IMOS Integrated **Marine Observing** System

Workshop Report:

The Australian Coastal and Oceans Modelling and Observations Workshop (ACOMO 2016)

11-12th October 2016, Shine Dome, Australian Academy of Sciences, Canberra

Prepared by:

Contents

1. Executive Summary

The third Australian Coastal and Oceans Modelling and Observations Workshop (ACOMO 2016) was held on the 11th and 12th October 2016, at the Shine Dome, Australian Academy of Sciences, Canberra. The meeting brought together over 90 participants from several organisations, including international organisations and private industry.

The aim of this meeting was to bring the national observations and modelling communities together and give an update on the activities and developments accomplished over the last two years. The workshop was focused around 5 different themes; namely, boundary currents; near-shore and coastal processes, polar dynamics, BGC and ecosystems and end user applications.

To follow up the intention for ACOMO to progressively move up from hydrodynamics to ecosystem models, the ACOMO 2016 workshop devoted a whole session on biogeochemistry and ecosystems. The extension into the ecosystem modelling included a keynote speaker, Simon Jennings, who provided a review of modelling from primary production to fish production, highlighting model inter-comparison and the need for systematic ecosystem observing.

Another important topic included in this workshop was discussion of a National Modelling System for Australia, as articulated in the National Marine Science Plan. Some of the issues discussed included the need for sustained modelling effort for both research and operations, choice of models and grids, scope (physics, biogeochemistry, ecosystems, ocean-ice), and governance.

In terms of concrete steps going forward, it was suggested to note:

- There is recognition of the need for scoping a National Modelling System in Australia, which should include user engagement, governance, and pathway for sustaining the system. It was suggested that providing access to model output through a single national infrastructure would be a good starting point. The aspiration to develop an Australian National Shelf reanalysis remains. An Ocean Modelling Working Group will be required to keep this moving forward.
- The downscaling of models to resolve processes at finer scales (including physics to ecosystems) presents challenges. Ensemble prediction is scientifically useful, but perhaps less so for users. Higher resolution data and observations are needed to help constrain the models, and event specific observing capability may be one way forward.
- Observation impact studies have a role, and we could collaborate more closely with the Numerical Weather Prediction (NWP) community who deal with similar problems.
- There is an opportunity to provide input to Geoscience Australia on bathymetry data needs, including data resolution and regions where it is needed.
- The need for understanding thermal structure on the North West Shelf continues to be an issue for industry in that region.
- The community continues to highlight the need for wave information. Coordination across states to provide wave data via the AODN is needed.
- There is value in long term coastline observations for the development of predictive models. A selection of representative sites that can give the context for the range of variability will be needed.
- Unresolved physics parameterization in the Antarctic region, such as vertical mixing and polynya formation, needs improving. This include linking together integrated models and observations and evaluate if we are getting the best out of both.

- There is a global need for systematic and sustained ecosystem observing, and definition of Essential Ocean Variables (EOVs) is helping with this. The 'FISH' Model Inter-comparison Project (MIP) presents an opportunity to bring the observations and ecosystem models together.
- There is a need to include size composition data in the plankton observations currently undertaken by IMOS in order to make them more useful for size based ecosystem models.
- Availability of nutrient observations is sparse and limited. New technologies, including Bio-Argo, may help improve this.
- There are an increasing number of models in regional areas running in routine mode, presenting enhanced opportunities for bringing research innovations into operational application.

2. Summary of actions and recommendations

A number of proposed actions and a small number of recommendations emerged through the course of the workshop, and are summarised below.

Boundary currents and shelf systems:

ACTIONS:

- **The ocean modelling community to provide guidance to GA and MNF on the priorities and needs for bathymetry data.** NOTE: a meeting took place in GA on the 13th of October where this and other issues were going to be discussed.

RECOMMENDATIONS:

- Thermal structure in the NWS continues to be an issue and having access to good bathymetry data, particularly between 100-600 m depth, in the region is very important
- As models move towards the sub-mesoscale there are questions on how to constrain these models and how can observations contribute. Work on observation impact and cost effectiveness is recommended, with potential collaboration with NWP which is looking at similar problems.
- Contribution of observations that are not IMOS are important (such as the ADAPTER data from UWA, NRL etc.) and discussions on how to make these data available through the AODN will be helpful
- Predictability at a finer scale is more challenging due to the chaotic nature of the processes being model. Options for improvement in the predictability could include ensemble predictions or in the case of extreme events to complement it with targeted observations such as those used by the NWP
- A system of a backbone (IMOS) that provides sustained observations, in combination with a movable capability for process studies (e.g. ADAPTER program in WA) would be an ideal observing system.

