



UK National Report for GODAE OceanView Science Team

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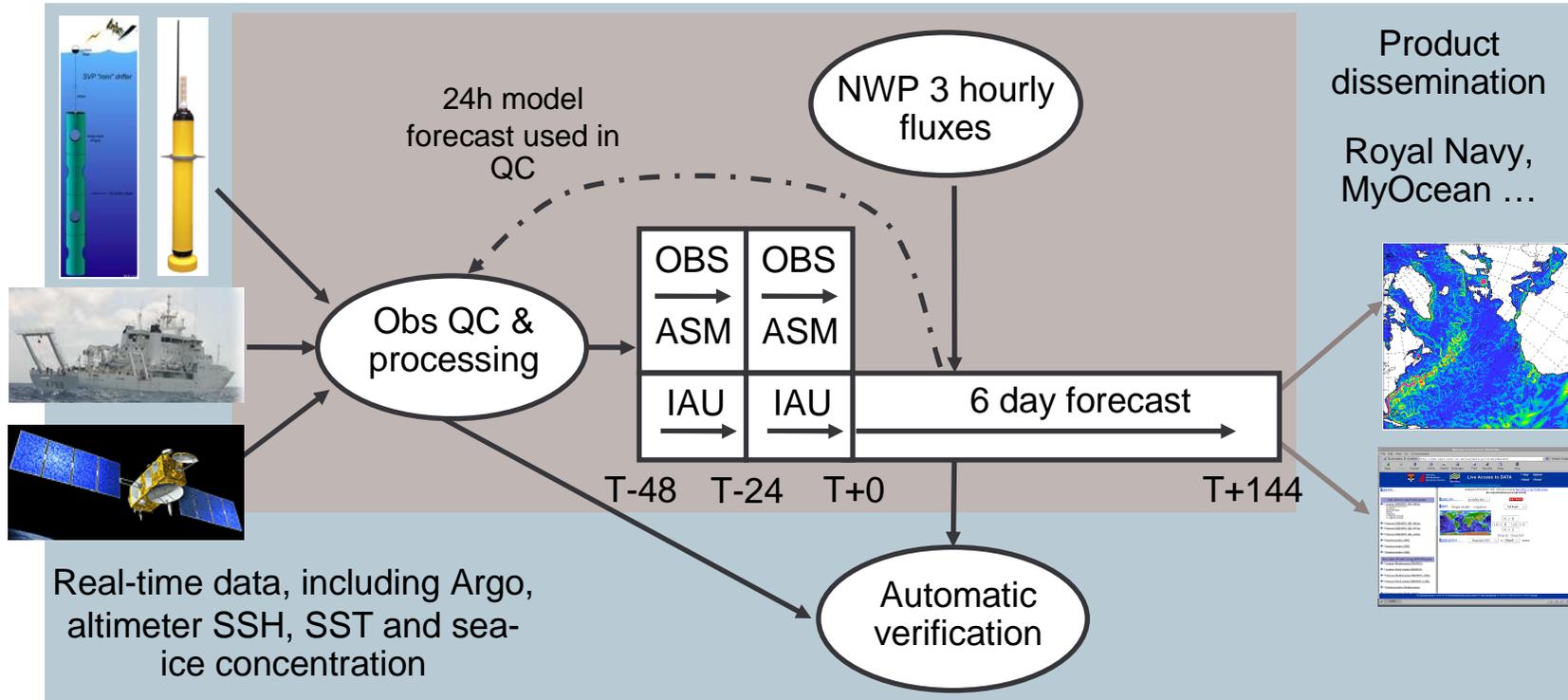


Introduction *Background*

- National Centre for Ocean Forecasting (NCOF) coordinates ocean forecasting activities within the UK (www.ncof.co.uk):
 - Met Office, NOC (Southampton and Liverpool), PML and ESSC.
 - Aim is to improve pull-through of research into operational systems.
- Contribute to the MyOcean project (www.myocean.eu.org), a European Marine Core Service.
- The products from the Met Office which are available through MyOcean include:
 - FOAM:
 - Global $\frac{1}{4}^{\circ}$ FOAM ocean model products. Interpolated onto a regular grid and tiled by region
 - North Atlantic $1/12^{\circ}$ FOAM ocean model products
 - European North-West Shelf ocean model products
 - Satellite derived global SST products from OSTIA, including a 20-year reanalysis, and the GHRSSST Multi-Product Ensemble (GMPE).

