GODAE OceanView

Meeting report

2nd GODAE Observing System Evaluation Workshop: Towards Routine Monitoring

4-5 June 2009

CLS/Mercator Ocean, Toulouse, France

This 2-day workshop was convened by Peter Oke (CSIRO) and Gilles Larnicol (CLS)

Organisers: Kirsten Wilmer-Becker (UKMet) and Corinne Guiose (CLS)

Contact address:

Kirsten Wilmer-Becker
GODAE Project Office Coordinator
The Met Office
FitzRoy Road
Exeter, EX1 3PB
UK
Email: Kirsten.Wilmer-Becker@metoffice.co.uk
Telephone: +44 (0)1392 884916

The OSE/OSSE workshop group[1], at CLS, Toulouse, France

The workshop website is www.godae.org/OSSE-OSE-Second-workshop.html

Presentations referred to in this report are downloadable from the GODAE website www.godae.org/GOVST-OSE-II-presentations.html.

[1] Back row from left: Anthony Weaver, Eric Dombrowsky, Gary Brassington, Jim Cummings, Stan Wilson, Laurent Bertino; Middle row from left: Fabrice Hernandez, Gilles Larnicol, Pierre-Yves, Le Traon, Andreas Schiller, Juliette Lambin, Gerald Dibarboure, Ichiro Fukumori, Dan Lea; Front row from left: Fabrice Hernandez, Marie Drevillon, Yosuke Fujii, Benoit Tranchant, Stephanie Guinehut, Elisabeth Remy, Peter Oke, Kirsten Wilmer-Becker

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I. Background

Purpose

To date, observing system evaluation activities conducted under GODAE, and related programs, have arguably been academic exercises, designed to assess the limitations of the Global Ocean Observing System (GOOS) for GODAE systems (including forecast, reanalysis and analysis systems). These have typically involved Observing system Experiments (OSEs). The nature of OSEs is that they are performed several years after observations are collected (e.g., during periods when data from 4 altimeters were available and when the Argo program was still incomplete). The GOOS is constantly changing. The significance of the completed OSEs, while providing important insights, is therefore increasingly irrelevant to the observational community. Many such activities were undertaken during GODAE. Results from many of these activities were presented at the 1st GODAE-OOPC OSE/OSSE meeting in November 2007 (in Paris; www.godae.org/OSSE-OSE-First-workshop.html), and were presented at the final GODAE Symposium, and will soon be published in a GODAE special issue of the *Oceanography Magazine*.

To have a real impact on the operational oceanography community, the GODAE community should plan to transition OSE activities towards routine monitoring. Conventional OSEs, where observation types are systematically with-held are probably too computationally expensive to be performed routinely. There are other less expensive diagnostic tools available that could be employed to monitor the GOOS for GODAE purposes. The purpose of this workshop is to explore these options, come to agreement on a way forward under GODAE Oceanview (GOV), the new sustained phase of GODAE, and establish a plan for coordinated routine monitoring of the GOOS for GODAE applications.

Scope

If information from GODAE quality control (QC) systems, assimilation diagnostics, and analysis/forecast sensitivities were collated, interpreted and delivered to the observational community, with specific conclusions and recommendations on a routine basis, the GODAE community may have a significant impact on the design and maintenance of the GOOS. This may involve the provision of regular (perhaps quarterly or monthly) reports that describe the relevant diagnostics from GODAE systems to the observation community.

Quality control

All GODAE systems include some form of quality control (QC) systems. These systems return information that, if coordinated, could return useful information to the observational community. For example, suppose several QC systems used under GODAE reject the data from the same Argo floats, altimeter tracks, XBT transects, SST swaths etc. This may be an indication of problems with instruments, sensors and/or processing. If coordinated, the GODAE community could return this information to the observational community.

Assimilation diagnostics

Basic assimilation statistics, like background/forecast and analysis innovations may provide useful information that could be fed back to the observational community.

Analysis sensitivities

With a relatively small computational overhead, all GODAE systems could estimate analysis self-sensitivities that provide an indication of how sensitive an analysis is to every assimilated observation or how the observations are complementary. This type of analysis is routinely used by the NWP community (e.g., at ECMWF) to identify the most/least beneficial observations and those observations that have minimal impact on each analysis.

