

# Data assimilation splinter sessions

Convenors:

Pierre De Mey-Frémaux (co-chair of the GOV COSS-TT)

Matt Martin (co-chair of the GOV DA-TT).

Introduction talk outline:

1. Data Assimilation at the Symposium.
2. Agenda for the data assimilation splinter sessions.
3. Data Assimilation Task Team in GODAE OceanView.
4. Links with OceanObs'19.
5. Outcomes of recent workshop on European marine data assimilation coordination.
6. Additional questions for the DA theme plenary speakers.

# Data Assimilation at the Symposium

## Tuesday, 7<sup>th</sup> May

- 09:45-10:30      PLENARY: Andrew A Moore (UCSC) and Stefano Ciavatta (PML)  
11:00-12:30      DA SPLINTER 1: Variational, ensemble and hybrid methods in ocean data assimilation I  
13:30-15:00      DA SPLINTER 2: Variational, ensemble and hybrid methods in ocean data assimilation II  
15:30-17:15      DA SPLINTER 3: Coastal/regional data assimilation and observation impact

## Wednesday, 8<sup>th</sup> May

- 11:00-12:30      DA SPLINTER 4: Biogeochemical and coupled ocean-atmosphere data assimilation

## Thursday, 9<sup>th</sup> May

- 09:00-13:00      TRAINING: Data Assimilation – Room 503

+ posters Mon-Wed



# Data assimilation splinter sessions (1/3)

## ***DA SPLINTER 1: Variational, ensemble and hybrid methods in ocean data assimilation I***

Chairs: P. De Mey-Frémaux and L. Nerger

Tuesday, 7<sup>th</sup> May

<b>11:00-11:15</b>		<b>Introduction to the Data Assimilation splinter sessions</b>
11:15-11:30	Usui	Development of regional high-resolution assimilation systems based on four-dimensional variational method at JMA/MRI
11:30-11:45	Fennel (Yu)	Hindcasting the subsurface oil plume after the Deepwater Horizon disaster in the Gulf of Mexico
11:45-12:00	Carrier	A Multi-Scale Approach to High Resolution Observations within a 4DVAR Analysis System
12:00-12:15	Mattern	Two simple ways for creating model-independent biogeochemical tangent linear and adjoint code
12:15-12:30	Ngodock	A method for estimating the analysis error covariance with 4DVar

## ***DA SPLINTER 2: Variational, ensemble and hybrid methods in ocean data assimilation II***

Chairs: M. Martin and H. Ngodock

Tuesday, 7<sup>th</sup> May

13:30-13:45	Testut	Assimilation of sea-ice concentration into a multi-category sea-ice model using an Ensemble Kalman Filter
13:45-14:00	Sanikommu	Impact of Atmospheric and Model Physics Perturbations on an Ensemble Data Assimilation System of the Red Sea
14:00-14:15	Nerger	Efficient Ensemble-Based Data Assimilation for High-Dimensional Models with the Parallel Data Assimilation Framework PDAF
14:15-14:30	While	Development of a global ocean ensemble data assimilation and prediction system at the Met Office.
14:30-14:45	Lea	Initial experiences in using ensemble information in data assimilation with the Met Office ocean forecasting (FOAM) system
<b>14:45-15:00</b>		<b>Short poster presentations</b>

# Data assimilation splinter sessions (2/3)

## ***DA SPLINTER 3: Coastal/regional data assimilation and observation impact***

Chairs: A. Moore and A. Teruzzi

Tuesday, 7<sup>th</sup> May

15:30-15:45	Liu (Smith)	Development of a Pan-Canadian Operational Regional Ocean Data Assimilation System
15:45-16:00	Santana	Model sensitivity experiments on data assimilation, downscaling and tides for the representation of the Cape São Tomé Eddies
16:00-16:15	Zhan	A data assimilation and forecasting system for the Red Sea
16:15-16:30	Hernandez	Impact of HF Radar Data Assimilation on Surface Currents in the Ibiza Channel
16:30-16:45	Maze	Ocean observing systems synergy over Western Boundary Currents
16:45-17:00	Tanajura	Assimilation of SMOS SSS into HYCOM with the REMO Ocean Data Assimilation System in the South Atlantic
17:00-17:15	Moore	Assessing the Impact of Ocean Observing Systems for Analysis-Forecast Systems in Support of U.S. IOOS