Introduction

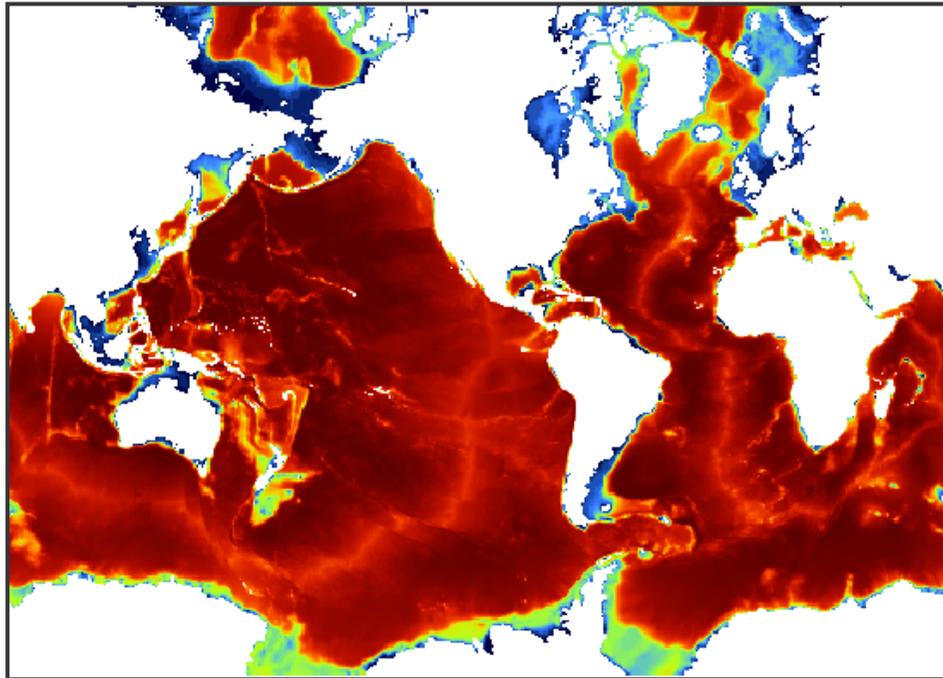
FOAM system overview



- daily cycle with 2-day hindcast and 6-day forecast each day for all configurations.
- runs on 8 nodes of IBM Power 6 supercomputer between 05:15 and 07:00UTC.
- operational FOAM takes up about 2% of the overall operational NWP suite.

Introduction

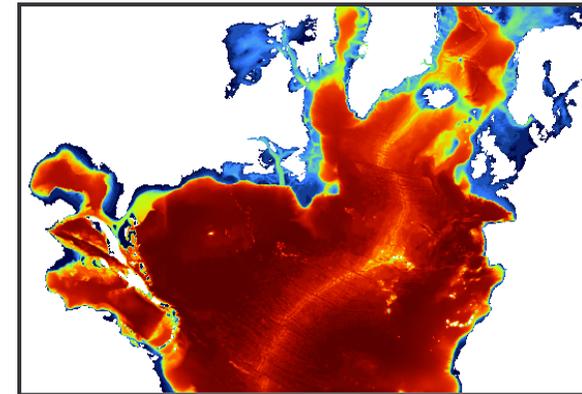
FOAM configurations



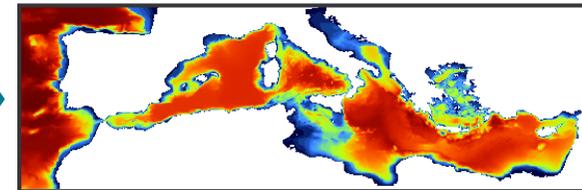
1/4° Global (orca025)

