational, Scientific and Cultural Organization

Intergovernmental Oceanographic Commission

Sustainable Development Goals

GO$_2$NE

Global Ocean Oxygen NEtwork

The Ocean is losing its breath
Declining oxygen in the world's ocean and coastal waters

Kirsten Isensee, Denise Breitburg, Marilaure Grégoire, Francisco Chavez, Daniel Conley, Véronique Garçon, Denis Gilbert, Dimitri Gutierrez, Gil Jacinto, Lisa Levin, Karin Limburg, Ivonne Montes, Wajih Naqvi, Andreas Oschlies, Grant Pitcher, Nancy Rabalais, Mike Roman, Kenny Rose, Brad Seibel, Maciej Telszewski, Moriaki Yasuhara, Jing Zhang.

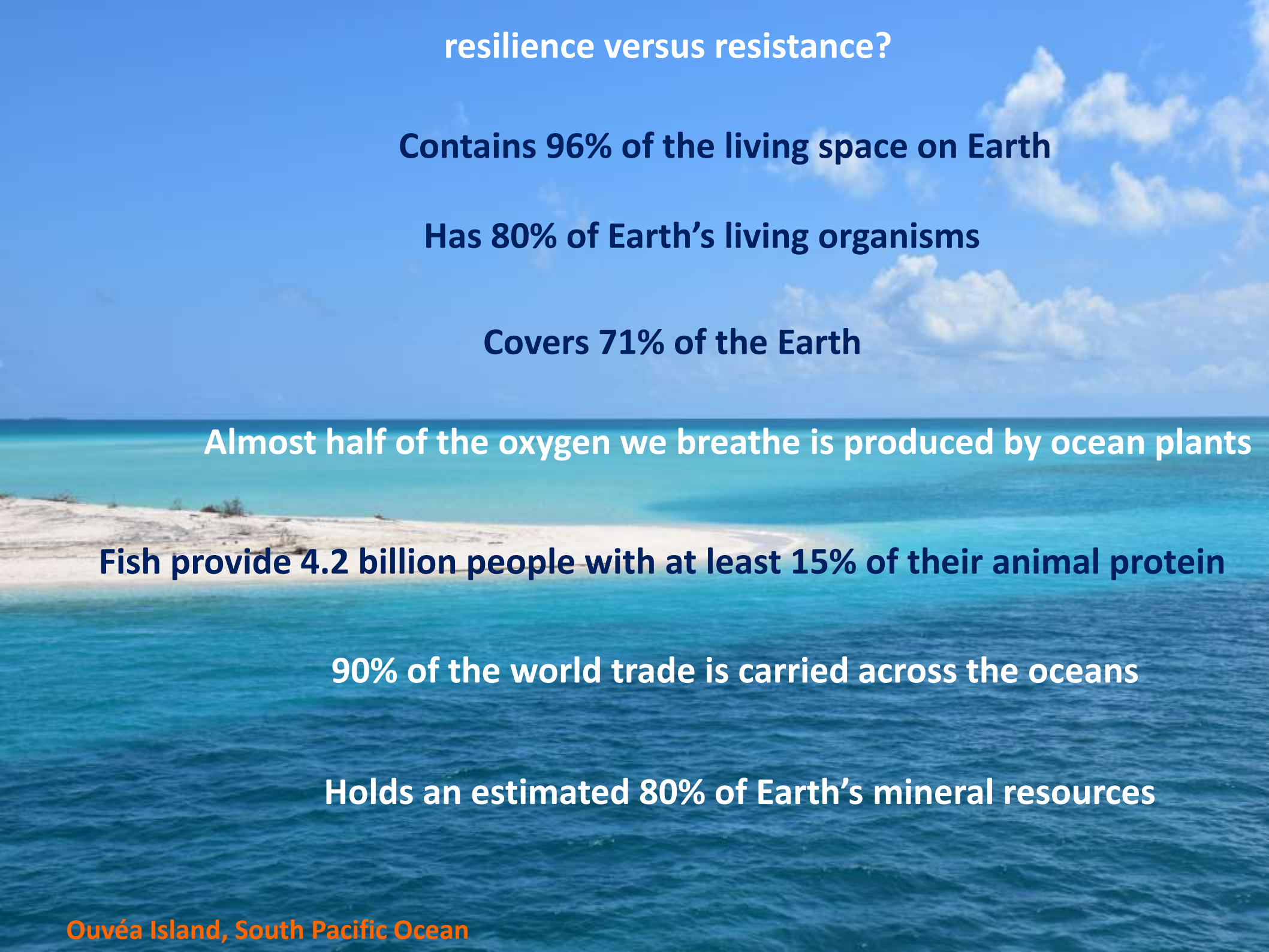
SFB 754 | Ocean Deoxygenation: Drivers and Consequences · Past · Present · Future ·

