TOWARD COASTAL ALTIMETRY APPLICATIONS

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SUMMARY

Although the treatment and corrections for the altimetric data are well known in the deep sea ocean, the precision and number of data dramatically decrease in coastal zones. This loss of data in highly strategic areas is partly due to degraded altimetric measurements, to land contamination in the atmospheric corrections and to the geophysical corrections (tides and sea level response to high frequency atmospheric forcing) computed from global models which are unadapted near the coast.

For some years, a dedicated data processing system has been therefore developed by the MAP (Margins Altimetry Project) group to recover information from altimetry over marginal seas: the X-Track software. A validation stage has been undertaken, where the data reprocessed with X-Track have been compared to available in situ observations and classical altimetric. The X-track processing tool enables a substantial increase in the number of available data in the coastal domain. The agreement between the X-track coastal altimetric sea level variations and tide gauge measurements is also improved. Different scientific applications also reveal that altimetric data offer the opportunity to document a large range of shelf and coastal ocean dynamics. Ever-increasing amounts of data from the different missions (T/P, Jason-1, Envisat, GFO and soon Jason-2) are reprocessed on a regional basis. Once they are validated, these data are made freely available through the CTOH website.

METHODOLOGY

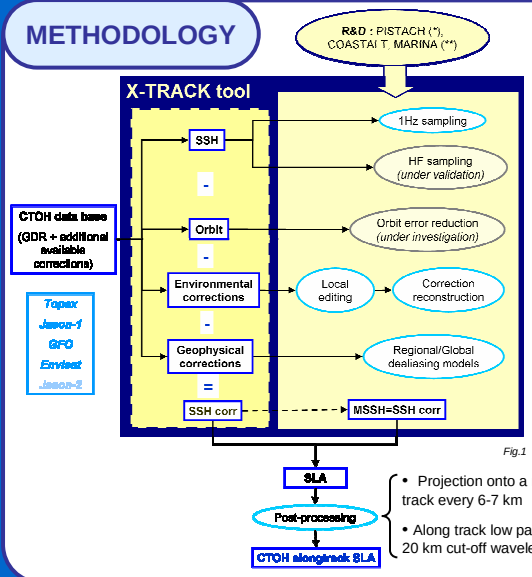

Fig.1

(*) See poster n°139 by Bouffard et al., *"Assessment of regional barotropic models toward the de-aliasing of altimeter data over coastal and shelf seas"*

(**) See poster n°24 by Roblou et al., *"On monitoring the coastal dynamics through an integrated approach (MARINA project)"*

- Projection onto a nominal ground track every 6-7 km
- Along track low pass Loess filter with a 20 km cut-off wavelength

VALIDATION

Example in the Northwestern Mediterranean Sea:

1.Comparison to a classical product (T/P+J1 from Jan. 1993 to Oct. 2007)

→ More data in coastal zones and around islands

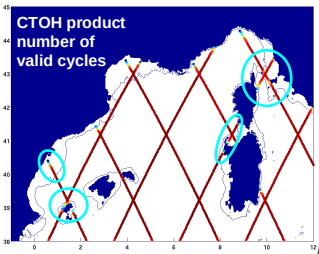

Fig.2.a

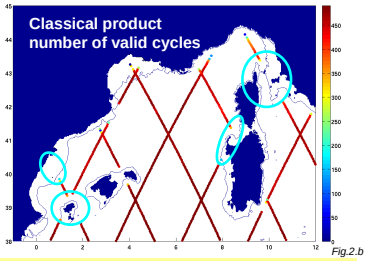

Fig.2.b

2. Comparison to tide gauge (TG) time series: Normalized Taylor diagrams

→High coherence between CTOH and classical altimetric products

→CTOH data closer to TG data in terms of correlation, rms and difference of rms

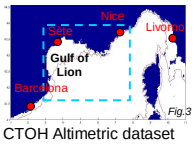

Fig.3

- CTOH Altimetric dataset
- Classical altimetric product
- Point of perfect altimetry/TG statistical agreement

