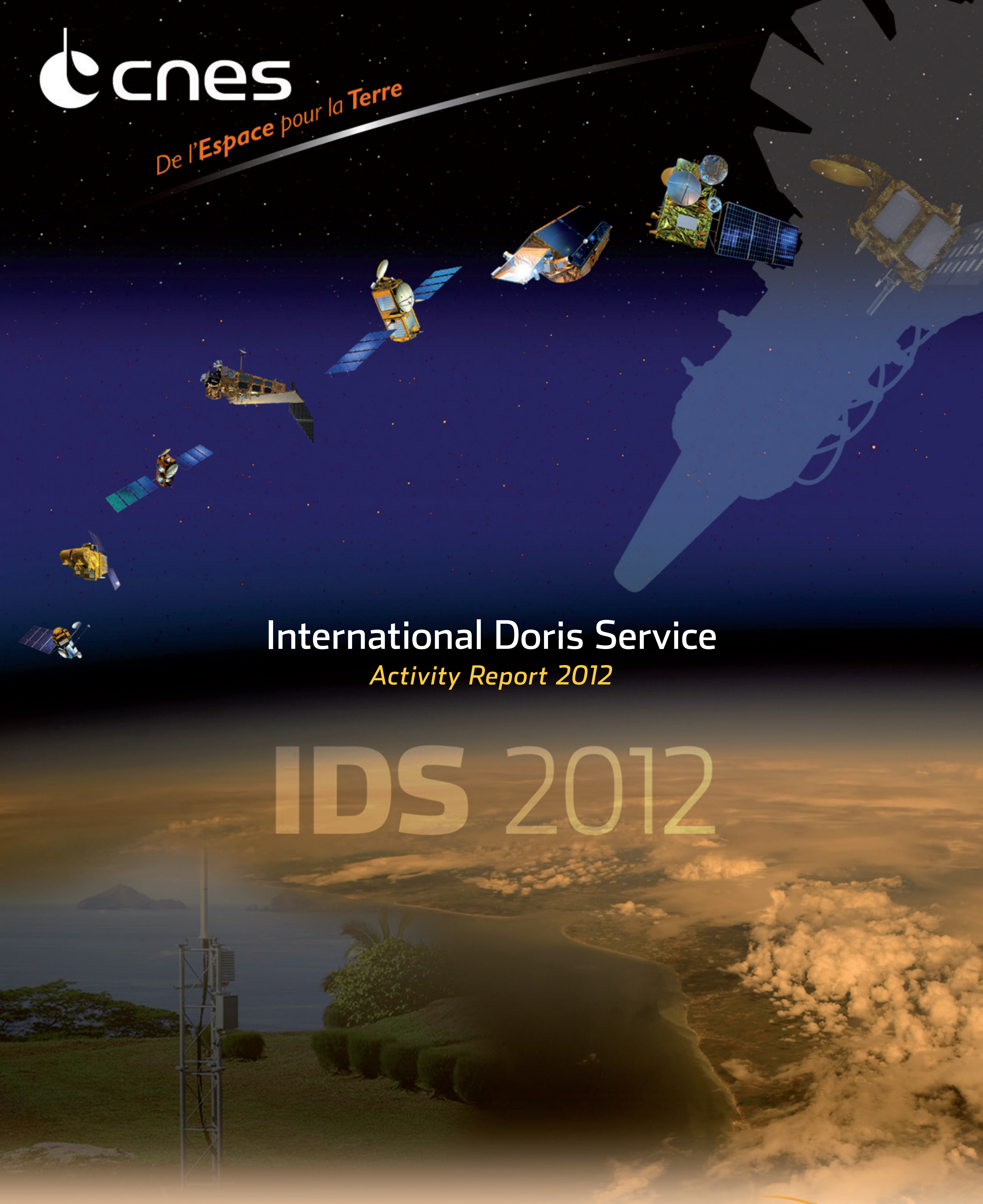
cnes
De l'Espace pour la Terre



International Doris Service

Activity Report 2012

IDS 2012

IGN
INSTITUT NATIONAL
DE L'INFORMATION
GÉOGRAPHIQUE
ET FORESTIÈRE

IDS

The International DORIS Service

January 2012 – December 2012 report

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In this volume, the International DORIS Service documents the work of the IDS components between January 2012 and December 2012. The individual reports were contributed by IDS groups in the international geodetic community who make up the permanent components of IDS.

The IDS 2012 Report describes the history, changes, activities and the progress of the IDS. The Governing Board and Central Bureau kindly thank all IDS team members who contributed to this report.

The IDS takes advantage of this publication to relay the thanks of the CNES and the IGN to all of the host agencies for their essential contribution to the operation of the DORIS system. The list of the host agencies is given in the appendix of this Report.

