Users Newsletter

June 2011, #6

Project News

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In-orbit missions

Jason-1 is now more than 9.5 years old and data are still very good. The degradation encountered in 2010 related to the star tracker performances have been largely reduced thanks to an in depth analysis of the platform gyro wheels behaviour. Since early December 2010, Jason-1 pointing accuracy is very good.

In case of large mispointing, the impact is minimized on I/GDRs products thanks to the ground retracking used for offline products, but if the off-nadir angle is too high (i.e. above 0.9 degrees) the altimeter may lose the return echoes leading to some loss of data.

Many scenarios have been considered by a Joint Working Group made up of CNES & NASA experts to find the best solution for the Jason-1 Extension of Life. At a meeting held on July 12 2010, a Joint Steering Group (JSG) approved the plan to keep the satellite on its current orbit after a partial tank depletion. The reason for partially depleting the fuel tank is to reduce the impact of an explosion due to a debris hit. The JSG also approved an emergency scenario in the event of fatal satellite failure. The fuel tank partial depletion operations were planned to take place from the end of July to the beginning of August but maneuvers were interrupted after an under performance detected on July 29th 2010. Products were affected in terms of quality and delay.

Artist view of Jason-2 (Credits CNES/D. Ducros).

Currently CNES and NASA project teams are in the process to extend the mission. On both sides the goal is to continue the observations made by Jason-1 for the next 2 years. As stated by the Project Scientist, "*the mission is still providing more that 98% good data coverage…Today, the Jason-1/Jason-2 altimeters are the key altimeter missions holding together the long-term scientific and operational analyses… Given the excellent quality of the ageing Jason-1 mission data, and its key role in the present altimeter constellation for ocean climate studies and operational applications, it is very important that this mission can be extended for the next two years in the current tandem configuration with Jason-2.*"

Agencies decision should be known in few weeks and could be linked to some additional tank depletion activities in order to minimize the risks to remain on the reference orbit.

Close to 3 years after launch, the **Jason-2** products continue to provide high-quality data to the altimetry community. The onboard orbit solution provided by the DORIS navigator performs very well with a radial RMS of about 3 cm. The quality improvement in orbit data is positively affecting the near-real-time OGDR products. Jason-2 IGDR products are routinely available to users within 1.5 days, meeting mission require-

ments. The constantly enhanced GDR products will be improved to take into account the changes required by the OSTST: new rain flag, new tide model, new calculation of radiometric parameters, added parameters in GDR or SGDR products, correction of minor bugs and usual file updates (altimeter characterization file, instrumental correction tables, wind & SSB tables). As a result, a complete reprocessing of Jason-2 GDR-C products is planned by the end of 2011. To conclude Jason-2 news, the prototype aiming to improve altimetry products in coastal and hydrological areas (called PISTACH) still routinely provides data and encouraging results. These new products are still under analysis by specific groups and users and the associated product handbook is available on the AVISO website.

Concerning **ENVISAT**, the products are of very good quality (bearing in mind that there is no longer any S-band altimeter). A complete reprocessing of the entire Envisat altimetry data set is ongoing. On October 22nd 2010, Envisat was moved to a drifting orbit and is expected to continue its mission up to 2013.

