

GCOS – 201
GOOS – 215
WCRP – 18/2016



Report of the Nineteenth Session of the Ocean Observations Panel for Climate (OOPC-19)

6-8th April 2016

The Mediterranean Institute for Advanced Studies
(IMEDEA), Esporles, Majorca, Spain.

www.ioc-goos.org/oopc19

The Ocean Observations panel for Climate is part of the Global Climate Observing System the Global Ocean Observing System and the World Climate Research Program. OOPC provides advice and guidance on observations to the Joint Commission for Oceanography and Marine Meteorology.



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1. Introduction

The Nineteenth session of the Ocean Observations Panel for Climate was held at the Mediterranean Institute for Advanced Studies, in conjunction with the Balearic Islands Coastal Ocean Observing and Forecasting System (SOCIB). The meeting was held in parallel with the JCOMM Observations Coordination Group. The two panels were welcomed SOCIB Director Joaquin Tintore on behalf of IMEDEA and SOCIB.

The meeting was attended by OOPC Members, 2 invited experts, and representatives of the CLIVAR basin Panels, and the co-chair of the Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM) Observations Coordination Group.

A large focus of the meeting was completing the GCOS Implementation Plan, in addition to progressing activities in the OOPC Work Plan. The first day of the meeting was held jointly with the JCOMM Observations Coordination Group, and hence was focused on discussing the structure and focus of the ocean section of the GCOS IP, and refining the network based actions for the plan. The Second day was focused on further refining the package of Essential Ocean Variable Specification Sheets, particularly ensuring consistent articulation of applications areas, and phenomena to capture. The 3rd Day focused on reviewing the panel's progress against the Work plan.

All presentations from the meeting, including the workshop talks, are available at www.ioc-goos.org/oopc19. Actions are identified throughout the text and also listed in appendix 2. Each action is shaded to indicate progress to date. Green = complete, yellow = in progress, red = due.

2. Joint OOPC-OCG Session

The joint day was focused on highlighting the drivers for sustained observations in the ocean, to deliver to:

- Climate (through the Global Climate Observing System, GCOS)
- Real time Services (through JCOMM Services Programme Area)
- Ocean Health (led through the GOOS Biology Panel).

The role of OOPC in brokering these requirements was discussed and the relationship between OOPC and OCG in developing systems based designs and network based targets to meet these requirements.

The GCOS programme has a 5 year assessment and reporting cycle, and a new GCOS Implementation Plan is due in 2016, building on the GCOS Status Report, delivered in 2015. Hence much of the day was focused on the input to the GCOS Implementation Plan:

OOPC Chair Bernadette Sloyan presented the outline of the GCOS Implementation Plan, and requested feedback on the structure. Notably, in this plan, there is a stronger focus on the major climate budgets and cycles, and also on observations to inform adaptation and mitigation. To this end in the ocean chapter, ECV based actions have been introduced, focused on what we need the observing system to enable us to deliver (i.e. annual updates of ocean heat content down to 2000m, within a certain level of uncertainty). These have been developed drawing on the EOVS Specification Sheets. For adaptation and mitigation, there is a need to increased consideration of coastal requirements. The plan still includes network based implementation actions, and these have been developed drawing on the draft Network Specification sheets.

The GCOS IP is one example of how network specification sheets will be used, underlining the need for networks to keep them up to date, particularly in articulating network missions and targets. The latest version of network specifications can be found in appendix 4. The meeting also discussed the EOVS Specifications, which then fed into the OOPC meeting that directly followed the joint OOPC-OCG session. Glenn Nolan (EuroGOOS) presented on behalf of the GOOS Regional Alliances, and encouraged OOPC and OCG to engage GRAs in review of EOVS and Network Specifications and also for consideration on expert panels to ensure regional view is represented.

It was noted that further focus was needed on requirements for real time services and coastal requirements in future OOPC sessions.

3. EOV Specifications

The panel reviewed a number of the EOV Specifications which have been developed to date and concluded that while technically accurate, they were inconsistent in approach as a package. It was agreed that the panel needed to break into groups, to look across the EOV specifications to improve consistency. 2 Break out groups focussed on the EOV Description table, and the Requirements table.

