



The Ocean Observations Physics and Climate panel

A panel of the Global Climate Observing System (GCOS), the Global Ocean Observing System (GOOS), and the World Climate Research Programme (WCRP)

Provides scientific advice to the Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM)*

Chairs: Bernadette Sloyan, John Wilkin
Secretariat: Katy Hill (GCOS/GOOS)

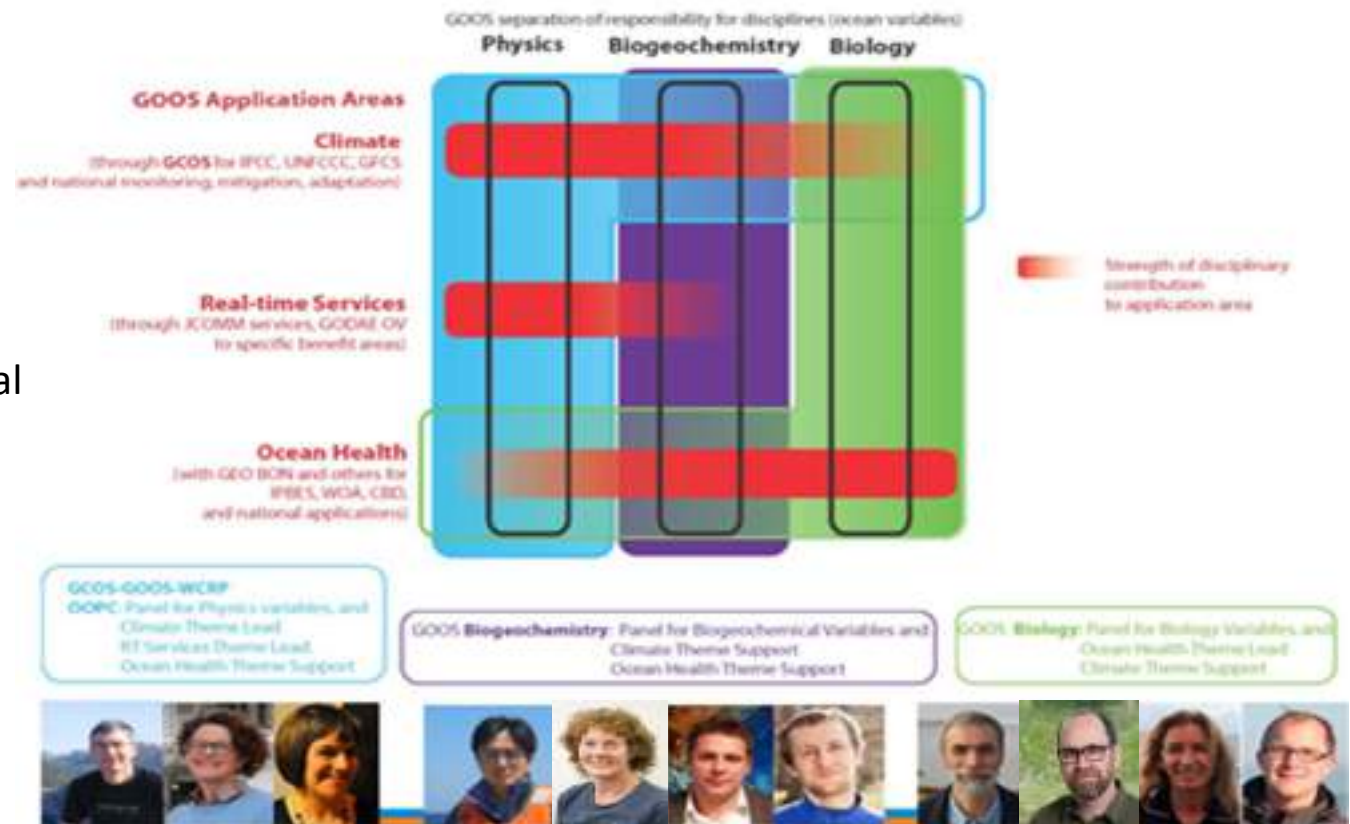
With input from GOOS Biogeochemistry and Biology Panels and JCOMM Observations Coordination Group

* – World Meteorological Organisation - Intergovernmental Oceanographic Commission



GOOS Panels

- From GOOS Perspective, OOPC has a large and important role to play, responsible for leading on
 - Physics Essential Ocean Variables
 - Leads on Climate applications (Ocean Essential Climate Variables)
 - Leads on Operational applications
 - Supporting Ocean Health applications.





Introducing

THE PANELS: OOPC, MARCH 2018

IOCCP OCTOBER 2018, BIO/ECO NOVEMBER 2019

Outline

- Major initiatives and opportunities.
- Requirements:
 - New perspectives and challenges
 - Observing system reviews evaluations to inform observing system development
- Observing network coordination and performance tracking
- Challenges and opportunities:
 - GCOS cross panel meeting – expectations and outcomes.



Major Initiatives, Drivers

OOPC Engagement in OceanObs'19



- Major decadal planning exercise. OOPC was instrumental in organising previous 2 OceanObs conferences.
 - 2 panel members are co-chairs of the Programme Committee.
 - 1 panel member co-chair of the sponsors committee.
- OOPC Secretariat supported establishing committees, project office, and coordinated initial sponsorship engagement.
- 140 Whitepapers under development aligned with themes:
 - OOPC members leading on key papers which align with OOPC Work Plan priorities.
 - OOPC Overarching paper on ocean observations for physics/climate
- Programme focussed on
 - Innovation, Integration, Interoperability Information.



UN Decade of Ocean Science for Sustainable Development

- Considered an ‘Innovation Incubator’ for the Ocean Observing System.
- Aim to position outcomes of OceanObs to be taken up by the Decade.
 - Aim: bolster Ocean Observations
- (See more in IOC, GOOS talks)



2021
2030 United Nations Decade
of Ocean Science
for Sustainable Development



IPCC Special Report 1.5 degrees C.

Are we in a position to track these changes?

- **Oceans.** Limiting warming to 1.5°C compared to 2°C: substantially reduce risks to marine biodiversity, ecosystems and their ecological functions and services to humans in ocean and coastal areas, especially Arctic sea-ice ecosystems and warm water coral reefs.
- a. With 2°C of global warming, it is very likely that there will be at least one **sea ice-free Arctic summer** per decade. This is reduced to one per century with 1.5°C global warming.
- b. **Ocean ecosystems** are experiencing large-scale changes with critical thresholds being exceeded at 1.5°C and above. Crossing these thresholds may have irreversible effects.
- c. The majority of **warm water coral reefs** are already experiencing the large-scale loss of coral abundance (cover) today and would lose a further 70-90% of cover at 1.5°C.
- d. **Ocean acidification** at 1.5°C is expected to amplify the adverse effects of warming, impacting the survival, calcification, growth, development, and abundance of a broad range of taxonomic groups (i.e. from algae to fish)
- e. The risk of **declining ocean productivity**, distributional shifts (to higher latitudes), damage to ecosystems (e.g. coral reefs, wetlands), loss of fisheries productivity (at low latitudes), and changing ocean chemistry (e.g., acidification, hypoxia) are projected to be substantially lower at 1.5°C compared to 2°C



