

National Report - Australia

a. Country – represented group

Background

1. Input data

In situ profile data:

- 2700 observations/day
- Du –sk 26/5/2008: duplicate check up time window change from 30 days to 15 days.
- 28/5/2008: implemented a filter on GST data extraction to reduce number of profiles from around 3500 to about 1500.
- No real time US godae data during 3-7 Dec 2008 due to ftp address transition. The real time US GODAE data has been restored at usgodae.org on 9 Dec 2008.

Altimeter:

- Envisat
 - 35000 observations/day
 - missing data on 1/7/2008 and 30/12/2008.
 - less than half normal number on 7-8/12/2008, 6-7/03/2009, 29/04/2009.
 - 28-29/04/2009 data recovered on 10/05/2009
- Jason 1:
 - 45000 observations/day
 - Missing data on 8-12/5/2008, 8-19/08/2009.
 - No data from 27 Jan to 9 Feb 2009 due to reposition.
 - Less than half data on 11/7/2008, 31/7/2008, 10/2/2009.
- Jason 2:
 - 50000 observations/day
 - Data from 8/5/2009.
- AMSRE SST
 - 600000 observations/day
 - Missing 3/9/2008.

Real-time tide gauge network for SEAFRAMES and NSW authority gauges has been established and evaluated. Tides gauge data is being combined with SLP, tide prediction and river discharge data as a coastal daily file. Initiatives underway to develop automatic quality control.

2. Data serving

No change to service technologies

Operational ftp

Opendap server - <http://opendap.bom.gov.au:8080/thredds/catalog.html>

Thredds servers being developed for support of aggregation

NetCDF4 data format being tested and software tools implemented onto a linux server

NCO operators

Fortran netCDF4 libraries

3. Data Management

Input data volumes

Profiles – 500 Mb/day

Altimeter – 4 Mb/day

SST – 24 Mb/day

Analysis volumes

BODAS – 950 Mbytes / run

Analysis cycle OFAM – 5 Gbytes/run

Near real-time analysis volumes

BODAS – 950 Mbytes / run

Near real-time analysis cycle OFAM – 5 Gbytes/run

Forecasts

8 Gbytes/run

Total ~ 22Gbytes / run

3. Models

MOM4p1 FMS mpp coding bug resolved for coupling with OASIS4

MOM4p1 implemented onto linux cluster and tested on exemplar SUN super-computer

OASIS4: a number of software bugs have been identified and resolved and submitted back to the core developers, software mods have been adopted

4. Assimilation method

BODAS, Ensemble OI (Oke et al., 2008), 72-members operational

Incremental initialisation implemented into trial operational system. An adaptive restoring scheme is being tested.

5. Assimilation products and dissemination

Innovations etc stored on opendap server,
<http://opendap.bom.gov.au:8080/thredds/catalog.html>

Produce surface maps of observations, forecast innovations and analysis innovations
Only shown on internal network

6. Systems

OceanMAPSv1.0c is a minor upgrade including:

- incremental initialisation,
- spline interpolated flux regridder,
- u,v initialisation.
- Jason-2
- NAVOCEANO L2P SST

New OFAM, MOM4p1 is being implemented for OceanMAPSv2.0 and BRAN3.0. Upgrade to the ocean model include:

- implicit tidal parameterisation for interior mixing (Lee et al. 2006?)
- implicit tidal parameterisation for bottom stress
- Improved topography (latest Smith/Sandwell)
- Improved surface fluxes for reanalysis (ERA-Interim)
- Higher vertical resolution near surface (5 m)
- Same horizontal grid – but plans to shift to 1/10 global next year.

BODAS is being implemented for OceanMAPSv2.0 and BRAN3.0. Upgrades include:

- improved solver – using a pre-conditioned conjugate gradient
- MPI-version for efficiency
- the operational system will increase the ensemble to 120 members
- improved initialisations – adaptive nudging
- Quality control for SST
- exploring options for performing analyses in a local ETKF framework

OceanMAPSv2.0 is being implemented with:

- ACCESS-g fluxes based on the UM prediction system.
- A daily forecast cycle is planned with sub-daily storage to capture sub-inertial time variability.

Coupled Limited Area Model (CLAM) research version implemented based on a regional ocean model MOM4p1 nested inside BRAN or OceanMAPS, OASIS and TCLAPSV4. A coupled inertial scheme has been implemented to derive realistic SST anomalies and SLA under TC winds.

CLAM trial operational version being developed based on MOM4p1, OASIS4 and UM7.

OASIS4 coupled to MOM4p1 and toy atmosphere completed.

GAMSSA implemented as an operational global SST analysis.

7. Links with GODAE pilot projects (Argo, GHRSSST)

- Helen Beggs continues to represent BLUElink within GHRSSST
- Susan Weijffels represents Australia in the Argo project
- Adaptive sampling strategies document was distributed to Dean Roemmich

8. Internal metrics and intercomparison plans

Inter-comparison of CLASS1 metrics conducted for both the South East Indian Ocean and South West Pacific in the eddy-resolving region of the BLUElink models. Plan to write up the results in a journal article.