Kiel, 2 Septembre 2018

United Nations Educational, Scientific and Cultural Organization

Intergovernmental Oceanographic Commission

UNESCO, Paris, 13-14 juin 2019

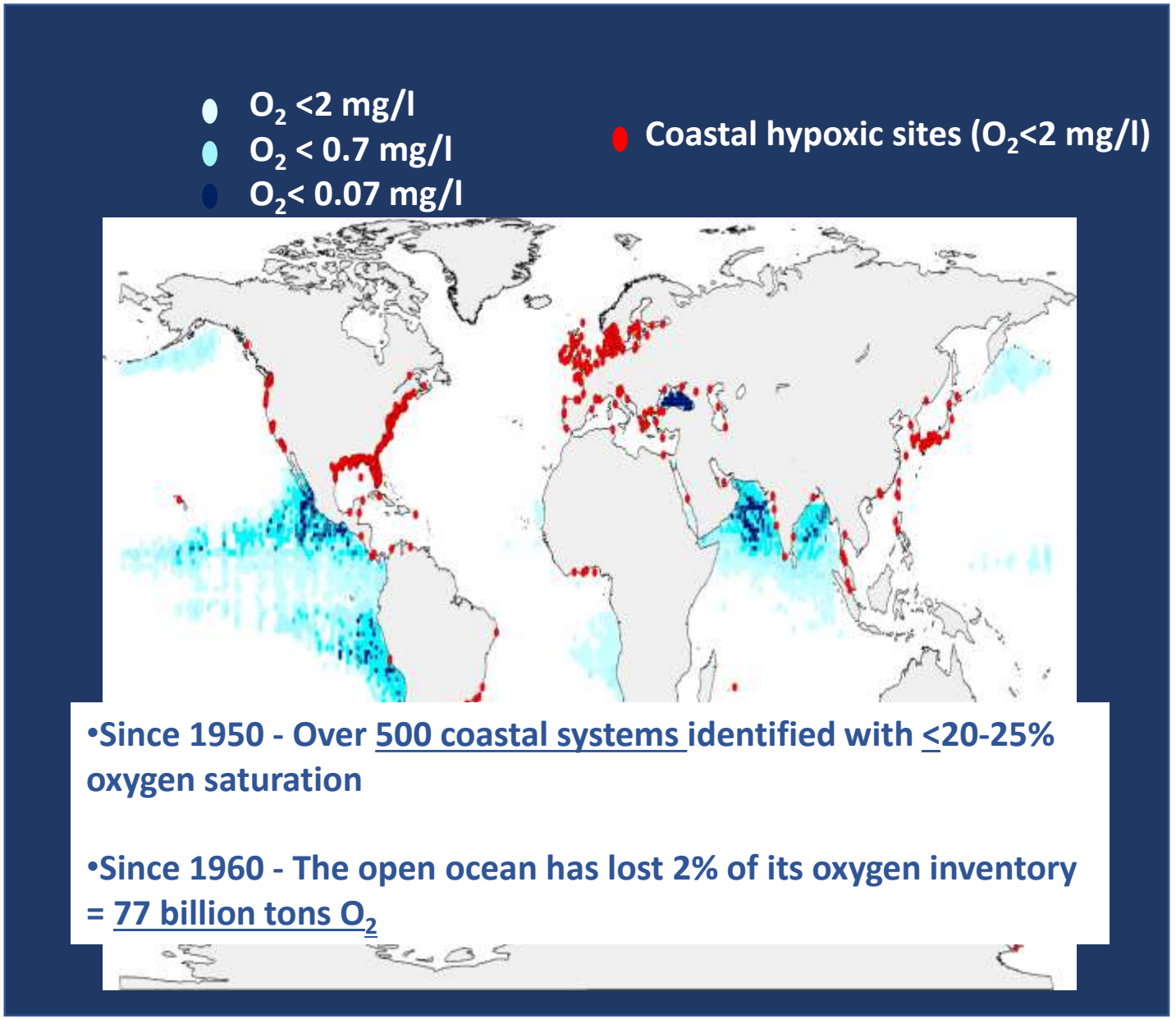

resilience versus resistance?
Contains 96% of the living space on Earth
Has 80% of Earth's living organisms
Covers 71% of the Earth
Almost half of the oxygen we breathe is produced by ocean plants
Fish provide 4.2 billion people with at least 15% of their animal protein
90% of the world trade is carried across the oceans
Holds an estimated 80% of Earth's mineral resources
Ouvéa Island, South Pacific Ocean

….in an open and coastal ocean losing its breath ……

Low oxygen waters:

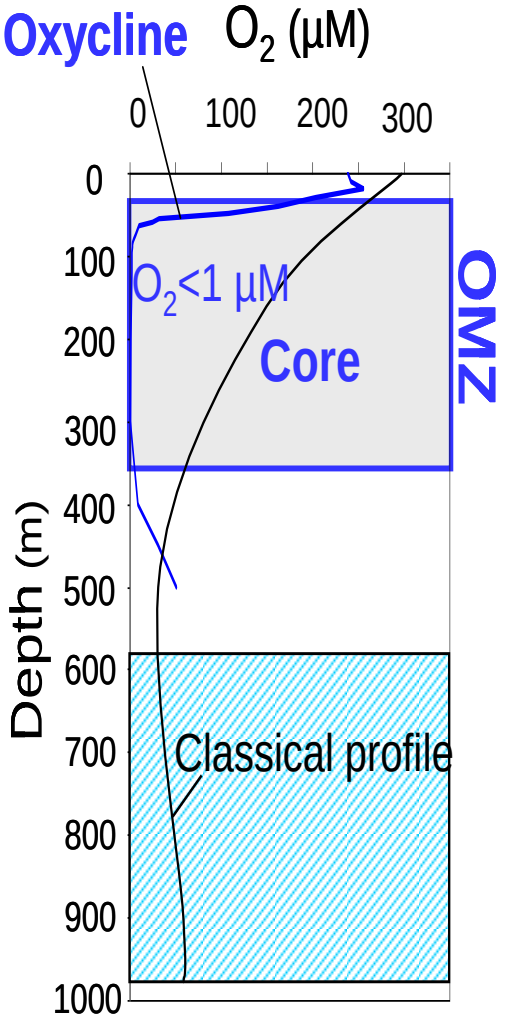
O_2< 1-2 mg/l

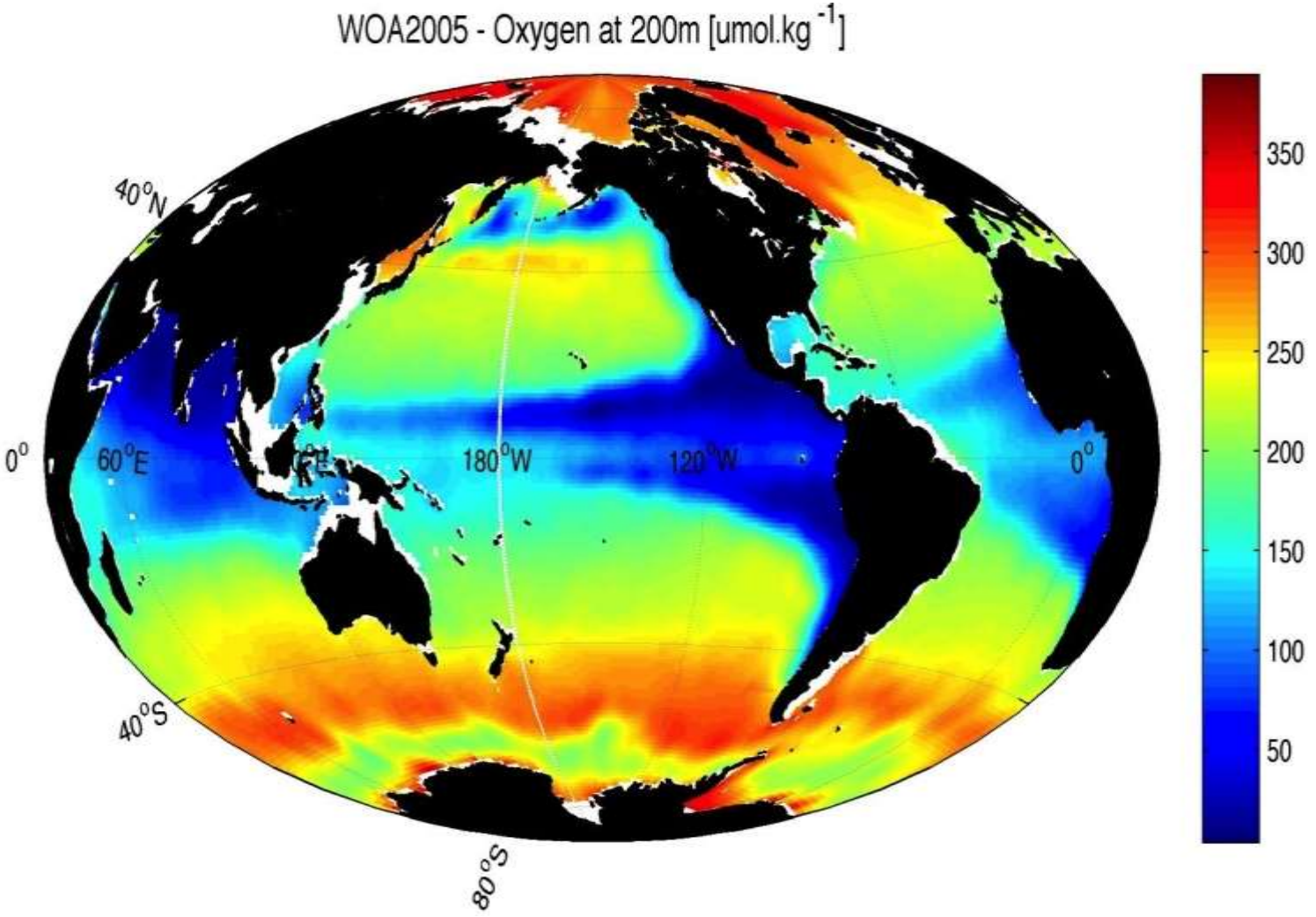
(oxygen concentration in the atmosphere = 300 mg/l)



Breitburg et al., 2018

Ocean oxygen





OMZ: Oxygen Minimum Zone: they play a fundamental role on climate (e.g., greenhouse effect through N_2O) and on ecosystems (e.g., respiratory barrier, nitrogen loss)

Main OMZ issues and impacts

OMZ

Climate
+
Ecosystems

GHGs

solas surface ocean lower atmosphere study

Local

DMS, aerosols (clouds)

Global

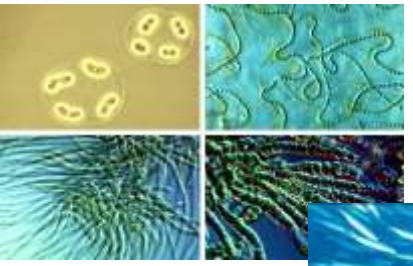
Greenhouse gases (CO_2; N_2O; CH_4)