## ***DA SPLINTER 4: Biogeochemical and coupled ocean-atmosphere data assimilation***

Chairs: S. Ciavatta and D. Lea

Wednesday, 8<sup>th</sup> May

11:00-11:15	Irie	Assimilation of vertical chlorophyll and oxygen profiles using the lognormal four dimensional variational method: A case study in Osaka Bay, Japan
11:15-11:30	Nerger	Assimilation of phytoplankton functional group data into a global coupled ocean-ecosystem model
11:30-11:45	Santana Falcón	Towards the assimilation of ocean color data into a physical-biogeochemical ensemble simulation for the North Atlantic
11:45-12:00	Teruzzi	Evaluation of the impact of multivariate assimilation on Mediterranean Sea biogeochemistry
12:00-12:15	Fujii	Development of weakly coupled atmosphere-ocean data assimilation system and the evaluation of the coupled reanalysis in JMA/MRI
12:15-12:30	Ngodock	Coupled Ocean-Atmosphere 4D-Var: Formulation and sensitivity analysis

# Data assimilation splinter sessions (3/3)

## Posters

P-47. Costa. Different strategies for assimilating Argo into a hybrid coordinate ocean model.

P-48. Kwon. Impacts of the observation system in the eastern Yellow Sea on the ocean analysis fields

P-50. Skakala. Assimilation of optical absorption by phytoplankton functional types into ecosystem model

P-51. Skakala. The Assimilation of Phytoplankton Functional Types for Operational Forecasting in the Northwest European Shelf

P-52 Verron (Leroux). Combining machine-learning data-driven strategies and large-ensemble ocean simulations to improve satellite-derived gridded products

P-53. Ciavatta. Assimilation of ocean-colour phytoplankton functional types to improve the reanalysis and prediction of ocean ecosystem models

P-54. Ngodock. Weak and strong constraints variational data assimilation with the NCOM-4DVAR in the Agulhas region using the representer method

P-55. Smith. Assimilation of High-Resolution Altimetry in a Canadian East Coast Forecasting System

P-56. Danielson. An approach to calibration and validation by linear regression

→ Short (1-slide) poster presentations in DA Splinter 2 (today 14:45-15:00)



# GOV Data Assimilation Task Team (DA-TT) (1/2)

*Co-chairs: Andy Moore (UCSC), Matt Martin (Met Office, UK)*

In GODAE OceanView (OceanPredict), the aim of the DA-TT is to **foster the development and evaluation of data assimilation systems** relevant to GOV to support the **coordination of the fundamental and challenging issues in the ocean forecasting process**, of which data assimilation is a significant part. The DA-TT holds regular **workshops**, often in collaboration with other task teams (Exeter, UK, 2015; Santa Cruz, USA, 2016; La Spezia, Italy, 2017).

Topics which have been the focus at recent DA-TT workshops include:

- Recent developments in global and regional ocean data assimilation systems
- Hybrid variational/ensemble data assimilation
- Model error and bias
- Error covariance modelling
- Coupled data assimilation
- Assimilation of new/novel observation types
- Studies of observation impacts, sensitivity, and assessments of observation networks
- Impact of physical data assimilation on unassimilated variables/processes, e.g. vertical velocities, vertical mixing.