The entire contents of this Report also appear on the IDS website athttp://ids-doris.org/documents/report/IDS_Report_2012.pdf

TABLE OF CONTENTS

TABLE OF CONTENTS 2
IDS AND DORIS QUICK REFERENCE LIST 5
GLOSSARY 9
1 INTRODUCTION 17
2 HISTORY 18
3 ORGANIZATION 21
3.1 GOVERNING BOARD 22
3.2 CENTRAL BUREAU 23
4 THE CENTRAL BUREAU: IDS INFORMATION SYSTEM 24
4.1 SUPPORT TO THE IDS COMPONENTS 24
4.1.1 ELECTION OF THE GOVERNING BOARD 24
4.1.2 IDS SURVEY 25
4.1.3 ORGANISATION OF IDS WORKSHOP IN VENICE 25
4.1.4 HY-2A DATA DISTRIBUTION 25
4.1.5 PLOTTOOL: A FAMILY OF WEB TOOLS TO PLOT TIME SERIES 25
4.2 IDS WEBSITE 26
4.3 IDS FTP SERVER 27
4.4 FUTURE PLAN 27
5 THE NETWORK 29
5.1 STATUS AND PERFORMANCE 29
5.2 EVOLUTION AND DEVELOPMENT 30
6 THE SATELLITES WITH DORIS RECEIVERS 33
7 IDS DATA FLOW COORDINATION 38
7.1 INTRODUCTION 38
7.2 FLOW OF IDS DATA AND PRODUCTS 38
7.3 DORIS DATA 41
7.4 DORIS PRODUCTS 43
7.5 SUPPLEMENTARY DORIS INFORMATION 44
7.6 FUTURE PLANS 44
8 IDS DATA CENTERS 45
8.1 CRUSTAL DYNAMICS DATA INFORMATION SYSTEM (CDDIS) 45
8.1.1 FUTURE PLANS 45
8.1.2 CONTACT 46
8.2 IGN DORIS DATA CENTER 46
8.2.1 CONTACT 46
9 IDS ANALYSIS COORDINATION 47
10 IDS COMBINATION 51

10.1 ACTIVITY SUMMARY 51
10.2 IDS ROUTINE COMBINATION 51
10.3 PRELIMINARY STUDIES FOR ITRF2013 53
10.4 FIRST HY-2A ANALYSES 55
10.5 COMMUNICATIONS 56
10.6 FUTURE PLANS 56

11 REPORT OF THE ESA/ESOC ANALYSIS CENTER (ESA) 57
11.1 INTRODUCTION 57
11.2 TESTING FOR ITRF2013 AND THE NEW ESAWD07 SOLUTION 57
11.3 FUTURE ACTIVITIES 58

12 REPORT OF THE GEODETICAL OBSERVATORY PECNY ANALYSIS CENTER (GOP) 59
12.1 SUMMARY OF ACTIVITIES 59
12.2 SOUTH ATLANTIC ANOMALY AND SPOT-5 59
12.3 COMPARISON OF THE EARTH RADIATION MODELS 59
12.4 DORIS RINEX FORMAT 60
12.5 TESTING THE DYNAMICAL ORBIT MODEL 60

13 REPORT OF THE GSFC/NASA ANALYSIS CENTER (GSC) 61
13.1 SINEX SERIES 61
13.2 TESTS WITH DORIS DATA 63

REPORT OF THE IGN/JPL ANALYSIS CENTER (IGN) 66
13.3 CONTEXT 66
13.4 PRODUCTS DELIVERED IN 2012 66
13.5 MAJOR IMPROVEMENTS IN 2012 68
13.6 NEW DEVELOPMENTS 68

14 REPORT OF THE INASAN ANALYSIS CENTER (INA) 69
14.1 INTRODUCTION 69
14.2 SOFTWARE UPDATE AND ANALYSIS RESULTS DESCRIPTIONS 70

15 REPORT OF THE CNES/CLS ANALYSIS CENTER (LCA) 71
15.1 INTRODUCTION 71
15.2 DATA PROCESSING AND PRODUCTS DELIVERED TO IDS 71
15.3 STATION VERTICAL COMPONENT CORRECTED 73
15.4 ANALYSIS OF THE DORIS HY2A DATA 74
15.5 NEW STAREC PHASE LAW 75
15.6 UPDATE OF SAA CORRECTIVE MODEL FOR JASON-1 75
15.7 PRELIMINARY SAA CORRECTIVE MODEL FOR SPOT5 76
15.8 CONTRIBUTION TO IDS AWG MEETINGS AND IDS WORKSHOP 76