Forecast sensitivities

Forecast sensitivities are relatively inexpensive tools that can be applied to some systems that would enable us to quantify the impact/importance of each observation on the forecast skill of a forecast system.

Outcomes

The key outcome of this workshop will be agreement on how GOV partners can and should move towards routine monitoring of the GOOS; agreement on how this can/should be coordinated between the international groups; and a staged plan for moving these activities towards routine monitoring so that the GODAE community can have a real impact on the design, assessment and maintenance of the GOOS.

II. Executive Summary

This was the 2nd meeting of the GODAE Observing System Evaluation (OSE) Task Team (TT). Some of the key questions that were addressed at this meeting relate to how the TT will function in practice; what types of activities will the TT pursue; how the TT will engage, and interact with, the international community – particularly the observation agencies and communities – to have a positive impact.

It was agreed that one of the key objectives of the TT is to demonstrate the value and importance of each observation platform (e.g., altimeters, SST programs, Argo, etc.) to GODAE systems. This includes reactive actions, when there are “observing system events”, like the safe-hold of an altimeter mission. It was agreed at this workshop that, under the coordination of the OSE TT co-chairs (Peter Oke and Gilles Larnicol), members of the OSE TT will be actively solicited for specific demonstrations of the impact of such events. This information would be consolidated by the co-chairs and delivered to the GOV co-chairs (Eric Dombrowsky and Andreas Schiller). The GOV co-chairs would then forward this information to GODAE patrons and observational agencies and communities as they deem appropriate. Several actions that will eventually help facilitate these activities were agreed at this workshop. This includes the routine consolidation and dissemination of common assimilation diagnostics from GODAE systems. These

diagnostics were discussed in session 2 of this workshop. This will help the OSE TT respond more efficiently and more effectively to observational events. It was also agreed that a new suite of analysis tools will be developed by each GODAE system. If they are found to be useful, these tools could be routinely applied to help demonstrate the value of observations to GODAE systems.

Another key objective of the OSE TT that was affirmed at this workshop is the role of the TT in supporting planning for new observation platforms. This might involve assessing the relative merits of different altimeter constellations, for example. Many TT participants already undertake such activities. Examples of these activities were presented in session 3, and several outstanding questions from the observational patrons were identified in session 1 of this workshop. A specific example that was highlighted at the workshop is the possibility of the discontinuance of Jason-1 operations. Some specific actions relating to this event were agreed upon at this workshop. These are detailed below. It is hoped that through greater coordination, the OSE TT might promote these types of studies so that the TT can contribute to discussions relating to planned changes to the observing system in a more timely and effective manner.

A special guest, Dr. Florence Rabier from Meteo-France, participated in the first day of the workshop. Dr. Rabier is a former chair of the NWP program THORPEX – an international NWP program that shares some of the goals and interests of the GOV OSE TT. One of these goals includes the design and assessment of the atmospheric observing system. Dr. Rabier shared the experiences of the NWP community in this area. This was very constructive and provided the workshop with some invaluable guidance and advice.

Several specific actions were agreed upon during the workshop. These include specific short-term actions relating to Jason-2, as well as development of new capabilities and consolidation and inter-comparisons of existing diagnostics.

III. Meeting Organisation

Meeting structure

The meeting consisted of a variety of invited talks from presenters coming from international institutions and observing system agencies. All presentations were given in a plenary forum, followed by an open discussion on the final day. The meeting started at 09:00 on Thursday, 4 June 2009 at CLS/Mercator, Ramonville, France and finished Friday, 5 June 2009 at 16:00. The arrangement of the meeting to run over 2 days allowed sufficient time for an overview of the status of relevant international programs, an update on the status of OSE activities and assimilation diagnostics from each GODAE partner, and discussion on future community activities.

Attendees

The workshop was well attended by GODAE partners and observational agencies. The GODAE partners represented at the workshop include Bluelink, CLS, JMA-MRI, Mercator, NRL-HYCOM, TOPAZ, UK Met; and the observational agencies represented include JCOMM-OPS (Argo, in situ programs), NOAA (altimetry), and CNES (altimetry). A complete list of attendees is at www.godae.org/2nd-OSE-WS-participants.html and in Appendix A.1.