N_2O, HX → O_3

Clouds → albedo

➢ **Key-role on climate**

Paulmier and Garçon, 2008



➢ Key-role on ecosystems

PP/Fisheries
Biodiversity/Shift

OMZ

Climate
+
Ecosystems

GHGs

Pelagia noctiluca ***Dosidiscus gigas***

Local

Respiratory barrier (zooplankton; fish/juvelines)
Toxicity (H_2S; red/brown (Sargassum) tides, eutrophication; MeHg)
Acidity (→calcification, corals; reduced metals/Cu)
Masculinization, «nanism », low vision
Fertilization (recycling, Fe)

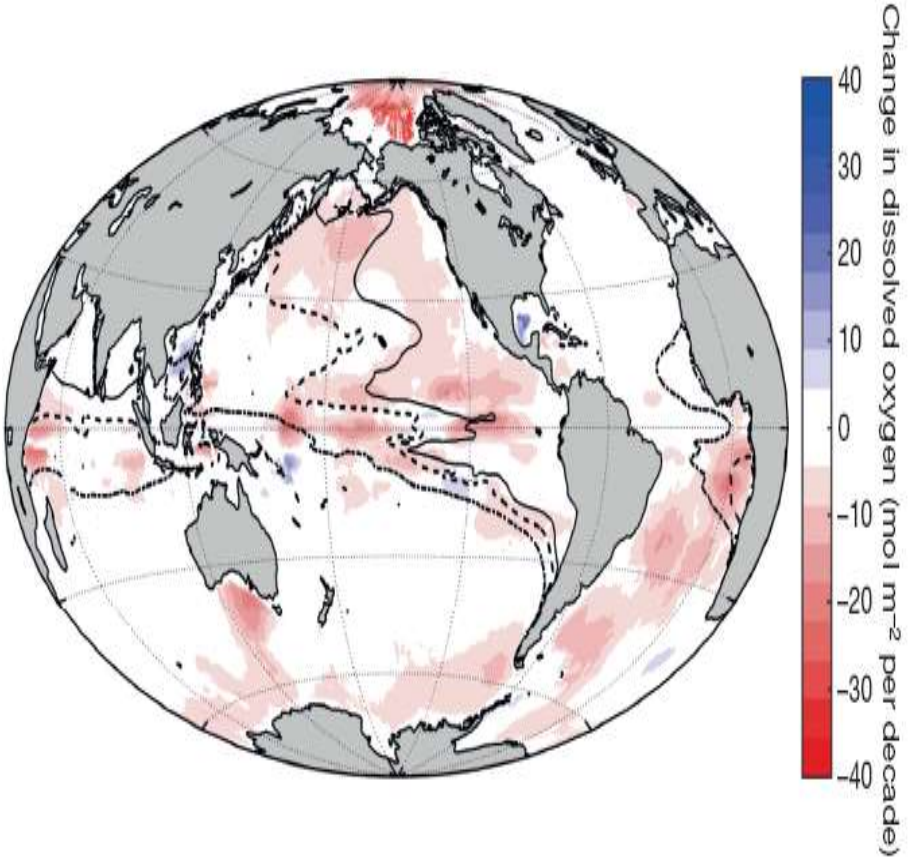
O_2 loss (atmospheric level regulation)
Nitrogen loss (denitrification, anammox)

➢ **Communities shift / adaptation**
(→geant bacteria, gelatinous, squids, benthic fish
➢ **Fisheries, top predators**

Robust evidences for ongoing ocean deoxygenation

OPEN OCEAN

Hot spots of changes
(> 60 % of the oxygen loss)
Tropical and North Pacific Ocean, Southern Ocean, South Atlantic Ocean, Arctic Ocean

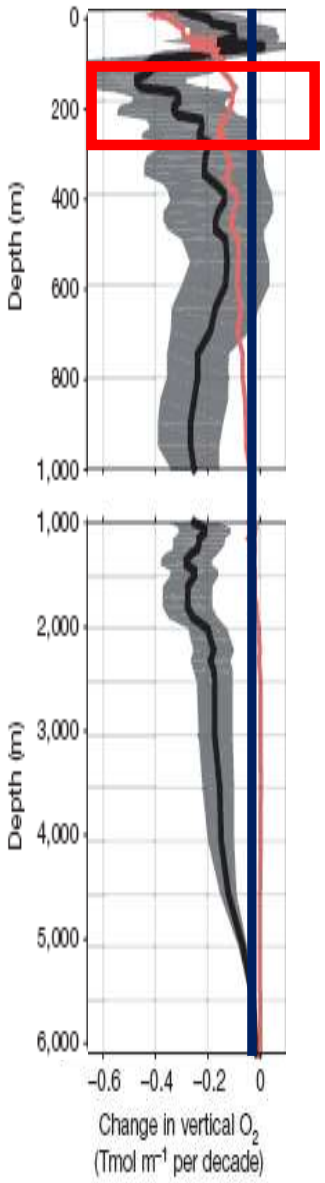


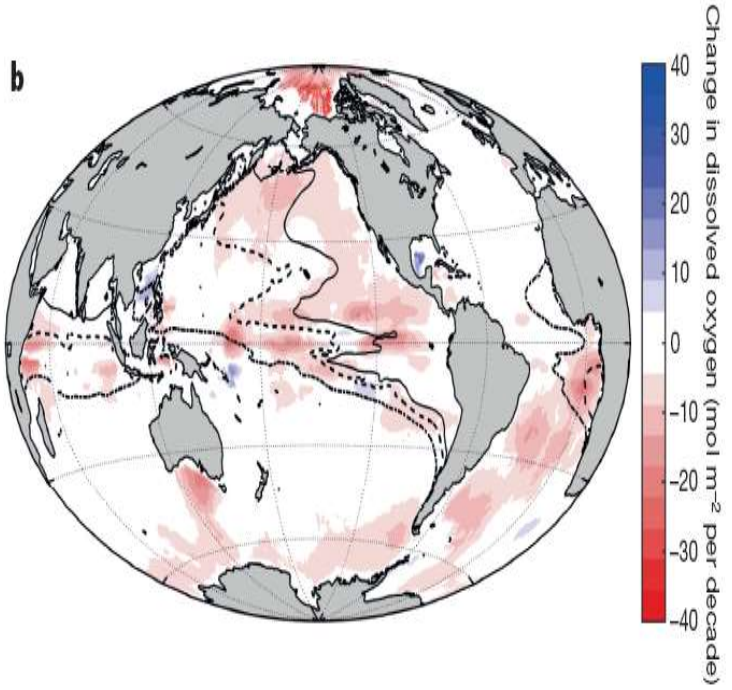
Schmidtko et al., 2017

Large variations in oxygen loss in different ocean basins and at different depths

Largest loss observed in the main thermocline 100-300m, as well as from 1000m to the bottom