Nearshore and coastal processes

ACTIONS:

- Logistics of getting important wave data on State by State is difficult, and therefore there is the need to coordinate with the States to make their wave data available through the AODN so users can have one-point access to these data. **The AODN to help coordination for a single access point of the States wave data.**

RECOMMENDATIONS:

- There is value for long term coastline observations for the development of predictive models. A selection of representative sites to give context of the range of variability will be necessary for long term coastal observing.

National Ocean Modelling System:

RECOMMENDATIONS:

- Threshold issues that include a National Grid needs more discussion. Exploring the possibility of unifying the currently independent regional modelling efforts, which could include of two-way coupling, standardising formats and delivery (unify location and formats).
- A mechanism for governance for a National Ocean Modelling System and a pathway for operationalising the models needs to be discussed and considered.
- Create a working group that could start looking into the resourcing and governance for a National Ocean Modelling System. Clarity on the needs for a sustained system as well as understanding and engagement of industry and government will be essential.

Polar dynamics and processes

RECOMMENDATIONS:

- Unresolved physics parameterization in the Antarctic region, such as vertical mixing and polynya formation, needs improving. This include linking together integrated models and observations and evaluate if we are getting the best out of both.

BGC and Ecosystem modelling and observations:

RECOMMENDATIONS:
- There is currently very limited amount of size spectra information openly available. It will be highly beneficial for the ecosystem modelling community to be able to access these data through the AODN.
- Higher trophic levels have a big role in BGC cycle, through ammonia input (130 Tg yr^{-1}) and carbonate production (3-15%) and thus should be considered a component in BGC models and linked up with the higher trophic levels.

End users

RECOMMENDATIONS:
- There is an opportunity to bring output from models running now routinely into a national infrastructure, as a first step towards a National Ocean Modelling System.

3. Introduction

The workshop was structured into five major themes:

1) Boundary currents and shelf systems

2) Nearshore and coastal processes

3) Polar dynamics and processes

4) BGC and Ecosystem modelling and observations

5) End user applications in oceanography

Two international speakers were invited to speak at the workshop; Dr Christopher Edwards from the University of California Santa Barbara and Dr Simon Jennings from the Centre for Environment, Fisheries and Aquaculture Science & University of East Anglia, UK. In addition, Dr Glenn Nolan, the Secretary General of the European Global Ocean Observing System (EuroGOOS) delivered a talk on "EuroGOOS member services to operational oceanography end-users in Europe".

The workshop was attended by over 90 people including representatives of NCRIS e-research capabilities, New Zealand's National Institute of Water and Atmospheric Research, Australian Maritime Safety Authority, Department of Defence, consulting industry, universities and other government agencies.
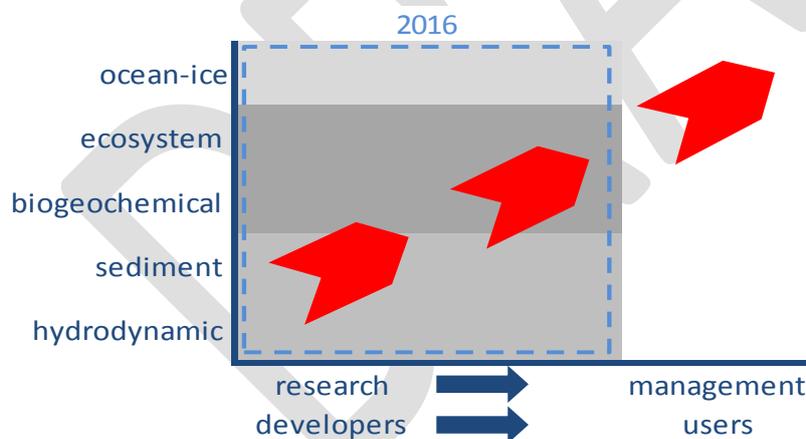

Figure 1. Future trajectory of ACOMO workshop.

An update on the progress of the action items raised at ACOMO 2014 (Table 1) is shown below.

Table 1. Action items from ACOMO 2014

Shelf reanalysis requirements:	
ACTION: IMOS and AODN to look into developing workflows that ensure we can deliver 'model ready' data on an ongoing basis.	Via MARVL3, the AODN has created a temperature and salinity data Atlas assembling data collected on the Australian shelf between 1995 to 2014 into a single data collection. These data is linked to MARVL for use
ACTION: A complete TTT needs to be formed and a workshop organized to discuss the scientific/technical issues to come up with a proposal	A technical task team (TTT) was formed and it scoped ANSR during 2014-2015. Currently the project is on pause pending resolution of governance and funding issues.
Biogeochemistry	
ACTION: IMOS to consider options for collecting nutrients at higher temporal resolution as funding permits	An inside review of IMOS activities with respect to nutrients and options for collecting more data was undertaken in 2015. Options for expanding these collections includes bio-Argo
Developments in coastal modelling and observations	
ACTION: IMOS to discuss access to surface wave data with the Bureau of Meteorology and other national and international partners, as it arose as an issue during the workshop and gaining access is important for the shelf and coastal research communities (including MARVL and ANSR amongst other projects).	There has been discussion with BoM, researchers and others about access to wave data as well as the possibility of having a single access point for these data. AODN will progress this during 2016-17.

