SSALTO DUACS

Adding global and regional operational altimeter products

G.Dibarboure, CLS Space Oceanography Division
P.Y Le Traon, CLS   -   N.Picot, CNES

Abstract

An overview of the SSALTO/DUACS multisatellite system is given: processing used to ensure stability and homogeneity and accuracy in DUACS products. The evolutions that one may expect in 2004 and 2005 are also presented : delayed time (DT) reprocessing, regional specific products, processing and algorithm upgrades…

Project Overview

Objectives: to provide operational applications with homogeneous and directly usable high quality altimeter data from **all** missions (see Fig. 1).
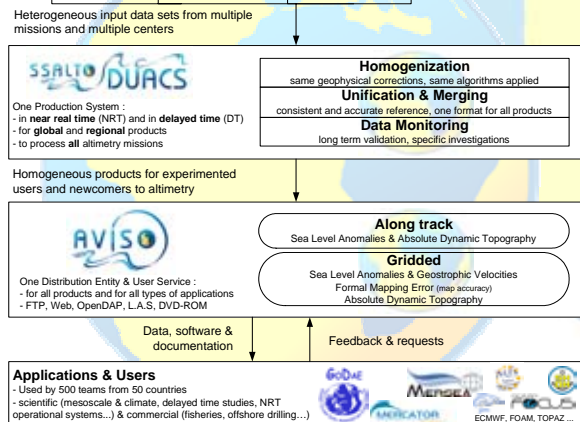
Input: the latest high-quality NRT Level 2 altimeter data (IGDR with MOE orbit) from all agencies and ground segments.

Processing: homogenization (update with the state of the art corrections, models…), complex data editing (threshold, splines, slope detection…), orbit error reduction (global crossover minimization and local inverse method), multi-satellite mapping.

Quality Assessment: daily reports, off-line validation, long term monitoring and specific investigations…

Fig 1 : Data flow from L1 the ground segment to the L3 applications

Heterogeneous input data sets from multiple missions and multiple centers

Homogenization
same geophysical corrections, same algorithms applied
Unification & Merging
consistent and accurate reference, one format for all products
Data Monitoring
long term validation, specific investigations

One Production System :
- in **near real time** (NRT) and in **delayed time** (DT)
- for **global** and **regional** products
- to process **all** altimetry missions

Homogeneous products for experienced users and newcomers to altimetry

Along track
Sea Level Anomalies & Absolute Dynamic Topography
Gridded
Sea Level Anomalies & Geostrophic Velocities
Formal Mapping Error (map accuracy)
Absolute Dynamic Topography

One Distribution Entity & User Service :
- for all products and for all types of applications
- FTP, Web, OpenDAP, L.A.S, DVD-ROM

Data, software & documentation   Feedback & requests

Applications & Users
- Used by 500 teams from 50 countries
- scientific (mesoscale & climate, delayed time studies, NRT operational systems…) & commercial (fisheries, offshore drilling…)

ECMWF, FOAM, TOPAZ …

Adding Delayed Time Products to NRT

The DUACS system will compute homogeneous and high precision along-track and gridded products based on delayed time data from all altimeter missions (see Fig. 2). This will be the first time in altimetry history that an homogeneous merging of 5 missions is carried out.

"All missions" features: state of the art processing upgrades, same missions used in the NRT system for a NRT/DT transition as seamless as possible.

"TP+ERS" features: totally reprocessed to integrate all upgrades, homogeneous data set (stable in time not dependent on the satellite availability), Jason and ENVISAT currently used in place of T/P and ERS

Fig 2 : NRT/DT Processing Overview

Near Real Time (~48h) — Delayed Time (>30 days)

IGDR MOE Orbit Corr — GDR POE Orbit Corr

NRT Component — DT Component — SSALTO/DUACS Same processing, same references, same corrections

«All Mission» Product — «All Mission» Product — Homogeneous «TP+ERS» Product — AVISO Same formats, same software, same documentation

Jason + T/P tandem + ENVISAT + GFO (merging all missions when/if they are available, best sampling available at a given time) — T/P + ERS Jason + ERS Jason + ENVISAT (same ground track, sampling stable in time)

Adding Regional Specific Products

In 2005, regional specific products based on combined altimeter measurements will be added to the DUACS system. Using common processing facilities to jointly serve global and regional applications has many advantages and benefits to all users (see Fig. 4).
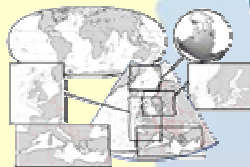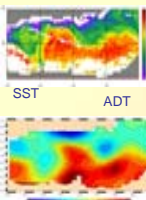
Fig 3 : MERSEA areas of interest

Objectives: These products will be distributed to regional operational projects such as MFSTEP or MERSEA (see Fig. 3).