3.1. EOV Description Table

In the breakout group for the EOV description table, the group decided that they needed to settle on some definitions for each of the components. These were:

- **Sub-variables** are components of the EOV/ECV that may be measured, *derived variables* of other EOV/ECVs, or inferred from other elements of the observing system, in the broad category of this EOV/ECV.
- **Derived Variables** are quantities or indicators calculated from the EOV or ECV
- **Supporting variables** are other EOV/ECVs, or other measurements from the observing system, that may be needed to deliver the EOV

3.2. Requirements Table

The articulation of science applications, questions and phenomena to capture was very heterogeneous across the specifications. The group decided it was best to follow the lead of the Biogeochemistry panel, and take a step back to identify key questions and phenomena to capture, listed below. These were then applied to each of the EOV Specifications. Each EOV had no more than 8 phenomena to capture.

Science Applications

- 1) Regular assessment of the current ocean state and its evolution
- 2) Projection of ocean state and variability on society (subseasonal, interannual, multidecadal)
- 3) Society's impact on oceans
- 4) Ocean knowledge for climate forecast and projection
- 5) Operational ocean services
- 6) Physics links to BGC and ecosystem

Table 1: Relationship between EOVs and Phenomena which need to be captured.

| Essential Ocean Variables > Phenomena | Temperature - surface | Temperature-Subsurface | Salinity – Surface | Salinity -Subsurface | Currents - Surface | Currents - Subsurface | Sea Surface Height | Sea State | Sea Ice | Ocean Surface Stress | Ocean Surface Heat Flux |
|--|-----------------------|------------------------|--------------------|----------------------|--------------------|-----------------------|--------------------|-----------|---------|----------------------|-------------------------|
| Circulation | X | X | | X | X | X | X | | | X | X |
| Fronts and eddies | X | | X | | X | X | X | X | | X | |
| Tides | X | | | | X | X | | | | | |
| Coastal processes | X | X | X | X | X | X | X | | | | |
| Air-sea fluxes | X | | X | | X | | | X | X | X | X |
| Surface waves | X | | | | X | | | X | X | X | |
| Near inertial oscillations | X | | | | X | | | | | | |
| Freshwater cycle | | | | X | | | | | | | X |
| Sea level | | X | | X | | | X | | | X | X |
| Upwelling | | X | | X | | | | | | X | X |
| Riverine | | | X | | | | | | | | |
| Heat storage | | X | | X | | | | | | | X |
| Stratification | | X | | X | | | | | | | X |
| Mixed layer | | X | | X | | | | | | X | X |
| Watermass | | X | | X | | | | | X | X | X |
| Sea ice extent | | | | | | | | | X | | X |
| Extreme events | | | | | | | X | | | X | X |

The revised EOV Specifications can be found in appendix 4.

After some discussion it was agreed that an ocean surface heat flux EOV/ECV should enable us to close the ocean heat flux. The current EOV for Sensible and Latent heat fluxes are components of the ocean surface heat flux, but in themselves do not close the ocean surface heat flux. It was agreed that we call the EOV/ECV Ocean Surface Heat Flux.

| | | |
|---|-----------------------------|-----------------|
| 1. EOV Specifications | | |
| ACTION: Each member of the break out group to work on two EOV specifications, defining derived variables | John Wilkin to lead | 22nd April? |
| ACTION: Add agreed Phenomena to each EOV Specifications requirements table and distribute them to group members to update the table | Bernadette to lead, | By end of April |
| ACTION: Katy to work on Revising Stommel Diagrams (as eps files) and updating network tables (consistency re. platforms verses networks) | Katy to lead | by end July |
| ACTION: Finalise EOV Specifications by September | Co-Chairs, Katy | September |
| ACTION: Proposed an EOV/ECV Ocean Surface Heat Flux, this will include sub-variable of Sensible and Latent Heat Flux, and long- and short wave radiation. Develop an EOV Specifications for the Ocean Surface Heat Flux (drawing on agreed questions, phenomena above). | Mark, Bob, Weidong, Albert; | By end of May |

4. OOPC Work Plan.

4.1. Indices

A discussion on indices was led by Steve Worley, Bob Weller and Mike McPhaden. It was concluded that good index needs to be easy to compute, simple to understand, dynamically relevant, societally relevant and reflects the utility of the observing system. OOPC has historically had a strong focus on the development and communication of ocean climate indices, which are displayed on the OOPC website. It is an area where OOPC and CLIVAR can potentially work together, to identify ways to expand the indices, particularly to subsurface metrics. Initial suggestions include

- Ocean Heat Content
- Atlantic Meridional Overturning
- Mode water volume.