Thermocline: 100-300m

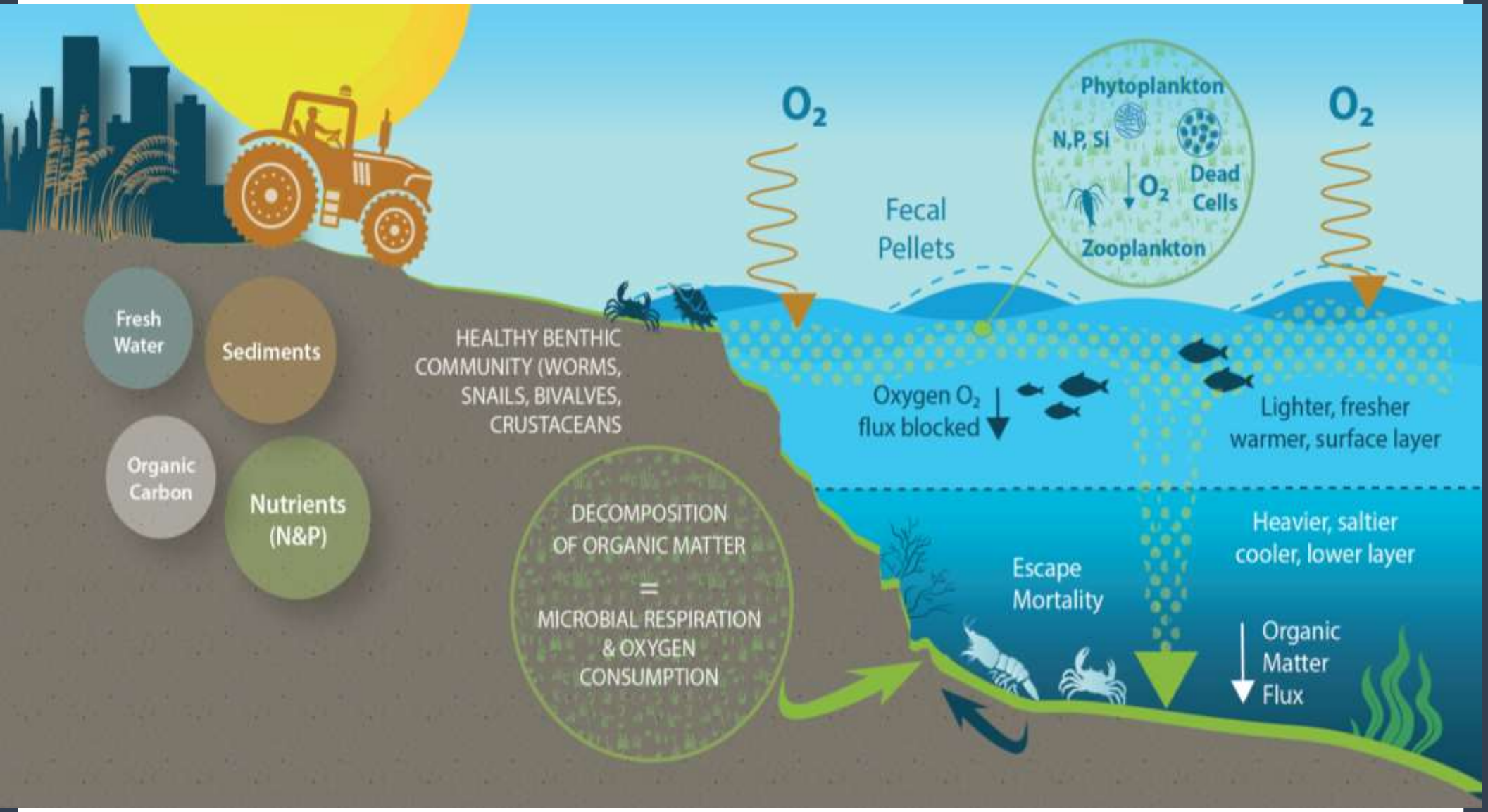




Hot spots of changes (> 60 % of the oxygen loss)

Tropical and North Pacific Ocean,
Southern Ocean,
South Atlantic Ocean,
Arctic Ocean

Schmidtko et al., 2017



United Nations Educational Scientific and Cultural Organization

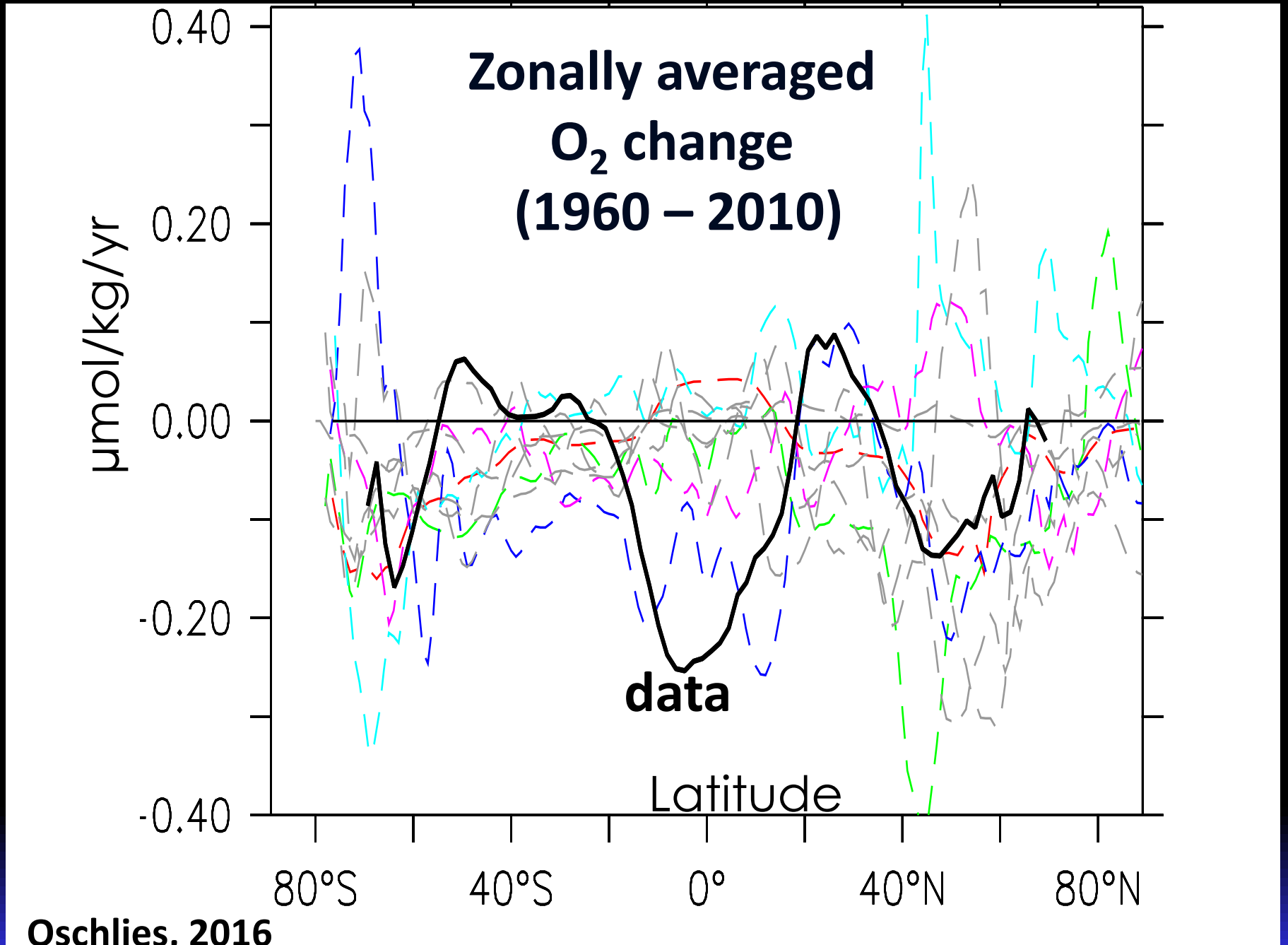
Intergovernmental Oceanographic Commission

GO$_2$NE

Global Ocean Oxygen NEtwork

How good are IPCC models to simulate oxygen?

