SSALTO/DUACS multimission altimeter products

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Data source	Mission/Model	Data Type	Delay	Robusteness
CNES/NASA	Jason-1	IGDR	48h	Operational
ESA/CNES	Envisat	IGDR	72h	Operational
NOAA	GFO	IGDR	72h	Best Effort
NASA/CNES	T/P	IGDR	>72h	Best Effort

Figure 1. Input data overview

SSALTO/DUACS is an operational system that unifies and combines altimeter data in near-real time. Heterogeneous data from multiple instruments, produced by various space agencies, are validated, unified, homogenized and merged to produce Sea Level Anomaly (SLA) or Absolute Dynamic Topography (ADT) data sets at high spatial and temporal resolutions. SLA and ADT are high-level, user-friendly products able to describe ocean structures and currents.

Because they merge data from at least three altimeter missions, and because they precisely remove large-scale errors, SSALTO/DUACS products are able to accurately map mesoscale signals such as ocean eddies (ocean "weather"), as well as to precisely estimate large-scale oceanic signals (ocean "climate").

There is a broad range of applications and users for these products: scientific studies for oceanography or climate; assimilation in operational models; and offshore and fishery industries or cruise optimization. SSALTO/DUACS data are distributed through an anonymous FTP server, or through the Web (Live Access Server and Opendap). The Aviso user service also provides active support for all users.

Input data

In early 2004, SSALTO/DUACS routinely processes four missions: Jason-1, Envisat, Topex/Poseidon, and GFO (see Figure 1).

Three types of altimeter data are produced: real-time data generated in a few hours (OSDR); near-real-time data produced in two-to-three days (IGDR); and delayed-mode data produced in more than 15 days (GDR). All three data sets are based on the same instrument measurements, but their quality is different.

Although produced in real time, OSDR altimeter products do not have a precise orbit determination. This would be a serious limitation to the quality of any user product based on these data sets. GDR data are very good quality, and notably provide a very good orbit determination. Unfortunately, they are not produced quickly enough for real-time processing like SSALTO/DUACS'.

Therefore, the SSALTO/DUACS system uses the latest high-quality altimeter data produced in near-real time (IGDR). These input data are distributed by multiple space/environmental agencies from the United States and Europe, including CNES, ESA, NASA, and NOAA (see Figure 2).
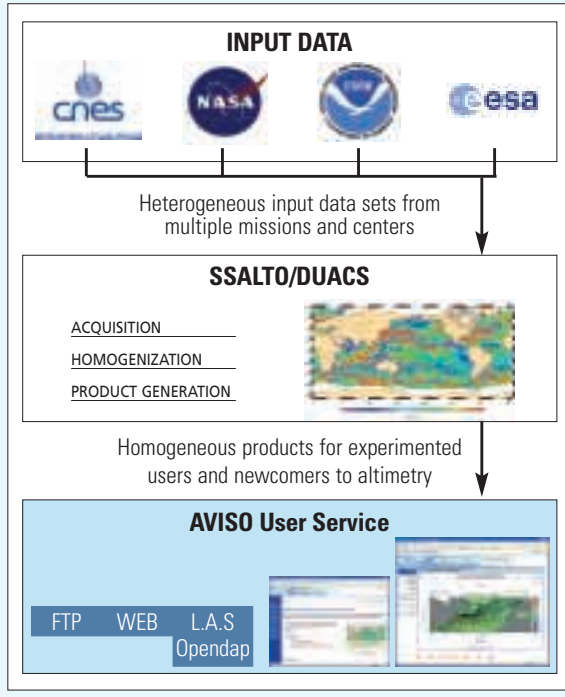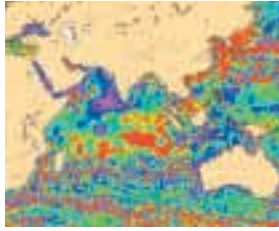

Figure 2. SSALTO/DUACS system overview

Data Processing

The main processing steps of DUACS are:

- continuous acquisition of altimeter data and auxiliary data (geophysical and environmental corrections of altimeter measurements)
- data homogenization (updates/ enhancements with state-of-the-art corrections, or models)
- complex data editing to remove erroneous or suspicious measurements
- orbit error and long-wavelength error removal
- production of along-track Sea Level Anomaly (SLA)
- mono and multi-satellite mapping (MSLA product).

In addition to data, DUACS produces continuously detailed daily and weekly quality reports and performs offline validation (comparison with delayed-mode GDR data) and long-term monitoring of data sets.

Products

Twice a week, SSALTO/DUACS generates along-track Sea Level Anomalies (SLA), and high-resolution Maps of SLA (MSLA) and their formal mapping errors. These products are distributed by the AVISO user service on FTP, Web, and through a Live Access Server. Real-time SSALTO/DUACS products are available for scientific applications, and data older than 30 days are available for all applications.