We would also want to identify what observations are informing an index, or a particular application, i.e. ENSO forecasts. It was proposed that the review and identification of indices, and the identification of the observations that underpin them, working with JCOMMOPS, would be a fruitful area of joint effort between OOPC and CLIVAR (through GSOP), and JCOMMOPS.

| Indices. | | | |
|----------|---|--|------------|
| 6 | ACTION: to review OOPC website indices, identify indices (particularly subsurface) that should be included, and where the data should come from.. | Matt, Steve, Sabrina, Johannes; ALL to provide input to this group | (Timeline) |
| 7 | ACTION: Matt Palmer to provide information doc in importance of ocean heat context, context. Template for other explanatory material. | (Matt Palmer) | Completed |
| 8 | ACTION: Ask JCOMMOPS to deliver dynamic maps to demonstrate the observations which go into each key index. | Chair, OCG: Secretariat | |

4.2. Tropical Pacific Observing System, TPOS 2020 Project.

Weidong Yu led the discussion on the TPOS 2020 project, emphasizing that a major change to the observing system, rather than a minor adjustment is envisioned, and feedback/advice will be needed from OOPC through the phased reporting process (see figure 1 below). The outcomes of TPOS 2020 will be delivered through an Interim Report (2016) which will include details of the main backbone observing system design, including details of pilots and process studies required to refine aspects of the observing system design which require further clarification. The draft report will be available during mid-2016. In parallel, a transition process will need to be established, to facilitate the transition both of the observing system and ongoing governance and oversight, in consultation with the globally coordinated observing networks (through JCOMM, WMO's Commission for basic systems) and implementing agencies.

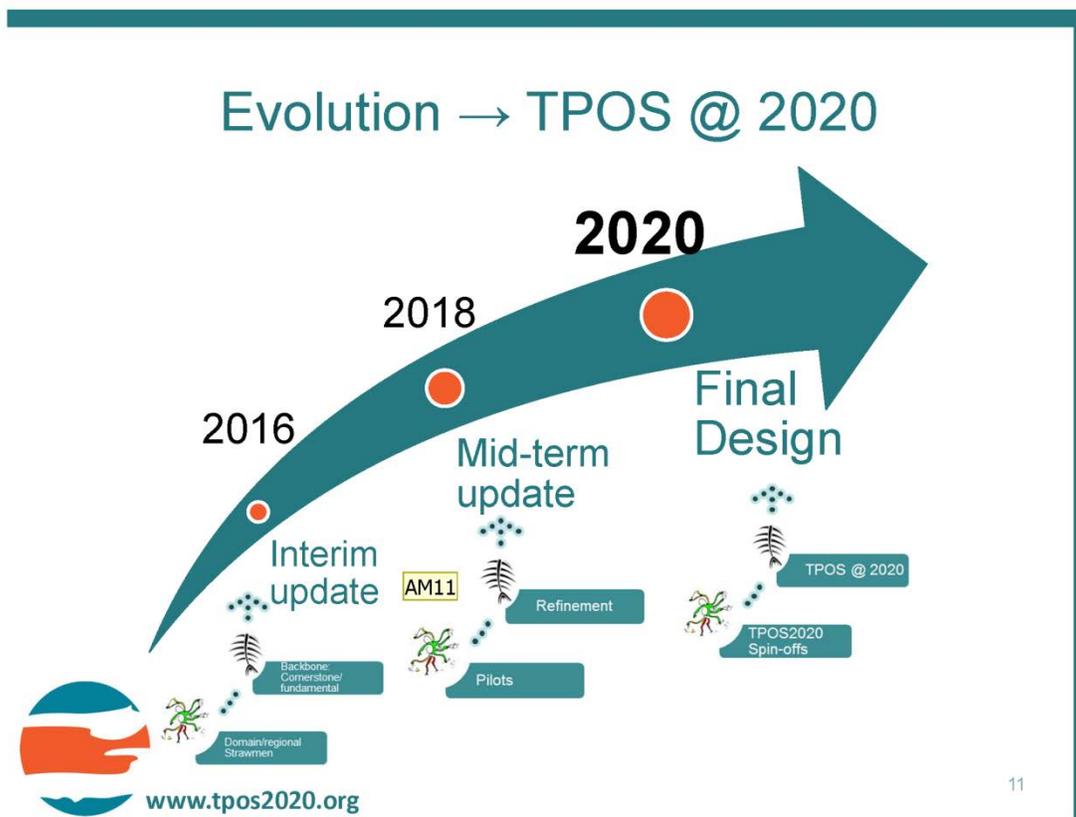


Figure 1. Proposed Phased reporting of the outcomes from the TPOS 2020 Project.

