Multi-satellite altimeter processing for sea level and ocean circulation monitoring

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The main objective of our Jason-1 investigation is to combine altimeter data from several missions for sea level and ocean circulation monitoring. Combining TOPEX/ POSEIDON (T/P), ERS-1/2, GEOSAT Follow On (GFO), ENVISAT and Jason-1 data will allow to map sea level variations over a long time with high accuracy and very good resolution. This opens up new avenues for oceanographic studies using satellite altimetry.

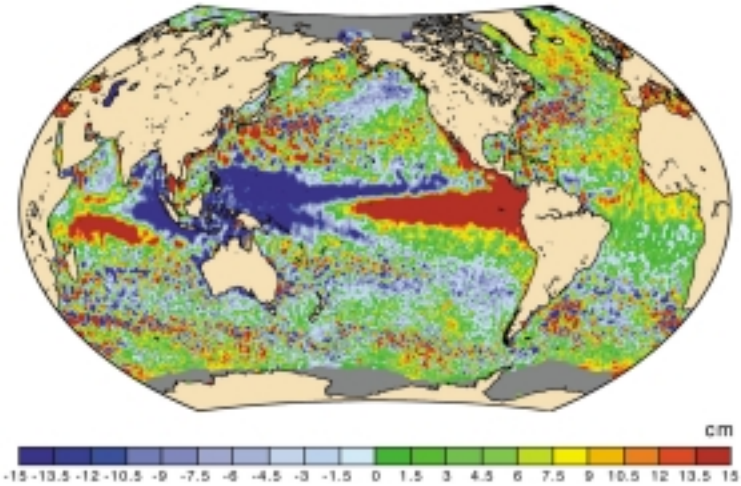

Figure 1: DUACS near-real-time processing of T/P and ERS-2 data during the 1998 El Niño event.

Work carried out in the CLS Space Oceanography Division will include:

• Precise inter-calibration of Jason-1, T/P and ENVISAT (altimeter and radiometer)
This task will follow up work by our team for the TOPEX, POSEIDON and ERS-1/2 altimeters [e.g. Le Traon et al., 1994; Stum, 1998]. Relative biases and drifts will be determined and monitored over the lifetime of all these altimetric missions.

• Development and/or testing of new altimetric corrections
This includes the analysis of the inverse barometer correction [e.g. Gaspar and Ponte, 1997; Ponte and Gaspar, 1999; Dorandeu and Le Traon, 1999] and the use of barotropic models and inverse techniques to correct for high-frequency effects, the improvement of electromagnetic (EM) bias models [e.g. Gaspar and Florens, 1998], the evaluation of new tidal models and the calculation of improved mean sea surface models.

• Estimation of a global mean dynamic topography by combining altimeter data, in-situ data and geoid models derived from the CHAMP, GRACE and GOCE missions
This will enable us to provide absolute dynamic topography measurements from altimetry.

• Improvement of data merging techniques for ocean circulation estimation
Merging techniques developed and used for T/P and ERS-1/2 [e.g. Le Traon et al., 1998; Le Traon and Ogor, 1998; Ducet et al., 2000] will be improved and applied to Jason-1 and ENVISAT. As part of this activity, we will also continue theoretical analyses on the contribution of multiple altimeter missions [Le Traon and Dibarboure, 1999; Le Traon et al., 2001].

• Development and exploitation of a near-real-time multi-mission altimeter processing system (T/P, ERS-2, GFO, Jason-1 and ENVISAT) (figure 1)

