SANGOMA: Stochastic Assimilation for the Next Generation Ocean Model Applications EU FP7 SPACE-2011-1 project 283580

Deliverable 6.7: Workshop 1 for operational users

Due date: 1/11/2012

Delivery date: 14/12/2012

Delivery type: Report , Public

J.-M. Beckers   A. Barth   Y. Yan   F. Laenen   M. Canter
University of Liège, BELGIUM

P.-J. Van Leeuwen   S. Vetra-Carvalho
University of Reading, UK

L. Nerger   P. Kirchgessner
Alfred-Wegener-Institut, GERMANY

A. Heemink   N. van Velzen   M. Verlaan   U. Altaf
Delft University of Technology, NETHERLANDS

P. Brasseur   J.-M. Brankart   G. Candille   S. Metref
CNRS-LEGI, FRANCE

P. de Mey
CNRS-LEGOS, FRANCE

L. Bertino   F. Counillon
NERSC, NORWAY

Chapter 1

Organisation

An important point is that the tools developed by SANGOMA are useful to the scientific and operational community. This was why a strong involvement of my-Ocean representatives in SANGOMA was planned and implemented (Two partners are also MyOcean partners and Eric Dombrowsky of myOcean is permanent member of the steering committee; among the "variable" advisors, we also invite myOcean representatives (D. Obaton, Ch.E. Testut)).

A workshop with operational users was planned at the month 12 in the DOW. During a GMES marine projects coordination meeting on 24/05/2012 in Brussels we discussed this matter with the myOcean group and it was agreed that we should reach this community together during the myOcean Science days to avoid asking potential users to come to two different meetings. Therefore invitations were send via the myOcean contact list but also directly from the SANGOMA side to a dozen of additional institutes interested in operational modelling (like Actimar and MUMM).

During the myOcean days, 60-70 participants attended the workshop on data assimilation and four oral presentations and four posters showed the SANGOMA approach. A call for feedback was also launched and a quick survey is still ongoing `http://www.surveymonkey.com/s/ZX3P9D8`, but intermediate results are analysed in the following.

Chapter 2

Meeting

The myOcean science days were held on 19 - 21 November 2012 in Geesthacht (Germany), with the first day dedicated to a plenary session. The second day four workshops were organised partly in parallel, once of which on Data Assimilaton, chaired by S. Dobricic and J.M. Beckers. The last day was held open for discussion (both in plenary and workshops themes) to identify emerging questions and ideas for collaborations between different GMES projects and different myOcean workpackages.

In the data assimilation workshop, four oral presentations were explicitly referring to SANGOMA and the last talk (J.M Beckers) presented the project and asked for feedback, including filling in of a quick survey: `http://www.surveymonkey.com/s/ZX3P9D8`.

13:30 - 14:20	Lunch break in Foyer Building 27	
14:20 - 17:30	Workshop 3: Data Assimilation, Chair: S. Dobricic + J.-M. Beckers	
14:20 - 14:40	J. Schulz-Stellenfleth	Assimilation of HF radar surface current data in the German Bight
14:40 - 15:00	L. Axell	Implementation of Ensemble 3D-Var for assimilation of sea ice variables, salinity and temperature
15:00 - 15:20	F-R. Martin-Lauzer	Variational assimilation of scalar fields in dynamical biogeochemical ocean model - a review of current issues
15:20 - 15:40	A. Teruzzi	Improving short-term biogeochemical forecasts for the Mediterannean Sea using a 3D variational assimilation scheme
15:40 - 16:10	Coffee break	
16:10 - 16:30	G. Candille	Advanced assimilation methods for the next generation of ocean monitoring and forecasting centres
16:30 - 16:50	M. Verlaan	Wave data-assimilation for SWAN using OpenDA
16:50 - 17:10	L. Nerger	An ensemble-based forecasting system for the North and Baltic Seas using the BSH circulation model and PDAF
17:10 - 17:30	J.-M. Beckers	Development of Stochastic Assimilation for the Next Generation Ocean Model Applications
17:30 - 18:30	Poster session	
18:30	Bus shuttle	