4. Boundary Current and Shelf Systems

The session's keynote was delivered by Dr Chris Edwards from the University of California Santa Cruz who talked about fully coupled BGC/Physical ocean data assimilation, methods and progress. The talk included an example of implementation of a variational method (4D-Var) in ROMS at the California Current System and the NPZD and NEMURO BGC models.

The session included talks on modelling work and observations of marine heatwaves, shelf dynamics, eddies, upwelling circulation among others undertaken in the Australian East Coast, GBR, South Australia, Western Australia and Tasmania. Key issues discussed in the session included:

- Models are downscaling to the sub-mesoscale, so how can these models be constraint at that resolution and improve our predictions? With the increase resolution, the predictability is less and more challenging due to the type of processes models are trying to predict. These makes it hard for an observing system to be able to deliver the observations needed to constrain those models, and thus from a predictive point of view ensemble predictions will need to be considered. However, ensemble prediction will not be useful in case of extreme events, which are important for end-users. Therefore, a combination of ensemble prediction and rapid deployment of equipment for targeted observations during an events could be a good approach.
- Issues with the ability to obtain high resolution bathymetry to use in models. Currently it is done manually because the Hydrographic office does not provide digital data, just the charts and GA does not provide the data at that resolution. It was agreed that **the ocean modelling community will provide guidance to GA and MNF on the priorities and needs for bathymetry data.**
- There is interest in doing observation impact experiments to assist in the design of our observing system. The NWP community is dealing with similar problems and there is potential for a closes collaboration between both communities. Some of the benefits include improving the design of the observing network and also provide insight into the cost benefit per observations. However, it is important to have clarity of the science questions that need to be answered. This include the identification of regions where the modelling is not good and could benefit from having observations.
- An ideal observing system could be one composed of a backbone (IMOS) that provides sustained observations, in combination with a movable capability for process studies (e.g. ADAPTER program in WA).
- Contribution of datasets that are outside IMOS, i.e. industry, other research groups is important but work around standards, metadata, needs to be addressed before the data goes into the AODN.

5. Nearshore and coastal processes

The session included talks on coastline monitoring, wave predictions, nearshore modelling work, beach processes and shoreline dynamics, among others. Cross-cutting talks that included end-user applications in nearshore and coastal processes modelling, such as eReefs, Wave Atlas, operational

near-shore models and sea level forecasting were also included. Key issues discussed in the session are:

- There is value of having long-term coastline observations to detect trends, climate variability and how it affects coastlines, storm responses, validate and develop predictive models. A ball park figure of ~20 representative sites that include sandy, coral, mangrove and rocky reefs will be a good start to give context on the rage of variability occurring around our coastlines and be able to look at trends once there is a long enough time-series.
- Waves are a big theme, and logistics to get wave data on a State by State basis is difficult so discussions with States on how to coordinate access to their data using a single access point is needed. **The AODN is keen on helping out and try to work and coordinate with States in order to get wave data.** There is also possibility of international collaboration through APEC.
- Other issues highlighted were the need to have a coastline observing system that includes long term target sites and sites for process studies and rapid response studies to develop models; and the need to look at the downscaling of models that can capture finer scale processes such as those in the GBR and estuaries.

6. National Ocean Modelling System

This discussion session was focused around the National Marine Science Plan requirement to create a National Ocean Modelling System. The following points were discussed:

- **There is recognition of the need for scoping a National Modelling System in Australia, which should include user engagement, governance, and pathway for sustaining the system.** It was suggested that providing access to model output through a single national infrastructure would be a good starting point. The aspiration to develop an Australian National Shelf reanalysis remains.
- The need to think around the concepts of experimental vs sustained systems as opposed to research and operations, with greater focus on the sustained component for research and operational purposes.
- Threshold issues that include a National Grid needs more discussion. There is good regional capability in the modelling space and it would be important to **explore the possibility of unifying the currently independent regional modelling efforts, which could include two-way coupling, standardising formats and delivery (unify location and formats).**
- The Forum for Operational Oceanography provides a good forum to discuss the need of such a system with candidate priority areas already identified (e.g. surface currents and surface waves). The FOO was designed to bring together R&D, service providers and end-users with the prospect of a follow up workshop in 2017.
- **Governance, scope and resourcing are among the issues that need further discussion**. There are different examples for governance structures that could be considered as candidates, including something akin to IMOS. In terms of scope, discussions on whether a National Ocean Modelling System should encompass physics to ecosystem modelling and socio-economics will be important. **A working group that could start looking into the resourcing and governance for**

a National Ocean Modelling System and can give clarity on the needs for a sustain system as well as understanding and engagement of industry and government could be the way forward.