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|--|---------------------------------------|------------------------|
| TPOS 2020 | | |
| ACTION: Review the TPOS 2020 interim report and consider recommendations in the context of OOPC global requirements 9 setting. | OOPC members, CLIVAR Representatives; | July-October this 2016 |

4.3. Deep Ocean Observing Strategy (DOOS)

Bernadette Sloyan and Sabrina Speich led a discussion on the progress in developing the Deep Ocean Observing Strategy, to seek input from OOPC on the future direction of the physics components of the system. The project is being established in earnest now, under the leadership of Lisa Levin (Scripps), with a kick off workshop to be held in December 2015. See www.deeпоceanobserving.org for more information. Currently, the deep sustained observations are from GO-SHIP (decadal survey) and some deep instruments on OceanSITES moorings. Future developments which will be part of the mix include Deep Argo; a 5x5 degree resolution array is proposed and is currently being tested regionally, which would be around around 1200 floats; and mooring arrays for monitoring deep boundary currents. For deep moorings, data pod technologies are being tested.

The next challenge will be to determine the right mix of observations required to capture requirements for spatial/temporal sampling requirements (for both climate, and multidisciplinary applications of the same platforms). It is also likely that requirements will be regionally varying. For instance, deep Argo pilots are currently targeting deep basins where large warming signals are being detected, and where there is a lack of

mooring data. Each network occupies a niche: GO-SHIP is spatially sparse (transects) and temporally sparse, but delivers highest quality, most comprehensive set of observations. OceanSITES is next highest quality, spatially sparse, but array can be design to address spatially heterogenous requirements (i.e. to capture regions of rapid change, or strong regional gradients), and provides high resolution temporal data. Deep Argo provides routine broad scale observations.

| DOOS | | | |
|------|--|--------------------|------|
| 10 | ACTION : Bernadette to keep OOPC informed of DOOS Progress. | Bob, Bernadette | |
| 11 | Bob Weller to provide information on OceanSITES mooring with deep T/S and those without. | Bob/Champika | 2016 |

4.4. Boundary Currents and their interactions with the shelf.

John Wilkin and Ananda Pascual led the discussion on the proposed OOPC boundary currents activity, following an OOPC sponsored session on observing and modelling open ocean/shelf connections at Ocean Sciences 2016. It is apparent that there are a number of activities developing, connecting up the coastal and open oceans, but there is need to improve coordination and communication amongst these projects. Historically, the observing system has been focused on the open ocean, and the very coastal ocean, and cross shelf observations have been a critical gap, important for understanding open ocean forcing on coastal systems and the cross shelf exchange of properties. Discussions focused on science drivers and requirements, Realistic and idealized modeling approaches , and increased used of multiplatform approaches. At a global level, networks have shown aspirations in setting targets in boundary current regions, including Ocean Gliders, Argo, and HF Radar. OOPC agreed that the panel had a role to build on this momentum and connect up the activities and discussions in the community through a Workshop. The outcomes of such a workshop should include recommendations to build on existing observing activities to develop intensive regional boundary current pilots, including complementary downscaling of climate models. One aim could be to identify the minimum configuration needed to get within 20% of total boundary current transport.

| Boundary Currents. | | | |
|--------------------|---|---|----------------------|
| 12 | ACTION Initiate conversations with key groups with observation programmes in boundary currents: to gauge interest in engaging in a workshop | John: Peach, Bernadette: EAC, Bernadette: Agulhas, John: an eastern boundary | By September 2016 |
| 13 | ACTION: Present proposal to GODAE Ocean View COSS TT meeting in April 2017 | John to present idea and seek engagement. | April 2017 |
| 14 | ACTION: Develop plans for a workshop, involving key groups who are involved in Boundary Current Field Campaigns | Bernadette, John, Katy | (Timing? Location?) |
| 15 | ACTION: Consider inviting COSSTT member to next OOPC meeting? | OOPC Co-Chairs | March 2017 |