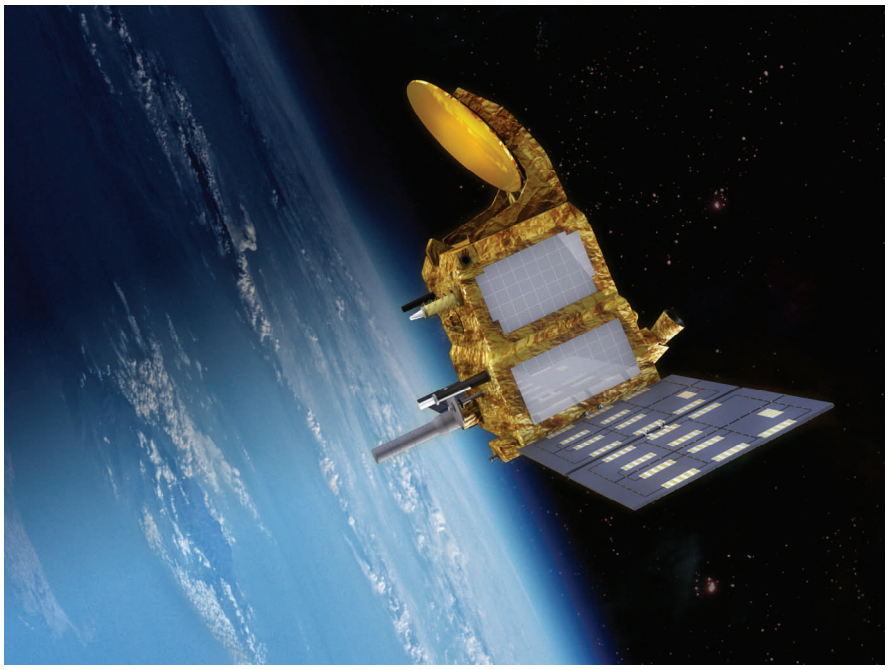
Cryosat-2 first results were presented on February 2011 at the ESA Cryosat Validation Workshop. All the science community have now free and easy access to all of the measurements. Data from the DORIS instrument onboard Cryosat-2 are available to users on the IDS website. Thanks to the satellite reaching latitudes of 88°, some ice-free areas not sampled by Envisat tracks are sampled by Cryostat. Early results from the mission have also demonstrated how CryoSat data are very valuable for sea level or ocean circulation studies at high latitudes.

Artist view of Cryosat-2 (Credits ESA).

Ongoing developments

SARAL/AltiKa is a mission conducted jointly by ISRO and CNES. ISRO is currently planning to launch the satellite in 2012 from India. Integration tests of the ground segment components were completed in 2010. A scientific workshop was held from 15th to 17th March 2011, bringing together about 70 PIs from India and other countries. The Payload Integrated Module provided by

CNES completed all the environmental and performance tests in 2010. Final reference tests are being performed before its shipment to Bangalore in the coming months.



Artist view of Saral (Credits CNES-ISRO/GEKO).

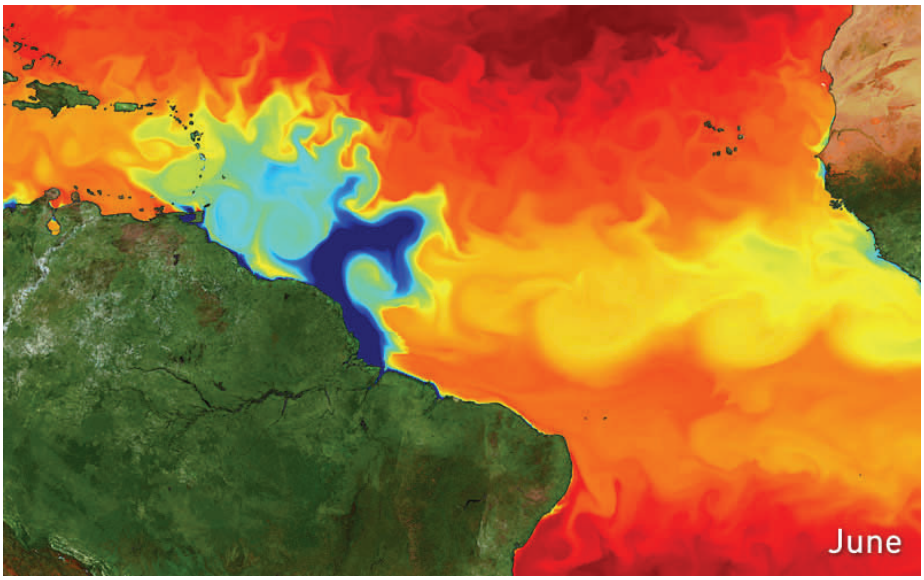
HY-2A is a French-Chinese collaboration between CNES and CNSA/NSOAS for altimetric and orbitography products. The launch is scheduled for the 25th of July 2011.

The **Jason-3** project (a joint EUMETSAT, NOAA, CNES and NASA mission) development is ongoing. The SSDR (System Synthesis Design Review) was held in February in France. Development of the ground segment begins in spring 2011 based on the renewal of most of the Jason-2 features and algorithms. The launch is planned for late 2013.

Sentinel-3 The ESA Sentinels will be the first series of operational satellites to meet the Earth observation needs of the European Union-ESA Global Monitoring for Environment and Security (GMES) programme. The pair of Sentinel-3 satellites will provide global, frequent and near-real-time monitoring of ocean, ice and land surfaces. The mission continues Envisat's altimetry, the multispectral, medium-resolution visible and infrared ocean and land-surface observations of ERS, Envisat and Spot, and includes enhancements to meet the operational revisit requirements and to facilitate new products and evolution of services. Sentinel 3-A development is going well, the system CDR has been achieved in April 2011. The launch is planned for November 2013.