- An easy pathway to operationalised models will need to be address, as there is currently no easy way to do it. However, while there are advantages of operationalising a modelling system, it could also delay innovation, such as the European case where the operational models are at most times behind state of the art models.

- An important building block for the implementation of a National Ocean Modelling System is the Australian National Shelf Reanalysis project (ANSR), which was scoped in 2014-2015. ANSR identified 4 key issues: 1) National Grid, 2) Observational database, 3) Cyber infrastructure, and 4) Resources and Governance. Ownership of a national grid was a sticking point, and the TTT recommended at the time of scoping to use ROMS. However, recent developments can now allow to couple regional grids of similar or different models making it possible to run a series of two-way coupled regional grids on a common compute infrastructure (e.g. NCI). Resources required for ANSR will be ~$1M pa co-invested for 5 years.

- Suggestions to keep a global system with regional focus in scope as global models continue to increase their resolution and it starts to converge with the regional models.

7. Polar dynamics and processes

The session included talks on modelling activities and initiatives in the Antarctic regions, including information about the Consortium for Ocean-sea Ice modelling in Australia (COSIMA), New Zealand initiative on sea-ice interactions, activities in Australia that includes the use of different modelling platforms, regional model domains (Amery, Totten, Mertz), coupling of ice-sheet and ocean models, the use of seismic observations to map ocean stratification beneath an ice shelf and high resolution modelling of dissolving ice shelves. The following points were discussed in the session:

- The importance for sea-ice modellers to include polynya formation in Antarctica and vertical mixing into their models to improve them. linking together integrated models and observations and evaluate if we are getting the best out of both.

- There are issues with unresolved physics, in particularly parameterization. There was discussion and some disagreement on the ability of observations currently collected to provide the necessary constraints for the models. While having a fully constraint model may not be possible, it is too early to stop making observations and decide what are the mechanics they need to consider in the models. There are new developments and technology that may be able to help, such as melt rate measurements.

- Numerical models can help to test what is the resolution needed for geometry (shape of bedrock, ice shelf) and decide if high resolution geometry is needed or not in order to answer the science questions that need answers.

- Need for Operational modelling sea-ice / ocean/ atmosphere modelling is needed in the region.

8. BGC and ecosystems

The session's keynote was delivered by Dr. Simon Jennings from Centre for Environment, Fisheries and Aquaculture Science and the University of East Anglia. He provided a review of modelling from primary production to fish production, highlighting model inter-comparison project the included 13

global models and the need for systematic ecosystem observing. The talks in this session ranged from ocean acidification that included historical reconstruction of pH, BGC modelling and plankton modelling and observations, including lobster larval dispersal and ichthyoplankton, habitat-forming organisms modelling and their response to climate change and ecosystem modelling efforts in the Southern Ocean and around Australia that include a toolbox of different models that can be accessed.

Key issues the session included:

- Higher trophic levels such as fish have a big role in BGC cycle, through ammonia input (130 Tg yr^{-1}) and carbonate production (3-15%) and thus should be considered a component in BGC models. While some BGC models include this as mortality term, it is a source of great uncertainty.
- Uncertainty in the estimates of high trophic level biomass is due to forcing of models based on GCM and ocean colour as opposed to downscale regional models based on local environment and direct observations.
- Models need to make better use of observations such as nutrients, with the potential of technological developments such as bio-Argo, and particle flux estimates able to help.
- It is critical and important to get zooplankton and the mesopelagic size composition observations to help models and improve biomass estimates. In Australia, data such as the Reef Life Survey has been very valuable. **However, there is currently very limited amount of size spectra information openly available. It is crucial for the ecosystem modelling community to access size-based data and have it available through the AODN.**
- Downscaled BGC and physical models are critical for the ability of ecosystem models to downscale to regional levels.
- Need to unify models with data across the size spectrum
- There is interest and support for a national grid that includes BGC shelves-sea model. This will be very helpful as there are already methods for 2-way coupling with ecosystem models, but it is important to have in mind and know the scales in which it needs to operate

9. End-user applications in oceanography

A special invited talk was delivered by Dr Glenn Nolan, Secretary General of EuroGOOS. He talked about the EuroGOOS system and their initiatives around observations, data management and monitoring and forecasting systems, as well as the development of different oceanographic products and services. Other talks within this theme included decision support tools for physical and BGC modelling, regional forecasting systems such as eSAMarine, observing system in estuaries such as Darwin and the surface current estimates to search for MH370. However, examples of end-user applications in oceanography were also included in other themes throughout the workshop.