Provides lateral boundary conditions for the regional models

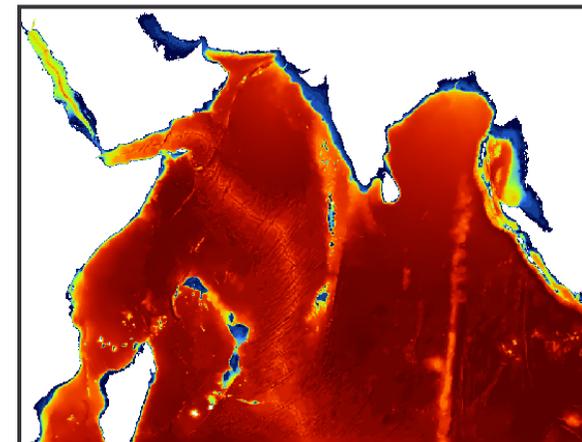
NEMO ocean model, at version 3.2, coupled to LIM2 sea-ice model



1/12° North Atlantic



1/12° Mediterranean



1/12° Indian Ocean

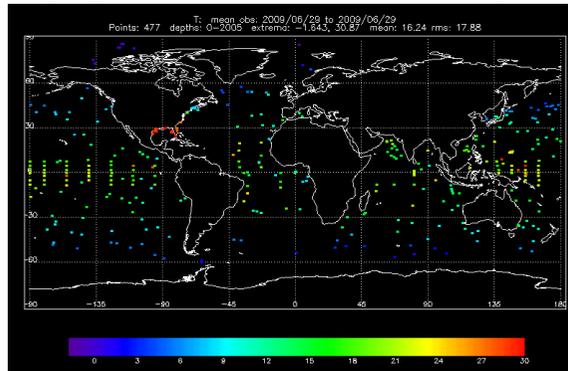


Introduction

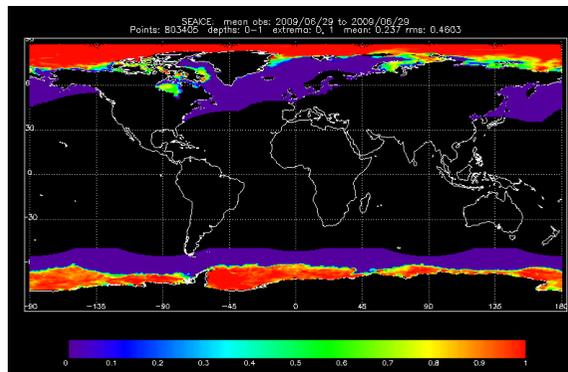
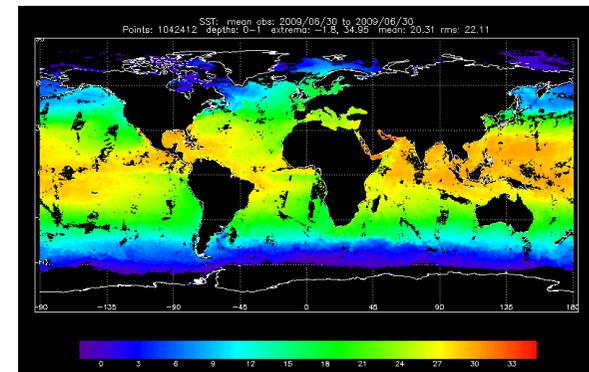
FOAM data assimilation

- Assimilation scheme has been developed from the Analysis Correction scheme.
- Satellite SST data from GHRSSST (MW and IR), in situ SST data from the GTS.
- Bias correction scheme to correct for satellite SST biases.
- SLA data from CLS/Aviso.
- MDT from latest CNES/CLS 09 product. On-line bias correction scheme.
- Temperature and salinity profile data (Argo, XBT, moored buoys, ...) from GTS.
- Sea-ice concentration data from EUMETSAT OSI-SAF.