Artist view of Sentinel 3 (Credits ESA).

Ocean Observatory



Salinity at the mouth of the Amazon river (Credits CNES/Mercator/MyOcean).

In order to promote oceanography, CNES, Mercator and MyOcean launched a communication project at the end of 2009 called the "Oceans Observatory". The aim of this project is to create an image/video database based on Mercator model outputs, MyOcean data and CNES altimetry data. Contracted to the MIRA Production company, about 15 different topics will be addressed during the project. High-resolution images and videos will be accompanied by text (French and English) describing the nature of the observed event and detailing how the results have been presented.

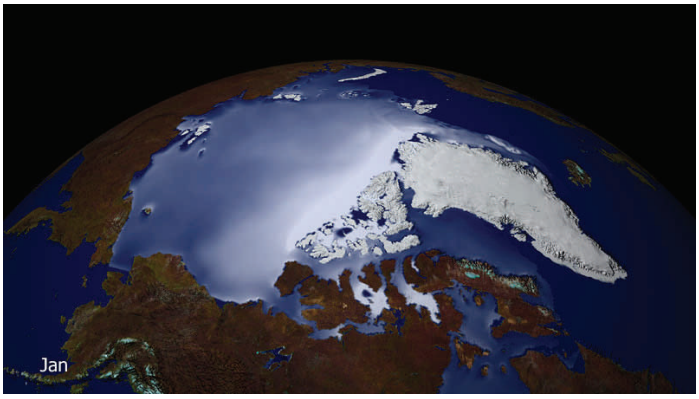
So far, the following themes have been addressed:

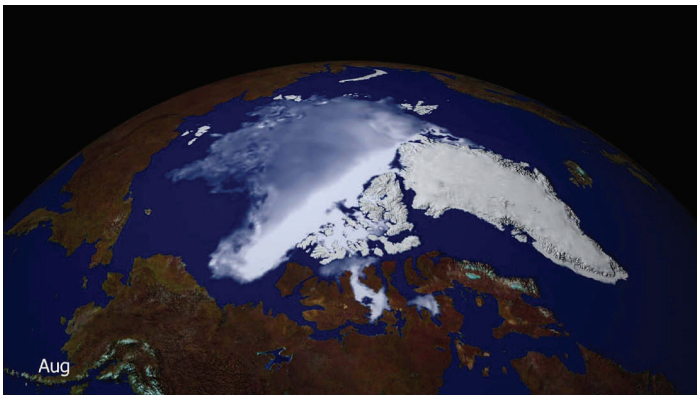
- Globes presenting global Sea Surface Height, Salinity and Temperature.
- Salinity at the mouth of the Amazon river.
- Ice thickness.
- Depth of mixing layer in the Bay of Biscay.
- Agulhas current.
- El Niño in the Equatorial Pacific Ocean.
- Sea Surface temperature in the Strait of Gibraltar.
- Currents in the North West Shelf zone (Atlantic Ocean).

To see the images, films and related texts, please visit the Mercator Daily Motion website or the MyOcean website. If you wish to refer to some of the themes, please use these links and credit the appropriate sources (Credits: CNES/Mercator/MyOcean).