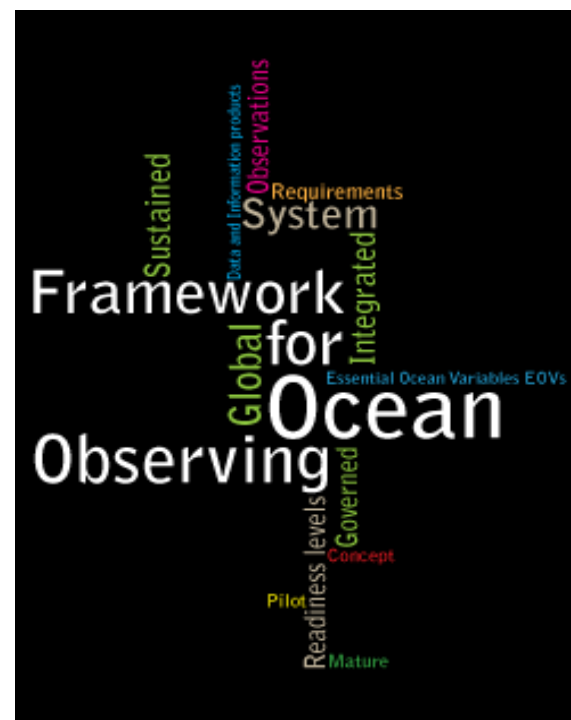
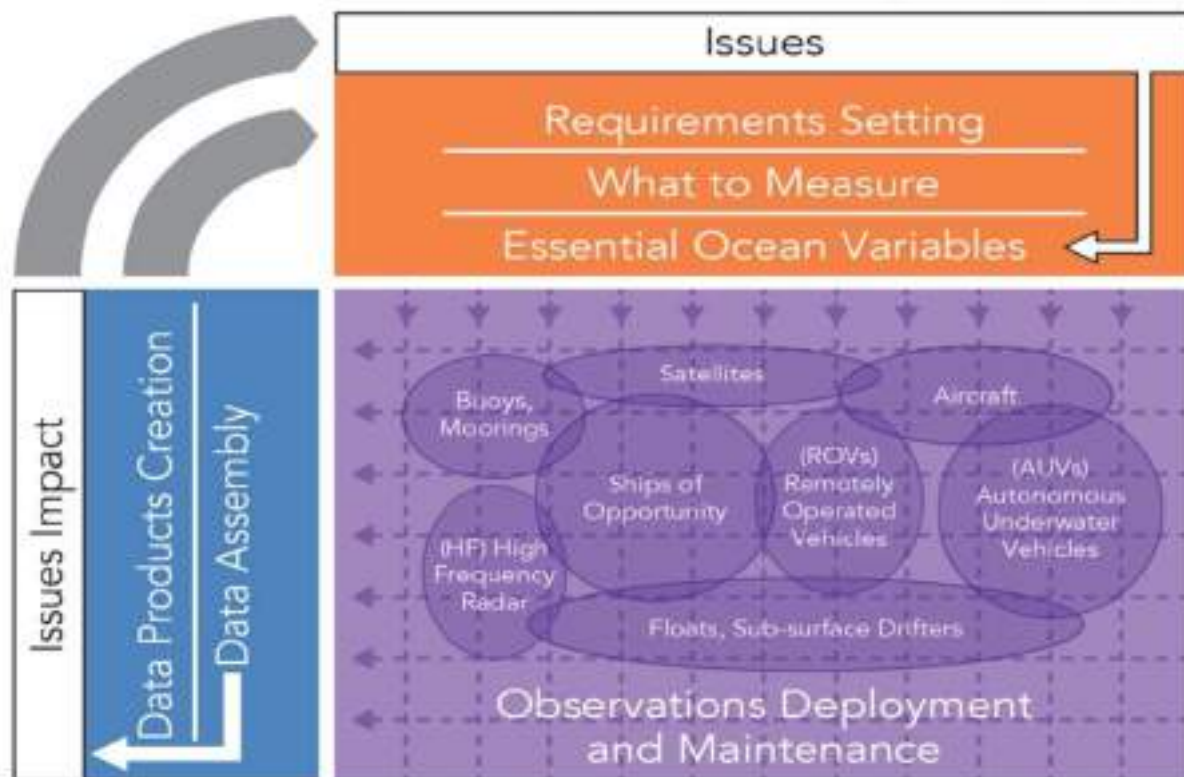
OOPC Focus

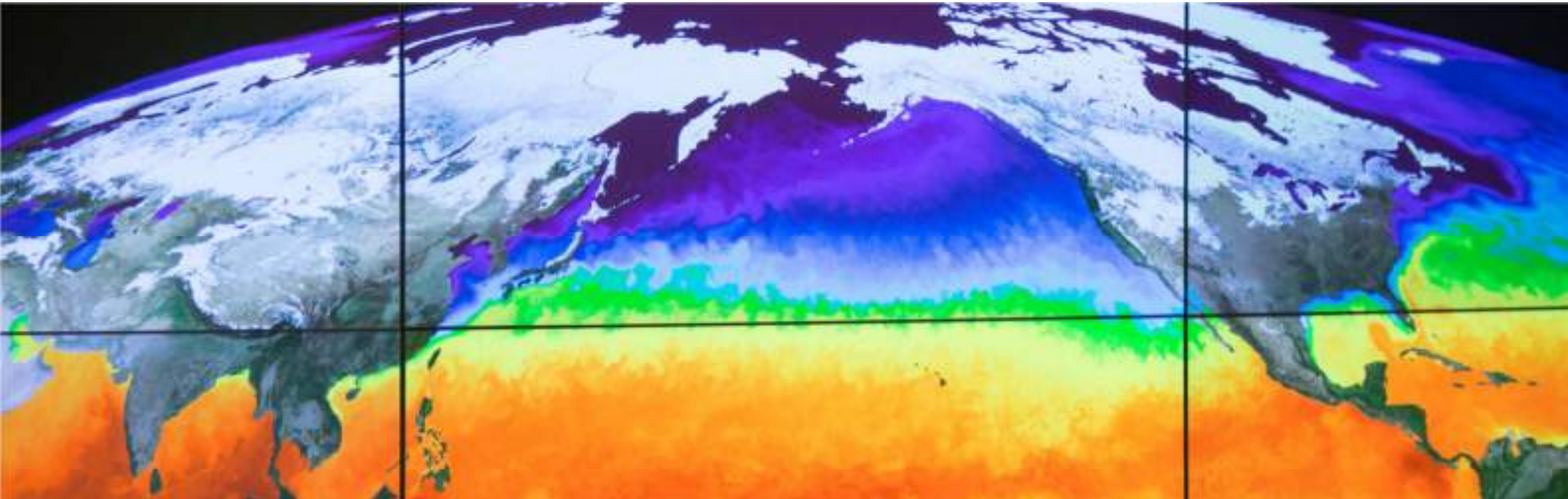
- **Assess, review and prioritize requirements** for Essential Ocean Variables, **EOVs** and Essential Climate Variables, **ECVs**
- Work with JCOMM OCG and regional bodies to **coordinate observing networks**
- **Review** the status of and **requirements for data and information management**
- Develop a **process for ongoing evaluation** of the observing system
- **Liaison and advocacy** for agreed plans
- Report to sponsors, partners.



Framework for Ocean Observing (FOO)

Framework for Ocean Observing Process Diagram





Developing Requirements and Observing System Design for
ESSENTIAL CLIMATE VARIABLES

EOVs and Essential Climate Variables (ECVs)

Physics

- Sea State
- Ocean surface stress
- Ocean Heat Fluxes
- Sea Ice
- Sea level
- SST
- Subsurface temperature
- Surface currents
- Subsurface currents
- Sea Surface Salinity
- Subsurface salinity

Biogeochemistry

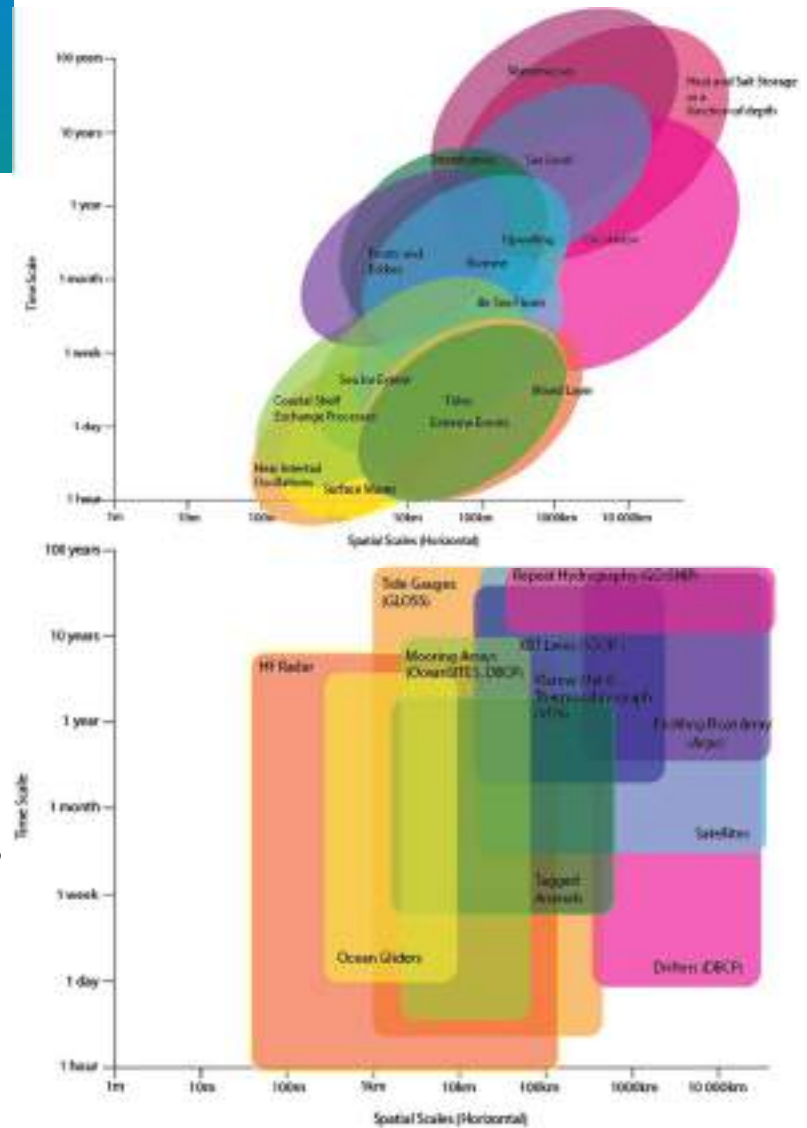
- Oxygen
- Nutrients
- Inorganic Carbon
- Transient tracers
- Particulate matter
- Nitrous oxide
- Stable carbon isotopes
- Dissolved organic carbon
- Ocean colour