4.5. Polar Seas

Mark Bourassa and Katsuro Katsumata led a discussion on polar seas observations, highlighting progress in technology enabling observations under the ice, the focus and activities of SOOS. The discussion moved onto the need for strengthening data integration and availability in high latitude regions, particularly in support of climate modelling; and more generally, the need to connect to the activities Obs4MIPS and Ana4MIPS for global observations, which are being championed by the WCRP Data Advisory Council. The discussion was limited

due to a shortage of polar expertise on the OOPC. The panel will address this gap in the membership ahead of the next meeting. .

| | | | |
|------------|--|--------------------------|---------|
| Polar Seas | | | |
| 16 | ACTION: Engage in Obs4MIPS and Anal4MIPS activities for global ocean observations, and report back at next OOPC re. recommendations. | Johannes, Steve, Sabrina | OOPC 20 |

4.6. Air Sea Heat and momentum fluxes

Mark Bourassa and Bob Weller led the discussion on fluxes, building on the previous day's discussion on defining Ocean Surface Heat Fluxes as an EO. Progress has been made in filling in gaps in global coverage through Ocean Observatories Initiative (OOI), Integrated Marine Observing System (IMOS), and need to work with the modelling community on areas of large uncertainty requiring focus. OceanSITES oversees moored flux sites activities, and a review of flux observations and requirements would be timely. OceanSITES has not set requirements for flux sites, becoming more of a community of practice; but have been approaching the community for feedback on where additional timeseries sites are required from the GOOS Panels and CLIVAR. OOPC and JCOMM OCG have requested OceanSITES work towards being able to a) Articulate what is being measured where in OceanSITES, and b) move towards developing requirements for different types of timeseries sites, starting with moored flux sites, including recommendations for future developments.

| | | | |
|----------------------------------|---|--|-----------|
| Air Sea heat and momentum fluxes | | 0 | |
| 17 | ACTION: OOPC to work with OceanSITES to develop a high level document describing status and plans for the global sustained observations of fluxes | Bob Weller (OceanSITES), Mark Bourassa (OOPC), Meghan Cronin (TPOS 2020), Simon Josey (), Matt Palmer, Tony Lee (GSOP) . | Timeline? |

4.7. Evaluation of the observing system

Johannes Karstensen, Matt Palmer and Mark Bourassa led the discussion on how OOPC, GSOP and GOV could work more closely together on guiding observing system design activities; both model and statistics based. The discussion built on an action from OOPC 18, and a background paper written by Johannes and Matt intersessionally. There is a strong focus on observing system evaluation in projects such as TPOS 2020 and AtlantOS, and so it is important that OOPC stays connected to these activities. In addition, it was agreed that OOPC, GSOP and GOV should work together to develop a position paper on approaches to observing system assessment, and how they could be coordinated within the community. The role of ERDDAP, which is being tested through JCOMM OCG to bring together heterogeneous datasets (i.e. Argo, GO-SHIP, OceanSITES into a common environment was highlighted. GSOP is pushing for availability of datasets in a standard format for the community. For instance, reanalysis datasets are not ingestible in a standard format.

| | | | |
|---------------------------------------|--|---|---------|
| Evaluation of Observing System Design | | | |
| 18 | ACTION: Comment on the approaches described in the Palmer and Karstensen paper | All | End May |
| 19 | ACTION: OOPC Connect to and support observing system design activities in AtlantOS and TPOS 2020 projects | Lead: Johannes Karstensen, Weidong Yu, to advise on opportunities, engage Matt Palmer | Ongoing |
| 20 | ACTION: Mark to provide link to paper on statistical approaches for discussion on how it might connect to broader community activities in OS Design. | Mark Bourassa | asap |

| | | | |
|----|--|---|-----------|
| 21 | ACTION: Write and publish a position paper (possibly to BAMS) on the different strategies for observing system assessment and coordination among the key communities (including GSOP; GOV) | Matt Palmer and Johannes Karstensen with input from Johnny Johannesen and Glenn Nolan | This year |
|----|--|---|-----------|

4.8. Potential new topics

Regional Evaluations: the Indian Ocean review.