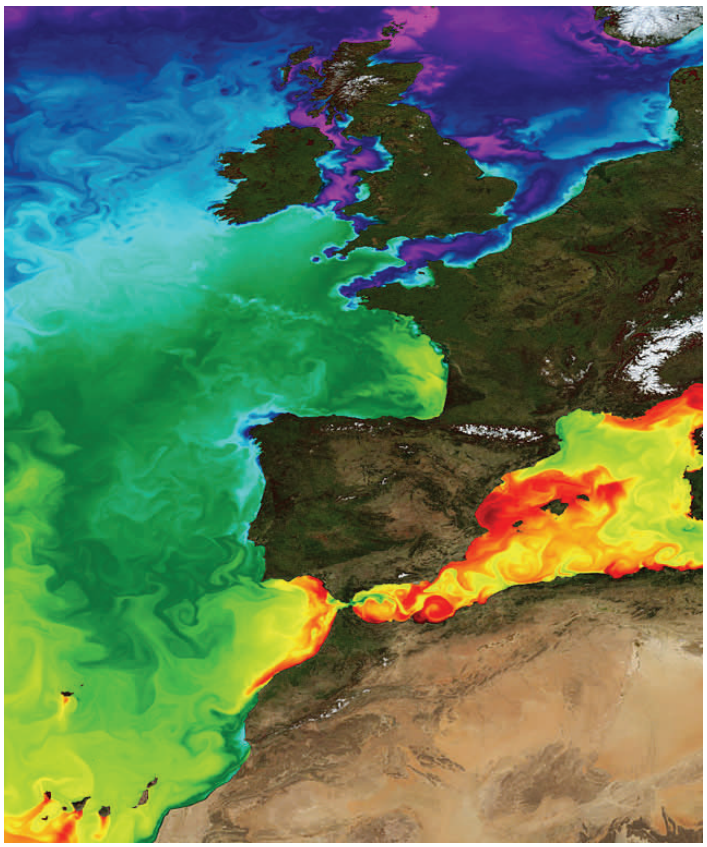
Many other topics are still being prepared (hurricanes, Gulf Stream, plankton blooms, etc.) and should be released soon.

At the end of the project (end of 2011), we expect to have a synthesis film summarizing all of our productions and we will even consider organizing an exhibition, as some of the high resolution images and animations can be considered as "Art".





Ice thickness in Arctic (Credits CNES/Mercator/MyOcean).



Sea Surface temperature in the Strait of Gibraltar (Credits CNES/Mercator/MyOcean).

Major Upgrades in the New BRAT Releases

Two new releases of the Basic Radar Altimetry Toolbox (BRAT) were performed in February (v3.0) and May 2011 (v3.0.1) including major upgrades to the software and the tutorial.

Developed under contract with ESA and CNES, the Basic Radar Altimetry Toolbox (BRAT) is an "all-altimeter" collection of tools, tutorials and documents designed to facilitate the use of radar altimetry data, including those from the next missions to be launched, for all applications. This new version can be downloaded from the Basic Radar Altimetry Toolbox website.

Software upgraded

This update is a major upgrade to the software, including:

- batch processing to delay the execution of an operation: BratScheduler,

- support for Topex and ERS RA waveform products,

- an easy 'drag & drop' feature to add files to the Dataset panel,

- an improved 'ascii export' facility: to export either the result of the operation (default) or only dumps of the expression data. In the previous version of Brat, 'ascii export' only dumped the expression data,

- several improvements to BratDisplay:

* Added support to display vector plots,

* Added support for new projections (Orthographic, Near-Sided Perspective, and Stereographic) of use for polar applications,

* the directory used to save exported images will now be remembered for consecutive exports

* the number of latitude/longitude grid lines will now increase/decrease depending on the zoom level.

* latitude/longitude grid lines now come with a text label showing the associated latitude/longitude value of the parallel/meridian.

* the center/zoom feature for worldplots has been greatly improved.

* the 'animation bar' is now shown by default if the plot can be animated.

- several bugs were also fixed.

Tutorial upgraded

The tutorial also includes several upgrades to the "Data Use Cases" section:

- Ice studies: Cryosat over continental ice

- Sea ice studies: Cryosat over sea ice

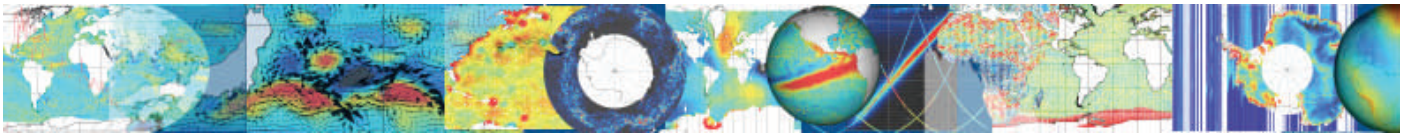
- Altimetry and gravimetry: Use of the GOCE toolbox in oceanography with altimetry

- Altimetry data processing for mesoscale studies: Computing geostrophic velocities

- Altimetry for coastal studies: The North Western Mediterranean Sea (with PISTACH data)

- Hydrology studies: Wetland and reservoir monitoring using satellite altimetry (with PISTACH data)

See the complete list of change versions on the readme file.



Data Use Case: Mapping Current Vectors

The new release of the Basic Radar Altimetry Toolbox (BRAT) presented above is able to map current vectors. Here is a step-by-step example showing currents swirling around the hills and valleys of the sea surface.