Meeting sessions

Session 1: Introduction and Overview of observing system components

Session 2: Assimilation diagnostics and metrics

Session 3: General Contributions on Evaluation of GODAE systems and OSE/OSSE activities

Session 4: Discussion: How to move forward?

The content of the presentations in session 2 were motivated by circulation of the following questions prior to the meeting.

- What assimilation diagnostics are currently computed from your system? How are they archived? How are they used? How could we use them to help monitor the GOOS?
- System overview:
    - Method (e.g. OI, Cooper and Haines, SEEK, EnOI, etc.)
    - What data are assimilated directly? with-held? super-obed?
- System diagnostics:
    - What diagnostics are computed routinely? (e.g., Background minus Observations, and Analysis minus Observations, …);
    - How are they used and interpreted?
    - How are they archived?
- System performance:
    - When/where/why does the system perform well/poorly?
    - What are the known limitations/problems with the system?
    - Do you already consider any diagnostics to monitor the GOOS?
        - to detect problems with instruments (biases etc);
        - to identify regions of the ocean that are under-sampled

The discussion in session 4 was motivated by the circulation of the following questions prior to the meeting.

- What can we, as the GODAE/OSE community, do to feed back information to the observation programs for the benefit of the broader oceanographic community?
- What is feasible?
- What is likely to be fruitful?
- Who will do what?

All presentations are available at: www.godae.org/GOVST-OSE-II-presentations.html.

Meeting report

This report contains a summary of the presentations and the action items resulting from the discussion in the last session of the meeting. The meeting was convened by Peter Oke and Gilles Larnicol. The meeting started at 9.00 on Thursday, 4 June 2009 at CLS, 8-10, rue Hermès, Parc Technologique du Canal, 31520 Ramonville Saint-Agne, France.

IV. Full Meeting Report

Summary of Presentations

Gilles Larnicol, the meeting host, welcomed everyone and dealt with practical details of the meeting location, internet access, lunch arrangements and so on.

Peter Oke gave an introductory presentation, describing the purpose of the meeting and the vision for the OSE TT under GOV.

Presentations in session 1 of the workshop included overviews of GOV, the Expert Team on Operational Ocean Forecast Systems (ET-OOFS), as well as summaries of the status and plans for satellite observation programs and in situ measurement programs. A presentation on the lessons learnt from THORPEX, an international program of the numerical weather prediction community with a focus on observing system evaluation and monitoring, was given by Florence Rabier from Meteo France, who was the chair of THORPEX. This presentation provided the workshop attendees with an excellent sense for what could be achieved as a community.

The introductory presentation on GOV, presented by Eric Dombrowsky, highlighted the need to transition and consolidates what GODAE has developed. The co-chairs of GOV are currently developing a document that describes the Terms of reference (ToR) for GOV. The GOV co-chairs identified a key role of GOV, relevant to this workshop, as the need to assess the impact of observations on forecasts and analysis and contributing to the discussions on the design of GOOS.

The introductory presentation on ET-OOFS, presented by Gary Brassington, identified one of the roles of ET-OOFS as a mechanism for establishing essential climate variables. This includes the establishment of a “statement of guidance” for operational centres. One way for the OSE TT to influence the operational GODAE systems is by providing recommendations for the statement of guidance.

The presentations from observation representatives identified the ongoing need for GOV to demonstrate the value of each observation component. Specific aspects of the design of the GOOS that the OSE TT could contribute to were described and are included in a "list of OSSE questions" in the action items listed below.

Presentations in session 2 of the workshop focussed on the developments, evaluation, and diagnostics that are routinely derived from existing GODAE systems. A representative of different GODAE partners, including NRL, Mercator, UK Met, Bluelink, TOPAZ, JMA, CLS, and CERFACS, described the status of their systems, the metrics and diagnostics that are routinely computed and archived, and the efforts to evaluate each system. It was clear that all GODAE systems compute a common set of diagnostics. These diagnostics include the innovation statistics (observation minus background and observation minus analysis fields), as well as statistics of the increments. Many groups also regularly compute metrics that quantify the performance of their system in forecasting eddies; and many groups routinely perform consistency checks between the error estimates and innovation statistics. These common diagnostics are referred to below, under Action 4.