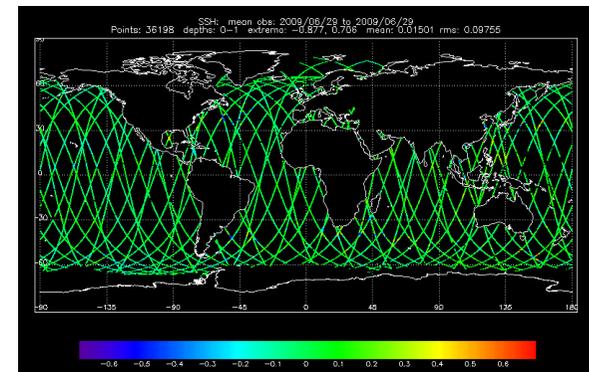
Temperature and salinity profiles
(Argo floats, XBTs, CTDs, buoys,...)



Satellite and in-situ SST
(AATSR, AVHRR, AMSRE, METOP)



Sea ice concentration
(OSI-SAF)



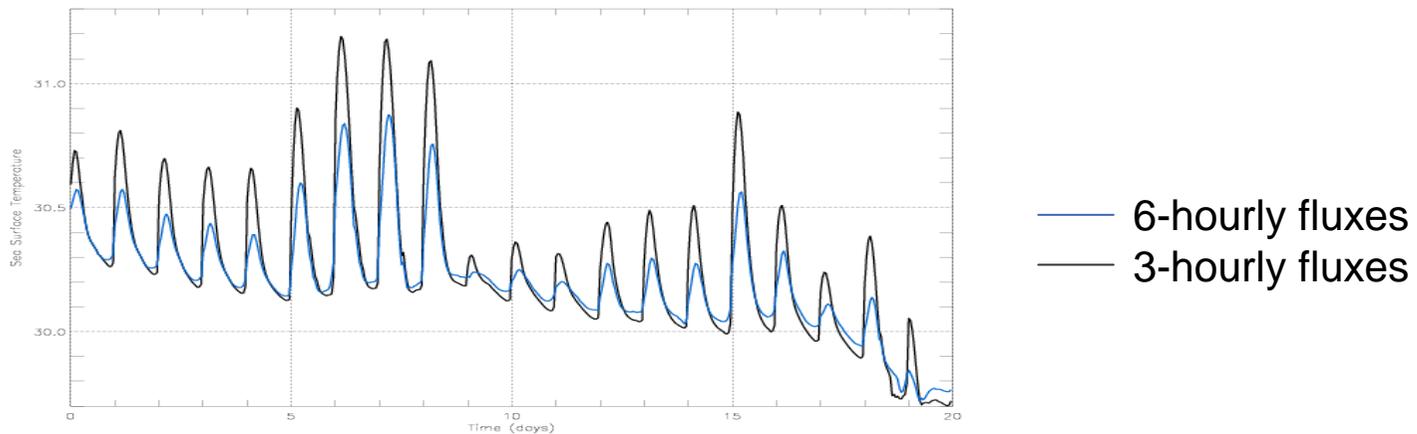
Satellite Altimeter SSH
(Jason 1, Jason 2, ENVISAT)



Developments *Model and assessment*

- Frequency of fluxes & diurnal cycle:
 - Impact of changing from 6-hourly to 3-hourly surface fluxes has been assessed.
 - Little impact on overall RMS errors against SST observations.

Time-series of SST for a single gridpoint in the Pacific warm pool.



- Ice modelling:
 - Plan to use the CICE sea-ice model in place of the current LIM2 sea-ice model in order to have a seamless system for short-range, seasonal and climate prediction.
 - Implemented sea-ice concentration assimilation scheme in CICE.
 - Further work required to improve sea-ice thickness in CICE before it is implemented.



Developments *Model and assessment*

Surface current assessment (derived from drifter locations for the whole global model for all of 2007 and 2008 giving over 774,000 current observations):

- Assessment using tropical mooring current measurements and surface drifters in tropical regions - both assessments show a (i.e. too strong) bias, particularly in the Tropical Pacific.