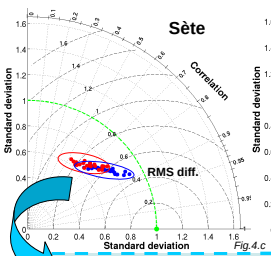

Fig.4.c

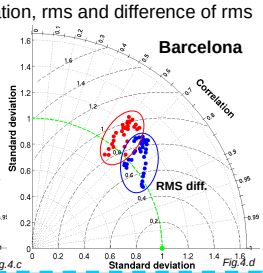

Fig.4.d

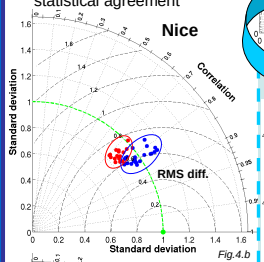

Fig.4.b

2.a. Regional pattern of correlation in the Gulf of Lion (Sète tide gauge)

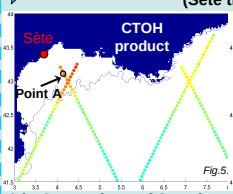

Fig.5.

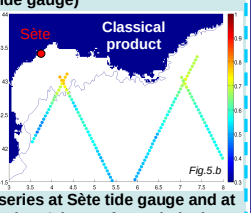

Fig.5.b

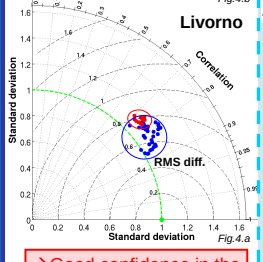

Fig.4.a

2.b. Comparison of SLA time series at Sète tide gauge and at point A of T/P + Jason1 track 146 (max of correlation)

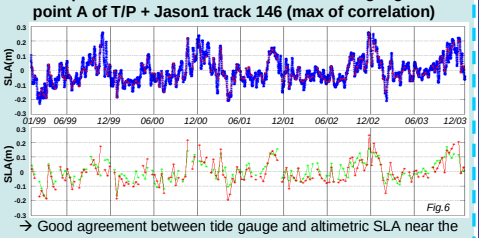

Fig.6

→Good confidence in the CTOH altimetric dataset

→ Good agreement between tide gauge and altimetric SLA near the coast for both the seasonal cycle and the high frequency signal.

DATA ARE NOW AVAILABLE ON:

http://www.legos.obs-mip.fr/en/observations/ctoh/COTIER/

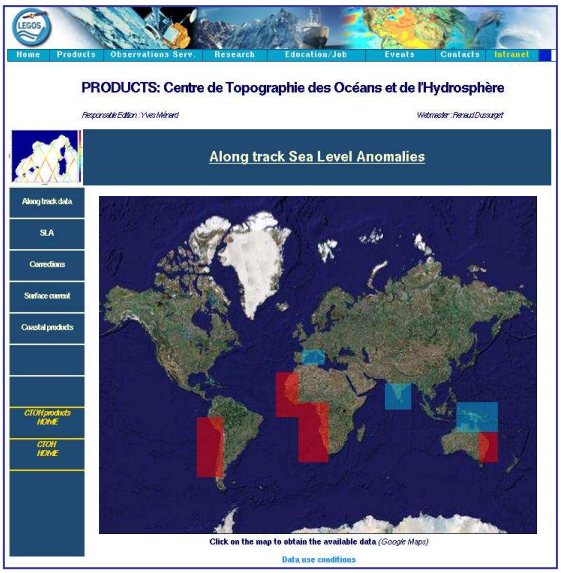

Fig.7

Available areas:

→**Northwestern Mediterranean Sea** *(38N - 45N ; 2W - 12E)*

→**Solomon Sea** *(30S - 10N ; 120E - 180E)*

→**Indian Coasts** *(0N - 27N ; 60E - 100E)*

Under validation:

→**Humboldt System**

→**South East Atlantic Ocean**

→ **Australian East Coast**

Note that CTOH alongtrack Sea Level Anomalies regional products can be provided for other areas on simple request at ***ctoh_products@legos.obs-mip.fr***.