Oral presentations
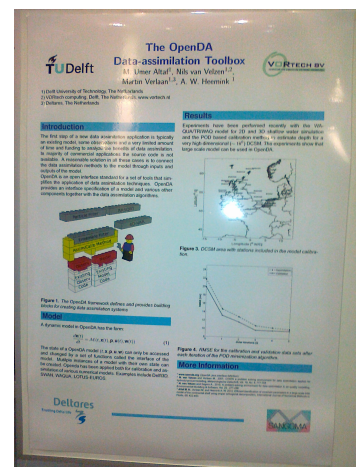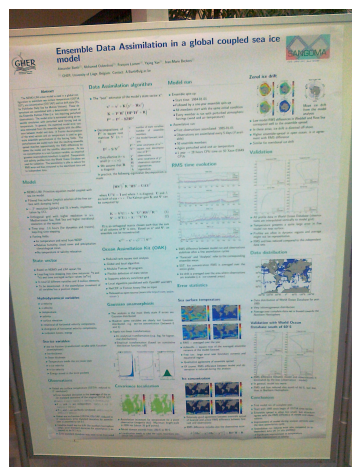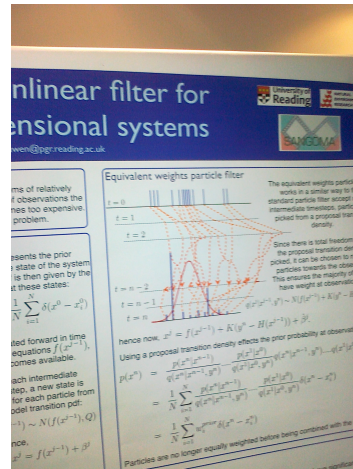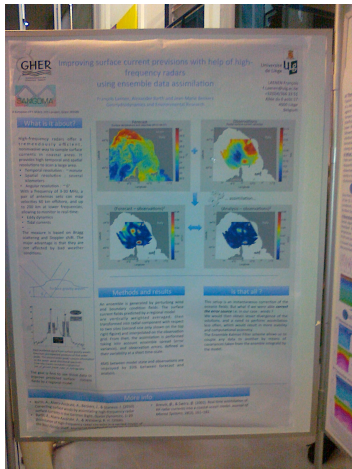
Posters

During the plenary session, S. Dobricic and J.M. Beckers presented a summary of the workshop[1]

> *"Most of presentations and posters studied different aspects of Ensemble Kalman Filter (EnKF) and variational methods. They were also applied to different processes like ocean dynamics, biochemical modeling, ice dynamics, waves, global ocean and coastal areas.*
>
> *Specific keywords were encountered several time: coastal problems, non-linearities and new data assimilation methods, covariance specification (localisation methods in ensembles, perturbation generation, non-gaussian, anamorphosis), bias problem, reanalysis at global and regional scale and technical issues (parallelisation, interfacing).*
>
> *An important issue that arose in several presentations was the need of insight into physical or biological models for efficient application of data assimilation. In other words it was necessary to generate perturbations, envisage the realizability and make clever simplifications consistent with our theoretical knowledge of observed and modelled processes."*

The discussion on the last day highlighted the following:

> *"Major research issues can be divided into four major groups. They are:*
>
> - *In coastal data assimilation arise new issues that include the assimilation of satellite data in coastal area, the upscaling of coastal in situ observations and the treatment of boundary conditions. Another issue is the ability of data assimilation schemes to assimilate more complex coastal and shelf seas observations.*
>
> - *The data assimilation should use as much as possible additional information offered by coupled models. These models combine ocean physics, biology, waves and atmospheric physics. The major arising issue is the estimate of background error covariances among variables in different models and the optimal design and use of observational data sets that give the information on the processes interfacing different models.*
>
> - *Observational System Experiments (OSEs) and Observational System Simulation Experiments (OSSEs) should provide a scientific mean to evaluate the impact of existing and future observational platforms.*

---

[1]The quotes are extracts from the workshop report being prepared by E. Stanev for myOcean.

By demonstrating the impact of existing observational platforms they should provide a strong argument for the observational community to argue for the need of maintaining existing satellite and in situ observational systems. They should further assist the decision making process to trim the existing and future observational systems in order to make the best use of the available resources. An especially important issue that would involve the use of OSEs and OSSEs is the data assimilation in emergency response situations. In this case it is necessary to design systems that in a case of an emergency in a small subdomain of the whole system would rapidly in the best way include information from new additional observations and from local models with a higher resolution and complexity.