Key points from this session include:

- End user products need to be consistent across regions in terms of quality, timeliness and resolution with appropriate documentation for both physical and BGC models and observations
- It is important that data formats are tailor to the people that are going to use the data and that the information is fit for purpose.

- When developing end-user products, it is important to ask the end users how they would like the information to be delivered, sometimes what the end-user wants is information delivered in its simplest form.
- There is a very big interest in waves from end-users in Australian and internationally.
- There is a need to design observing systems that overlap with the regions where human activities and populations are.
- Information sharing is crucial to have greater impact, and engagement with stakeholders is very important.
- There is an opportunity to bring output from models running now routinely into a national infrastructure, as a first step towards a National Ocean Modelling System.
- There are pros and cons of operationalising and centralising a system, it has the advantage of an increase in rigour in the system that is being used operationally but the downside is a decrease in the innovation because implementation as an operational system is difficult. In many instances the operational systems are behind state of the art models.

10. Wrap up

The workshop wrapped up at 4:50. Some important final points include:

- The continued increase in resolution in models that span from physics, BGC and ecosystems with an increase need of observations to constraint these models
- Access to data from other projects (ADAPTER), sources (waves and others) and near the coast is needed. Perhaps working with other programs already established nearshore to work around data standards and collection may provide a way and an opportunity for IMOS to extend into the coast by leveraging those programs
- There needs to be discussions with GA to access good bathymetry data at the scales needed for the models.
- The NWP approach of observing system design experiments could be followed for the marine environment but there are still questions of who should fund this, the observing system or the modelling community.
- Sustained observing with relocatable observing assets to monitor extreme events has been an approach that needs further discussion, particularly the need to focus on the questions that need to be answered
- Size based approach gives a way to think about how IMOS can start helping the ecosystem modelling community and gives us ways to better exploit that.
- New technologies coming upstream and needs to be looked at, particularly with respect to nutrients where more observations are needed.
- The National Modelling System discussion has started but there needs further discussion with a modelling community group may need to be form to move it forward that can consider if the models developed at the regional level can be served in a common way. A working group to lead that will be form with perhaps BoM leading.
- There is interest for ACOMO 2018 with perhaps a focus on end-users

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The Shine Dome, Australian Academy of Sciences, Canberra 11-12th October 2016

11th October 2016

8.00–8.30	Arrival, registration and coffee	
8.30–8.40	Tim/Ana	Welcome/introduction/Housekeeping.
Theme Boundary Currents (Chair: Moninya Roughan)		
8.40–9.20	Chris Edwards	Keynote: Fully Coupled Biogeochemical/Physical Ocean Data Assimilation
9.20–9.35	Moninya Roughan, Colette Kerry, Shivanesh Rao, Nina Ribbat, Carlos Rocha, Paulina Cetina Heredia, Amandine Schaeffer, Brian Powell	Modelling and Observing the East Australian Current System and its impacts on shelf circulation, Lagrangian transport and biogeochemistry
9.35–9.50	John Middleton, David Griffin, John Luick and Mike Herzfeld	Hydrodynamic Modelling of the circulation in the Great Australian Bight
9.50–10.05	Gregory Ivey, Jeff Book, Richard Brinkman, Cynthia Bluteau, Alexis Espinosa, Nicole Jones, Sam Kelly, Ryan Lowe, Matt Rayson, Tao Xu, Zhenlin Zhang	Sub-mesoscale dynamics on the Australian North West Shelf (NWS) from Ningaloo to the Kimberley
10.05–10.20	Ivica Janekovic, Charitha Pattiaratchi and Badema Grcic Colette Kerry, Moninya Roughan, Brian Powell and Peter Oke	Predicting the ocean and continental shelf dynamics off Southeastern and central Western Australia using advanced ROMS capabilities
10.20–10.35	Tatiana Rykova and Peter Oke	Merging of East Australian Current eddies observed by Argo float
10.35–10.50	Coffee	
10:50–11.05	Hugo Oliveira, John Middleton, Peter Oke, Richard Coleman	The Upwelling circulation along the shelves of the Great Australian Bight: Idealized simulations and the role of banks and valleys.