Presentations in session 3 included a description of various activities involving conventional OSEs and OSSEs. For example, one presentation included results from a series of OSEs designed to assess the degradation of the performance of the JMA-MRI seasonal prediction system when data from Argo or the TAO array are with-held. Several presentations described results from studies designed to assess the impact of coastal and shelf-scale observations; and several presentations addressed the potential impact of new and future satellite observations, such as sea-surface salinity observations, or altimetry (GOCE, high resolution, Jason 3) on GODAE systems. While all of these studies have merit, it is clear that these activities lack the coordination that is probably needed for them to have real impact. This recognition, in part, motivated Action3 below.

Workshop Outcomes and list of actions

Outcomes from this workshop include an agreement on the objectives of the GOV OSE TT, agreement on the organisational structure of the TT, TT membership, and its relationship to other international groups. Additionally, four specific actions were identified. Details of these actions, including deadlines, are presented below.

Action 1: 4-year work plan

The deadline for the action is 15 July.

The GOV OSE TT co-chairs will generate a 4-year work plan. This will describe how the OSE TT will function under GOV; the relationship between the OSE TT and inter-comparison/validation TT; the role of the OSE TT in the international context. The OSE co-chairs will be circulate the work plan to OSE members and the GOV science team for comment before seeking endorsement from the GOV co-chairs.

Specific discussion on issues to be included in the work plan include:

- How will the OSE TT and the Inter-comparison/Validation TT interact?
- Should the OSE TT become a joint GODAE OceanView and ET-OOFS TT?
- How will the OSE TT engage with the broader community?
- Should the OSE TT join, or possibly lead, a SCOR working group on OSE?

Many of these issues were deferred to the GOV ST meeting (held on 8-10 June 2009 at CLS/Mercator), and some issues are yet to be worked through. These will be addressed in the process of writing and refining the OSE TT work plan.

Action 2: Short-term actions, recommendations for Jason-1

The deadline for provision of Jason-1 recommendations was agreed to be 15 July 2009. However, immediately following the workshop the OSE TT co-chairs drafted a letter to the Ocean Surface Topography Science Team (OSTST), including results from Dan Lea (UK Met), stating the view of GOV to the potential discontinuance of Jason-1 operations. The GOV co-chairs subsequently forwarded this letter and results to Josh Willis, and others, from the OSTST prior to the OSTST meeting, held in 22-24 June 2009.

In general, the workshop demonstrated that the GOV OSE TT has a key role to play for the provision of recommendations to the observing agencies and community. This indicates that there are likely to be regular, specific short term actions for the OSE TT. These will be managed by the co-chairs. The issues relating to Jason-1, described above, is an example of such an action.

The motivation for this action items is to demonstrate the benefits of continued Jason-1 operations for GODAE systems. Such a demonstration is required by July 2009. Jim Cummings agreed to collate results that demonstrate the benefits of Jason-1 for wave height forecasts; and Gary Brassington and Daniel Lea agreed to collate results that demonstrate the benefits of Jason-1 for the operational Bluelink and UK Met systems respectively. These results are to be forwarded to the OSE TT co-chairs, who will collate them and forward them to the GOV co-chairs for dissemination to GOV patrons as appropriate.

Action 3: OSSE activities

The deadline for this action is 15 July 2009.

The motivation for this activity is to ultimately facilitate the timely response of the GOV OSE TT to potential developments in possible new observing system platforms. Workshop participants agreed to:

- identify a single nature run to be used for OSSE activities (ideas for possible nature runs should be sent to the OSE TT co-chairs);
- collate a list of key questions that we need to ask (ideas for “GODAE OSSE questions” should be sent to the OSE TT co-chairs); and
- communicate OSSE ongoing activities.

Additionally, the OSE TT co-chairs will seek input on OSSE questions from observational agencies and facilitate access to community nature run once a suitable run has been identified and agreed upon.