GODAE intercomparison period is being used as a benchmark for OceanMAPSv1.0c upgrades to the operational system. Presents a tough test.

Bureau of Meteorology is participating in the Quality control intercomparison project.

9. Targeted Users and envisioned external metrics

Royal Australian Navy are a partner of the BLUElink project

Oil and Gas industry have been provided forecasts over the North West Shelf.

Australian Pacific Applied Scientist Associates have implemented BLUElink products into their OILMAPS software. Evidence of the skill of the BLUElink products are being evaluated. A demonstration of the capability took place

Non-tidal coastal sea level from OceanMAPS has been evaluated to demonstrate skill in mid-latitudes regions. A total coastal sea level is being developed for regional offices for extreme event warnings for SES and port authorities. Both low total sea level and high sea level require a warning system. A detailed analysis on the errors of the different contributions to sea level is underway.

SST forecasts cannot beat persistence of the GAMSSA/RAMSSA analyses. Applications for NWP are limited until this is resolved. Why? discovery of two problems, low variability in GHRSSST products, time correlation of buoy data for GHRSSST products.

10. Reanalysis activities

BRAN2.2 is the latest version

(<http://www.cmar.csiro.au/bluelink/exproducts/index.htm>)

BRAN3 is planned for 2010.

11. Computing resources

Bureau of Meteorology, CSIRO and Australian National University collaborated on a super-computing procurement to replace the existing NEC SX6 system. SUN microsystems was the successful vendor. The system will be based on 2500 Sun Blade (1500 at ANU, 1000 at BOM) server modules based on the new Intel "Nehalem" Xeon processor.

Operations have access to an offsite exemplar system to port and test compilation. Transition of the new system will begin in July 2009 with further implementation in Sep 2009.

A LSDSS (Large data storage) data storage system has been procured and will be implemented over the next five years.

12. Consolidation phase and transition to operational systems (activities)

Automatic quality control system revision based on review of intercomparisons

Initialisation remains a high priority activity

Implementation of AMSR-E L2P for robust cloud clearing

Implementation of NAVOCEANO L2P, foundation SST to improve robustness and constrain closer to the coast and straits

Revision of the 5 day behind real-time ocean analysis.

Transition to a daily forecast cycle.

Servicing

Maintaining the monthly chart discussions - transfer the lead to the operations staff

Focusing on expanding the metrics and inclusion of more groups

Continuing to prepare a "Significant mesoscale oceanography" bi-monthly report in the Australian Meteorological and Oceanographic Society Bulletin.

13. GODAE Achievements and measures of success

Robust delivery of the forecast system. Most significant issues have been impacts from observing system maintenance. Indication of no redundancy.

Publications

Brassington, G. B. and P. Divakaran, 2009: The theoretical impact of remotely sensed sea surface salinity observations in a multi-variate assimilation system, *Ocean Modelling*, 27, 70-81 10.1016/j.ocemod.2008.12.005

Sandery and Brassington, *Coupled Limited Area Modelling for Tropical cyclone and Ocean Prediction in Australia*, Proceedings of the International Workshop on Tropical Cyclone-Ocean Interaction in the Northwest Pacific, JeJu Korea, 27-29 April 2009.

Significant Mesoscale Oceanography article for BAMOS bulletin, Feb, (edited G. Brassington and P. Sandery)

Significant Mesoscale Oceanography article for BAMOS bulletin, Apr, (edited G. Brassington and P. Sandery)

Hurlburt et al. (Brassington, Oke, Pugh and Schiller co-authors), 2009: High resolution global and basin-scale ocean analyses and forecasts, Peer reviewed invited paper for special issue of *Oceanography*

Dombrowsky et al., (Brassington co-author), 2009: GODAE systems in operation, Peer reviewed invited paper for special issue of *Oceanography*

Hernandez et al., (Brassington co-author), 2009: Validation and Intercomparison studies within GODAE, Peer reviewed invited paper for special edition of special issue of *Oceanography*

Davidson et al., (Brassington co-author), 2009: Applications of GODAE ocean current forecasts to search and rescue and ship routing, Peer reviewed invited paper for special issue of *Oceanography*

Goni et al. (Sandery co-author), 2009. *Applications of satellite-derived ocean measurements to tropical cyclone intensity forecasting*. Peer reviewed invited paper for special special issue of *Oceanography*

Goni et al. (Sandery co-author) , *The ocean observing system for tropical cyclone intensification forecasts and studies*. White paper accepted for OceanObs09

Cummings et al (Brassington co-author), GODAE ocean data quality control intercomparison project, White paper accepted for OceanObs09

J.D. Blower et al. (Tim Pugh co-author), Serving GODAE data and products to the ocean community, to appear in *Oceanography* 22(3) September 2009

F. Blanc et al. (Tim Pugh co-author), Evolution in data and product management for serving operational oceanography, a GODAE, to appear in OceanObs'09 conference in Sept 2009