11.05–11.20	Amandine Schaeffer, Simone Cosoli, Anthony Gramoulle, Ivica Janekovic, Alessandra Mantovanelli, Hrvoje Mihanovic , Charitha Pattiaratchi, Jennifer Penton, Moninya Roughan	Submesoscale eddies observed by HF radars along the East Australian Current and the Rottnest continental shelf
11.20–11.35	Claire M. Spillman, Craig Steinberg, Jessica Benthuysen, Mike Herzfeld, Hemerson Tonin, Scott Bainbridge, Richard Brinkman, Chari Pattiaratchi, Felicity McAllister and Mark Baird, William Skirving, David Wachenfeld and Rachel Pears	Monitoring & Modelling this Summer's Extreme Temperatures on the GBR leading to a Mass Coral Bleaching Event on the Great Barrier Reef
11.35–11.50	Eric C. J. Oliver, Véronique Lago, Alistair Hobday, Neil J. Holbrook, Scott Ling, Craig Mundy	<u>Identifying historical marine heatwaves off eastern Tasmania with a regional ocean model</u>
11.50–12.05	Ming Feng, Ningning Zhang, Jens Zinke	Climate drivers of marine heatwaves in the southeast Indian Ocean
12.05–12.20	Discussion	
12.20–1.00	Lunch	
Theme Nearshore and Coastal (Chair: Ryan Lowe)		
1.00–1.15	Ian Turner, Tom Beuzen, Mitch Harley, Matt Phillips, Kristen Splinter, Josh Simmons	40-Years of coastline monitoring at Narrabeen: the value of observations to beach process modelling
1.15–1.30	Alexander Atkinson, Hannah E. Power, Theo Moura, Tim Hammond and Tom E. Baldock	Variability and accuracy of wave runup predictions by empirical models on the NSW and QLD open ocean coastline
1.30–1.45	Ryan Lowe, Jeff Hansen, Graham Symonds, Mark Buckley, Andrew Pomeroy, Gundula Winter, Laura Elena Segura, Mike Cuttler, Edwin Drost	Improving predictions of nearshore processes and shoreline dynamics for beaches along Australia's rocky and coral reef coasts
1.45–2.00	Michael Kinsela, David Taylor, Sean Garber, Joanna Burston and Ed Couriel	NSW Nearshore Wave Transformation Tools: Towards an Improved Understanding of Coastal Wave Climates

2.00–2.15	Jason Antenucci, Simon Mortensen, Caroline Lai and Thomas Uhrenholdt	Operational Nearshore Models for Australian Waters
2.15–2.30	Ian R. Young, S. Zieger and A.V. Babanin	Development and application of a global satellite database of wind and wave conditions
2.30–2:45	Mark Hemer, Stefan Zieger, Tom Durrant, Julian O'Grady, Ron K. Hoeke, Kathleen L. McInnes and Uwe Rosebrock	The Australian Wave Energy Atlas
2.45–3.00	Yasha Hetzel, Ivica Janekovic, Charitha Pattiaratchi, E.M.S. Wijeratne, Aron Roland	Resolving wave effects on storm surges with an unstructured high resolution 2–way coupled surge–wave model for Australia
3.00–3.15	Diana Greenslade, Justin Freeman, Holly Sims, Frank Colberg, Stewart Allen, Eric Schulz, Mirko Velic, Prasanth Divakaran, Jeff Kepert, Andy Taylor, Andrew Donaldson, Jason Brownlee Rick Bailey, Mikhail Entel	Development of an operational coastal sea– level forecasting system
3.15–3.30	Coffee	
3.30–3.45	Mark E. Baird, Mathieu Mongin, Jenny Skerratt, Karen Wild– Allen, Emlyn M. Jones, Mike Herzfeld, Nugzar Margvelashvili, Farhan Rizwi, Barbara Robson, Cedric Robillot	eReefs marine modelling: an inter– governmental agency collaboration providing management–relevant estimates of ocean state and the impact of river loads.
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3:45–4:00	Gary Brassington, Narendra Tuteja, Greg Stuart & Jamie Treleaven	eReefs: an integrated catchment and coastal forecasting system for the Great Barrier Reef
4.00–4.15	Tim Moltmann, John Gunn, Jan Flynn, Andreas Schiller, Louise Minty, Roger Proctor, Peter Oke, Moninya Roughan, Emlyn Jones	A National Ocean Modelling System for Australia – what could it look like?
4:15–4:45	Discussion	
4:45–5:00	Dr Ian Poiner, IMOS Advisory Board Chair	Closing
5:00–6:30	Poster session	
7.00 – Late	Dinner – The Parlour	

