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D2A.1 Several years of ocean analyses to be used as initial conditions for the seasonal-to-decadal hindcast production

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CERFACS

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Dissemination Level		
PU	Public	PU
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the Consortium (including the Commission Services)	

D2A.1: Several years of ocean analyses to be used as initial conditions for the seasonal-to-decadal hindcast production

As an input to the production of Stream 1 seasonal to decadal hindcasts, three partners of WP2A.1 (ECMWF, METO-HC and CERFACS) have produced ocean analyses over the period 1991 to 2001. Those initial conditions have been used to produce initial conditions in two seasons (1st of May and 1st of November) for four models: ECMWF (HOPE-IFS), METO-HC (GloSea), CERFACS (ARPEGE-V3-ORCA) and CNRM (ARPEGE-V4-ORCA). As a set of preliminary decadal hindcasts has been designed for Stream 1 to be initialized in May of 1994 and 1965, additional sets of ocean analyses have been produced for the early 1960s as well as initial conditions for May 1965. All ocean analyses streams are able to produce ensembles of 9 hindcasts, either through the perturbation of ocean initial conditions or through the availability of ensembles of analyses.

In addition to this main production, partners have investigated some side aspects of ocean initialisation, as described in the following.

ECMWF

Assessment of the impact of wind stress and SST perturbations on ocean analyses has been carefully examined. A document on the ECMWF ocean analysis describing the impact of the wind stress perturbations in the set of analyses created for ENSEMBLES has been prepared and made available in http://www.ecmwf.int/research/EU_projects/ENSEMBLES/documents/docu_oceananalysis.pdf. Among other aspects, the effect of the new set of wind stress perturbations versus a previous set used in operational forecasts, the features of the new ocean assimilation system a comparison between the DEMETER and the ENSEMBLES stream1 ocean analyses are discussed.

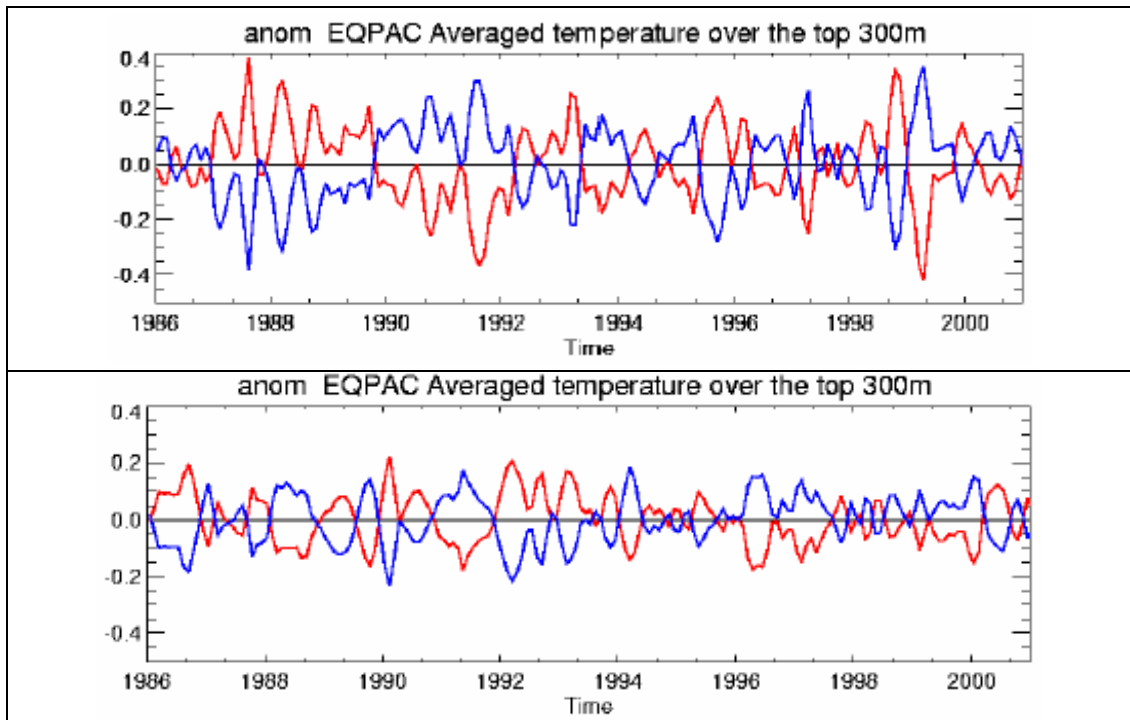


Figure 1: impact of the DEMETER wind stress perturbations (top) and the new ones produced for ENSEMBLES (bottom) on the top 300m temperature.

METO-HC

The wind stress and SST perturbations provided by ECMWF have been combined with the data assimilation development done within the EU FP5 ENACT project to produce a new set of ocean analyses to initialize ENSEMBLES seasonal to decadal hindcasts. Tuning of these has involved tuning the model analysis (see figure 2 for an example of results) and then careful calibration of the ocean ensemble to ensure that subsurface intra-ensemble anomalies are representative of known uncertainties.

