

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

Deliverable 3.3:

Report on Implementation

Due date: 30/04/2014

Delivery date: Status Draft – 08/04/2014

Delivery type: Report, public



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Contents

1 Introduction	4
2 Status of Implementations	5

Chapter 1

Introduction

In work package 3 of SANGOMA existing data-assimilation methods investigated and new methods are developed that allow for non-linear models and non-linear observation operators. The different methods will be implemented as modules for the data-assimilation tool boxes used by the SANGOMA partners.

The purpose of this deliverable is to report on the implementation of one common new data assimilation method in all toolboxes.

Chapter 2

Status of Implementations

Currently, the SANGOMA consortium is discussing possible choices for the data assimilation method to be implemented in all toolboxes. The discussions reached a short list of

- Equivalent weights particle filter (EWPF)
- Multivariate Rank Histogram Filter (MRHF)
- Gaussian Mixture Filter

The EWPF is the research focus of the SANGOMA partner at University of Reading [van Leeuwen, 2010, van Leeuwen and Ades, 2013]. The MRHF is currently developed by the Partner of CNRS-LEGI [S. Metref, personal communication]. The Gaussian-mixture filter is an extension of the Kalman filter that models non-Gaussian state distributions as sums of multiple Gaussian distributions.

The discussions involve the consideration of the method's features, implementation complexity, as well as readiness for a common implementation. The EWPF is a fully non-linear method that does not base on a modeling of distributions. However, the particle forecasting is rather complex as it involves a stochastic perturbation. In addition, the proposal density has to be applied in the form of a "nudging term" and the equivalent weights step has to be implemented in a model-dependent way. The MRHF does imply a modeling of the distributions by an ensemble weighting scheme following the histogram of the ensemble distribution. It is currently under development, and it has to be checked if a sufficient description of the method can be prepared to allow for a common implementation in the different assimilation tool boxes. The Gaussian mixture filter is less advanced as the distributions are modeled by a sum of Gaussian functions. However, it is also less skillful for the treatment of non-linear models and observation operators. As such, an implementation of the EWPF or MRHF would be preferable.

This deliverable will be adapted and completed as soon as the consortium reaches a decision on the method to be implemented and the method can be documented.

Bibliography

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