OceanPredict '19

GODAE OceanView  
Symposium | 6-10 May 2019  
Halifax, Canada

Advancing the science and application of ocean predictions

# GOV Data Assimilation Task Team (DA-TT) (2/2)

[www.godae-oceanview.org/science/task-teams/data-assimilation-tt/](http://www.godae-oceanview.org/science/task-teams/data-assimilation-tt/)

Themes:

- Improving the representation and parameterisations of error covariances for data assimilation
- Improving the capacity of current data assimilation systems to make use of all available observations
- Development of data assimilation systems for coupled models
- Development of hybrid data assimilation for the ocean

Current activities in the DA-TT work plan:

1. Improving understanding of error covariances in existing DA systems via a common set of coordinated single observation experiments
2. Identifying and quantifying model and forcing bias that are common in global data assimilation systems via coordinated experiments
3. Promoting the development of hybrid data assimilation methods in the ocean (e.g. ensemble variational methods)
4. Organise meetings of the TT to foster the development of data assimilation, establish linkages, forge collaborations, and encourage joint publications

# Links with OceanObs'19

## DA-related OceanObs'19 CWP's from GOV task teams

### *Data Assimilation task team (DA-TT):*

Moore AM, Martin MJ, Akella S, Arango HG, Balmaseda M, Bertino L, Ciavatta S, Cornuelle B, Cummings J, Frolov S, Lermusiaux P, Oddo P, Oke PR, Storto A, Teruzzi A, Vidard A and Weaver AT (2019). Synthesis of Ocean Observations Using Data Assimilation for Operational, Real-Time and Reanalysis Systems: A More Complete Picture of the State of the Ocean. *Front. Mar. Sci.* 6:90. doi: 10.3389/fmars.2019.00090.

### *Coastal Ocean and Shelf Seas task team (COSS-TT):*

De Mey-Frémaux, P., N. Ayoub, A. Barth, B. Brewin, G. Charria, F. Campuzano, S. Ciavatta, M. Cirano, C. Edwards, I. Federico, S. Gao, I. Garcia Hermosa, M. Garcia Sotillo, H. Hewitt, L. Hole, J. Holt, R. King, V. Kourafalou, Y. Lu, B. Mourre, A. Pascual, J. Staneva, E. Stanev, H. Wang, and X. Zhu (2019). Model-observations synergy in the coastal ocean. *Front. Mar. Sci.*, in press.

### *Observing System Evaluation task team (OSEval-TT):*

Fujii, Y. et al. (2019) Observing System Evaluation Based on Ocean Data Assimilation and Prediction Systems: Ongoing Challenges and Future Vision for Designing/Supporting Ocean Observational Networks. *Front. Mar. Sci.*, in press.





# Workshop on developing a European marine DA strategy (1/2)

Held at Mercator Ocean International (MOI), Toulouse on 5 & 6 September 2018. Objectives were to:

- Develop a long-term vision for a European marine data assimilation (MDA) infrastructure.
- Develop cooperation and joint activities in an operational marine data assimilation context.
- Identify steps to converge on tools and approaches.
- Provide inputs to discussions on MOI data assimilation strategy.

Attendees:

- 40 experts from MOI and its shareholders as well as external DA experts.
- Operational systems represented: MOI, Met Office, NERSC, CMCC, ECMWF, ECCC, Meteo France.

Agenda included presentations on:

- MDA in operational systems - status and short term (2 years) plans;
- State of the art in data assimilation systems;
- Long term (10 year) vision for the development of MDA systems.

Presentations available at <https://atlas.mercator-ocean.fr/s/AdpCFKBGPo87gnp>



# Workshop on developing a European marine DA strategy (2/2)

## Outcomes:

- Enthusiasm among participants to develop stronger collaborations between marine data assimilation groups in Europe. There is much to be gained from regular exchanges, sharing of experience and the development of collaborations.
- An MOI expert team on MDA has been set up that will propose and monitor joint actions between MOIs shareholders.
- To hold a workshop similar to that reported here biennially so that information, experience, new ideas and findings, progress on actions and the development of collaborations can be shared and promoted.

The **first meeting** of the MOI expert team was held in **April 2019**. Three initial areas of mutual interest have been identified and working groups formed on:

1. Altimeter data assimilation and MDT (Mean Dynamic Topography) estimation
2. How to generate a good ensemble
3. How to model observation error correlations.



Any additional questions for the plenary speakers?