16 REFERENCES 78

17 PUBLICATIONS (2012) 80

APPENDIX 1: THE IDS INFORMATION SYSTEM 81

1 WHAT AND WHERE 81

2 WEB AND FTP SITES 81
2.1 IDS WEBSITE 81

2.2 IDS FTP SERVER......84
2.3 DORIS WEBSITE......85
2.4 DATA CENTERS' WEBSITES......85

3 THE MAIL SYSTEM......86
3.1 DORISMAIL......86
3.2 DORISREPORT......87
3.3 DORISSTATIONS......87
3.4 IDS ANALYSIS FORUM......87
3.5 OTHER MAILING LISTS......88

4 HELP TO THE USERS......88

APPENDIX 2: DORIS STATIONS COLOCATION WITH TIDE GAUGES......89

APPENDIX 3: DORIS STATIONS / HOST AGENCIES......90

IDS AND DORIS QUICK REFERENCE LIST

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   http://ids-doris.org/

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3. **Data Centers**
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   IGN: ftp://doris.ensg.eu and ftp://doris.ign.fr

4. **DORISmail**
   The DORIS mail service is used to send information of general interest to the DORIS community. To send a DORISMail, use the following address: dorismail@ids-doris.org

5. **IDS Analysis forum**
   The IDS Analysis Forum is a list for discussion of DORIS data analysis topics. To start a discussion on a specific topic, use the following address: ids.analysis.forum@ids-doris.org

6. **List of documents and links to discover the DORIS system**
   http://ids-doris.org/analysis-documents.html

7. **Citation**
   The following article is suggested for citation in papers and presentations that rely on DORIS data and results:

   > Willis P., Fagard H., Ferrage P., Lemoine F.G., Noll C.E., Noomen R., Otten M., Ries J.C., Rothacher M., Soudarin L., Tavernier G., Valette J.J. (2010), The International DORIS Service, Toward maturity, Advances in Space Research, 45(12):1408-1420, DOI: 10.1016/j.asr.2009.11.018

8. **List of DORIS publications in international peer-reviewed journals**
   http://ids-doris.org/report/publications/peer-reviewed-journals.html

9. **Overview of the DORIS satellite constellation**
   http://www.aviso.oceanobs.com/en/doris/doris-applications/index.html

10. **Site logs**
    DORIS stations description forms and pictures from the DORIS installation and maintenance department: http://ids-doris.org/network/sitelogs.html

11. **Virtual tour of the DORIS network with Google Earth**
    Download the file at http://ids-doris.org/network/googleearth.html and visit the DORIS sites all around the world.

12. **Web tools for plotting time series**
    Plottool is a family of tools to visualize time series in an interactively way: http://ids-doris.org/plot-tools.html
    Use STCDtool to display North, East, Up position residuals of the DORIS stations and POEtool for orbit residuals and amount of measurements from the CNES POD

13. **More contacts**
    For particular requests, you may also contact the following persons:

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GLOSSARY

AC

Analysis Center

AGU

American Geophysical Union. AGU is a scientific society that aims to advance the understanding of Earth and space. AGU conducts meetings and conferences, publishes journals, books and a weekly newspaper, and sponsors a variety of educational and public information programs.

AVISO

Archiving, Validation and Interpretation of Satellite Oceanographic data. AVISO distributes satellite altimetry data from TOPEX/Poseidon, Jason-1, Jason-2, ERS-1 and ERS-2, and Envisat, and DORIS precise orbit determination and positioning products.

AWG

Analysis Working Group

CB

Central Bureau

CDDIS

Crustal Dynamics Data Information System

CLS

Collecte Localisation Satellites. Founded in 1986, CLS is a subsidiary of CNES and Ifremer, specializes in satellite-based data collection, location and ocean observations by satellite.

CNES

Centre National d'Etudes Spatiales. The Centre National d'Etudes Spatiales is the French national space agency, founded in 1961.

CNRS

Centre National de la Recherche Scientifique. The Centre National de la Recherche Scientifique is the leading research organization in France covering all the scientific, technological and societal fields

CryoSat-2

Altimetry satellite built by the European Space Agency launched on April, 8 2010. The mission will determine the variations in the thickness of the Earth's continental ice sheets and marine ice cover.

CSR

Center for Space Research, the University of Texas

CSTG

Coordination of Space Technique in Geodesy

DC

Data Center

DGXX

DORIS receiver name (3rd Generation)

DIODE

Détermination Immédiate d'Orbite par DORIS Embarqué. Real-time onboard DORIS system used for orbit determination.

DORIS

Doppler Orbitography and Radiopositioning Integrated by Satellite. Precise orbit determination and location system using Doppler shift measurement techniques. A global network of orbitography beacons has been deployed. DORIS was developed by CNES, the French space agency, and is operated by CLS.

ECMWF

European Centre for Medium-range Weather Forecasting

EGU

European Geosciences Union

EOP

Earth Orientation Parameters

Envisat

ENVIronmental SATellite Earth-observing satellite (ESA)

ESA

European Space Agency. The European Space Agency is a space agency founded in 1975. It is responsible of space projects for 17 European countries.