ZONAL	RMS Error	Correlation	No. Obs
Equatorial Buoys	0.248	0.768	16,627
Drifters	0.242	0.734	92,796

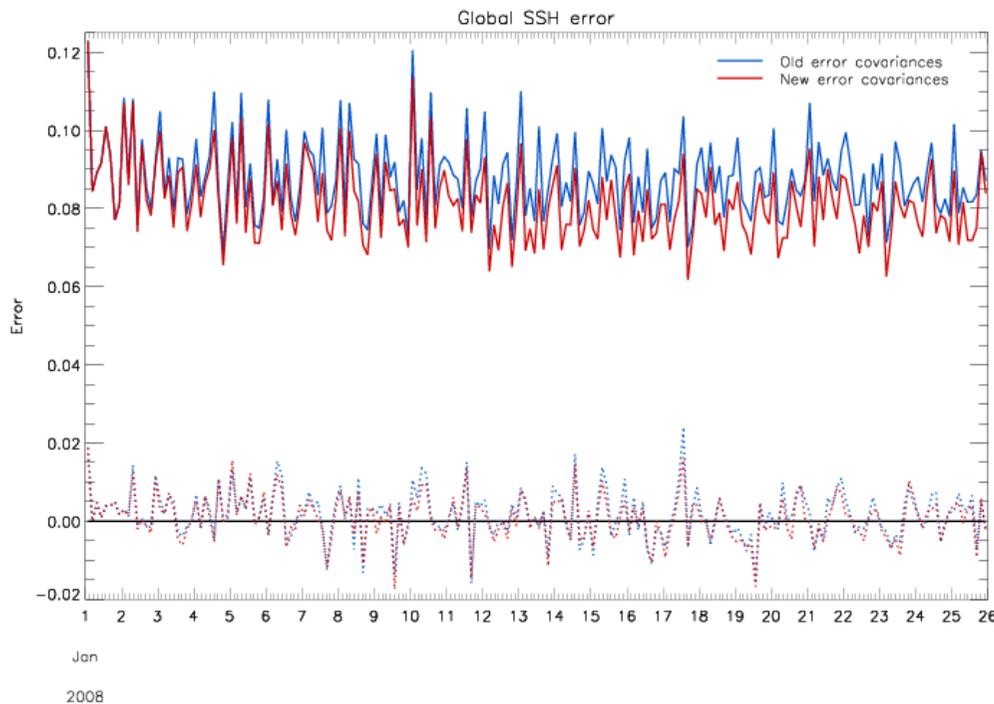
- FOAM currents in the Southern Ocean are too westerly (i.e. the ACC is too weak), although wind-slip in drifters could contribute to this.

ZONAL	RMS Error	Mean Error	Correlation	Obs. / day
Global	0.215	-0.003	0.537	1059
Tropical Pacific	0.210	-0.065	0.708	159
Southern Ocean	0.242	0.078	0.297	240



Developments *Data assimilation – error covariances*

- New seasonally varying error covariances calculated from 2-year hindcast of FOAM system, using combination of NMC method and a method using innovations.
- Positive impact on observation-minus-background statistics.
- Being implemented operationally.



RMS errors – January 2008

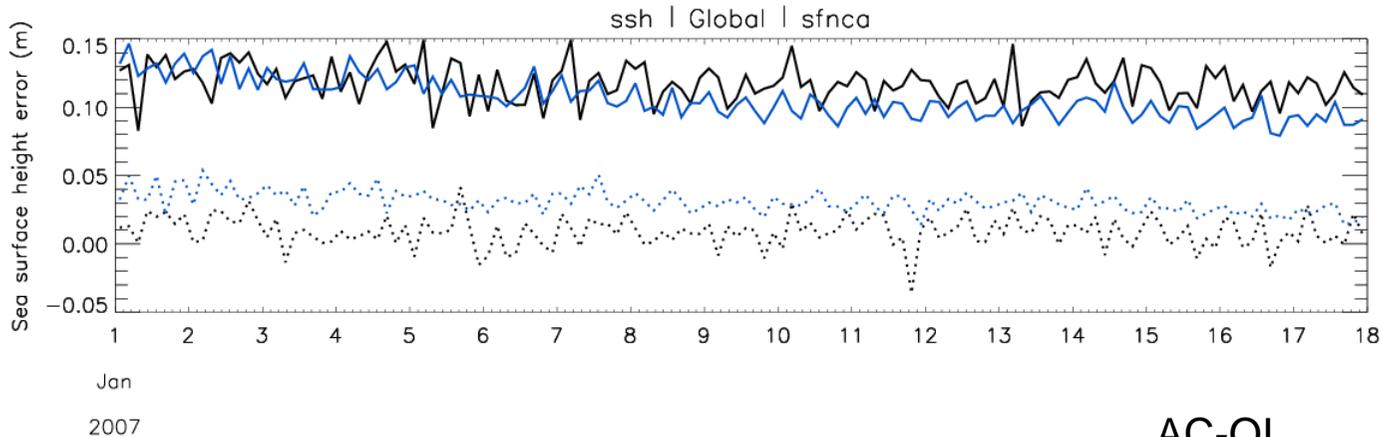
	AATSR SST	SSH
Old	0.516	0.088
New	0.492	0.082



