WEEKLY SATELLITE SEA SURFACE TEMPERATURE AROUND CORSICA, A DINEOF ANALYSIS OF AVHRR DATA (1998) FORESEEING COMPARISON WITH INTERPOLATED AND MODELLED FIELDS.

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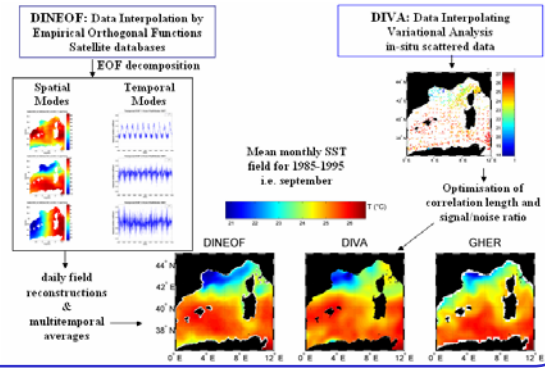
1. INTRODUCTION AND BACKGROUND

Providing wide coverage and high spatio-temporal resolution, SST satellite archives are valuable sources of information for sound understanding of the ocean dynamics, including validation of hydrodynamical modelling studies. Yet original SST fields have also many gaps (clouds, retrieval problems), but they are known to exhibit strong spatial and temporal correlations for regions of similar dynamics. This is exploited by the parameter free statistical technique DINEOF (Data Interpolation with Empirical Orthogonal Functions) (Alvera-Azcárate et al., 2005; Beckers et al., 2006) to produce full weekly analysis of the variability of the sea surface temperature (SST) in the whole Western Mediterranean at weekly temporal resolution during the year 1998. A detection of outliers implemented in DINEOF analysis during the RECOLOUR project allows pointing out unusual or invalid SST data. With particular interest of the MARE center in the environmental changes potentially occurring around Corsica, this study is realised foreseeing a comparison of DINEOF weekly averaged satellite reconstructed fields with those obtained by the GHER 3D hydrodynamical model implemented over the whole area (higher resolution around Corsica). Comparisons with other reconstruction techniques (Optimal Interpolation by Marullo et al., 2007) and other approaches (*in situ* Data Interpolating Variationnal Analysis, Fig.1) are under development (Fig.1; Troupin et al., 2008; Lenartz et al., 2009), and will expand over 20 years.

Find RECOLOUR Project : http://modb.oce.ulg.ac.be/projects/2
Discover DINEOF tool at : http://groups.google.com/group/dineof

Figure 1 – Mediterranean SST climatology seen by DINEOF / DIVA / GHER model



Original Data set : Pathfinder 1998 SST remapped at 1/16°; 73,5 % of missing data
DINEOF analysis synthesized the dynamics into 32 modes; the variability of the input signal explained (varex) by the 3 dominant EOFs = 98,8 % (Fig. 2).

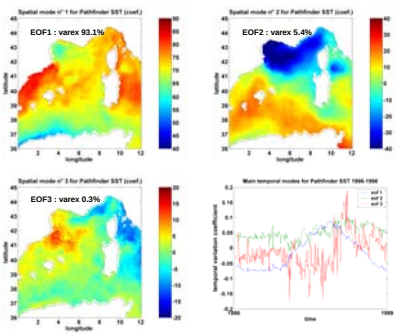


Figure 2 – SST, 1998 : 3 principal modes

2. DINEOF PRODUCTS, 1998

An outlier detection scheme recently implemented (Sirjacobs et al., 2008) within the DINEOF error calculation scheme (Beckers et al, 2006) calculates an outlier coefficient as the ratio between the residual error and the expected reconstruction error. It is efficient in pointing out unusual or invalid Mediterranean SST data, as illustrated by the isolated low temperature zone observed in the middle of warm waters between the Spanish coast and the Balearic islands (20/10/1998; Fig.3). The corresponding pixels of the outlier fields show high values, underlying an abnormal pattern regarding the dynamics captured by DINEOF analysis, which result either from invalid data due to undetected clouds or artefacts from the remapping process, or from really unusual localized upwelling regarding the rest of the data set.

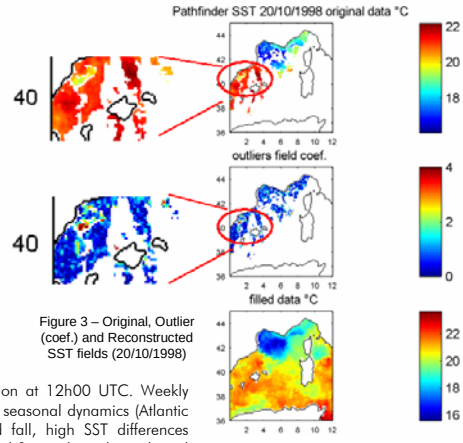


Figure 3 – Original, Outlier (coef.) and Reconstructed SST fields (20/10/1998)

Daily SST fields are reconstructed by temporal EOF interpolation at 12h00 UTC. Weekly averages illustrated in Fig.4 shows high resolution vision on the seasonal dynamics (Atlantic water entering along northern African coast in summer and fall, high SST differences between east and west coasts of Corsica and Sardinia in July and September, channel wind cooling effect east of the strait of Bonifacio separating both islands, …).

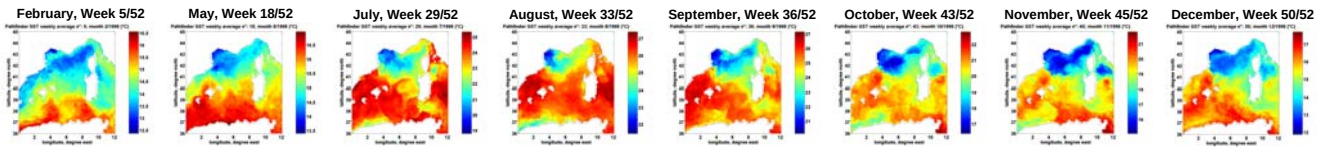


Figure 4 – Weekly SST fields averaged from daily regular reconstructions (at 12h00 UTC),

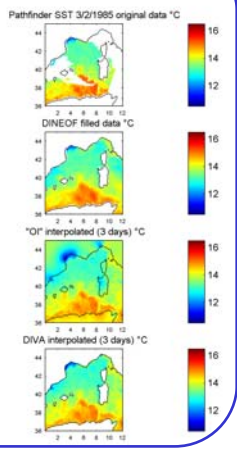
3. CONCLUSIONS and PERSPECTIVES

DINEOF methodology:

- Allowed efficient reconstruction of SST weekly dynamics over the whole western Mediterranean, conserving nice vision of relatively small scale signals, even from highly clouded remote sensing scenes and databases
- Constitutes a powerful approach for enhancing quality of original databases by outlier elimination, as for early detection of unusual changes.

Future developments:

- Quantifying RMS differences between DINEOF reconstructions and modelled fields
- Compare DINEOF with « OI » methods (as illustrated on the right for a DIVA and OI schemes using 3 days of data with gaussian filter): which resonstruction is closest to input data, in which conditions, how to fuse advantages of both methods?



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