Applications

Current applications include Mercator, GODAE and MFS models, seasonal and climate forecasting centres, offshore and fisheries (see figures 3 to 5). Using common processing facilities to jointly serve scientific (e.g. scientific cruise optimization), operational (mesoscale and climate) and commercial customers has many advantages

and benefits to all users. About 40 systems in a dozen different countries are currently using SSALTO/DUACS products for near-real-time scientific and operational applications. This number has been growing steadily since the beginning of the project (about one or two new users per month).

The number of users of the Live Access Server has been increasing quickly since it came on line in early 2003. More than 1,000 maps per month are currently distributed through the Aviso Live Access Server. The DUACS website distributes graphical products (pictures and animations) and It receives up to 800 visitors per month.

System History 2002/2003

Near-real-time processing of altimeter data has been developed by CLS as part of DUACS (Developing Use of Altimetry for Climate Studies), a European Commission three-year project which started in February 1997. Coordinated by CLS, DUACS involved four of the major climate research teams in Europe.

The system has demonstrated that altimeter data could be processed in near-real time with sufficient accuracy to help improve climate simulations and seasonal climate forecasts, as well as operational oceanography applications.

Since the end of DUACS, the system has continued to provide NRT altimeter data for operational oceanography applications. In the meantime, a new version has been developed. The new operational SSALTO/DUACS system is part of the CNES SSALTO multimission ground segment.

This system incorporates many improvements in the processing algorithms and is able to merge Topex/Poseidon, ERS-2, Geosat Follow on (GFO), Jason-1 and Envisat data. It has been designed to serve operational oceanography (Mercator, GODAE) as well as climate forecasting (ECMWF) systems.

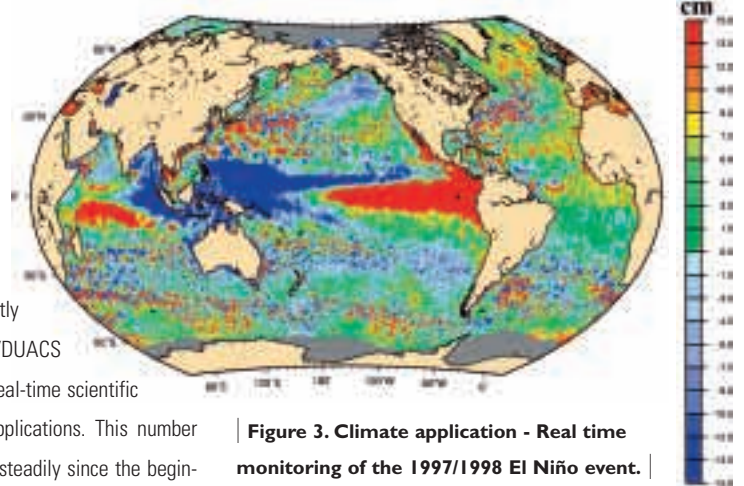The SSALTO/DUACS system is funded by CNES and the Midi-Pyrénées Regional Council.

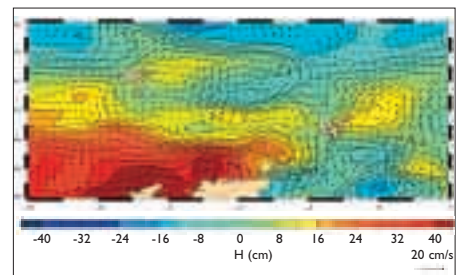Figure 3. Climate application - Real time monitoring of the 1997/1998 El Niño event.

Figure 4. NRT Map of Sea Surface Height based on Jason-1, Envisat and GFO data (Faroe Island & Shetland Island) used as a prototype for offshore applications (EMOFOR project).
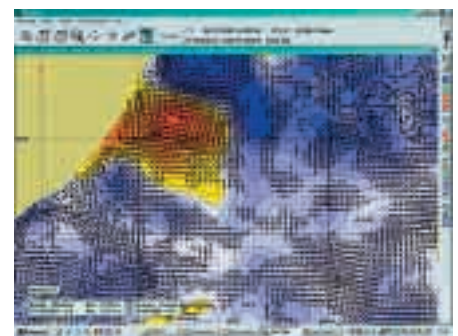

Figure 5. Commercial application - Screenshot from CATSAT onboard software, displaying SSALTO/DUACS MSLA.

Contacts & Information

For more information regarding SSALTO/DUACS, please contact the Aviso user service (aviso@cls.fr) and check out the SSALTO/DUACS website: http://www.aviso.oceanobs.com/duacs/