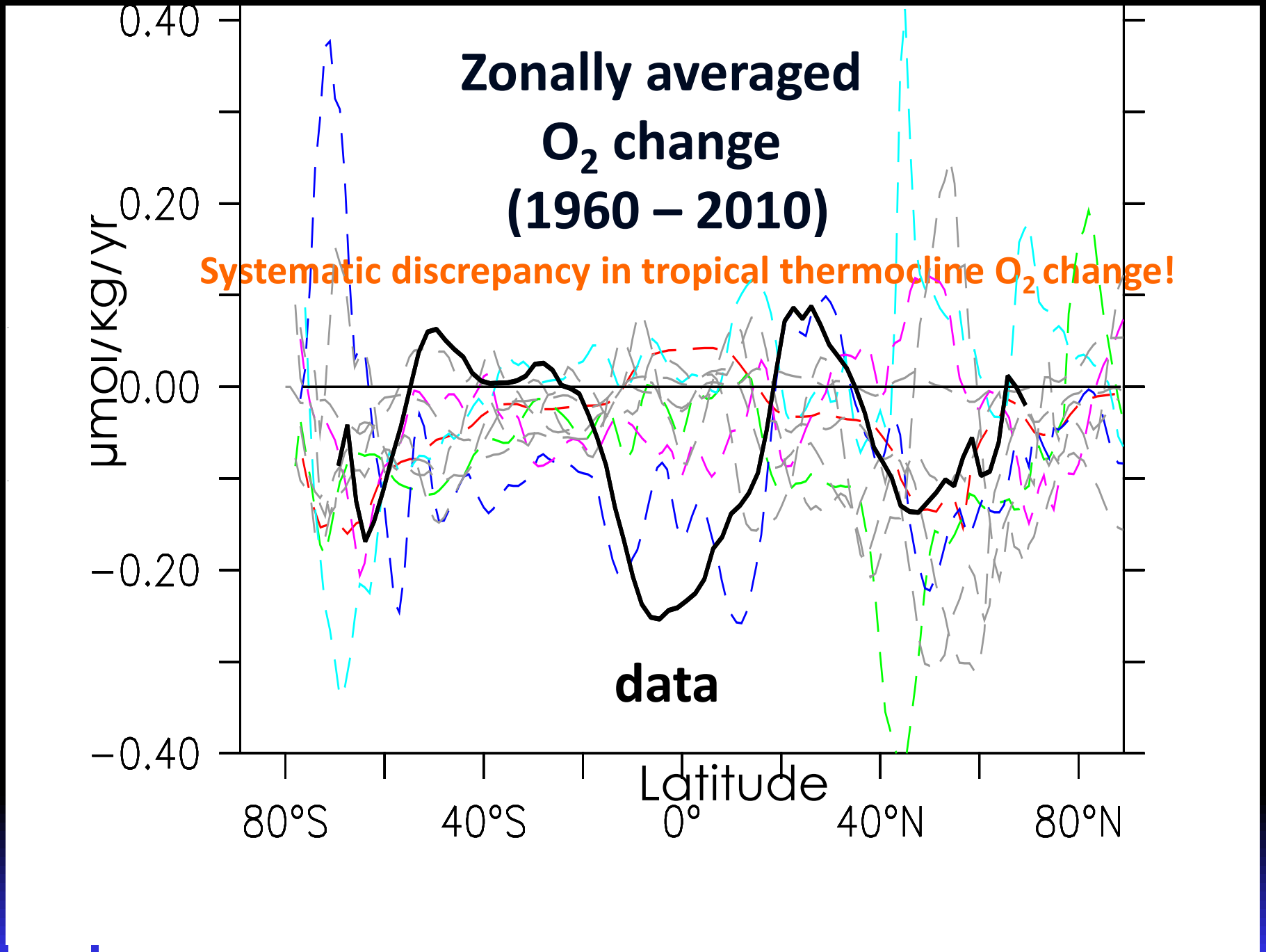
Colour: Ensemble of models



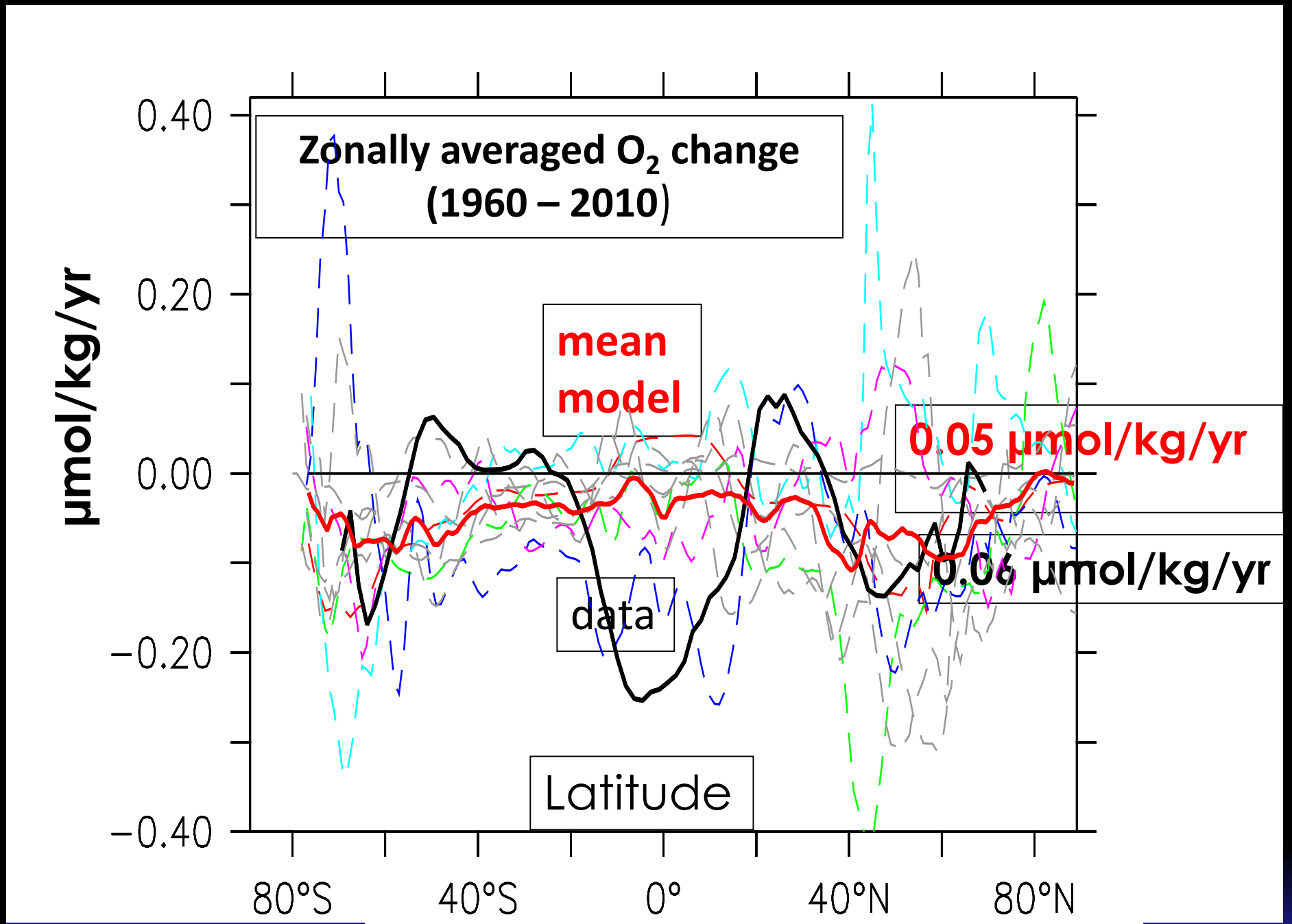
Oschlies, 2016

How good are IPCC models to simulate oxygen?