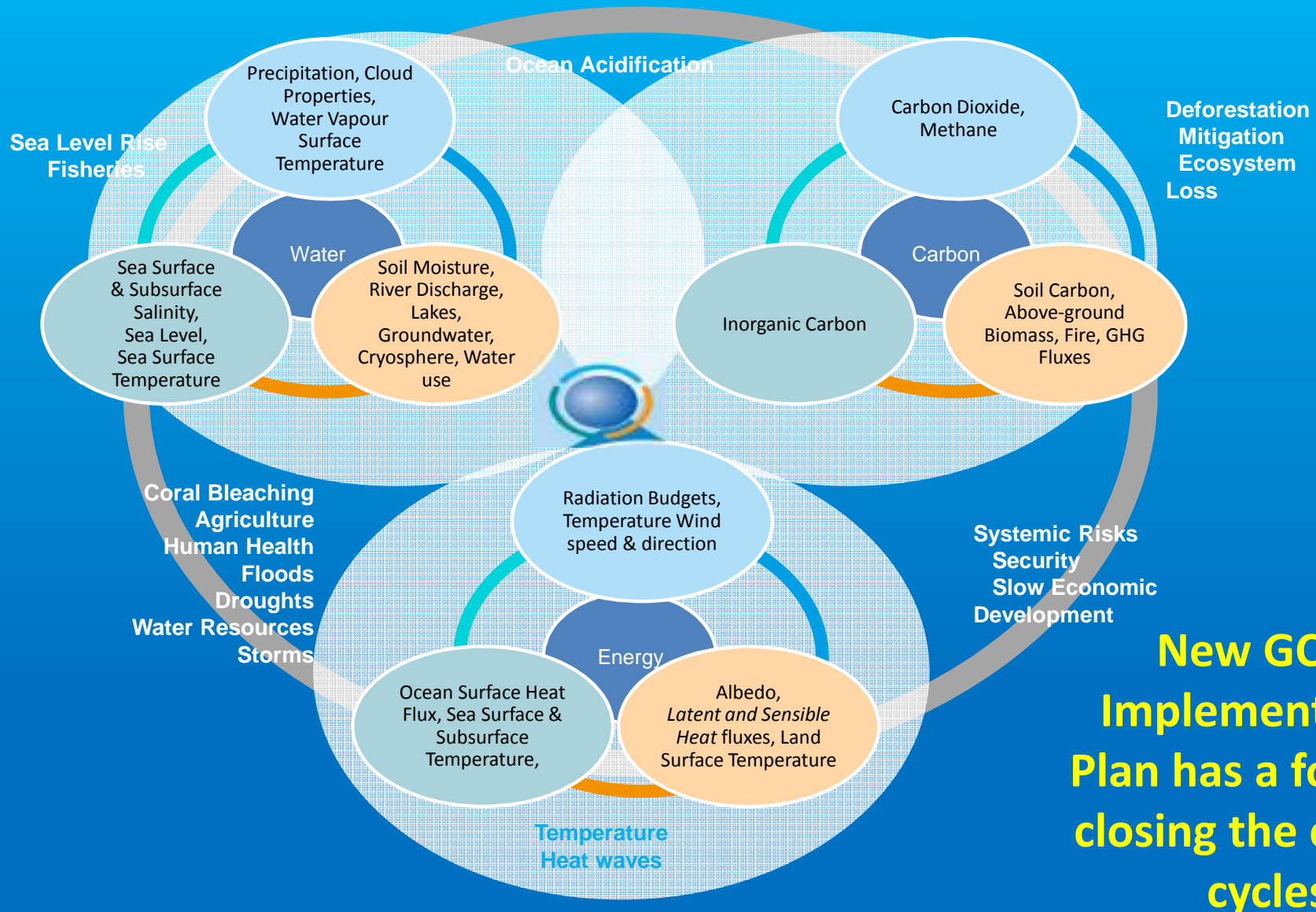
Biology and Ecosystems

- Phytoplankton biomass and diversity
- Plankton
- Zooplankton biomass and diversity
- Fish abundance and distribution
- Marine turtles birds and mammals abundance and distribution
- Hard coral cover and composition
- Marine Habitat
- Seagrass cover and composition
- Mangrove cover and composition
- Macroalgal cover and composition
- Microbe biomass and diversity (*emerging)
- Benthic invertebrate abundance and distribution (*emerging)
- Ocean sound

Developing requirements for Essential Ocean Variables

- EOV Specifications
 - Mapping of societal drivers, applications, phenomena, EOV requirements, observing components, data streams.
 - Phenomena approach; easy to draw out requirements for different applications (e.g. climate relevant phenomena)
 - Seeking clarification, agreement between GCOS/GOOS on requirements setting, terms, etc before updating (see GCOS-GOOS paper).
 - Important to ensure that Panel efforts meet needs of both GCOS, GOOS
 - Clarity on terminology, how one maps to other particularly important for users.



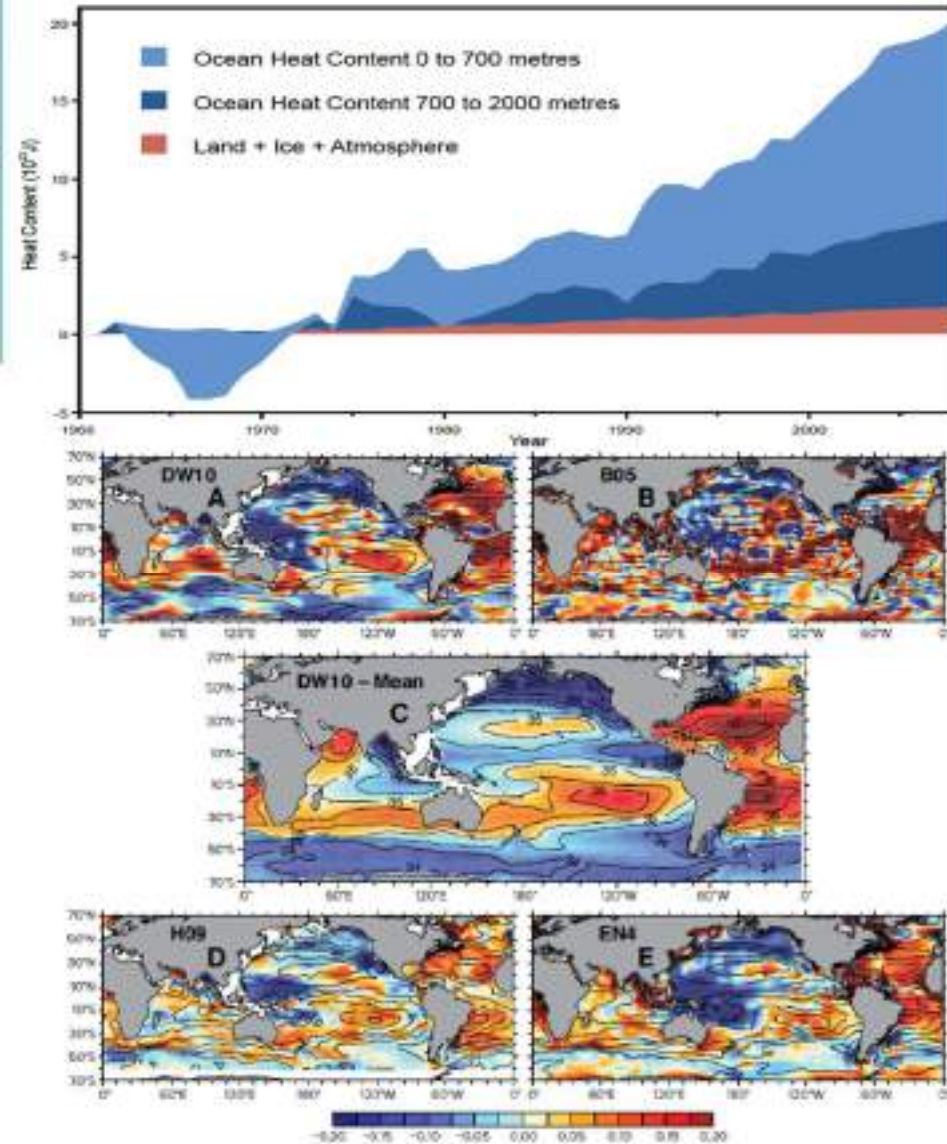


**New GCOS
Implementation
Plan has a focus on
closing the climate
cycles**

Review: Ocean Heat and Freshwater Storage

(Leads: Matt Palmer, Paul Durack).