Mike McPhaden presented a proposal for an Indian Ocean Observing System (INDOOS) review for discussion and consideration by OOPC. It was well received by the panel, and OOPC agreed to endorse the activity. The OOC Chair Bernadette Sloyan, and Secretariat Katy Hill will ensure progresses with advice from OOPC.

| | | |
|---------------------------------------|--|------------------------------|
| Indian Ocean Observing System Review. | | |
| 21 | ACTION: OOPC to respond to Bernadette to email Mike McPhaden, cc-ing GOOS IndoOS review proposal Executive By Mid May 2016, ahead of the GOOS SC | By Mid May, ahead of GOOS SC |

Cross GOOS panel connections: Super EOY Workshop

A workshop is being organized to look at the development of requirements and integrated observing system design across the 3 panels of GOOS in February 2017 in Miami. The workshop will focus on 3 cases from an integrated point of view: Boundary Currents and their interaction with the shelf, Oxygen Minimum Zones, and Primary Production. OOPC members are engaged in the workshop, and a report will be provided to the OOPC-20 meeting.

5. Preparations for OceanObs19 Conference

Eric Lindstrom is leading the development of plans for the OceanObs19 meeting, to be held in the second half of 2019. Input and engagement is sought from OOPC.

Potential themes include:

- Showcasing societal benefits from sustained ocean observations
- Flow of observations into data systems
- Integration across scales, platforms, etc.
- Developing capacity
- Innovation , observing strategy.

Feedback is welcome on both the themes and the structure of the meeting. It is hoped that the process will be more streamlined for community whitepapers than previously, as the previous OceanObs09 produced a very large set of whitepapers which represented a large body of work from the community. The First conference announcement will be sent out in the first half of 2017.

6. Panel membership

Firstly we would like to thank our two outgoing Co-Chairs, Toshio Suga who stepped up to the GOOS Steering Committee, and Mark Bourassa who stepped down for family reasons. Toshio and Mark have co-chaired OOPC since 2013, and have overseen the period of change for the panel which now sits in a strong position at the interface of the GCOS and GOOS Programmes. Thank you Mark and Toshio! Bernadette stepped up to replace Toshio last year, and we will be working to secure a co-chair to replace Mark in the coming months.

We would also like to thank Steve Worley, who has also stepped down from the panel due to other professional commitments.

The OOPC panel membership is now down to 6 full members, about half of what would be ideal; as while we have engaged new experts in each meeting, the departures from the panel have outstripped the recruitments. We therefore need to engage new experts as a matter of urgency in 2016, in order to fulfill OOPC obligations. Bernadette and Katy will be in touch with the Panel and seeking input more broadly to fill the gaps in the panel expertise.

7. Next meeting.

The 20th Session of OOPC will be held 14-17th March 2017 at Woods Hole Oceanographic Institute, USA, graciously hosted by OOPC's longest serving panel member, Bob Weller.

Appendix 1: Agenda

**Joint meeting of the 19th Session of the Ocean Observations Panel for Climate (OOPC-19)
and the
7th Session of the JCOMM Observations Coordination Group
6 April 2016, IMEDEA, Esporles, Spain.**

We will run from 9am – 6 pm, with coffee breaks at 10.30am and 3.30pm; Lunch will be served at 12.30-1.30pm

Wednesday 6 April 2016 - OOPC and OCG

1. Requirements

- 1.1. High level drivers for sustained ocean observations and context for the GCOS Implementation Plan (IP), GOOS Strategic Mapping: Delivering to Climate (including adaptation, real time services, Ocean Ecosystem Health (Albert/Bernadette)
- 1.2. EOVS Specifications, Draft GCOS IP Ocean Section (Bernadette).
- 1.3. Discussion: consequences for EOVS/ECVS, requirements of networks. Requirements of and need for network specification sheets.

2. Presentation 'ALBOREX: an integrated multi-platform experiment for the study Meso and Submesoscale processes' (Ananda Pascual)

3. Network Missions/Targets (defined)

- 3.1. Review of Draft GCOS IP 2016 action items
 - 3.1.1. How have network targets changed since 2010 and status report? (OCG Chair and Bernadette) – See Network Specifications.
 - 3.1.2. Revision of GCOS Actions items - changed/improved?
- 3.2. Emerging networks, technologies: closing gaps, meeting new requirements for EOVS, etc. (technology developments, integration of various platforms, regional specific requirements polar, coastal, waves). (Bernadette Sloyan/Glenn Nolan)
- 3.3. Progress in developing initial 'no regrets' targets for biogeochemistry? (Report from IOCCP Meeting/OCG Discussions) (Maciej Telszewski)
- 3.4. Develop methods/techniques to enable reporting against action items
 - 3.4.1. JCOMMOPS
 - 3.4.2. Data Management
 - 3.4.3. Meta data requirements

Joint Day Background docs:

- *EOVS specifications*
- *Network specifications (draft)*
- *2016 GCOS IP Ocean Section (Draft)*
- *2010 Ocean Section Actions (To be updated)*

19th Session of the Ocean Observations Panel for Climate (OOPC-19)
7-8 April 2016, IMEDEA, Esporles, Spain.