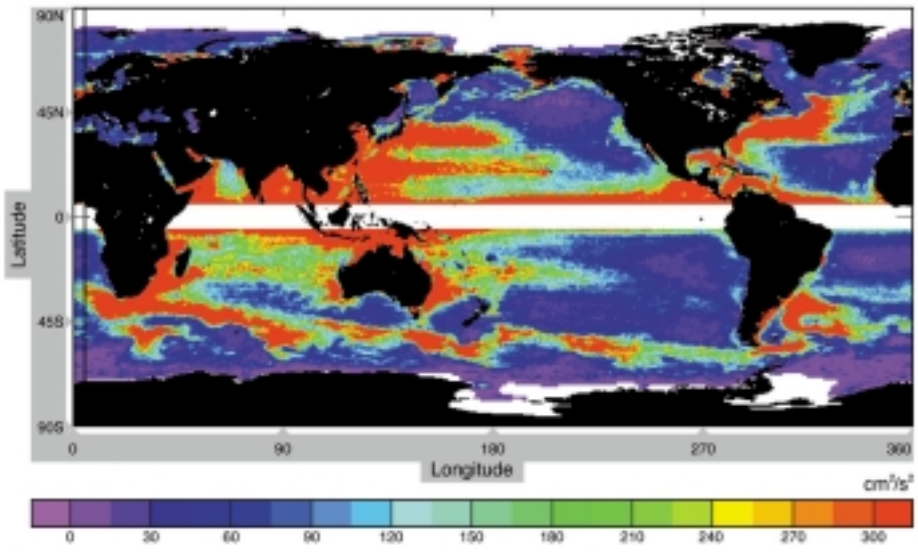

Figure 2: Eddy kinetic energy derived from the combination of T/P and ERS-1/2 over a five-year period [Ducet et al., 2000]. The map presents a very detailed description presumably never before achieved at a global scale. Units are cm²/s².

The objective will be to provide high-accuracy altimeter data in near-real time for operational oceanography projects (e.g. MERCATOR, GODAE, MFS) and applications. Merging techniques will be adapted to the less precise near-real-time data.

• Use of combined altimeter data sets to analyze large-scale and mesoscale sea level variations

The combined altimeter data sets will be used to analyze sea level variations over a long period of time (at least 10 years) and with a high resolution [e.g. Ducet et al., 2000; Ducet and Le Traon, 2001] (figure 2). This will include comparison of combined altimeter data sets with eddy resolving models (e.g. Los Alamos, CLIPPER, MERCATOR) (figure 3) and in-situ data (Argo profiling floats, drifters). The objective of these comparisons will be to validate the ocean models but also to better understand and interpret sea level variations observed from altimetry. These analyses will be global but we will also carry out more detailed regional analyses in the Mediterranean and Black seas and in the Azores/Canary regions [Larnicol et al., 1995; Hernandez et al., 1995; Le Traon and Gauzelin, 1997; Ayoub et al., 1998; Ducet et al., 1999; Stanev et al., 2000].

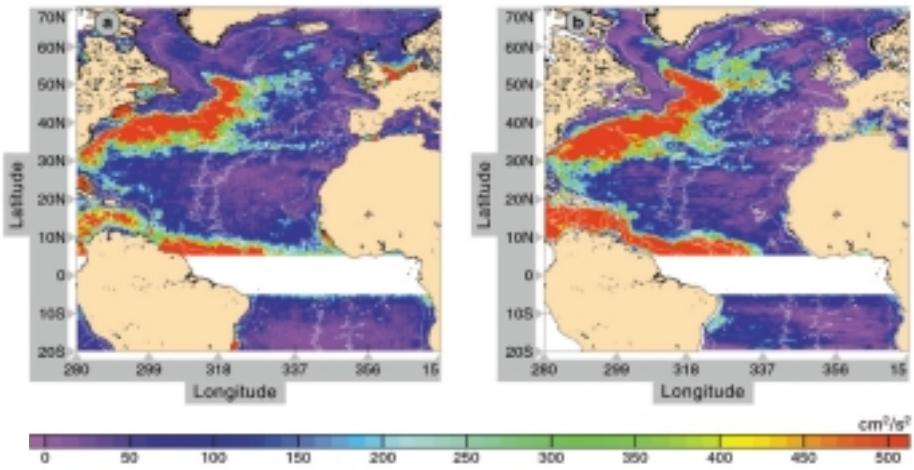

Figure 3: Eddy kinetic energy derived (a) from T/P and ERS-1 and (b) from the Los Alamos 1/10° high-resolution model [Smith et al., 2000]. Units are cm²/s².

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