Brat, a logical sequence of 5 steps

BRAT is organized around a graphical user interface (BratGui) with menus and tabs, each being a step toward an operation/display of your data.

1. The first step is to create the Workspace. A workspace enables you to save and re-use all the choices, computation formulas, etc. you use during a session.

2. Dataset tab, to define the dataset to which the operations/displays will relate.

3. Operations tab, to define the operations to be performed on the dataset (statistics, resampling, thresholds, output format files)

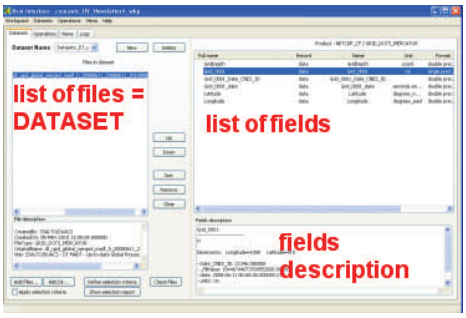
4. Views tab, to define and save the graphical output of the computed operations (title, palettes, zoom, map projection).

5. Display Component: graphical interface enables you to see, configure and save the displays.

Create a workspace and a dataset

The first step is to create the workspace: Menu File > Workspace > New.

Then download the data onto your computer. Here we have chosen to represent a Map of Absolute Dynamic Topography (MADT) superimposed on geostrophic current vectors in the Mediterranean Sea. Download a file for a given date (see how to access MADT data from the Aviso website) from the authenticated ftp server: /donnees/ftpsedr/DUACS/regional-mfstep/dt/upd/madt/merged/h/dt_upd_med_merged_madt_h_20101201_20101201_20110329.nc



BRAT 'Dataset' tab with the loaded file, the listed fields and the filed description.

With BRAT, list all the data file(s) needed to create your Dataset: on the Datasets tab, click on "New" (next to "Dataset name"). A default name is given (Datasets_1). Click on "Add Files" at the bottom left. Retrieve the file previously loaded onto your computer. The list of file(s) will then appear in the left-hand box. Click on the file on the left to list, in the right-hand box, each field included. Click on a variable to see the field description on the bottom right.

Create an operation

Click on the "Operations" tab. Click on "New". A default name is given (Operation_1). You can then start defining the expression you wish to compute. Choose the dataset you have just defined (Datasets_1). Below, you can see the list of available fields.

In the "Data expressions" box (in the middle) four items are displayed:

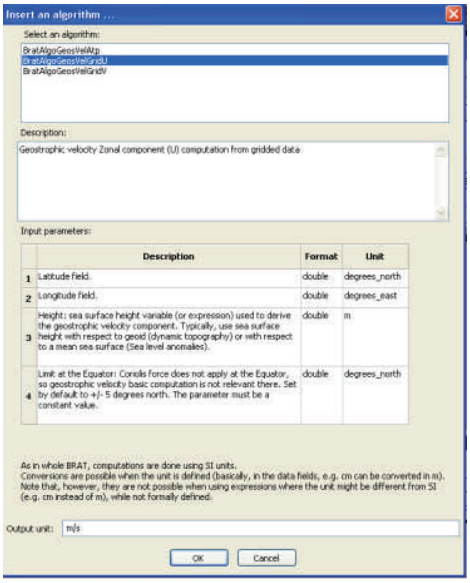
• "X", to be completed with the longitude; choose "Longitude" from the list of fields, drag and drop it in the "X" box.

• "Y" to be completed with "Latitude"

• "Data expression":

o drag and drop "Grid_0001" from the Fields (which contains the MADT height values) into the "Data expression" box and rename it (with a right-mouse click) with MADT.

o With a right-mouse click on Data, select "Insert empty expression", and rename this new expression with "U" (for zonal or East component). Click on the grey box "Expression" and then on the "Insert algorithm" button. A pop-up window opens. This contains three existing algorithms. One is for the along-track geostrophic velocity computation, and the other two are for U and V. Choose the appropriate one. A function-like expression is inserted in the Expression box. You have only to check that longitude and latitude match the existing variables within your datasets (sometimes they may be called "lon" and "lat"), and to insert the height from which you want to compute geostrophic velocities (here Grid_0001) instead of the 'height' indication within the function variables.



Insert algorithm pop-up window.

