ORAS4: The ECMWF Ocean Reanalysis System 4

Magdalena A. Balmaseda and Kristian S. Mogensen
European Centre for Medium Range Weather Forecasts

This poster describes the ECMWF operational ocean re-analysis system, implemented in 2010.

http://www.ecmwf.int/products/forecasts/d/charts/oras4/reanalysis/

It consists of 5 ensemble members, covering the period 1958-Present, continuously updated. It is used for:

1) Initialization of the operational monthly and seasonal forecasts.
2) Initialization of decadal forecasts.
3) Climate variability studies.

Ocean Heat Content from ORAS4, Balmaseda et al GRL, 2013

Impact on ORAS4 in SST Seasonal Forecasts

Anomaly correlation: ORAS4 CNTL Persistence

• Large imbalance in the surface heat fluxes from Atmospheric re-analysis. Note jump in the transition to ERA-Interim, due to excessive solar radiation
• Assimilation compensates for errors in the ERA heat flux, in both mean and variability.

ORAS4 and Global Heat Budget

• The Bias correction is negative and relatively stable.
• The largest variability in the assimilation flux comes from the SST, especially the Pinatubo event.
• The assimilation increment shows little variability. Although small, the advent of Argo is visible. The Pinatubo signal is due to the ocean observations.

ORAS4 could be used to estimate the mean and time variability of the oceanic heat transport.

(GW2000: Ganachaud and Wunsch 2000)

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References:


ORAS4 Main Ingredients

Ocean Model: NEMO V3.0 ORCA1 and 42 levels (ocean)
Data Assimilation: NEMOVAR (3D-Var)
Data: Temperature and Salinity Profiles (EN3-XBT corrected and GTS), SST (HADISST/ OIv21x1 /OSTIA), along track Altimeter Sea Level (AVISO). See figure below.
Forcing: ERA40/ERA-INTERIM/ECMWF NWP (see figure below)
Ensemble Generation: wind perturbations, observation coverage, spin-up

ORAS4 shows reduced RMSE and bias respect the CNTL, in both T and S.
The bias in ORAS4 is more stable in time.

Fit to subsurface observations (T & S)

Fit improves with time, both ORAS4 and CNTL.

• Not only more subsurface observations, but better surface forcing and SST data, and different spatial sampling

Fit to Currents (Moorings ADCP)

The ADCP current data from the moorings are not assimilated, and are a valuable independent data set to validate the reanalysis.
Note the positive effect of the Assimilation in the Pacific and Atlantic Undercurrent.

Fit to Altimeter Sea Level

Time correlation (1993-2008) with Sea Level from altimeter data is used to assess the temporal consistency.
The assimilation of T & S improves the correlation in most of the ocean.
Assimilation of altimeter improves it even further.

How Good it is ORAS4?


CNTL: as ORAS4 but without T/S/SLA assimilation. Only SST and atmospheric forcing

ORAS4 and CNTL persist over a longer period of time.

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