DRAFT AGENDA

Arrangements: We will start each day by 9am, Coffee at 10.30 and 3.30, and lunch from 12.30-1.30. We will aim to be finished by 6pm each day.

Thursday 7 April 2016 – OOPC

1. Overarching societal, science drivers, phenomena across EOVS specs. (Bernadette and Mark, Discussion)

ECV/EOVs revision and finalization of ocean physics by OOPC and invited experts. Work through OOPC member comments on the ECV/EOVs one-by one. Modify real-time if required. Revision of EOVs to focus on:

- Identify major gaps. Where there are gaps, what can we do to help the communities move forward?
- Accuracy requirement (Leads: Bernadette and Mark)
 - 1.1. SSH
 - 1.2. SST
 - 1.3. Subsurface temperature
 - 1.4. SSS
 - 1.5. Subsurface salinity
 - 1.6. Sea surface currents
 - 1.7. Subsurface currents
 - 1.8. Sea state
 - 1.9. Ocean surface vector stress
 - 1.10. Sensible and latent heat flux

2. Review of GCOS Implementation Plan (IP) draft version 1

3. Determination of GCOS IP Action Items (drawing on EOVS, Network Specifications).

Friday 8 April 2016 – OOPC Specific Science Foci (joint OOPC/CLIVAR contributions)

4. OOPC Work Plan areas: (Discussion: On each of the items below we should review progress and develop actions for next 12 months) (refer to OOPC Workplan 2015 update).
 - 4.1. Ocean Indices/Products, (Steve Worley, Bob Weller, Mike McPhaden)
 - 4.2. Tropical Pacific Observing System, TPOS 2020: (Weidong Yu)
 - 4.3. Deep Ocean Observing: (Bernadette Sloyan, Sabrina Speich)
 - 4.4. Boundary current and shelf interactions: (John Wilkin, Ananda Pascual)
 - 4.5. Polar Seas – Sea ice and floating ice shelves: (Mark Bourassa, Katsuro Katsumata)
 - 4.6. Air-sea heat and momentum fluxes: (Mark Bourassa, Bob Weller).
 - 4.7. Evaluation of observing system design (Johannes Karstensen, Matt Palmer, Mark Bourassa)
 - 4.8. Possible new topics based on discussion from Thursday (Bernadette Sloyan, Mark Bourassa).
 - 4.9. Interaction/partnership with other science organizations and programs (CLIVAR, GODAE, AtlantOS, ...)
5. Review and iteration of OOPC Work Plan (Bernadette Sloyan, Mark Bourassa)
6. OceanObs19: OOPC's goals

OOPC Background Docs:

- *EOV Specifications*
- *OOPC Work Plan(2015 update)*
- *Network Specifications (draft)*
- *GCOS Implementation Plan Ocean Section (Draft)*

Appendix 2: Actions Summary "

A summary of actions is included below, including colour shading indicating progress made since the meeting. Green = complete, yellow = in progress, red = due.