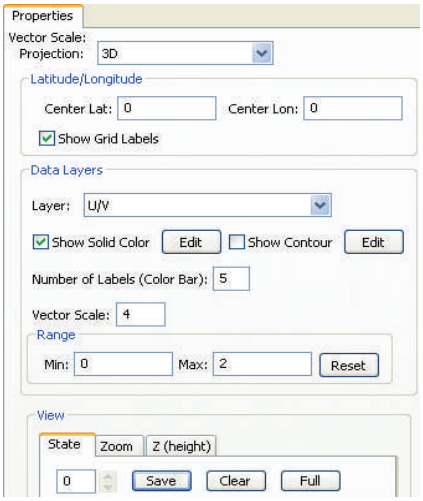
o Repeat for a new expression named "V" (for meridional or North component).

• "Selection criteria": optional. No conditions are set here.

Now, **click on "Execute"**, The "Log" tab opens, to monitor the operation. When the operation is finished ("ENDED"), the software switches automatically to the Operations tab (the tab from which the last operation was launched).

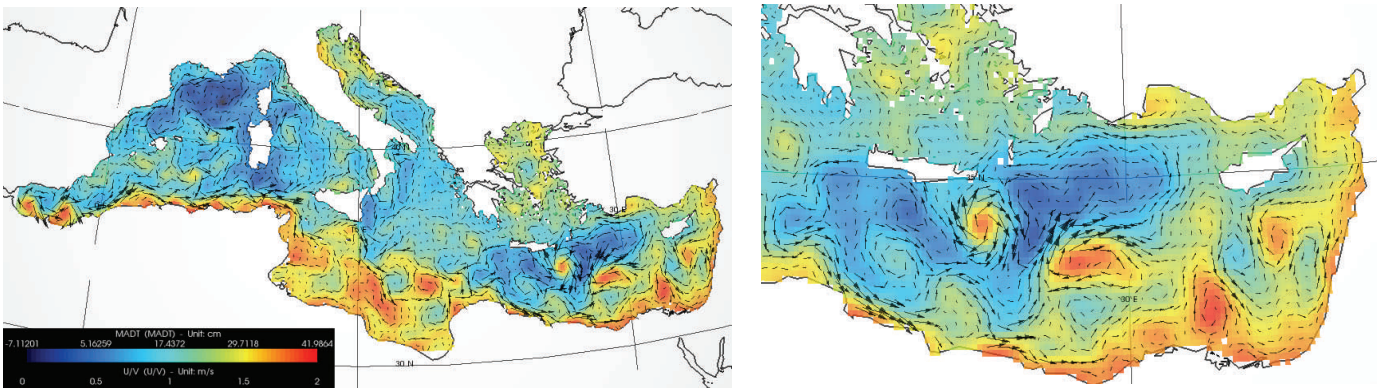
Current vector mapping

Go to the "Views" tab, and click on "New" to create a new operation. Rename it to reflect the MADT + absolute geostrophic velocities view. A list of available operations is given on the left; drag and drop your chosen Operation or use the arrows to move it to the right. Three Expression names are transferred: MADT, U and V. Click on the selected U expression and below, click on the box "East component", then click on the selected V expression and below, click on the box "North component". Finally, click on "Execute".



Parameters settings in the visualisation window: change the vector scale and the range for the U/V layer.

The display window opens, and your map is created with a projection in 3D (by default). Occasionally the arrows may appear oversized, which makes a rough map! In this case it is necessary to configure the vector scale and the range for the U/V Layer.



Map of Absolute Dynamic Topography superimposed to absolute geostrophic velocities in Mediterranean Sea on the left and zoom on the Eastern Mediterranean Sea on the right on 2010/12/01.

Tsunami Observation by Altimetry

On 11th March 2011, a 9.0-magnitude earthquake off Japan's north-eastern coast generated a huge wave which, breaking on the shore, devastated everything in its path. By measuring sea surface height or roughness, altimetry satellites can theoretically detect tsunami waves in the open ocean.

