9-year Monitoring Of The DORIS Sites 3-D Motions

L. Soudarin[1], J.F. Crétaux[2] , J.J. Valette[1], A. Cazenave[2]

CLS, Ramonville, France [2]*LEGOS-GRGS, Toulouse, France*

Contacts and links

Laurent.Soudarin@cls.fr
Jean-Francois.Cretaux@cnes.fr
Jean-Jacques.Valette@cls.fr
Anny.Cazenave@cnes.fr

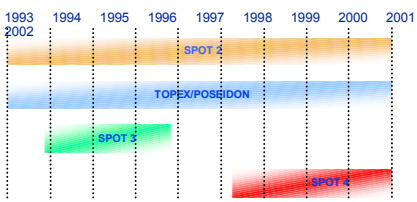
CLS http://www.cls.fr
LEGOS-GRGS http://www.omp.obs-mip.fr/omp/legos
IDS http://ids.cls.fr
CNES http://www-projet.cst.cnes.fr:8060/DORIS/index.html

Purpose

In 2001, the LEGOS/CLS Analysis Centre for the International DORIS Service (IDS) has processed all the DORIS data available since January 1993 with a new computation modelling based on the ITRF-2000 coordinates and velocities as a priori values, and the GRIM5-C1 gravity model, among others. The data set analysed until now represents 25 years (1993/01 – 2001/12) of radial velocity measurements done between the permanent emitting ground stations and the on-board instruments on the SPOT-2, -3, -4, and Topex/Poseidon satellites. It concerns nearly 60 sites covering 10 major tectonic plates. Details about the computation strategy are given at the following address: ftp://ids.cls.fr/pub/ids/center/analysis/legos.acn
Our objective is to continue to routinely process all new collected observations including the new missions Jason-1, Envisat, and Spot-5, in order to provide products to the IDS regularly (orbit ephemeris, earth rotation parameters, station network coordinates and velocities, geocenter coordinates, …).

Monthly coordinate sets are computed with no-rotation constraints (free network) and are expressed in ITRF2000 after a 7-parameter transformation. Coordinate time series have been performed for all the stations. Corresponding plots and data files are available on the IDS web site (http://ids.cls.fr). We show here some examples for stations with good observation history. The repeatability is on the order of 1 - 1.5 cm rms for more than 35 sites in the three directions.
In addition to secular tectonic plate motions, periodic variations can be observed and related to seasonal loading effects (see Crétaux et al., JGR 2002, in press). The 30-cm south-westward displacement measured at Arequipa is of seismic origin.

Three-dimensional absolute positions and velocities have also been computed directly from the inversion of the global 9-year matrix constructed from the complete data set. Horizontal velocities are shown below for sites far from plate boundaries and for sites in boudary zones. Vertical vectors are also reported.
Comparison with kinematic models and combination with results of other space techniques in which the DORIS observations are going to bring new constraints to crustal movements are currently in progress.



Analysed data (january 1993 to december 2001)

Some monthly time series

Terre Adélie
Antarctica (French base)

ADEA

Badary
Russia

BADA

Dakar
Senegal

DAKA

Everest
Nepal

EVEB

Kauai
USA (Hawaii)

KOKA

Metsahovi
Finland

META

Richmond
USA

RIDA

Yellowknife
Canada

YELA

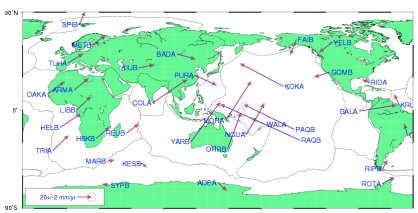
AREA

Arequipa (Peru)
DORIS antenna displacement detection

On June 23rd 2001, a major earthquake with magnitude 8.4 occurred near the coast of Peru. Aftershocks followed on July 7th with magnitude up to 7.6.

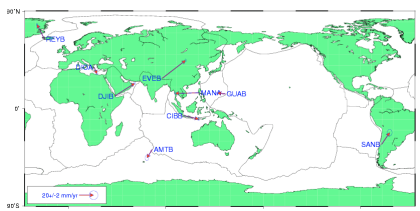
A 30-cm south-westward displacement is observed in the time series of the DORIS station of Arequipa, located 190 km far east from the epicenter.

Intra-plate absolute horizontal velocities



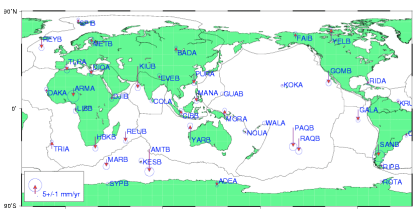
DORIS horizontal velocities with 99% confidence ellipses

Horizontal velocities in deformation areas



DORIS horizontal velocities with 99% confidence ellipses

Linear vertical motions



DORIS vertical velocities with 99% confidence ellipses

Geocenter motion

These plots show Helmert's translation parameters (TX, TY, TZ expressed in mm) derived from the comparison between each monthly coordinate set and a global solution.

These time variations of the center of figure relative to a mean position can be interpreted as the motion of the Earth's center of mass.