The current working list of "key GODAE OSSE questions" includes:

- Do we need a reference altimeter mission?
- What is the optimal design of Jason-4?
- What is the optimal design for Cryosat 2?
- What is the value of “drifting altimeter missions” with addition error?
- Often, as observation platforms age their accuracy diminishes. What are the error thresholds for which observations remain useful for GODAE systems?
- Is a 3x3 Argo array optimal? Can GODAE systems be used to refine this design?
- What are the potential benefits of Sea Surface Salinity satellite observations?
- What is the impact of Argo in exclusive economic zones? How important is this data for constraining GODAE systems?
- How many T/S levels are assimilated by models? (50, 1000, …)
- Is there a need for deep ocean floats? (e.g., Argo measuring closer to full depth?
- Argo doesn't measure the marginal seas - what is the benefit of monitoring these regions?
- What is the relative impact of different SST observations (e.g., AVHJRR, AMSR-E, AATSR, etc.) on GODAE systems?

Action 4: Community diagnostics

The specific actions and deadlines for this action are:

- the OSE TT co-chairs will generate and circulate a metrics document by 30 September 2009; and

- GODAE partners are requested to indicate their ability to provide these data routinely, and the conditions under which they can provide data, by 31 October 2009 (one month after the metrics document is circulated).

The motivation for this activity is to facilitate timely demonstrations of the impact of "observing system events" (e.g., safe hold of altimeter mission; addition of new observations). Based on the presentations in session 2, it is clear that each group already calculates and archives common diagnostics in observation space. These include a vectors of assimilated observation (and/or super-observations), background fields and analyses for each observation type (SLA, SST, T/S), interpolated to each observation location. The workshop participants agreed to make these fields available so that they can routinely be synthesised for different domains (e.g., each western boundary current regions, tropical basins, etc.) and disseminated on the GODAE website. Additionally, each group agreed to provide analysis and 0-5 d forecasts of zonal and meridional velocities, sea-level anomalies, sea-surface temperatures, and mixed-layer depth. It was noted that some groups will require permission to release these data in NRT. The availability of these fields will allow the OSE TT:

- to quantify forecast errors and how these change with "events";
- to enable qualitative animations with drifter trajectories overlaid;
- to estimate eddy statistics (paths, intensity, etc); and
- perhaps even just for the 1st and 3rd Monday of each month.

The OSE TT co-chairs will generate a metrics document, based on the metrics already established by the inter-comparisons/validation TT, and will circulate this to relevant workshop participants. This metrics document will be co-authored by both the OSE and inter-comparison/validation TT co-chairs (Fabrice Hernandez and Matt Martin).

Action 5: Capability building

An immediate action item is for Peter Oke to circulate relevant references (see below) and sample code.

The relevant references for analysis sensitivity are:

Cardinali, C., S. Pezzulli, E. Andersson, 2004: Influence-matrix diagnostic of a data assimilation system. *Quarterly Journal of the Royal Meteorological Society*, **130**, 2767–2786.

Chapnik, B., G. Desroziers, F. Rabier, O. Talagrand, 2006: Diagnosis and tuning of observational error in a quasi-operational data assimilation setting. *Quarterly Journal of the Royal Meteorological Society*, **132**, pp. 543–565 doi: 10.1256/qj.04.102.