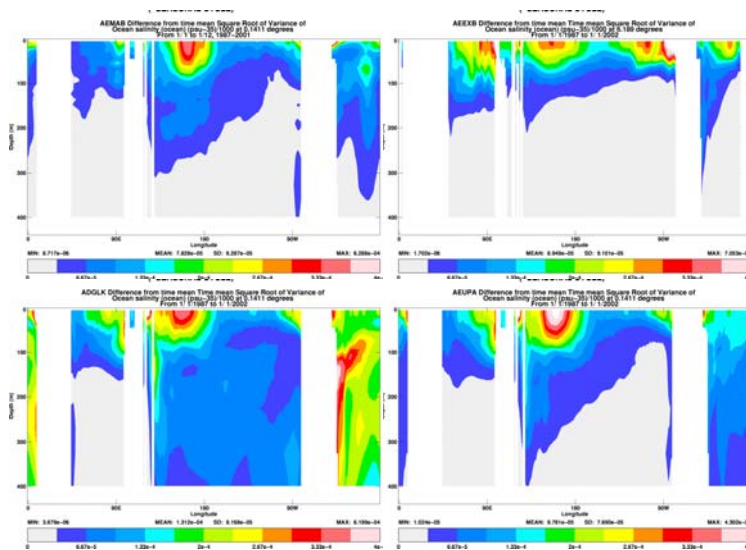


Figure 2: A comparison of sub-surface salinity variance in equatorial-depth sections for the ENSEMBLES ocean analyses generated for 1987-2001. Top left is monthly

salinity variance in an objective model-free analysis (i.e. close to observations), top right is for a forced ocean model, bottom left is a forced model with data assimilation, and bottom right is a forced model with data assimilation and a module to preserve water mass properties.

METO-HC intends to investigate the influence of several initialization techniques on seasonal hindcasts. To do so, initial conditions for the 1st and the 15th of each starting month have been produced, and hindcasts produced at those two dates will be compared, either with the perturbed ocean approach (as in DEMETER and in the other ENSEMBLES systems) and with the “lagged average” approaches where the ocean is kept unperturbed and the atmosphere initial conditions are lagged by one day.

CERFACS

A comparison of the ensemble statistics from the new ENSEMBLES analyses obtained using the updated version of the 3D-Var system has been carried out (see figure 2). In addition, an ensemble strategy has been designed for two purposes: a) to calibrate the background-error covariance model; and b) to produce ocean analysis ensembles for coupled model initialization. The ensemble is defined as a set of 3D-Var analyses produced by perturbing both the SST and wind-stress forcing fields, and the assimilated in situ temperature and salinity observations. This second ensemble strategy will be used for Stream 2.

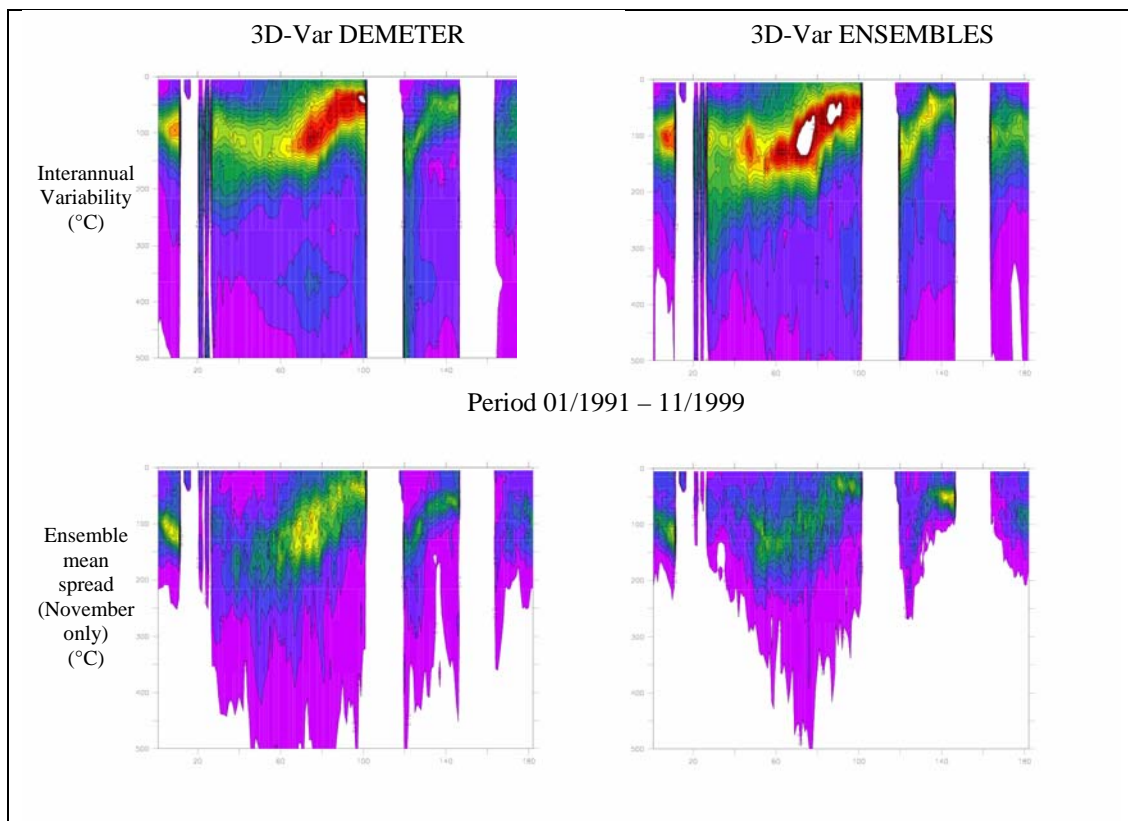


Figure 2: Comparison of (top): the variability of the 3D-Var analyses obtained in DEMETER (left) and in ENSEMBLES (right), and (bottom) of the corresponding spread for the November 1st ensembles.