Fig 4 : Maps of SST and Absolute Dynamic Topography in Alboran Sea (MFSTEP-like product) on 2003/01/08.

Good consistency is brought by the regional specific processing and the use of 4 satellites.

Courtesy of A.Pascual et al. (see References)

SST   ADT

Regional specific Processing: improved mapping software to precisely take into account islands or coasts, regional specific correlation functions, barotropic model to correct for high frequency signals, removable IB and tidal corrections

Processing upgrades

The continuous improvements on DUACS processing will be kept up in 2005. Upgrades already scheduled:

❖ NRT Operational use of a global barotropic model (MOG2D) to correct for high frequency signals (see Fig. 5). This is notably important for regional products.
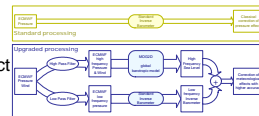
Fig 5 : Using MOG2D to correct altimeter products

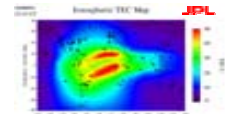❖ **GIM** based ionosphere correction for GFO. This correction will be based on NRT TEC grids from JPL (Fig. 6).

❖ A new 7-year mean dynamic topography (**MDT**) has been computed using GRACE data. This work was done by MH.RIO at ISAC-CNR, Italy under an ESA fellowship grant. The DUACS system will use this MDT in early 2005 to produce better ADT data (see Fig. 7).
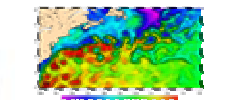
Fig 6 : GIM TEC Grid to be used in the GFO ionosphere correction process (courtesy of A.Komjathy, JPL).

❖ Notable upgrades to the Large Wavelength Error (**LWE**) reduction software to better take into account regional specificities.

Fig 7 : Absolute dynamic topography based on the new MDT plus SLA.

❖**Local MSS** along each satellite ground track to better account for cross-track gradient effects in the SLA process (Dorandeu and al, 2003).
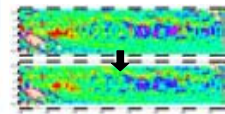
❖ Integration of **CryoSat** on ocean if NRT data become available.

❖ The geostrophic velocity processing will be improved in the equator band. The **equatorial geostrophy** approximation used so far was based on Picault et al. [1989]. It will be replaced by the method proposed by Lagerloef et al, [1999] (see Fig.8). Comparisons with TAO buoys data show notable improvements in DUACS products.

Fig 8 : Zonal velocities in Tropical Pacific with the old (top) and new (bottom) equatorial geostrophy approximation

❖**Web** & user documentation will be redesigned to be more detailed, consistent and user friendly (DT/NRT, global/regional) It will give the latest data validation and monitoring status in real time.

Bibliography

❖ Dorandeu, J, et al., 2004 : Jason-1 global statistical evaluation and performance assessment. Calibration and cross-calibration results. (Marine Geodesy, in Press)
Pascual.A. et al, 2004 : Mesoscale mapping capabilities of multisatellite altimeter missions : first results with real data in the Mediterranean Sea (submitted to JMS)
❖ Le Traon, P.Y, Dibarboure, G., 2004 : An illustration of the contribution of the T/P-Jason tandem mission to mesoscale variability studies. Marine Geodesy, 27, 3-14
❖ Dorandeu, J. et al., 2003 : Reducing Cross-Track Geoid Gradient Errors around TOPEX/Poseidon and Jason-1 Nominal Tracks: Application to Calculation of Sea Level Anomalies. JAOT, 20,12, pp. 1826–1838.