12th October 2016

Theme Polar Dynamics (Chair: Ben Galton-Fenzi)		
8.30–8.45	Craig Stevens, Stefan Jendersie, Alison Kohout, Pat Langhorne, Natalie Robinson & Mike Williams	New Zealand Initiatives on Ice-Ocean Interaction: Polar Ocean Processes from Ice Shelves to the Marginal Ice Zone
8.45–9.00	Andy Hogg	Consortium for Ocean-Sea Ice Modelling in Australia (COSIMA)
9.00–9.15	David E. Gwyther, Ben K. Galton- Fenzi, Michael S.	Complications in ice shelf-ocean modelling revealed through idealised simulations
9.15–9.30	Bishakhdatta Gayen, Mainak Mondal and Ross W. Griffiths	High Resolution Simulation of Dissolving Ice- shelves in Sea Water
9.30–9.45	Jason L Roberts, Ben Galton-Fenzi, Greenbaum, David Gwyther, Steve Rintoul, Young, Carson, Blankenship, Siegert	Airborne Antarctic Oceanography
9.45–10.00	Leo Peters	Mapping ocean stratification and seafloor bathymetry beneath Antarctic ice shelves: a seismic approach
10.00– 10.15	Ben Galton-Fenzi	The state of regional polar modelling
10.15–	Discussion	
10.30–	Coffee	
Theme BGC and Ecosystems (Chair: Julia Blanchard)		
11.00– 11.45	Simon Jennings	Keynote: From primary production to fish production; role of ecological and environmental processes
11.45– 12.00	Andrew Lenton	Past and future changes in Ocean Acidification around Australia
12.00– 12.15	Helen Macdonald, Niall Broekhuizen, Mark Hadfield, Joanne O'Callaghan, Graham	Modelling of biogeochemical dynamics in New Zealand shelf seas
12.15– 12.30	Jennifer Skerratt, Claire Davies, Mark E. Baird, Anthony Richardson, Mathieu Mongin, Karen Wild-Allen, Ruth	Phytoplankton and zooplankton in the GBR: Insights from IMOS NRS observations and the eReefs model

12.30–12.45	Iain M. Suthers, James Smith, Jason D. Everett, Anthony Miskiewicz, Anthony Richardson and Ana Lara–	Long-term observations of weighted temperature-salinity habitats of larval fish in the western Tasman Front: seasonal, species and family level patterns
12.45–1.15	Lunch	
1.20–1.35	Paulina Cetina-Heredia, M. Roughan, G. Liggins, A. Jeffs, M.A. Coleman	Developing models to predict East Rock Lobster larval dispersal along NSW
1.35–1.50	Martin P. Marzloff, Eric C.J. Oliver, Neville Barrett, Neil J. Holbrook, Lainey James, Simon Wotherspoon,Craig R. Johnson	Differential vulnerability of deep-reef habitat-forming organisms to Climate change
1.50–2.05	Stuart Corney, Jessica Melbourne-Thomas, Andrew Constable, Rowan Trebilco and	Integrated ecosystem modelling in the Indian Sector of the Southern Ocean
2.05–2.20	Julia Blanchard, Ryan Heneghan, Jason Everett, Rowan Trebilco, Anthony J. Richardson	Modelling the size spectrum: from individuals to ecosystems and from bacteria to whales
2.20–2.35	Discussion	
Theme End user applications in oceanography (Chair: Emma Sommerville)		
2.39–3.09	Glenn Nolan, V. Fernandez, E. Buch, P. Gorringe, D. Eparkhina	EuroGOOS member services to operational oceanography end-users in Europe. Abstract
3.09–3.24	Scott Condie, Rebecca Gorton and Karen Wild-Allen	Decision support tools realizing the potential of physical and biogeochemical modelling Abstract
3.24–3.39	Charles James, Paul Sandery, John Middleton, Trent Mattner, Shane Roberts, Kirsten Rough, Henry Ellis, Ana Redondo	eSAMarine, Phase 1: Developing a now- cast/forecast system for Australia's Southern Shelves
3.47–4.02	M. Herzfeld, F. Rizwi and M. Baird	RECOM : A RElocatable Coastal Ocean Model
4.00–4.15	Coffee	
4.20–4.35	David Griffin, Mark Hemer, Charles James and Mike Herzfeld	What do we mean by "Surface Current"?
4.35–4.50	O Makarynskyy, D K Williams	Assessing fluxes through oceanic boundary of Darwin Harbour
4.50–5.00		DISCUSSION
5.00–5.30		Wrap up

Posters

Boundary Currents	
Jessica Benthuysen, Hemerson Tonin, Michael Herzfeld	Freshening events and hypersaline conditions in the Central Great Barrier Reef
Nina Ribbat, Moninya Roughan, Brian Powell	Mean circulation on the continental shelf off South-East Australia 31.5-34.5: The Hawkesbury Bioregion 2012-2013
Amandine Schaeffer, Moninya Roughan, Tim Austin, Ben Hollings, Edward King, Alessandra Mantovanelli, Stuart Milburn, Benedicte Pasquer, Charitha Pattiaratchi, Robin Robertson, Dennis Stanley, Iain Suthers, Dana White	Mean hydrography on the continental shelf from 26 repeat glider deployments along Southern Australia
Helen Beggs, Chris Griffin, Leon Majewski, Edward King and Janice Sisson	IMOS sea surface temperature products suitable for near-coastal applications
Boris Kelly-Gerreyn, Chris Tingwell, Sergei Soldatenko, Peter Steinle, Robert de Maid & Agnes Lane	Fit for Purpose Marine Observations - using models for data impact studies and network design
Boris A. Kelly-Gerreyn, Brian Ingham, Jane Warne, Helen Beggs &	The Australian Bureau of Meteorology's core marine observing networks
Phil Reid, Bernadette Sloyan, Claire Spillman and Rob Argent	SST in Australia EEZ
Robin Robertson	Surface Mixed Layer Dynamics, Winds, Tides, and Vertical Mixing Parameterizations in the Regional Ocean Modeling System (ROMS)
Sarath Wijeratne, Charitha Pattiaratchi and Roger Proctor	ozROMS - a high resolution16 year re-analysis product for Australian and Indonesian Seas
Peter R. Oke, Tatiana Rykova, Bernadette Sloyan, Susan Wijffels	Guidance for glider deployments in an energetic western boundary current: East Australian Current example
Madeleine Cahill and Hugo Bastos de Oliveira	Monitoring Coastal Upwelling using Altimetry: a Feasibility Study