Colour: Ensemble of models

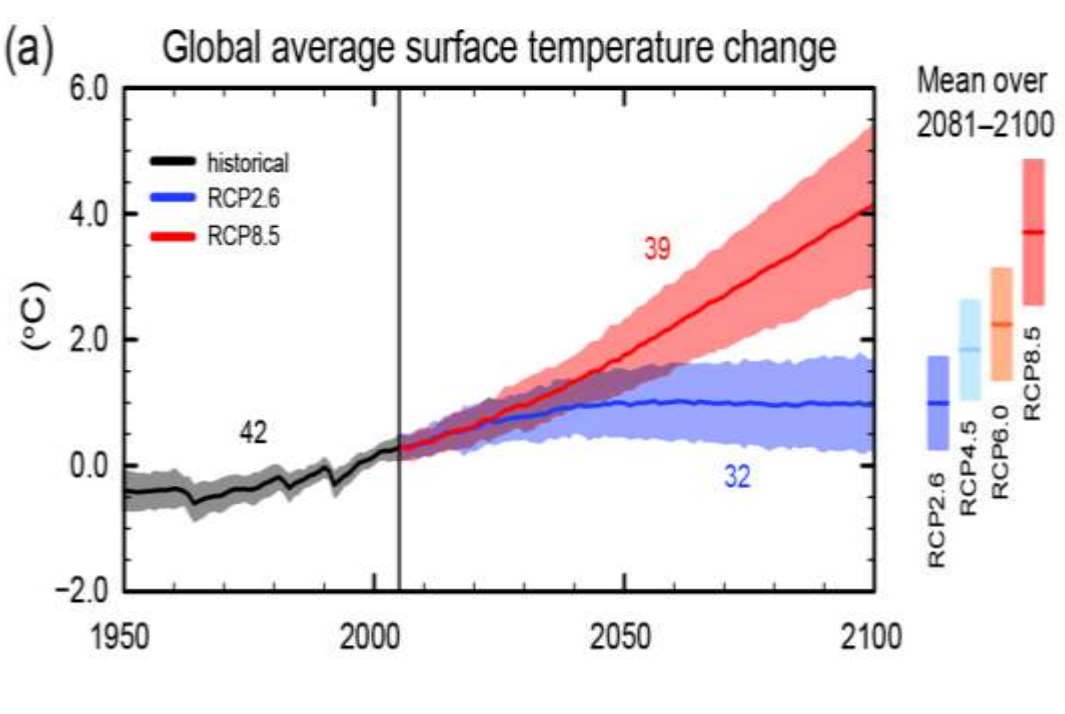


CMIP5 models do not reproduce observed tropical O_2 decline

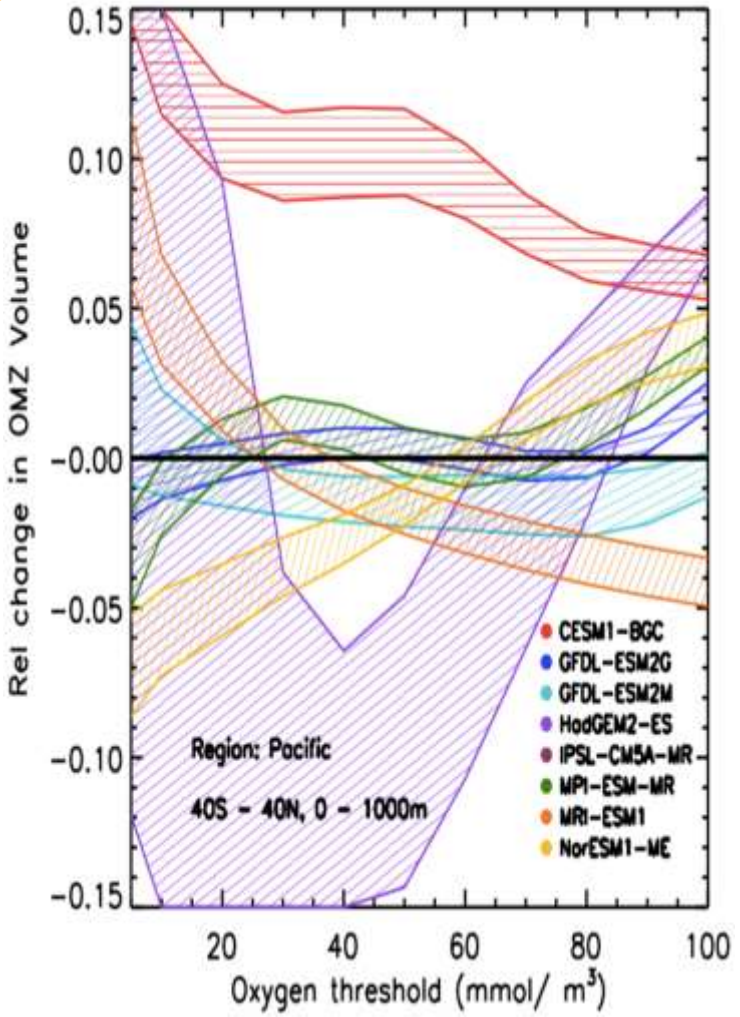


Oschlies, 2016

Continued emissions of greenhouse gases will cause further warming and changes in all components of the climate system



IPCC, AR5, 2013



Cabré et al., 2015

Integrated multi-scale approach

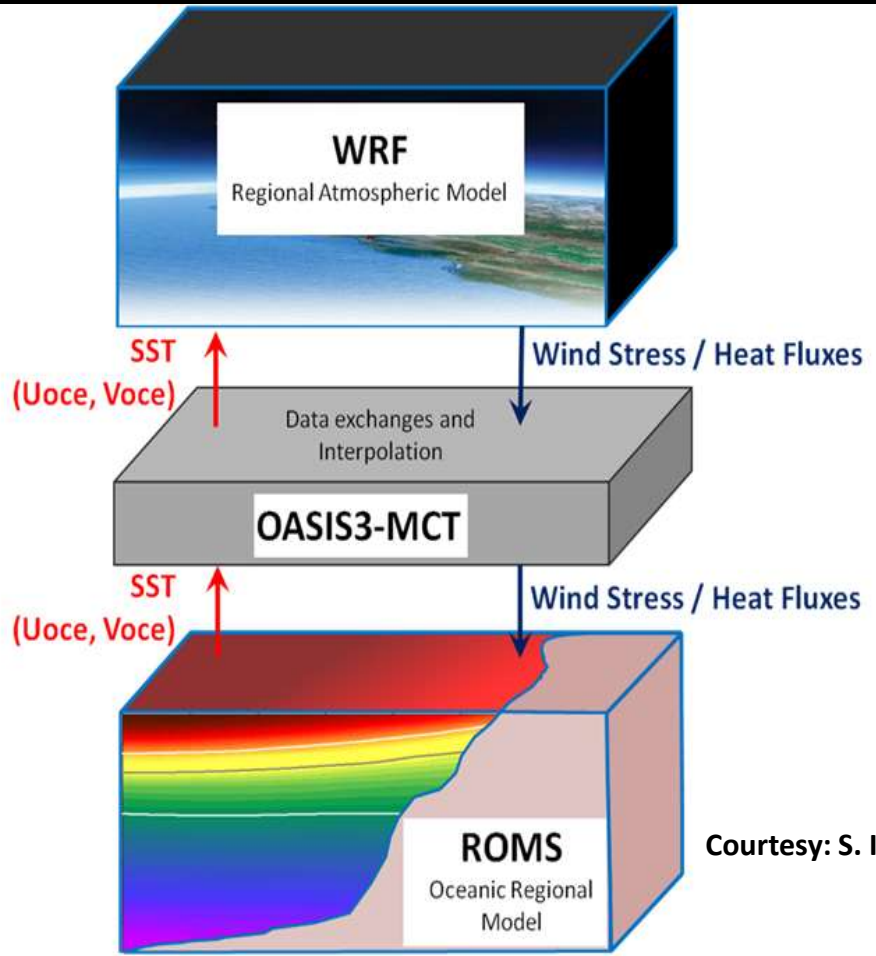
EXPERIMENTATION

specific in situ data and experiments

Continuous interaction

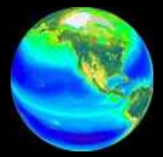
MODELLING

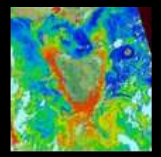
Parameterizations from process to regional and global coupled paltforms

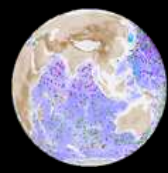


Courtesy: S. Illig





Integrated means Educating people for engaging people in these challenges.