Developments

Data assimilation - NEMOVAR

- NEMOVAR implementation
 - Incremental 3DVar FGAT scheme (4DVar also available)
 - Implementing in FOAM in R&D mode.
 - Testing so far in 1/4° global NEMO (ORCA025).
 - Balance operators being investigated.
 - Updated code with new minimisation algorithm.
 - Now uses an implicit diffusion operator for modelling the covariances.



AC-OI
NEMOVAR

RMS (mean)
0.119 (-0.009)
0.108 (-0.031)



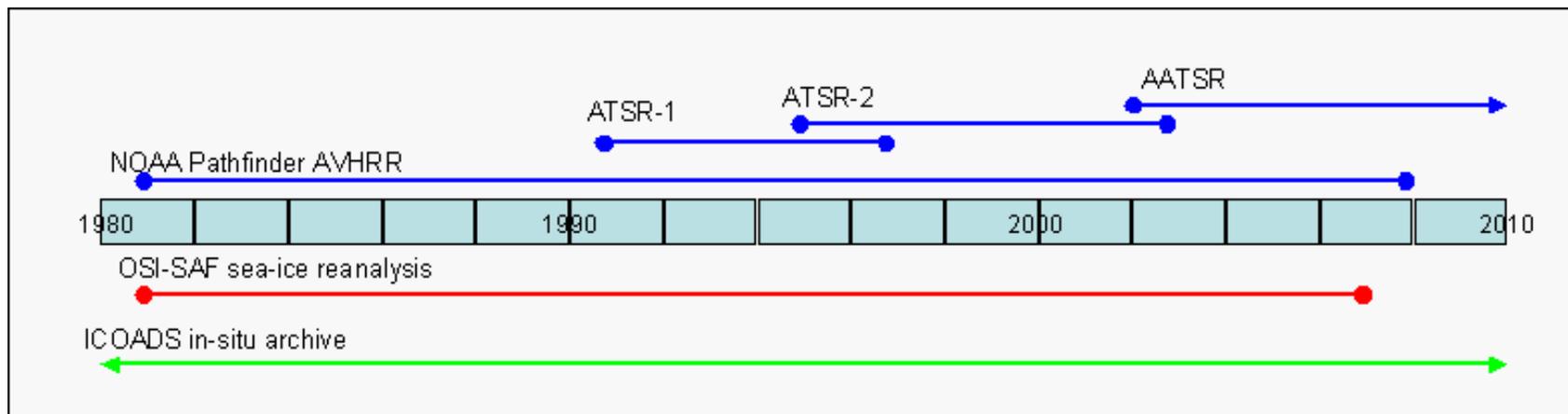
Developments *Reanalysis*

Model reanalysis:

- Work with NOCS (model development) and ESSC on ocean reanalysis.
- Using the joint Met Office/NERC supercomputer, MONSoon – also enables sharing and joint development of code.
- Using $\frac{1}{4}^\circ$ resolution, 75 level NEMO model with FOAM assimilation scheme.
- Plan to run from 1991 using ERA Interim surface forcing, assimilating profile data (from EN3 data-set), altimeter SLA data and satellite SST data.

SST reanalysis:

- OSTIA reanalysis from 1985-2007 will be available before end 2010.
- Based on the operational OSTIA system on a $\frac{1}{20}^\circ$ grid.