Shifting plates

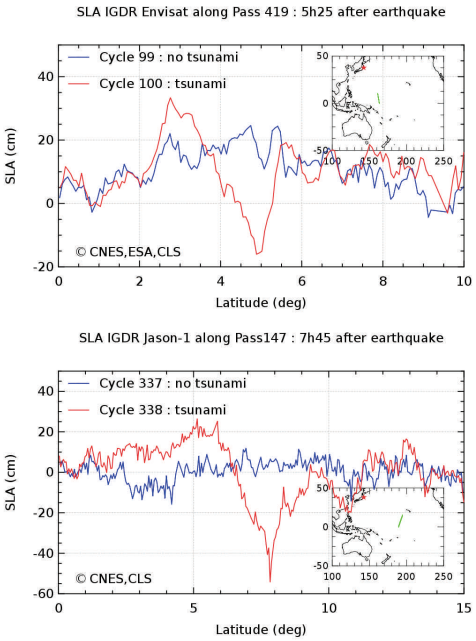
In the Pacific Ocean, where the tsunami of 11th March 2011 occurred, the Pacific tectonic plate is forced beneath the less dense North America plate. As these plates converge, with one sliding beneath the other, they gradually become distorted through the subduction movement of 85 mm/year, at the same time accumulating a huge amount of pressure. When a certain threshold is reached, it causes a sudden break in the fault which instantly releases all the stored energy, triggering an earthquake of enormous magnitude. In the case of the Japan tsunami, the fault line moved upwards by 30-40 m along a 300 km stretch.

When this phenomenon occurs, the abrupt movement of the fault causes the sea bottom to rise and the water's surface to deform, although its low amplitude (just a few tens of centimetres) makes it barely detectable at the time. The resulting wave spreads across the ocean basin at a speed approaching 800 km/h. When the waves approach the coasts, the reduced depth of the ocean forces them to slow down. This loss of velocity translates into an increase in wave height. Particular geographical characteristics of the coastline can have a channelling effect, causing resonance phenomena and amplifying wave size even further.

Altimetry measures height and roughness

By measuring sea surface height, altimetry satellites can theoretically detect the relatively small amplitude of tsunami waves in the open ocean if they overfly the waves within the few hours after the earthquake and if the signal is strong enough to be isolated from ocean variability. Due to this low probability, altimetry satellites do not form part of a tsunami early warning system.

With the tsunami of 11th March 2011, three altimetry satellites (Jason-1, Envisat and Jason-2) observed the front wave over the Pacific Ocean between 5 and 22 hours after the earthquake. The two examples given here were made with the IGDR data (+ 3 days).



IGDR SLA for Envisat pass 419 (top) and Jason-1 pass 147 (bottom) for the cycle during the tsunami (in red) and the previous cycle (in blue) (Credits CNES/ESA/CLS).

Envisat detected the first wave front 5 hours and 25 min after the earthquake with a trough-to-crest amplitude of up to 50 cm. Jason-1 measured a larger amplitude (60 cm), 7 hours and 45 min after the earthquake.

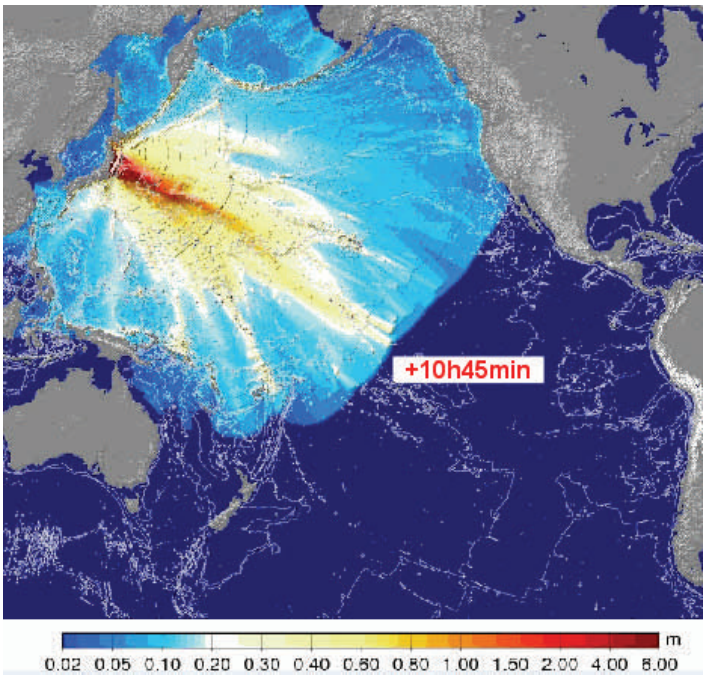
Ocean surface roughness measured by altimeters can also be used to detect tsunamis away from the shore (Godin et *al.*, 2009). Indeed, statistical analyses of multiple years of satellite altimeter observations have demonstrated, in the case of the Sumatra-Andaman tsunami (2004), distinctive variations in backscatter coefficient (σ_0). This method can be adapted to other kinds of sensors (radiometers, scatterometers) measuring, not at nadir point along the track, but over broader swaths, and may be an important element in a future system for tsunami detection and warning.