Deoxygenation Management and Policy Strategies

Ecosystem-Based Mitigation to Restore and Protect the Environment

Reduce anthropogenic nutrients reaching coastal waters to reduce eutrophication-driven deoxygenation

Reduce greenhouse gas emissions to reduce deoxygenation due to climate change

Develop aquaculture practices and limits to protect oxygen content of waters

Adaptation to Restore and Protect Marine Organisms and Fisheries

Create marine protected areas and no-catch zones in well-oxygenated areas that can serve as a refugia; protect populations during low oxygen periods.

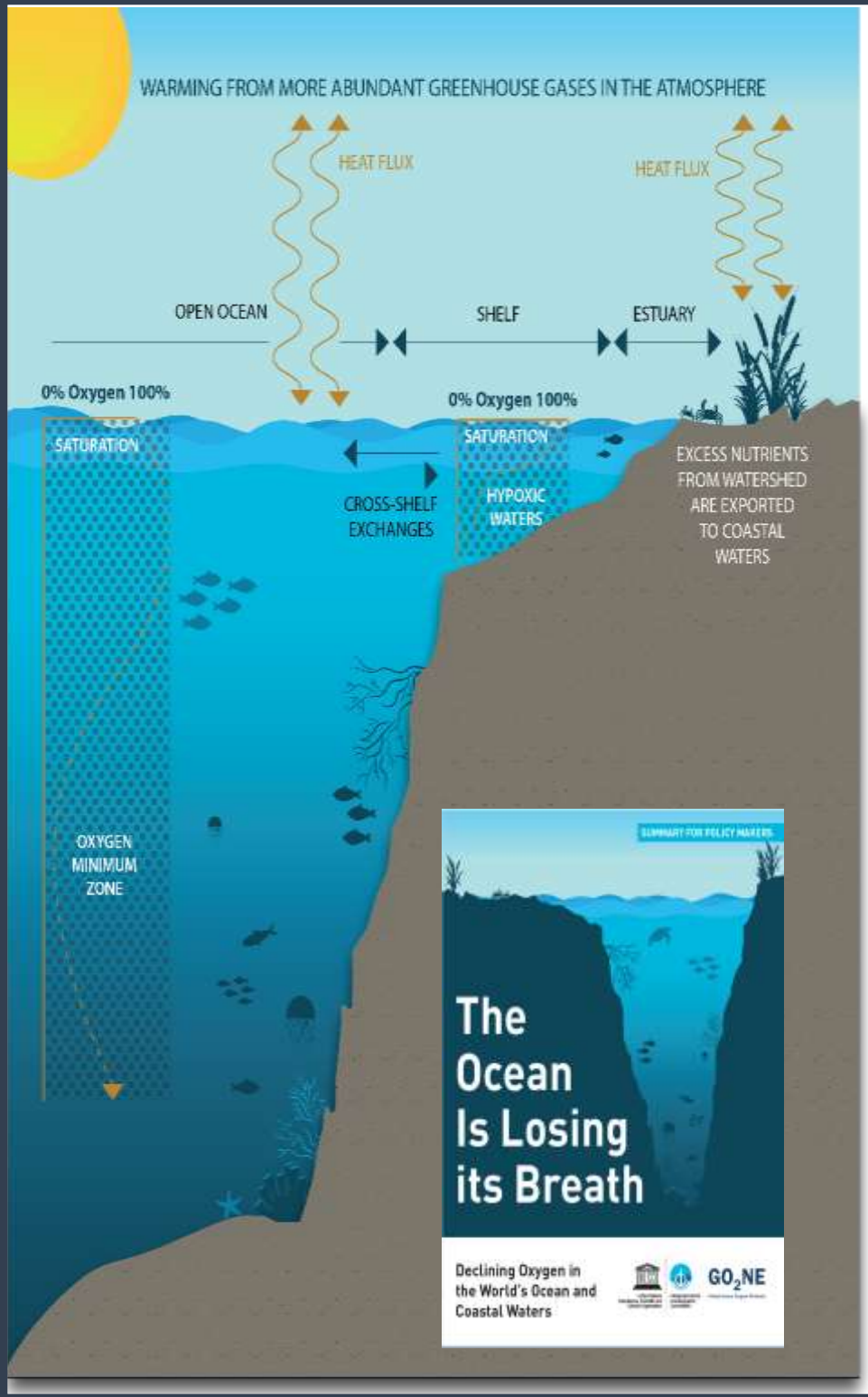
Consider effects of low oxygen on production, non-fishing mortality and fishing mortality in setting catch limits

Reduce fishing pressure on hypoxia intolerant species. Utilize fishing gear that minimizes additional stress on oxygen-impacted fish stocks and ecosystems.

Implement and maintain monitoring and analysis programs

Monitoring, data analysis and dissemination of results are critical detect problems and determine the effectiveness of management and restoration efforts

Breitburg et al., 2018



GO$_2$NE

Global Ocean Oxygen NEtwork

United Nations Educational, Scientific and Cultural Organization

Intergovernmental Oceanographic Commission

- Technical brief: Declining oxygen in the world's ocean: 15 things to know
- Contribution to the http://ocean-oxygen.org

- Scientific papers – assessments
- Capacity building
- **Advice to stakeholders, including policy makers, scientific institutions and governments, e.g. UNFCCC**
- Public outreach
- Scientific conferences

International Ocean Carbon Coordination Project

Towards a sustained global observation network for marine biogeochemistry

Calendar

IOCCP meetings, IOCCP-related meetings as well as events related to a wider scope in marine biogeochemistry.

VIEW

IOCCP E-list

Subscribe to the IOCCP mailing list to receive frequent news updates and quarterly newsletter IOCCP Conveyor

Name

E-mail

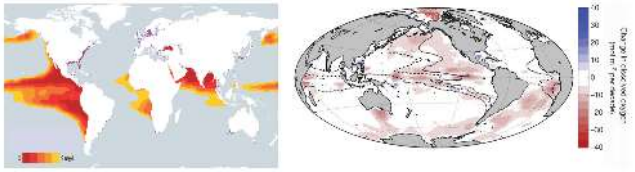
Subscribe

Oxygen

Oxygen (O_2) is essential for nearly all multicellular life. Subsurface oxygen concentrations reflect a balance between supply through circulation and ventilation and consumption by respiratory processes. Changes in either of these processes is susceptible to lead to changes in O_2 distribution. A global ocean O_2 observing network will act as a sensitive early warning system for trends that climate change is causing. Ocean deoxygenation (decline in O_2 concentration) is under way in part because of ocean warming and increased stratification, but also because of increased nutrient loads in the coastal ocean. Deoxygenation has been largely under the radar to most people including policy advisers and decision makers. Yet it is deoxygenation that will have profound implications not just for ecosystems but also for communities and economies that depend on a healthy ocean. It is one of the prices we are now paying for the fact that the ocean has been shielding us from the worst effects of climate change which would otherwise have resulted from the continuing excessive emissions of carbon dioxide and other greenhouse gases.

To find out about IOCCP's role in coordinating global ocean O_2 observations, click on the Current IOCCP Activities tab below.