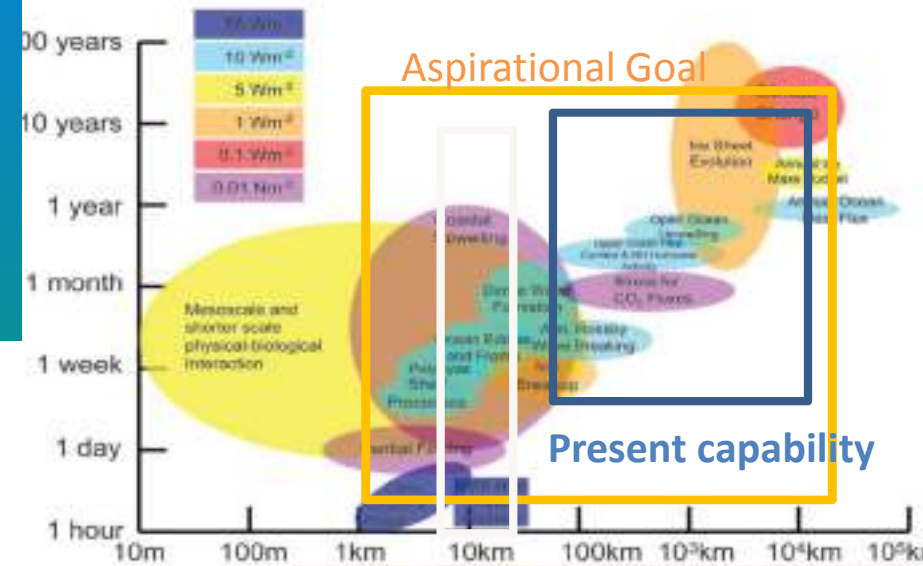
- Around 20 Experts invited to engage.
- Aim: undertake a review of the observing system for capturing changes in Heat and Freshwater Storage:
 - Review drivers, requirements (space/time scales).
 - Agree on set of global/regional analyses.
 - Workshop to review analyses, agree on drafting of review paper.
- Outcomes: recommendations on observing system gaps, adjustments; improve integration, products.
- Proposed workshop: late 2018 or early 2019, UK Met Office.
- **OO'19 Community Whitepaper outlining approach**



Strategy: Air-Sea Heat Fluxes

Meghan Cronin Bob Weller, (OOPC)
Marjolaine Krug (OOPC - link to boundary currents), Liz Kent (AOPC).

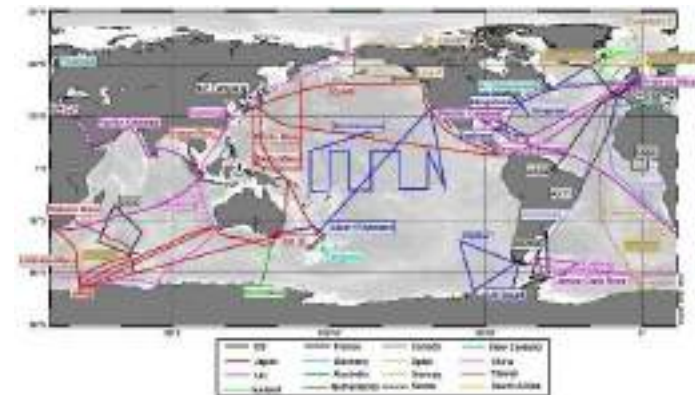
- **Motivation:**
 - Air Sea Fluxes key to understanding and predicting climate from days to decades.
 - Large uncertainties in flux products
 - New techniques and technologies mean opportunity to make progress. .
- **AIM: outline ambitious forward strategy for improving estimates of air-sea fluxes**
 - Drivers for improved flux estimates, need to engage modelling groups.
 - Coordinated requirements, observing system design (atm, ocean, land)
 - Satellite-In Situ integration
 - Data curation (historical ship, next gen direct flux data).
- **Future: include fluxes of properties, gases (engage GOOS BGC Panel).**



Aspirational Goal:
Random regional uncertainty <10W/m2
Bias error < 1 W/m2, Error in basin average < 1 W/m2



Surface ocean CO₂ observations

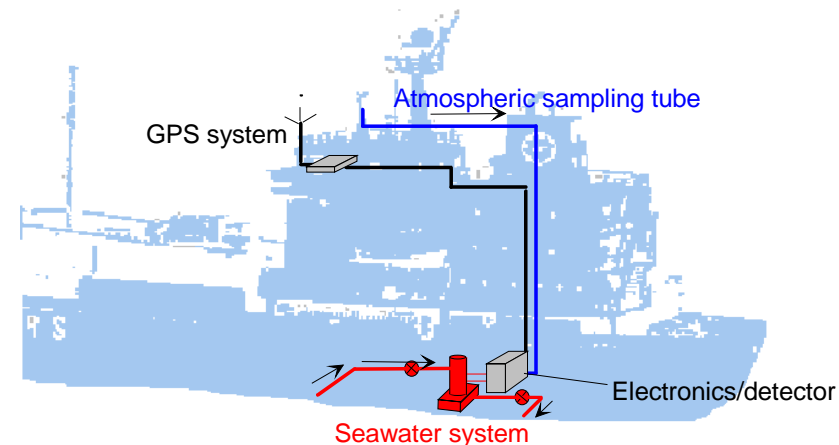


Objectives:

- To provide a coordinated framework of surface water CO₂ data of known high-quality following established principles and best practices to determine accuracy in order to:
 - Provide annual estimates of **global air-sea CO₂ fluxes** to within 0.2 Pg/yr.
 - Determine **trends of surface water pCO₂** to within 0.2 μatm/yr
- To provide reference data of known quality for validation and intercomparison with other data

Note:

- **Atmospheric CO₂** from some data originators (discussions with GAW)
- **Need to connect to AOPC re. surface ocean/atm. Observing requirements, targets**



Global Atmospheric Watch (GAW)

WMO has recognized the first marine vessel as a regional station in the GAW network.

GAW seeks to understand the short-term variability and long-term trends in the composition of the atmosphere.

The instruments for dedicated atmospheric composition and meteorological sensors are onboard the vessel on a permanent basis, which together with the underway ocean surface sensors provide a perfect platform for monitoring the ocean—atmosphere boundary layer.



Requirements for Ocean Acidification



SDG Indicator 14.3.1 Methodology accepted by the IOC-UNESCO Executive Council

Ocean Acidification becomes one of GCOS WMO's Global Climate Indicators

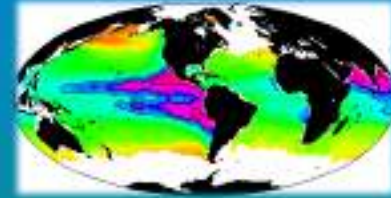
Working towards time series based synthesis products



GOA-ON Data Portal Explorer:
<http://portal.goa-on.org/Explorer>



Setting requirements for Oxygen EOJ/ECV & ocean deoxygenation phenomenon



www.sfb754.org

www.ioccp.org/oxygen

To find out about IOCCPs role in coordinating global ocean O₂ observations, click on the Current IOCCP Activities tab below.