APPLICATIONS

Examples in the Northwestern Mediterranean Sea

1. Model validation:

Correlations between altimetry and SYMPHONIE regional model Sea Level Anomalies (SLA):

→ High consistency in deep sea regions

→ Lower correlations in coastal areas, due to a short lag between the altimetric data and the model (see Bouffard et al., 2008 a)

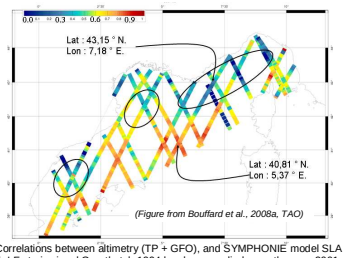

Fig.8: Correlations between altimetry (TP + GFO), and SYMPHONIE model SLA to which LF steric signal Greatbatch 1994 has been applied, over the year 2001.

2. Coastal process monitoring:

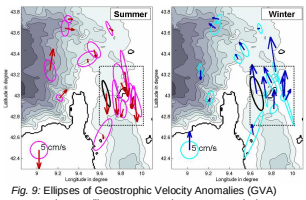

Fig. 9: Ellipses of Geostrophic Velocity Anomalies (GVA) computed at satellite crossovers: the summer and winter seasons are defined during the multimission time period (2002 to 2005). Bathymetry (m) is indicated by contour lines. The arrows indicate the mean polarization of the GVA. The black ellipse corresponds to the in situ current measurements. *(Figure from Bouffard et al., 2008b, GRL)*

Velocity anomalies at altimetric crossover points:

→ Good agreement with in situ currentmeter data

→Ability to monitor ocean dynamics from high frequency to interannuality (see Bouffard et al., 2008b) in an area where classical data are eliminated (see *fig.10*)

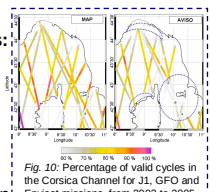

Fig. 10: Percentage of valid cycles in the Corsica Channel for J1, GFO and Envisat missions, from 2002 to 2005 *(Figure from Bouffard et al., 2008b, GRL)*

3. Other on-going applications or perspectives:

- Spatio-temporal structure of the East Indian coastal current (F. Durand)
- Circulation study and model validation in the Solomon Sea (A. Melet, L. Gourdeau, J. Verron)
- Study of the upwelling of Papua – New Guinea (M.H. Radenac, E. Zakharova)
- And many others perspectives such as extreme events signatures, internal waves, etc...

REFERENCES

Bouffard, J., S. Vignudelli, M. Herrmann, F. Lyard, P. Marsaleix, Y. Ménard, and P. Cipollini (2008a): Comparison of ocean dynamics with a regional circulation model and improved altimetry in the North-western Mediterranean. Terr. Atmos. Ocean. Sci., 19, 117-133, doi:10.3319/TAO.2008.19.1-2.117(SA)

Bouffard, J., S. Vignudelli, P. Cipollini, and Y. Menard (2008b), Exploiting the potential of an improved multimission altimetric data set over the coastal ocean, Geophys. Res. Lett., 35, L10601, doi:10.1029/2008GL033488.

Durand, F., D. Shankar, F. Birol, S.S.C. Shenoi (2008a): Spatio-temporal structure of the East India Coastal Current from satellite altimetry, Journal of Geophysical Research, in press

Durand, F., D. Shankar, F. Birol, S.S.C. Shenoi (2008b): Estimating boundary currents from satellite altimetry: A case study for the east coast of India. Journal of Oceanogr, Vol. 64, No. 6, pp.831-845, 2008.

Roblou L., F. Lyard, M. Le Hénaff and C. Maraldi (2007): X-TRACK, A new processing tool for altimetry in coastal oceans, Proc. ENVISAT Symposium, Montreux, Switzerland