Changes in ocean oxygen content



(left) Global map showing coastal sites (purple dots) and open ocean sites (red to yellow, at 300 m of depth) where O_2 levels are below 2 mg-L^{-1} (Adapted from Breitburg et al., 2018). (right) Change in oxygen content of the global ocean in mol-O_2 m^{-2}-decade^{-1}. (From Breitburg et al., 2018)

Véronique Garçon
Responsible
SSG Member

OXYGEN EOV

Specification Sheet

Information Exchange:
www.ocean-oxygen.org

CURRENT IOCCP ACTIVITIES

STATUS OF OBSERVATIONS | REFERENCES

DATA SOURCES & INFORMATION PRODUCTS | RESOURCES

PAST ACTIVITIES | PROJECTS & PROGRAMS

Oxygen data platform scoping workshop

Sopot, Poland,

Institute of Oceanology Polish Academy of Sciences (IO PAN)

November 11-12, 2019

To develop a roadmap among the community interested in the issue of ocean deoxygenation towards an **open access oxygen data platform for the world ocean**.

Quality controlled (data quality flags assigned based on consensus reached by data contributors and users) data synthesis product, with underlying raw data available in one place or if impossible then distributed but available, with metadata clearly defined and available for each data and with a DOI assigned to each data set.

The oxygen data synthesis product :
all eulerian and lagrangian observations, i.e. Winkler titrations measurements,
sensors data on CTDs and on fixed moorings/time series,
sensors on BGC-ARGO floats and on gliders/wavegliders and on any remote vehicle/platform.

First additional eulerian (sensors on CTD data) then tackle the lagrangian oxygen data.
To be inspired from the SOCAT initiative, a community-driven effort for the community users.

Several levels of improvements to current oxygen data management could be proposed:

First level improvements would be to gather data from the existing several databases in which data is readily freely accessible in electronic format, without restriction, to remove duplicate data and to filter data, e.g. by applying methodology from Schmidtko et al. (2017), from WOD, or defining other ones (Marilaure, Florian, Hernan)

Second level improvements are to correct information for OMZs and coastal hypoxic sites, based on some experts' recommendations in these regions.

Third level improvements will be to connect with the Argo and OceanGliders communities and also with the coastal regional community through the efforts of GO_2NE, WESTPAC, VOICE, EBUS SCOR WG, EMODnet Chemistry, NOAA, etc.

Tentative agenda

Day One

Morning

Welcome and introduction (NOAA Officials, Kirsten Isensee (IOC UNESCO), Maciej Telszewski (IOCCP))

Scoping workshop objectives, expected outcomes and local logistics (Véronique Garçon (CNRS), Marilaure Grégoire (Univ. Liège), NOAA tbc) – Group discussions

What does exist presently?
Hernan Garcia (NOAA) WOD 2018 presentation
Are Olsen or Toste Tanhua (GLODAP co-chairs) GLODAPv2 presentation
Sunke Schmidtko (GEOMAR): Oxygen data atlas presentation
Florian Ricour or Marilaure Grégoire (University of Liège) Ongoing collecting efforts
Steve Riser (University of Washington) or Denis Gilbert (Institute Lamontagne) BGC ARGO-profiling float oxygen data set
Todd O'Brien (Time series O_2, NOAA) - IGMETS
Bob Diaz (Virginia Institute) The oxygen coastal data base

The SOCAT approach and spirit
Benjamin Pfeil (University of Bergen) or /and Kevin O'Brien (NOAA)
Groups splitting and identification of common questions : O_2 sensors on CTD, on fixed moorings/time series, BGC –Argo- O_2, gliders/wavegliders/ remote vehicles/platforms O_2

Afternoon

Each subgroup will work in parallel but participants should be free to rotate between groups.
Based on each sensor/technique used for sampling/measuring, each group should investigate how:

To implement standard and uniformed automatic quality checks on the whole data set and subjective check,
To define specific quality control/correction based on the technique/sensors used for sampling and what kind of metadata are needed to conduct this,
To implement the recommended quality control and to build the reference oxygen data set,
To update or define the flagging.
A special attention should be brought in the very low oxygen environments which require careful proper validation for O_2 Winkler titrations as well as for O_2 sensors.

Session 1 : **O_2 sensors on CTD and calibration with Winkler measurements**
Session 2: **O_2 sensors on fixed moorings/time series**
Session 3 : **BGC –Argo- O_2 and *in situ* air calibrations**
Session 4 : **Gliders/wavegliders/ remote vehicles/platforms O_2**
Session 5 : **Estuaries and coastal ocean O_2 observations**

Day 2

Short report back from afternoon discussion.

Morning

Continued discussion, recommendations elaboration and synthesis report writing for each subgroup :
Session 1, Session 2, Session 3, Session 4, and Session 5.

Afternoon

Reports from each session and general discussion**Potential list of participants:**

Elaboration of commonly agreed strategy to go forward, dream team on each task

Potential list of participants

Arne Koertzinger or Andreas Oschlies or Hela Mehrtens from GEOMAR
Fei Chai (University of Maine)
Hiroshi Uchida (JAMSTEC)
Stephen Riser (University of Washington)
Denis Gilbert (Lamontagne Institute)
Emilio Garcia Robledo (Cadiz University)
Siv Lauvset (University of Bergen)
Sunke Schmidtko (GEOMAR)
Daniele Bianchi (UCLA)
Benjamin Pfeil (University of Bergen)
Kevin O'Brien (NOAA-PMEL)
Hernan Garcia (NOAA)
Virginie Thierry (IFREMER Coriolis Center)
Florian and/or Marilaure Grégoire (University of Liège, GO2NE)

Toste Tanhua (GEOMAR, GOOS co-Chair, GLODAP Co-Chair)

Todd O'Brien (NOAA)
Heather Benway (OCB)
Maciej Telszewski (IOCCP, GO2NE)
Veronique Garçon (CNRS-LEGOS, IOCCP, GO2NE)
Masao Ishii (JMA-MRI, IOCCP)
Toshio Suga (Tohoku University, Argo SC)
Kirsten Isensee (IOC-UNESCO, GO2NE)
Denise Breitburg (Smithsonian Institute, GO2NE)
Dan Conley (Lund University)
Bob Diaz (Virginia institute of Marine Sciences)
Ivonne Montes (IGP) or/and Dimitri Gutierrez (IMARPE)
Peter Pissierssens or Pieter Provoost (IODE)
Henri Bettig (IOW)

Titration Winkler : ship cruises

Autonomous sensors
Need of Winkler calibration
Electrochemistry
Optics

Electrochemistry :

SBE 43 Seabird Electronics

Clark polarographic membrane
Fast response time <1s
Initial accuracy 2% of oxygen saturation
Precision: ~ 1 μmol/kg

Extensive calibration and maintenance work
Electrochemical drift : loss of sensitivity with time
Membrane biofouling
Cleaning of sensor after each cast and store sensor in anoxic condition

Optical sensors:

Oxygen luminescence quenching of a platinum porphyrin complex (fluorescent indicator) immobilized in a sensing foil

Long term stability and high precision
Careful calibration of temperatureresponse (individual sensor factory-calibration plus in situ calibration check/correction based with simultaneous Winkler measurements)

Aanderaa optodes 3830/3835 and 4330
Resolution of 1 μM, accuracy of 5μM
Biofouling issue, beryllium-copper alloy net
Air calibration for correcting any drift
Simultaneous Winkler measurements when deployed
For 4330: response time <8s

SBE 63 sensor : moorings and Argo floats
Initial accuracy is 3 μmol/ kg and resolution of 0.2 μmol/ kg
Response time < 6s

Pyroscience and TUG optodes

Oxygen measurements on existing platforms

Visit www.oceanbestpractices.org

Look for oxygen ,all bibliography

Argo floats experience
Ferrybox systems
Glider experiences
CTD profilers

Biofouling protection for oxygen sensors

Thank you
for your attention!

Institute of Oceanology Polish Academy of Sciences in Sopot, Poland.

Institute of Oceanology
Polish Academy of Sciences (IO PAN)
Powstańców Warszawy 55
81-712 Sopot, Poland

The institute's conference room is equipped with modern multimedia facilities. All participants will have access to Wi-Fi (also via EDUROAM).

Photo 1: IO PAN bird's eye view, main entrance and logo on the building wall visible as from Powstańców Warszawy St.