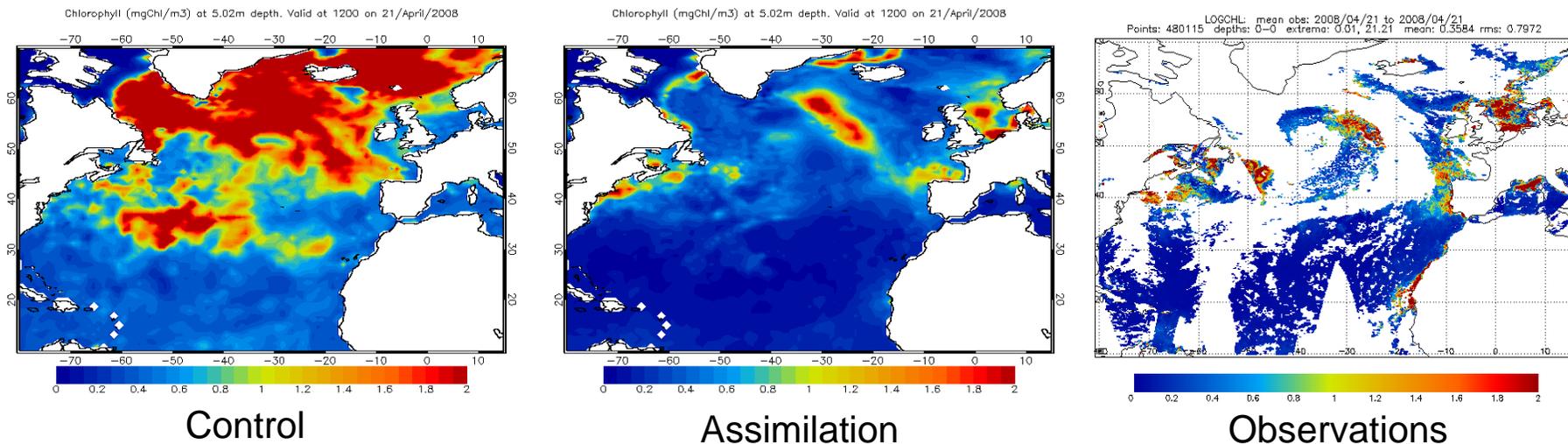


Developments

Ecosystem modelling and assimilation

Ocean colour assimilation:

- NEMO-HadOCC coupled physical-biogeochemical model in global 1^o configuration.
- Assimilating temperature, salinity and SST data using the FOAM assimilation scheme.
- Running pre-operationally on a daily basis, assimilating satellite ocean colour data from MERIS/MODIS provided by GlobColour project.



pCO₂ assimilation:

- To demonstrate the feasibility of assimilating ship-based measurements of pCO₂ into the NEMO-HadOCC system described above.



Developments

Users and data serving

- Royal Navy receive FOAM data through dedicated comms links.
- Oil spill modelling: data to support the Gulf of Mexico oil spill, and for the oil spill near Australia.
- A demonstration system has been set-up to provide surface winds and surface currents to BMT and the UK Maritime and Coastguard Agency (MCA), in order to support search and rescue operations.
- FOAM data is being used for ship routing applications, for instance by SMHI.
- SST forecasts from FOAM are also being made available to the BBC as part of the Met Office contract.
- Boundary conditions provided to the Met Office shelf-seas modelling system.

- The Met Office hosts the MyOcean service desk (servicedesk@myocean.eu.org) which deals with enquiries from users of all model and observational data-sets contributing to the MyOcean project.

- Data serving: ftp and OpenDAP access to FOAM data available.