Helping to Predict Tsunami Wave Heights

These altimetry results are currently being used to compare and validate the forecast models. According to the close correlation or the discrepancies between altimeter observations and model predictions, other effects may be tested in models to further improve the simulation of tsunami propagation and dissipation.

References:

Godin, O. A., et *al.*: Variations in sea surface roughness induced by the 2004 Sumatra-Andaman tsunami, Nat. Hazards Earth Syst. Sci., 9, 1135-1147, doi:10.5194/nhess-9-1135-2009, 2009.



Forecast of the wave amplitude and time of propagation computed by the CEA model (Credits CEA).

SIPAD - SSALTO

On the 16th of February 2011, the new CNES/SALP online data catalogue was opened to public users. Available at the following address (http://aviso-data-center.cnes.fr/ssalto), this new catalogue is called the "AVISO CNES Data Center" and replaces the obsolete "AVISO Products Catalogue". This new system is used for archiving, ordering and disseminating data.

Twenty years of data archived

The basis of the system is the huge CNES archive of altimetry and/or DORIS products and auxiliary data covering about 20 years of data. The following altimetry missions or DORIS carrier missions are referenced in the catalogue: Topex/Poseidon, Jason-1 & 2, SPOT-2, 4 & 5 plus Envisat and Cryosat-2 (DORIS). The future missions such as HY-2A, SARAL/AltiKa, Jason-3, etc. will also be included in the catalogue. The altimetry products available are classical level 2 core mission products such as O/I/GDRs, S-I/GDRs from the beginning of Topex and Jason altimetry missions. Please note that value-added products such as the SSALTO/DUACS multi-mission data are not disseminated through this catalogue for the moment. **Moreover, this catalogue does not replace the usual "Data" pages on the Aviso website** which redirect to ftp sites. This catalogue should be considered as a complementary tool, useful for ordering a large amount of data or for retrieving old products that have been cleaned from routine ftp access.

Available data

In addition to geophysical products, the catalogue references satellite information (orbit revolution files, ionospheric correction, etc.), location products (level 1 DORIS measurements), ephemeris (MOE, POE) and products specific to on-board instruments (altimeter, radiometer).

Concerning the common auxiliary data available, they range from environmental products (Earth rotation parameters, atmospheric correction data, solar activity parameters, etc).

Features

By navigating through the list of data proposed in the catalogue, users can see the number of products available and the period covered by the data.

Once ordered, data can be delivered to a dedicated user workspace directly on the catalogue website in a personal area, or to an FTP site defined by the user.

To order products, users have to fill in a registration form in the "Registration" menu and accept the AVISO product license before receiving their account information (login/password).

Two classes of public users have been defined: public/expert. By default, each registration is classified as 'public' with access to a standard list of products and limited quotas for user workspace and ftp transfer. 'Expert' class is reserved for specialists, PIs or experts need more specific products and extended quotas for user workspace and ftp transfer.

It is also possible to receive products on a regular basis by asking the AVISO helpdesk (aviso@oceanobs.com).

This new environment will evolve in the coming years to better respond to user needs, so comments or suggestions addressed to the AVISO helpdesk are warmly welcome.

Events

• **13-17 June 2011**	GODAE Ocean View: GSOP, CLIVAR Work shop (Santa Cruz, USA)
• **16-17 June 2011**	GMES and Climate Change (Helsinki, Finland)
• **14-22 July 2011**	39th COSPAR Scientific Assembly (Mysore, In dia)
• **27-29 September 2011**	Smos Science Workshop (Arles, France)
• **18 October 2011**	Argo and Altimetry Workshop (San Diego, USA)
• **16-18 October 2011**	5th Coastal Altimetry Workshop (San Diego, USA)
• **19-21 October 2011**	2011 Ocean Surface Topography Science Team meeting (San Diego, USA)
• **5-9 September 2011**	2011 EUMETSAT Meteorological Satellite Confer ence (Oslo, Norway)
• **5-9 December 2011**	AGU Fall meeting (San Francisco, USA)

Aviso Users Newsletter

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