Changes in ocean oxygen content

(left) Ocean was showing coastal areas (pink) and open ocean areas (red to yellow) at 20% of oxygen where O₂ levels are below 2 mg L⁻¹ (followed from Steinhilber et al., 2012). (right) Change in oxygen content of the open ocean in the O₂ in 'Oceans' (from Steinhilber et al., 2011)

OXYGEN ECV
Specification Sheet

Information Exchange:
www.ioccp.org

CURRENT IOCCP ACTIVITIES

STATUS OF OBSERVATIONS	REFERENCES
DATA SOURCES & INFORMATION PRODUCTS	RESOURCES
PAST ACTIVITIES	PROJECTS & PROGRAMS



Ocean Deoxygenation: Drivers and Consequences - Past - Present - Future -
INTERNATIONAL CONFERENCE KIEL GERMANY
3 - 7 September 2018
SFB 754

Kiel Declaration on Ocean Deoxygenation

Participants of the international conference
"Ocean Deoxygenation: Drivers and Consequences - Past - Present - Future"
3 - 7 September 2018 in Kiel, Germany organized by:
Kiel Collaborative Research Center SFB 754 and Global Ocean Oxygen Network (GO₂NE) - IOCCP (IOCCP)

The ocean is losing its breath



REVIEW SUMMARY

Science

OCEANS

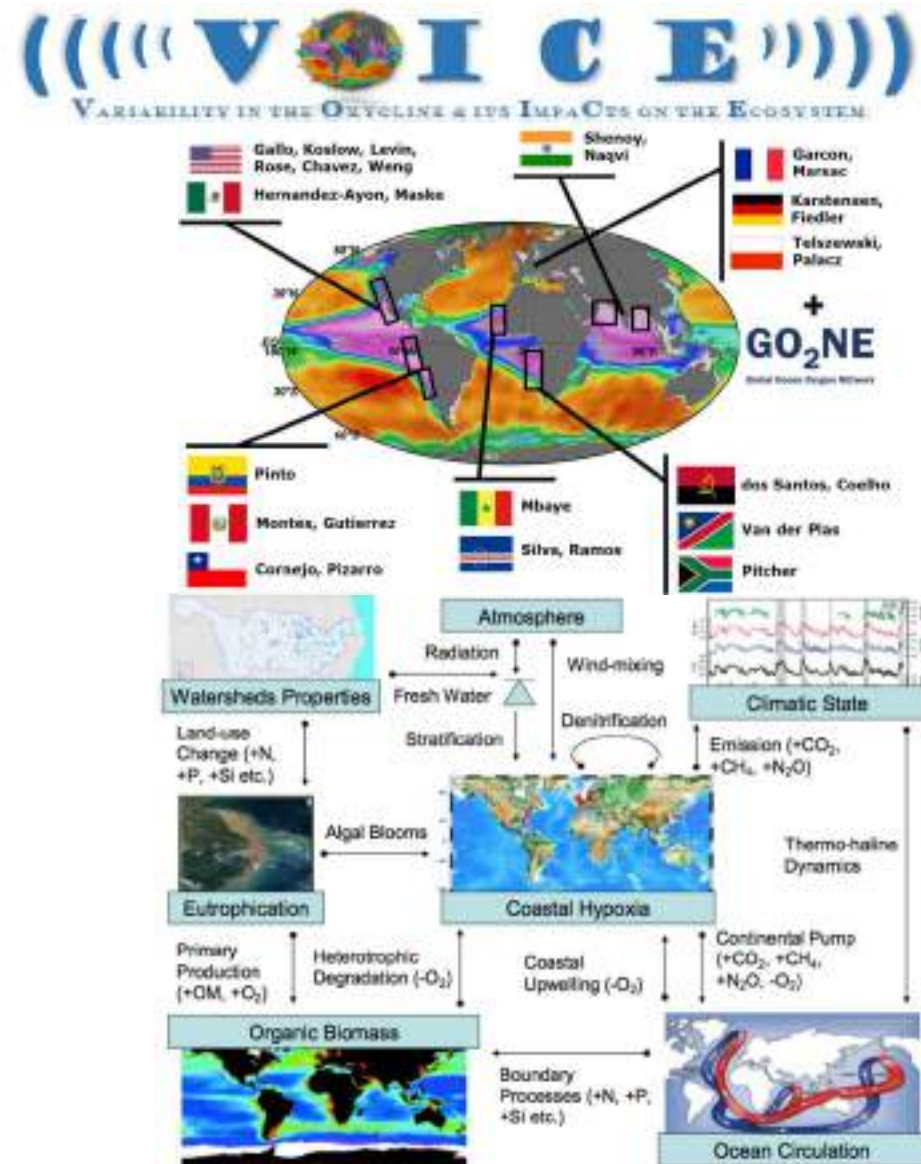
Declining oxygen in the global ocean and coastal waters

Dennis Breitburg,¹ Lisa A. Levin, Andrea Ortolini, Marianne Grigolon, Francisco F. Chavez, Daniel J. Conley, Yimengqi Guo, Denis Gilbert, Dorete Gutierrez, Kirsten Jenner, Gill S. Jørgensen, Karla E. Limburg, Doreen Menden, S. W. A. Ngugi, Grant C. Parker, Nancy N. Rabalais, Michael E. Roman, Kenneth A. Rose, Rod A. Stoeckl, Maciej Troszowski, Mariaki Yasuda, Jing Zhang

Oxygen Minimum Zone (OMZ) observing system: general requirements

- Climate Drivers:
 - (e.g. OMZ expansion, deoxygenation, N₂O greenhouse gas release)
- Many OMZ observing targets are truly multidisciplinary require simultaneous Physics, Biogeochemistry, Biology/Ecosystems observations,
- Multiplatform approach needed to capture all relevant scales and timescales.
- GO₂NE Observing network for Oxygen
- VOICE Project: to advance development of observing system design for Oxygen Minimum Zones, building on existing networks.

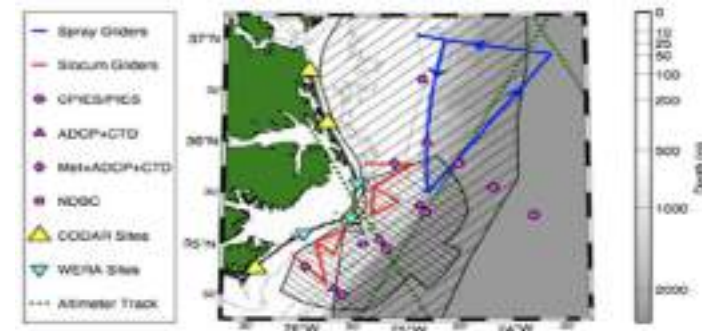
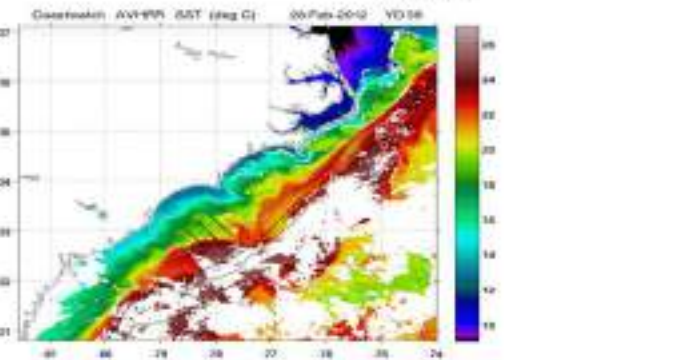
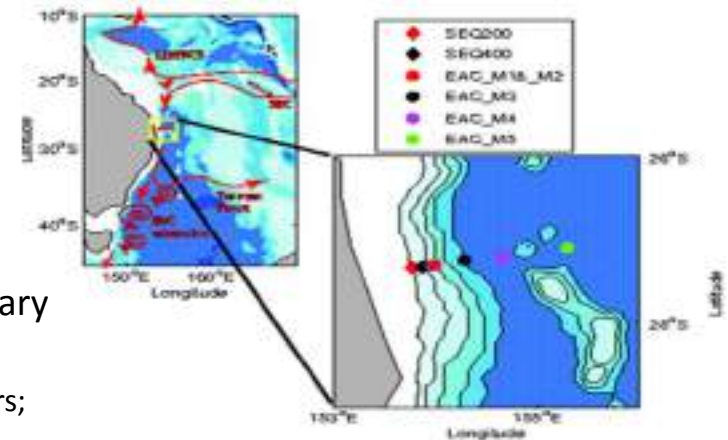
OceanObs'19 Community White Paper: Multidisciplinary ocean observing in the world ocean's OMZ regions: from climate to fish – the VOICE initiative



Project: Boundary Currents

Leads: John Wilkin, Maria Paz Chidichimo, Marjolaine Krug

- **AIM:** Establish an ongoing project to guide, support the development of boundary current observing systems
 - Leveraging OO'19 Whitepapers (Boundary Currents 'super' paper; Coastal BGC/Eco papers; Network based papers; New technologies)
 - Reviews of mature BC obs. systems and process studies.
 - Collaboration with OceanPredict through OSSEs etc.
 - Engage GRAs on capacity development, open data, collaboration/access to coasts; articulate societal impacts
 - Work with observing networks to coordinate multi-platform approaches and model synthesis
- **Progress:**
 - Sent out communique, seeking input and interest from broader community.
- **Next Steps:**
 - Developing prospectus for project
 - Establish Steering Committee (12-15 people)
 - Work toward a community workshop around pilot project themes: WBC fluxes; EBC OMZ; OSSEs to design multi-platform sustained systems