Gabriela Semolini Pilo, Peter Oke, Tatiana Rykova, Richard Coleman and Ken Ridgway	Spatial patterns of eddy vertical speed using a global eddy-resolving model output
Matthew R. Archer, Moninya Roughan, Shane Keating and Amandine Schaeffer	Meandering of the East Australian Current at 30ºS
Nearshore and Coastal	
Hua Xiao Wang	Effects of dredging and its spoil dumping on suspended-sediment dynamics: Observation and numerical simulation in Darwin Harbour, Australia
Youn-Jong Sun, X H Wang, Donghui Jiang	A coastal upwelling by wind-driven forcing in Jervis Bay, NSW: A numerical study of 2011
Joshua Simmons, Mitchell Harley, Kristen Splinter, Ian Turner	Coastal erosion model calibration and validation: a critical evaluation utilising observations from a data-rich coastline
Shivanesh Rao, Moninya Roughan, Nina Ribbat	Understanding the influence of freshwater discharge in Sydney Harbour and the Hawkesbury Bio-region
A. Zhong, Neal Moodie, Stefan Zieger and Diana Greenslade	Operational wave modelling and forecasting in Australia
Oleg Makarynskyy, David K. Williams, Dina Makarynska, Andrew P. Negri	Using data from NRS Darwin for improved hydrodynamic and hydrocarbon spill modelling assessments
BGC and Ecosystems	
Karen Wild-Allen, Scott Hadley, John Andrewartha	Anthropogenic nutrient dynamics in the Derwent and Huon Estuaries in southeast Tasmania
Carlos Rocha, Christopher Edwards, Colette Kerry, Moninya Roughan	Towards biogeochemical modelling of the EAC system
Barbara Robson, Jenny Skerrat, Mike Herzfeld, Karen Wild-Allen, Mathieu Mongin, Emlyn Jones, Nugzar Margvelashvili, Murray Logan, Britte Schaffelke	Evaluating a marine model for the Great Barrier Reef: from time-series to emergent properties

Jamie Treleaven, Luke Garde, Edward King and Greg Stuart	Marine Water Quality service for the Great Barrier Reef
Vivian Yeung, Jason D. Everett, Anthony J. Richardson and Iain M. Suthers	Quantifying the oceanographic and seasonal patterns of zooplankton size-structure at the IMOS National Reference Stations
Jason D. Everett, Anthony J. Richardson, Mark E. Baird and ZOOM Task Team	Bridging the zooplankton gap between models and observations: The IMOS Zooplankton Ocean Observations and Modelling Task Team (ZOOM)
Polar Dynamics	
Phil Reid and Rob	Antarctic coastal exposure
Robin Robertson	Tidal Effects in the Amundsen Sea
Wilma Huneke, Andreas Klocker, Ben Galton-Fenzi	Heat transport across the Antarctic Slope Front
Madelaine Rosevear, Ben Galton-Fenzi, Mark Rosenberg	Basal Melting of Antarctic Ice Shelves
End user applications in	
Craig Stevens, Joanne O'Callaghan, Mark Hadfield, Ben Knight, Peter McComb, Ross Vennell and Stephen	A New Initiative for Connecting Observations and Modelling in the Central New Zealand Zone
Aurel Moise, Tim Pugh, Ben Evans	Community Research Services – The Australian Climate and Weather Science Virtual Laboratory
Hemerson Tonin, Craig Steinberg, Richard Brinkman and Elizabeth (Libby) Evans- Illidge	Improving water security for Great Palm Island – a preliminary study towards implementation of desalination plant.
Greg Hibbert and Andy Taylor	Research dialogue to connect global ocean forecasts with Dynamic Under Keel Clearance® services
Tim Ingleton	Mind the gap: building towards a completed high-resolution nearshore digital elevation model and bathymetry for improved management of the NSW Coast