- *An important research issue that brings together the variational and Kalman Filter communities is the hybrid approach combining variational and Kalman Filter methods. It combines the best features of each methods, by providing error estimates from both the Kalman Filter and variational approaches. This issue further includes the research on localisation methods by addressing the problem of teleconnections. It is also directly linked with the issues arising from the nesting and the application of unstructured grids.*

There were some additional issues that are not made part of the previous four groups:

- *It was postulated that some novel types of data assimilation schemes could be used with more complex models that will be developed in future.*

- *Our data assimilation schemes are designed for statistically most probable situations. It is, however, important to study their performance in extreme oceanographic events. This is also a cross discipline problem involving observational and modelling communities.*

- *There is an important problem of the observational operator design. This is technical problem especially related to the variational systems and involves the collaboration with observational and modelling communities.*

- *The computational efficiency and complexity of implementation become an arising technical problem that may be a part of the assessment matrix design, and therefore the research can be made together with the validation community."*

Discussions related to SANGOMA were mainly on coordination with NEMO-ASSIM, the pertinence of benchmarks and the need to demonstrate efficiency of observational networks by OSSE approach. Suggested collaborations were

- benchmarks (a way to interact between VAR and KF; research and operational)

- metrics (cross-cutting with observational, modeling and validation groups)

- code sharing or coordination (NEMOASSIM-SANGOMA): capacity building, avoiding duplicating efforts, making tools more robust

Some separate individual discussions showed interests in joint organisation of workshops by several GMES projects with the obvious advantages

- Scientific: sharing of new ideas, possibly leading to collaborations between scientists

- Downstream users: larger public, avoid invitation of same users to several project meetings
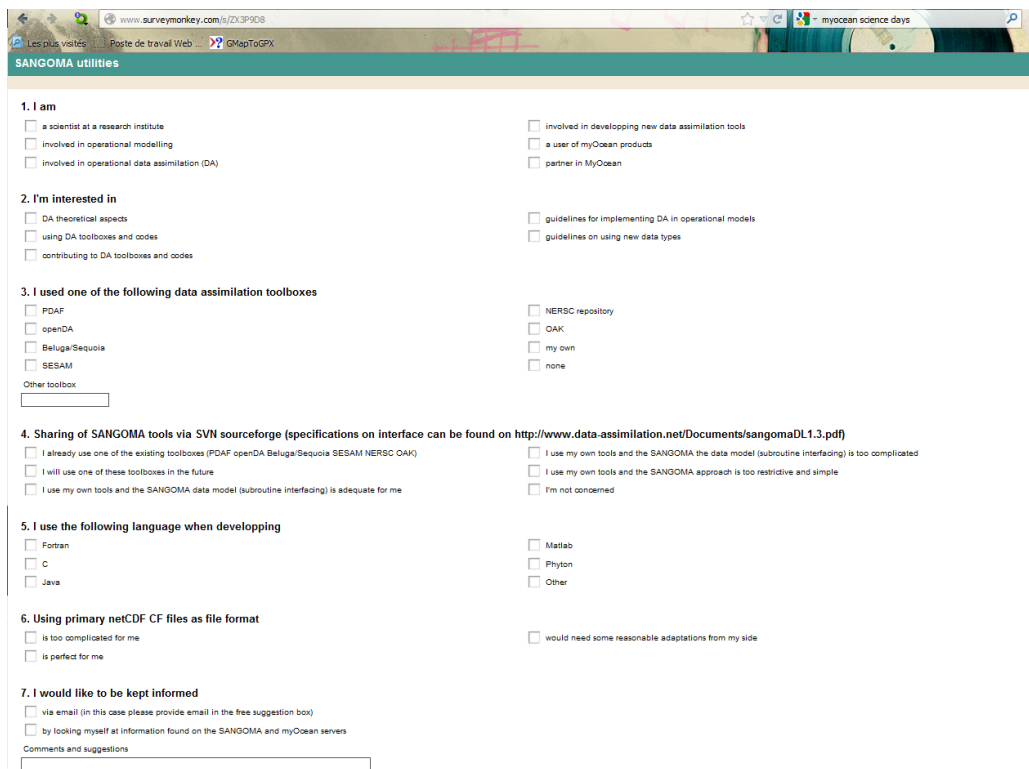
Chapter 3

Follow-up and plans

- Analysis of the survey (8 responses up to now: all seem quite satisfied with specifications)

- Coordination with NEMO-ASSIM

Chapter 4

On-line survey

On-line survey

The detailed results are given hereafter, including all individual responses. Though statistically 8 responses are normally not leading to strong significance we consider that the number is already indicating a good interest in our project, as data assimilation remains a topic for specialists. Therefore we think that the responses are quite representative for the DA community and the main conclusion of the survey is that globally the specifications of SANGOMA seem to be pertinent and adapted:

- Those who manifested their interest were dominantly scientists in research institutes or developpers of DA in an operational context.

- Interests seem more on learning and using tools from SANGOMA than to contribute.

- Only a few of those who responded use one of the existing partner's toolbox but instead use their own.

- Fortran is still the predominant programming language.

- Data model (via files or in memory) is considered fit for purpose.

- Some of the responses remained anonymous but three private firms active in coastal ocean forecasting contacted us directly and will be kept informed on the project progress.