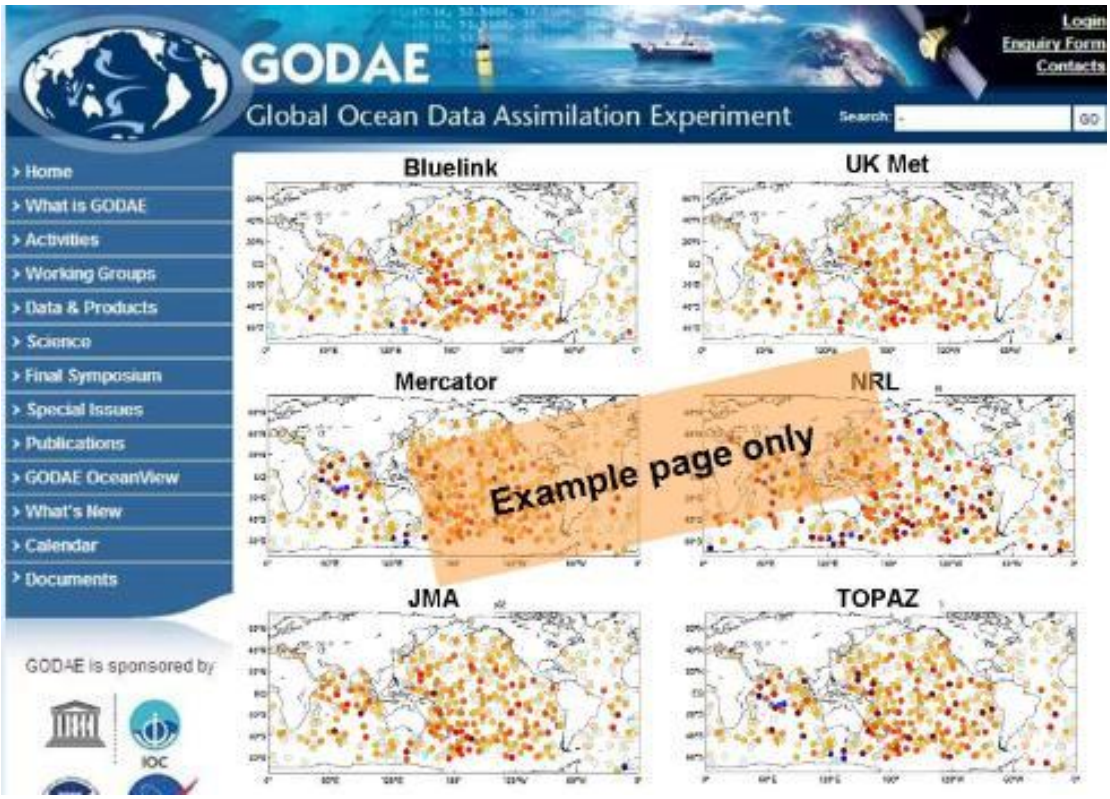
Rabier, F., P. Gauthier, C. Cardinali, R. Langland, M. Tsyrulnikov, A. Lorenc, P. Steinle, R. Gelaro, K. Koizumi, 2008: An update on THORPEX-related research in data assimilation and observing strategies. Nonlin. Processes Geophys., 15, 81–94.

The target deadline for the development of this capability is 30 September 2009. If all goes to plan, a demonstration case, with each group computing and sharing their analysis self-sensitivity estimates, will be undertaken in the last quarter of 2009. This will be prompted and coordinated by the OSE TT co-chairs.

The motivation for this activity item is to develop the capability that will facilitate the routine evaluation of the impact of every assimilated observation that can be fed back to the relevant observation agencies. Workshop participants agreed that calculations of analysis self-sensitivity are possible for all groups. These calculations require an additional analysis to be performed using a perturbed set of observations. These calculations are relatively inexpensive. The analysis self-sensitivity estimates are computed in observation space, and can be used to compute the sub-trace for different variables and regions.

Representatives from each GODAE partner agreed to develop this capability in research mode. Additionally, representatives from each GODAE partner agreed to perform this analysis for a demonstration case, and to work towards routine performance.

A possible mechanism for delivery of action item 3 follows below.



Appendices

Appendix A.1 – Attendance list

Co-chairs:	Gilles Larnicol	CLS, France
	Peter Oke	CSIRO, Australia
Participants:	Mathieu Belbeoch	JCOMMOPS
	Laurent Bertino	NERSC, Norway
	Gary Brassington	BoM, Australia
	Jim Cummings	NRL, USA
	Eric Dombrowsky	Mercator Ocean, France
	Marie Drevillon	Mercator Ocean, France
	Gerald Dribaboure	CLS, France
	Yosuke Fujii	JMA/MRI, Japan
	Ichiro Fukumori	JPL/NASA, USA
	Stephanie Guinehut	CLS, France
	Corinne Guiose	CLS, France
	Fabrice Hernandez	Mercator Ocean, France
	Juliette Lambin	CNES, France
	Pierre-Yves Le Traon	Ifremer, France
	Dan Lea	Met Office, UK
	Florence Rabier	Meteo France
	Elisabeth Remy	Meteo France
	Marie-Helene Rio	CLS, France
	Andreas Schiller	CSIRO, Australia
	Benoit Tranchant	CERFACS, France
	Hester Viola	JCOMMOPS
	Anthony Weaver	CERFACS, France
	Kirsten Wilmer-Becker	Met Office, UK
	Stan Wilson	NOAA, USA

Appendix B.1 - Session information

Presentations will be motivated with the following questions prior to the meeting:

Session 1: Overview of observing system components and activities (open session)

- What is the status, plans, progress, strengths and weaknesses of each platform?