| Number | Action | Who | Timeline |
|-------------------------------|---|--|-------------------|
| 1. EOVS Specifications | | | |
| 1 | ACTION: Each member of the break out group to work on two EOVS specifications, defining derived variables | John Wilkin to lead | 22nd April? |
| 2 | ACTION: Add agreed Phenomena to each EOVS Specifications requirements table and distribute them to group members to update the table | Bernadette to lead, | By end of April |
| 3 | ACTION: Katy to work on Revising Stommel Diagrams (as eps files) and updating network tables (consistency re. platforms verses networks) | Katy to lead | by end July |
| 4 | ACTION: Finalise EOVS Specifications by September | Co-Chairs, Katy | September |
| 5 | ACTION: Proposed an EOVS/ECV Ocean Surface Heat Flux, this will include sub-variable of Sensible and Latent Heat Flux, and long- and short wave radiation. Develop an EOVS Specifications for the Ocean Surface Heat Flux (drawing on agreed questions, phenomena above). | Mark, Bob, Weidong, Albert; | By end of May |
| Indices. | | | |
| 6 | ACTION: to review OOPC website indices, identify indices (particularly subsurface) that should be included, and where the data should come from.. | Matt, Steve, Sabrina, Johannes; ALL to provide input to this group | (Timeline?) |
| 7 | ACTION: Matt Palmer to provide information doc in importance of ocean heat context, context. Template for other explanatory material. | (Matt Palmer) | Complete |
| 8 | ACTION: Ask JCOMMOPS to deliver dynamic maps to demonstrate the observations which go into each key index. | Chair, OCG: Secretariat | |
| TPOS 2020 | | | |
| 9 | ACTION: Review the TPOS 2020 interim report and consider recommendations in the context of OOPC global requirements setting. | OOPC members, CLIVAR Representatives; | July-October 2016 |
| DOOS | | | |
| 10 | ACTION : Bernadette to keep OOPC informed of DOOS Progress. | Bob, Bernadette | |
| 11 | Bob Weller to provide information on OceanSITES mooring with deep T/S and those without. | Bob/Champika | 2016 |
| Boundary Currents. | | | |
| 12 | ACTION Initiate conversations with key groups with observation programmes in boundary currents: to gauge interest in engaging in a workshop | John: Peach, Bernadette: EAC, Bernadette: Agulhas, John: an eastern boundary | By September 2016 |

| | | | |
|---------------------------------------|---|--|------------------------------|
| 13 | ACTION: Present proposal to GODAE Ocean View COSS TT meeting in April 2017 | John to present idea and seek engagement. | April 2017 |
| 14 | ACTION: Develop plans for a workshop, involving key groups who are involved in Boundary Current Field Campaigns (Timing? Location?) | Bernadette, John, Katy | (Timing? Location?) |
| 15 | ACTION: Consider inviting COSSTT member to next OOPC meeting? | OOPC Co-Chairs | March 2017 |
| Polar Seas | | | |
| 16 | ACTION: Engage in Obs4MIPS and Anal4MIPS activities for ocean obs, and report back at next OOPC re. recommendations. | Johannes, Steve, Sabrina | OOPC 20 |
| Air Sea heat and momentum fluxes | | | |
| 17 | ACTION: OOPC to work with OceanSITES to develop a high level document describing status and plans for the global sustained observations of fluxes | Bob Weller (OceanSITES), Mark Bourassa (OOPC), Meghan Cronin (TPOS 2020), Simon Josey (), Matt Palmer, Tony Lee (GSOP) . | Timeline? |
| Evaluation of Observing System Design | | | |
| 18 | ACTION: Comment on the approaches described in the Palmer and Karstensen paper | All | End May |
| 19 | ACTION: OOPC Connect to and support observing system design activities in AtlantOS and TPOS 2020 projects | Lead: Johannes Karstensen, Weidong Yu, to advise on opportunities, engage Matt Palmer | Ongoing |
| 20 | ACTION: Mark to provide link to paper on statistical approaches for discussion on how it might connect to broader community activities in OS Design. | Mark Bourassa | asap |
| 21 | ACTION: Write and publish a position paper (possibly to BAMS) on the different strategies for observing system assessment and coordination among the key communities (including GSOP; GOV) | Matt Palmer and Johannes Karstensen with input from Johnny Johannesen and Glenn Nolan | This year? |
| Indian Ocean Observing System Review. | | | |
| 21 | ACTION: OOPC to respond to IndoOS review proposal | Bernadette to email Mike McPhaden, cc-ing GOOS Executive By Mid May 2016, ahead of the GOOS SC | By Mid May, ahead of GOOS SC |
| 4. Next meeting | | | |
| 22 | ACTION: Identify dates and location of next OOPC meeting | Co-Chairs, Katy | asap |
| 5. Membership | | | |
| 23 | ACTION: Identify areas of expertise which OOPC needs. Circulate with OOPC members, CLIVAR representatives, WCRP secretariat for input for potential members. Consideration of choice of new should include gender and geographical balance of the OOPC membership | Co-Chairs, Katy | asap |

Appendix 3: Attendees

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Appendix 4: EOV Specifications

<To be added>

DRAFT



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