Biological EOVs Implementation Plans

IMPLEMENTATION OF BIOLOGICAL EOVS

TO BE CONTRIBUTED BY OOPC



November 2017
Dar es Salaam, Tanzania



- Sea surface height
- Sea surface temperature
- Surface currents
- Sea surface salinity
- Ocean surface heat flux



June 2018
Santa Cruz, CA, USA



- Sea surface height
- Sea surface and subsurface temperature
- Surface and subsurface currents
- Sea surface and subsurface salinity
- Ocean surface heat flux



September 2018
Hobart, Australia

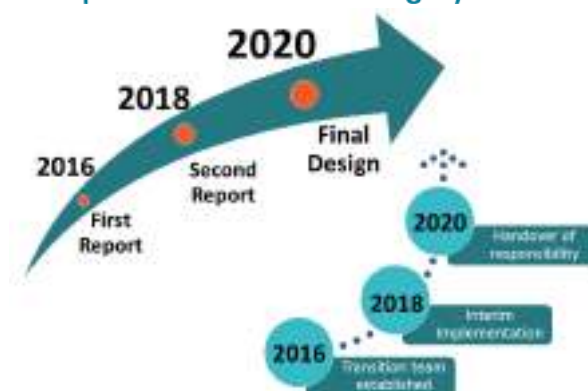


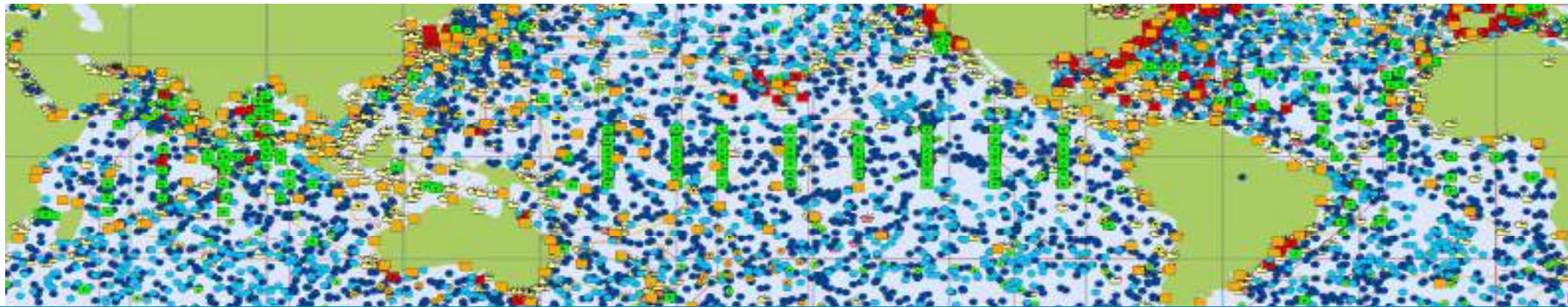
- Sea surface height
- Sea surface temperature
- Surface currents
- Sea surface salinity
- Ocean surface heat flux

...and for the rest of the EOVs as they develop...

Working with regional projects and reviews:

- OOPC provides support and guidance on conducting reviews to ensure they help in advancing the global effort.
- Identifies synergies and opportunities to connect regional reviews and efforts.
- Considers recommendations, challenges and advances in requirements/approaches and recommendations in global context.
- Assists in connecting projects into higher level science and coordination bodies



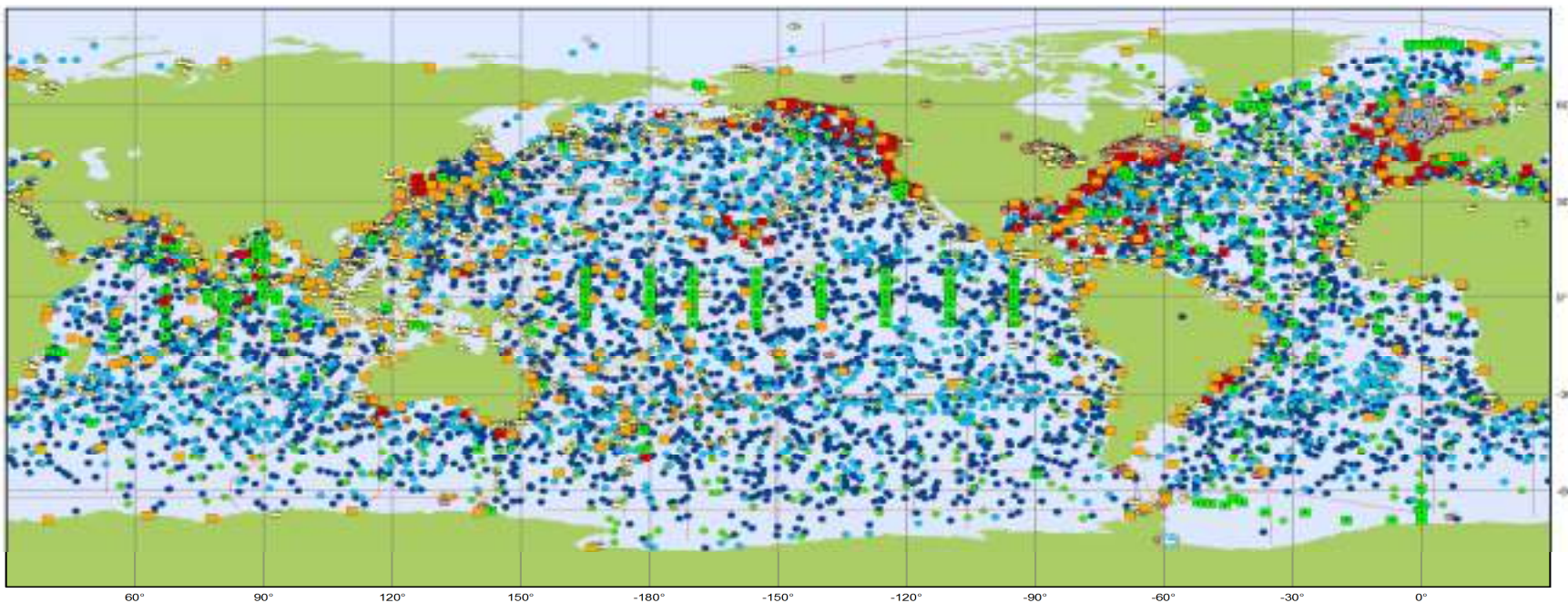


Working with JCOMM Observations Coordination Group

THE OBSERVING NETWORKS.



JCOMMOPS



Main in situ Elements of the Global Ocean Observing System

January 2018

- | | | | |
|--|---|---|---|
| <p>Profiling Floats (Argo)</p> <ul style="list-style-type: none"> ● Core (3895) ● Deep (44) ● BioGeoChemical (314) | <p>Data Buoys (DBCP)</p> <ul style="list-style-type: none"> ● Surface Drifters (1410) ■ Offshore Platforms (102) ● Ice Buoys (12) ■ Moored Buoys (370) ▲ Tsunameters (33) | <p>Timeseries (OceanSITES)</p> <ul style="list-style-type: none"> ■ Interdisciplinary Moorings (333) — Research Vessel Lines (61) <p>Repeated Hydrography (GO-SHIP)</p> <ul style="list-style-type: none"> ■ Tide Gauges (252) | <p>Ship based Measurements (SOT)</p> <ul style="list-style-type: none"> ■ Automated Weather Stations (261) ■ Manned Weather Stations (1745) ● Radiosondes (14) — expendable BathyThermographs (37) |
|--|---|---|---|



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Monitoring status and Impact of the Observing System

Ocean Observing System Report Card 2018

Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM) of the World Meteorological Organization (WMO) and UNESCO's Intergovernmental Oceanographic Commission (IOC)



GLOBAL OCEAN OBSERVATIONS

Real-time ocean observations...

...are critical to predict, manage and mitigate the effects of extreme weather events that have high impact on the safety of life, property and the economy.

For example surface measurements from ships, aircraft and buoys provide critical information for marine forecasts for shipping and fisheries, additionally warmer ocean temperatures, rising sea level and variability in the major basins are trends that influence natural phenomena such as tropical cyclones.