Developments *Visualisation*

<http://data.ncof.co.uk:8080/ncWMS/godiva2.html>

Auto-zoom on select

- Met Office Web Map Service
 - North West Shelf Hourly 3 level
 - North West Shelf Daily 17 level
 - OSTIA SST
 - GMPE
 - Global - Southern Ocean
 - Global - Arctic Ocean
 - Global - Global Ocean
 - sea_water_potential_temperature
 - sea_surface_height_above_geoid
 - sea_ice_area_fraction
 - sea_ice_thickness
 - ice meridional current
 - ice zonal current
 - sea_water_salinity
 - northward_sea_water_velocity
 - eastward_sea_water_velocity
 - sea_water_velocity
 - Global - Indian Ocean
 - Global - Mediterranean
 - Global - North Atlantic

[User guide](#)

Layer: Met Office Web Map Service > Global - Global Ocean > sea_water_potential_temperature
Units: degC
Depth (m): 0
Date/time: 28 Sep 2010 12:00:00 UTC [first frame](#) [last frame](#)

[Fit layer to window](#)

September, 2010						
Today						
Sun	Mon	Tue	Wed	Thu	Fri	Sat
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

Select date

34.96
22.00
9.042
-3.916

linear
auto
lock

test image [Open in Google Earth](#) [Screenshot](#)

Overlay opacity: 100%

Powered by [OpenLayers](#) and [OGC](#) standards

[Permalink](#) | [email](#)





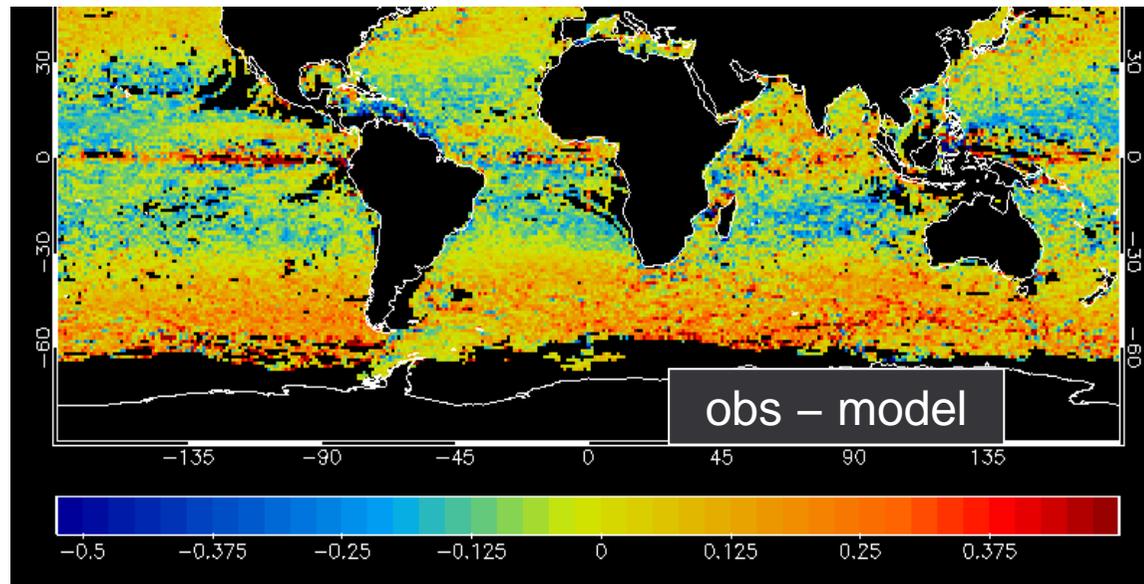
Summary and future work

- Summary:
 - Continued development of operational FOAM system.
 - Joint reanalysis activity with ESSC and NOCS.
 - Ecosystems – pre-operational running of coupled physical-biological low resolution model.
- Future work:
 - Continue implementation of NEMOVAR.
 - Ecosystem modelling implementation operationally.
 - Assessing and improving diurnal cycle in FOAM.
 - Development of a global coupled ocean-waves-atmosphere-seaice for short to medium range forecasts:
 - Working groups have been set-up on: boundary layer model improvements, coupled forecasting, wave coupling, coupled initialisation.
 - Plan to develop a system based on ORCA025L75 coupled to UM at N216L85 resolution.



Southern Ocean currents

- Strong positive mean error suggests FOAM currents in the Southern Ocean are too westerly (i.e. the ACC is too weak)



- However this is contrast to our analysis of the volume transport through the Drake Passage (which at 173 Sv. is well above the estimated ACC value of 130 Sv.)