Session 2: Assimilation diagnostics (open session)

- What assimilation diagnostics are currently computed from your system? How are they archived? How are they used? How could we use them to help monitor the GOOS?
- System overview:
  - Method (e.g. OI, Cooper and Haines, SEEK, EnOI, etc.)
  - What data are assimilated directly? with-held? super-obed?
- System diagnostics:
  - What diagnostics are computed routinely? (BG minus Obs, An minus Obs, biases, …);
  - How are they used/interpreted?
  - How are they archived?
- System performance:
  - When/where/why does the system perform well/poorly?
  - What are the known limitations/problems with the system?
- Do you already consider any diagnostics to monitor the GOOS?
  - to detect problems with instruments (biases etc);
  - to identify regions of the ocean that are under-sampled

Session 3: OSE/OSSE activities (open session)

- Presentations will be solicited from invited participants and others on recent OSE/OSSE activities

Session 4: How to move forward? (closed session)

- What can we, as the GODAE/OSE community, do to feed back information to the observation programs for the benefit of the broader oceanographic community? What is feasible? What is likely to be fruitful? Who will do what?

Appendix B.2 – Meeting agenda

Day 1 - Thursday, 4 June 2009

09:00	Peter Oke/Gilles Larnicol - Welcome and workshop objectives
Session 1:	**Introduction and Overview of observing system components (open session)**
09:30	Andreas Schiller/Eric Dombrowsky - Status of GODAE OceanView
09:45	Gary Brassington – Status of JCOMM ET-OOFS
10:15	Juliette Lambin/Gerald Dibarboure - Satellite altimetry: status and products
10:45	Mathieu Belbeoch/Hester Viola - JCOMM-OBS international coordination and Argo and other in situ programs status
11:15	**Coffee break**
11:30	Jim Cummings - Forecast sensitivity: towards routine monitoring of the GOOS at NRL
11:45	Florence Rabier - Lessons learned from THORPEX
12:30	**Lunch**
Session 2:	**Assimilation diagnostics and metrics (open session)**
13:30	Marie Drevillon - Mercator-Ocean
13:50	Jim Cummings - NRL
14:10	Anthony Weaver - Ensemble/Var diagnostics
14:30	Dan Lea - UK Met Office
14:50	Gary Brassington/Peter Oke - BLUElink
15:10	Laurent Bertino - TOPAZ
15:30	**Coffee break**
16:00	Yosuke Fujii - JMA
16:20	Gilles Larnicol/Stephanie Guinehut – CLS
16:40	Anthony Weaver/Peter Oke - Discussion *What diagnostics are could be fed back to observational groups to support design, maintenance and justification for the GOOS? Can we coordinate our routine activities to help support each other and help improve our systems?*
18:00	End of Day 1
20:30	**Dinner**

Day 2 - **Friday, 5 June 2009**

Session 3:	**General Contributions (15-30 minute presentations depending on numbers; open session); Topics include: Evaluation of GODAE systems, OSE/OSSE activities**
09:00	Yosuke Fujii - OSE experiments using the JMA ENSO forecasting system
09:20	Laurent Bertino - Evaluating the assimilation of Ferrybox data between Norway and Denmark
09:40	Gary Brassington - Impact of SSS on a multivariate assimilation system
10:00	Marie-Helene Rio - Impact of GOCE for modelling centers: status of GOCINO

10:20	Gerald Dibarboure - Future altimetry design : from impact studies to operational metrics or the reverse ?
10:40	**Coffee break**
11:00	Peter Oke - Potential impact of HF radar and gliders on ocean forecast system
11:20	Elisabeth Remy - Sensitivity studies within GLORYS project (title to be confirmed)
11:40	Benoit Tranchant - Multivariate data assimilation (SAM2) of Simulated (SMOS and Aquarius) SSS in a 1/3° Atlantic ocean model (MNATL)".
12:00	Peter Oke/Gary Brassington - GODAE inter-comparisons around Australia
12:30	**Lunch**
Session 4:	**How to move forward? (closed session)**
13:30	Discussion: • Currently available assimilation and QC metrics • Proposal for routine observing system assessment • International coordination • Options for engaging with observational community
15:30	**Coffee break**
16:00	Action: - Collating information and disseminating
18:00	End of Day 2

Appendix C.1 – Presentations

Following the agenda items, presentations can be downloaded from the table below.