In situ and satellite observations, particularly of upper ocean temperature and salinity ahead of tropical cyclones, are fundamental to improve the representation of the upper ocean thermal structure that significantly influence the development and the intensification of tropical cyclones.

Unmanned gliders, profiling floats and drifters are very useful platforms for gathering real-time upper ocean observations that are key for tropical cyclone forecasting. These instruments, deployed in the tropical oceans during cyclone seasons, enable improved storm intensity forecasts.

Real-time ocean observations in regions where tropical cyclones occur are necessary to improve early warning systems and for timely decision making to manage risk and improve emergency response efficiency.

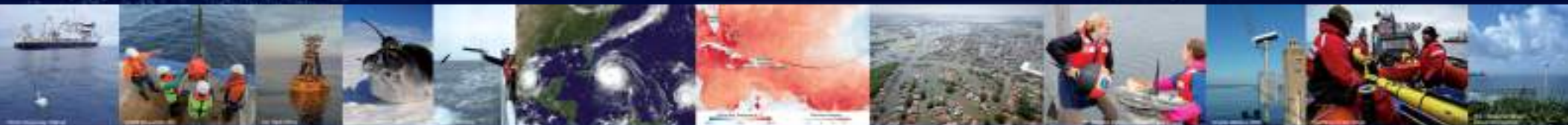
INTERNATIONAL PARTNERS

Significant progress has been made over the last few years in weather and climate forecasts, in increased early warning systems of sea as well as on land, and better scientific understanding of climate change and variability. This progress is the result of contributions and collaborations from many nations to support ocean observing, many of them also contribute as WMO Members and IOC of UNESCO Member States.

However, a much smaller number of nations and partners contribute to the global-scale dimension of the ocean observing enterprise and the infrastructure needed to keep the entire system operating efficiently, with the increasing societal demand for ocean-based observations and information. Our challenge is to grow the global ocean observing system to meet those demands. Consequently, a wider alliance of contributors is needed to maintain and improve the existing observing efforts.



JCOMM thanks all Members/Member States and contributors for their continued support and encourages further contributions to improve the global ocean observing system to better meet society's needs.



Worldwide number of observing systems that have been established during the 2018 season of the global ocean observing system.

Map showing the number of observing systems that have been established during the 2018 season of the global ocean observing system.

Map showing the number of observing systems that have been established during the 2018 season of the global ocean observing system.



The 2017 Atlantic hurricane season...

...was one of the most destructive on record. Damage costs exceeded 250 billion dollars in the United States alone, with recovery for the world's 191 Caribbean islands still under way. The US National Oceanic and Atmospheric Administration (NOAA) made accurate advance predictions that the season would be above average. The outlook was based, in part, on ocean observations. Without the forecasts and warnings, the loss of life would have been even higher. Gliders and air-deployed micro floats provided higher density measurements ahead of hurricanes Irma and Jose, which helped to improve the forecast of storm intensity by the days and hours before they made landfall.

Ocean observations for education and outreach activities

Ocean observation data and instruments are being integrated into many educational and outreach activities in 2018. The 100th Anniversary of the JCOMM was celebrated and brought together ocean scientists, educators, marine commanders, sailing community and students who were willing to share resources and experiences in in situ ocean observing educational activities and to establish new international collaborative partnerships. These activities allow the students to engage by using in situ data in their classrooms and to form partnerships with scientists in different countries. This type of educational partnership mirrors international scientific collaborations in ocean observing.

JCOMM

For more information visit www.jcommops.org
 If you wish to contribute to the global ocean observing system, please contact secretary@jcommops.org
 Admin: jcommops@iupui.edu (Coordination Group) and jcommops@iupui.edu (Administrative Support Office)

More information at: www.jcommops.org/reportcard2018



Monitoring status and Impact of the Observing System

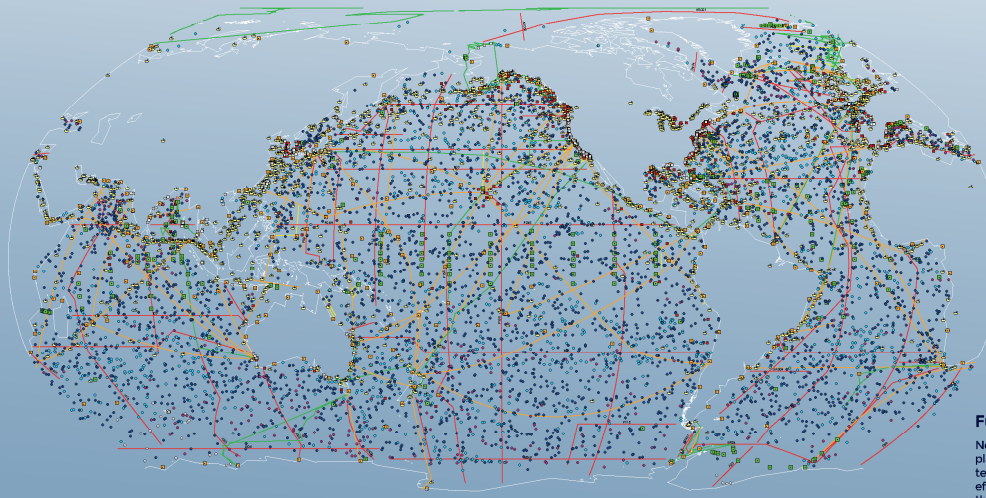
IN SITU AND SATELLITE OBSERVING SYSTEM STATUS

In situ and satellite observations are fundamental for delivering marine weather and ocean services (e.g. forecasts) to support safety of life and property at sea, maritime commerce and the well-being of coastal communities. Not only they underpin scientific knowledge and the intricate relationship between the ocean, the atmosphere and the ice, but they also provide insights into the global weather and climate system and the impacts of long-term climate change. These ocean observations also provide information on the occurrence of marine natural hazards and increasing stress on the ocean from human activities, both posing challenges to sustainable development.

The Ocean Observing System Report Card 2018 seeks to inform ocean observing stakeholders, society and decision-makers about the status of the global ocean observing system coordinated by the Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM).

The global ocean observing system has developed significantly over the last few years, with emerging networks and sensors helping to meet new requirements and to deliver critical data at different time and space scales. For instance, global ocean heat content, increasing ocean acidification and sea level rise can now be observed with unprecedented accuracy. Continued availability and expansion of *in situ* observations are vital to maintaining, and improving upon, that success.

For many years, the satellite network has enabled us to accurately measure fundamental variables such as: ocean surface temperature and salinity, ice coverage, ocean color (an indication of ocean productivity), sea level and sea surface winds. The satellite network relies upon and complements the *in situ* observations. Together they provide foundational knowledge about the ocean environment and enable a wide range of forecasts and services.



Map legend: see *in situ* and emerging networks tables. Symbols size in the map are exaggerated in the order of hundreds kilometres for readability.

JCOMM <i>in situ</i> networks	Implementation		Data & metadata			Comments
	Status	Trend	Real-time	Archived high quality	Metadata	
Ship based meteorological measurements - SOT/MOS	★★★★	↔	★★★★	★★★★	★★★★	Increasing number of Automatic Weather Stations installed globally.
Ship based oceanographic measurements - SOT/SOOP	★★★★	↔	★★★★	★★★★	★★★★	More than 95% of data transmitted in real-time.
Ship based aerological measurements - SOT/ASAP	★★★	↔	★★★	★★★	★★★	European E-ASAP programme is providing the only real-time and stable real-time radiosonde.
Icebergs - SOT/IBS	★★★	↔	★★★	★★★	★★★	Real-time icebergs data is critical for shipping and maritime.
Sea level pressure - SOT/SLP	★★★	↔	★★★	★★★	★★★	High resolution sea level pressure data being transmitted in real-time.
Sea surface temperature - SOT/SST	★★★	↔	★★★	★★★	★★★	High resolution sea surface temperature data being transmitted in real-time.
Sea surface salinity - SOT/SSS	★★★	↔	★★★	★★★	★★★	High resolution sea surface salinity data being transmitted in real-time.
Profiling floats - Argo	★★★★	↔	★★★★	★★★★	★★★★	More than 1 scientific paper per day logged.
Repeated transects - GO-SHIP	★★★★	↔	★★★★	★★★★	★★★★	Increased international participation: Ireland leads its 1 st cruise.

The *in situ* global ocean observing system is composed of multiple platforms, including ship-based weather stations, moored and drifting buoys, autonomous profiling floats, dedicated research vessels and tide gauges, which observe a range of essential environmental variables.

Although the *in situ* ocean observation system provides many fundamental observations, it remains vulnerable, as many of its components are reliant on short-term commitments through research programmes.