Agenda item	Title of presentation / download	Presenter
Welcome	Welcome and meeting objectives (.ppt, 0.6MB)	Gilles Larnicol (CLS)
Introduction	GOVST-OSE Introduction (.ppt, 22MB)	Peter Oke (CSIRO)
1.1	Status of GODAE OceanView (.ppt, 0.2MB)	Eric Dombrowsky (Mercator Ocean)
1.2	Status of JCOMM ET-OOFS (.ppt, 7.5MB)	Gary Brassington(BoM)
1.3a	Satellite altimetry: status and products (part 1) (.ppt, 2.3MB)	Juliette Lambin (CLS)
1.3b	Satellite altimetry: status and products (part 2) (.ppt, 2.3MB)	Gerald Dibarboure (CLS)
1.4a	JCOMMOPS & Argo, DBCP, SOT, OceanSITES (.ppt, 4MB)	Mathieu Belbeoch (JCOMMOPS)
1.4b	Data Buoy Cooperation Panel Ship Observations Team OceanSITES (.ppt, 4MB)	Hester Viola (JCOMMOPS)
1.5	Observation Impact using a Variational Adjoint System (.ppt, 1MB)	Jim Cummings (NRL)
1.6	Lessons learnd from THORPEX (ppt, 5.2MB)	Florence Rabier (Meteo-France)
2.1	Overview of Mercator Ocean Cal/Val activities (.ppt, 1.6MB)	Marie Drevillon (Mercator Ocean)
2.2	Overview 1/12º Global HYCOM Nowcast/Forecast System	Jim Cummings (NRL)
2.3	Assimilation diagnostics from a global 3D-Var system (.pdf, 0.4MB)	Anthony Weaver (CERFACS)
2.4	Assimilation diagnostics and metrics – UK Met Office FOAM system (.ppt, 22MB)	Dan Lea (Met Office)
2.5	BLUElink ocean forecast: System (.ppt, 20MB)	Gary Brassington/Peter Oke (BoM/CSIRO)
2.6	TOPAZ evaluation (.ppt, 7MB)	Laurent Bertino (NERSC)
2.7	Quality Control and Diagnostic of Observation Data in Operational Ocean Data Assimilation Systems in JMA (.ppt, 9.5MB)	Yosuke Fujii (JMA-MRI)
2.8	Ocean state estimates from the observations - Contributions and complementarities of Argo, SST and Altimeter data (.ppt, 11MB)	Gilles Larnicol/Stephanie Guinehut (CLS)
3.1	OSE Experiments Using the JMA-MRI ENSO Forecasting System (.ppt, 4MB)	Yosuke Fujii (JAM-MRI)
3.2	Data assimilation exercise in the Skagerak (.pdf, 2.9MB)	Laurent Bertino (NERSC)
3.3	Estimating observing system error thresholds using an asymptotic approach (.ppt, 14MB)	Gary Brassington (BoM)

3.4	Impact of GOCE for modelling centres: status of GOCINO	Marie-Helene Rio (CLS)
3.5	Future altimetry design: From impact studies to operational metrics or the reverse? (.ppt, 5MB)	Gerald Dibarboure (CLS)
3.6	Potential impact of HF radar and gliders on ocean forecast system (.ppt, 4.5MB)	Peter Oke (CSIRO)
3.7	Observation impact studies with ocean reanalysis (.ppt, 3.3MB)	Elisabeth Remy (Mercator Ocean)
3.8	Interest of assimilating future Sea Surface Salinity measurements from SMOS and Aquarius missions in an operational ocean forecasting system (.ppt, 2.3MB)	Benoit Tranchant (CERFACS)
3.9	GODAE inter-comparisons around Australia (.ppt, 16.5MB)	Peter Oke (CSIRO)