Emerging networks with existing capabilities	Highlights	Readiness level
Autonomous profiling floats	High resolution sea surface temperature and salinity data being transmitted in real-time.	★★★★
Sea level pressure	High resolution sea level pressure data being transmitted in real-time.	★★★★
Sea surface temperature	High resolution sea surface temperature data being transmitted in real-time.	★★★★
Sea surface salinity	High resolution sea surface salinity data being transmitted in real-time.	★★★★
Animal borne sensors	Regional pilots, polar ocean observations.	PILOT

More information on Global Ocean Observing System readiness level at: www.jgoosocan.org

Challenges

Today, one of the greatest challenges facing the global ocean observing system is in securing the sustained resources needed to meet the expanding societal demands. This includes filling observation gaps such as in the Arctic, the Southern Ocean, regional basins and the deep ocean below 2,000 meters; and to expand our capability to measure more biogeochemical and ecosystem variables. Other specific challenges include the increasing costs to maintain moorings and deploy instruments in remote areas, in a context of decreasing access to academic and commercial ship time, and the communication to coastal communities to avoid vandalism to the existing moored buoys.

Optimization of resources, technology development and coordination with partner countries to share best practices and transfer expertise can enhance and enable expansion of the system. Developing global initiatives in these areas is an ongoing challenge that carry many benefits. Only by having a fully integrated and rigorously monitored ocean observing system will we be able to respond to the many scientific and societal needs to ensure a healthy ocean and a healthy planet.

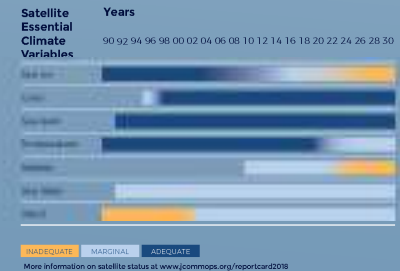
✦ We need to strengthen international cooperation to maintain and improve the system, and to increase the levels of long-term funding needed to sustain an efficient, integrated, innovative and fit for purpose global ocean observing network.

Future

New technologies based on autonomous platforms, smart sensors and improved telecommunications can offer more cost-efficient solutions towards improving the global observing system. Using these technologies helps to improve the multidisciplinary ocean observing system as well as responding to new requirements. It is important to introduce gradually technological and scientific innovations alongside the existing observing networks while preserving some stability. The diversity

and complementary nature of the systems should ultimately lead to better quality observations both spatially and temporally and better measurement accuracy.

The observing system also needs to develop stronger links with the downstream users of the observations, in order to increase system responsiveness and to ensure that it is fit for purpose. Developing these vital end-to-end links is both a current and future challenge.

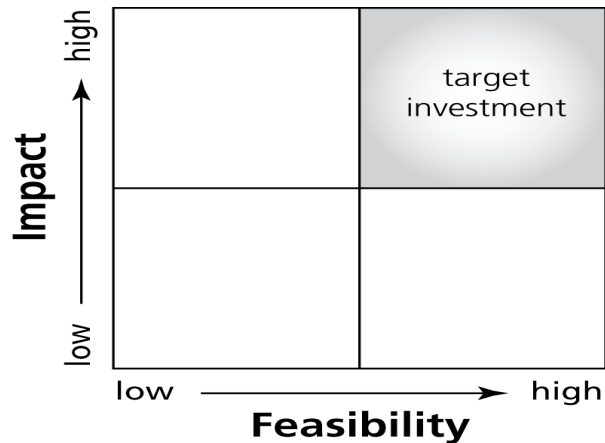


More information on satellite status at: www.jcommops.org/reportcard2018

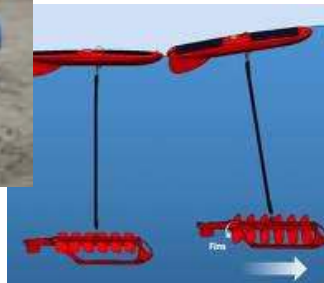


Key Messages

Essential Climate Variables: Emerging Technologies

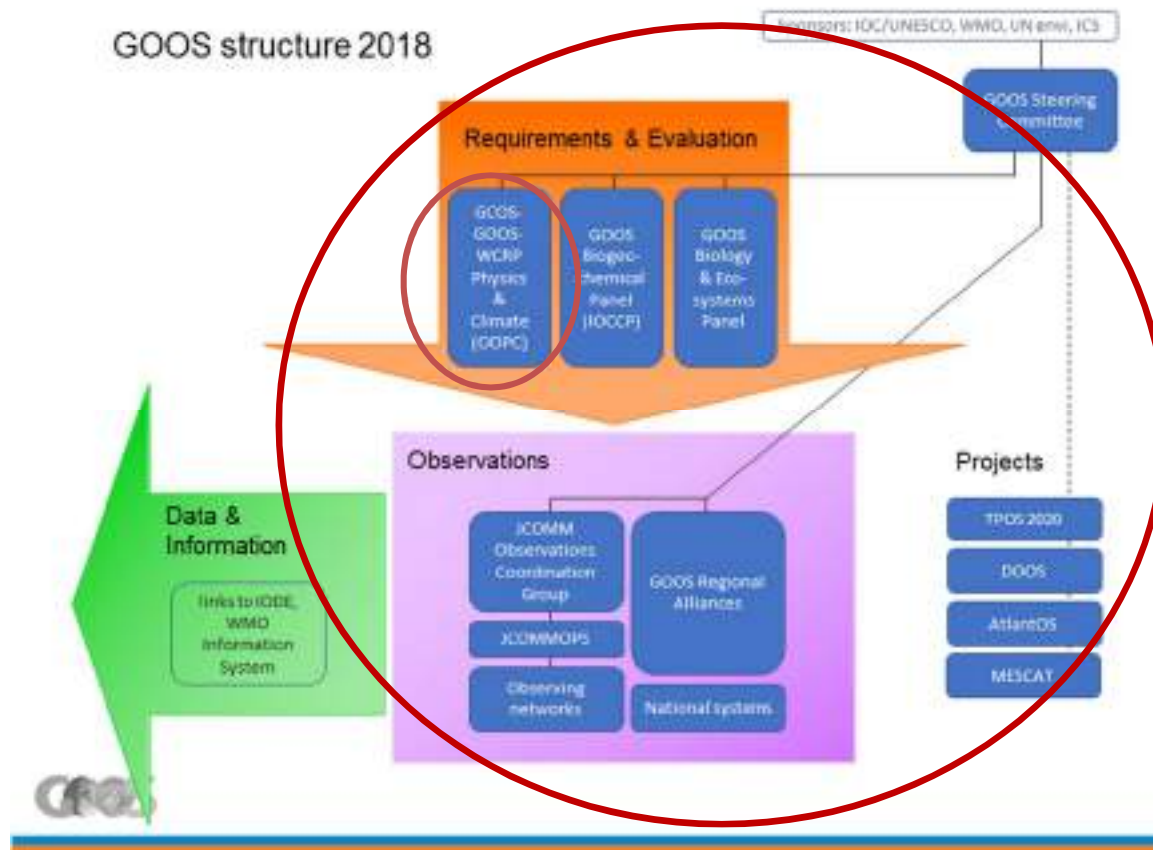


- Advances in understanding combined with technology development (explosion!).
- Period of significant growth.
- Guidance and oversight needed to evolve O.S. in coordinated way.



Key Messages

- OOPC has a complex, multifaceted mandate, with large engagement overhead.
 - GCOS Ocean ECVs, GOOS Physics EOVs (and delivering to climate applications, operational services)
 - OOPC draws on other GOOS panels, JCOMM OCG, GRAs in order to deliver to GCOS.
 - Challenging for one panel, with one staffer! GCOS-GOOS relationship paper to be presented during the meeting



GCOS All Panel Meeting - Expectations

- OOPC will include reps from other GOOS panels, JCOMM OCG,
 - Covers full set of ECVs and how they are implemented.
- Key thematic areas of interest:
 - Connecting the Energy, Hydrological Cycle:
 - Heat and Freshwater Storage – (Review underway by OOPC, engaging WCRP colleagues)
 - Air Sea Fluxes (heat and momentum) - (discussion commenced with AOPC) .
 - Connecting the Carbon Cycle: To be discussed with TOPC Potential focii.
 - Land-sea fluxes
 - Biosphere observations for climate
- Preparation needed for meeting
 - Chairs/Vice Chairs form Organising Committee: Teleconference to discuss/agree on focii, priorities.
 - Arrange Thematic calls for key focii with key panel experts to discuss/agree on focus/aims of discussions in Marakech, preparations, experts to engage.
- Planning timeline?





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