ESA, esa

acronyms for *ESA/ESOC* Analysis Center, Germany

ESOC

European Space Operations Centre (ESA, Germany)

EU

European Union

EUMETSAT

EUropean organisation for the exploitation of METeorological SATellites

GAU, gau

acronyms for the *Geoscience Australia* Analysis Center, Australia

GB

Governing Board

GDR-B, GDR-C, GDR-D

Versions B, C, and D of **Geophysical Data Record**

geoc

Specific format for geodetic product: time series files of coordinates of the terrestrial reference frame origin (geocenter)

eop

Specific format for geodetic product: time series files of Earth orientation parameters (EOP)

GGOS

Global Geodetic Observing System

GMF

Global Mapping Function

GNSS

Global Navigation Satellite System

GLONASS

Global Navigation Satellite System (Russian system)

GOP, gop

acronyms for the *Geodetic Observatory of Pecný* Analysis Center, Czech Republic

GRGS

Groupe de Recherche de Géodésie Spatiale

GSC, gsc
acronyms for the *NASA*/*GSFC* Analysis Center, USA

GSFC
Goddard Space Flight Center (NASA).

HY-2
HY (for **HaiYang** that means 'ocean' in Chinese) is a marine remote sensing satellite series planned by China (HY-2A (2011), HY-2B (2012), HY-2C (2015), HY-2D (2019))

IAG
International Association of Geodesy

IDS
International DORIS Service

IERS
International Earth rotation and Reference systems Service

IGN
Institut Géographique National, French National Geographical Institute
(**Institut national de l'information géographique et forestière** from January 1st, 2012)

IGN, ign
acronyms for *IGN/IPGP* Analysis Center, France

IGS
International GNSS Service

ILRS
International Laser Ranging Service

INA, ina
acronyms for the *INASAN* Analysis Center, Russia

INASAN
Institute of Astronomy, Russian Academy of Sciences

IPGP
Institut de Physique du Globe de Paris

ISRO
Indian Space Research Organization

ITRF

International Terrestrial Reference Frame

IUGG

International Union of Geodesy and Geophysics

IVS

International VLBI Service for Geodesy and Astrometry

Jason

Altimetric missions (CNES/NASA), follow-on of TOPEX/Poseidon. Jason-1 was launched on December 7, 2001 and Jason-2 was launched on June 20, 2008.

JOG

Journal Of Geodesy

JASR

Journal of Advances in Space Research

LCA, lca

acronyms for the CNES/CLS Analysis Center, France (previously LEGOS/CLS Analysis Center)

LEGOS

Laboratoire d'Etudes en Géodésie et Océanographie Spatiales, France

LRA

Laser Retroreflector Array. One of three positioning systems on TOPEX/Poseidon and Jason. The LRA uses a laser beam to determine the satellite's position by measuring the round-trip time between the satellite and Earth to calculate the range.

MOE

Medium Orbit Ephemeris.

NASA

National Aeronautics and Space Administration. The National Aeronautics and Space Administration is the space agency of the United States, established in 1958.

NCEP

National Center for Environmental Prediction (NOAA).

NLC, ncl

acronyms for *University of Newcastle* Analysis Center, UK

NOAA

National Oceanic and Atmospheric Administration. The National Oceanic and Atmospheric Administration (NOAA) is a scientific agency of the United States Department of Commerce focused on the studies of the oceans and the atmosphere.

OSTST

Ocean Surface Topography Science Team

POD

Precise Orbit Determination

POE

Precise Orbit Ephemeris

Poseidon

One of the two altimeters onboard TOPEX/Poseidon (CNES); Poseidon-2 is the Jason-1 altimeter.

RINEX/DORIS

Receiver INdependent EXchange. Specific format for DORIS raw data files, based on the GPS-dedicated format

RMS

Root Mean Square

SAA

South Atlantic Anomaly

SARAL

Satellite with ARgos and Altika

SINEX

Solution (software/technique) Independent Exchange. Specific format for files of geodetic products

SIRS

Service d'Installation et de Renovation des Balises (IGN). This service is in charge of all the relevant geodetic activities for the maintenance of the DORIS network.

SLR

Satellite Laser Ranging

SMOS

Service de Maintenance Opérationnelle des Stations (CNES). This service is responsible for the operational issues of the DORIS stations

snx see SINEX

SOD

Service d'Orbitographie DORIS, CNES DORIS orbitography service

SPOT

Système Pour l'Observation de la Terre. Series of photographic remote-sensing satellites launched by CNES.

sp1, sp3

Specific format for orbit ephemeris files

SSALTO

Segment Sol multimissions d'ALTimétrie, d'Orbitographie et de localisation precise. The SSALTO multi-mission ground segment encompasses ground support facilities for controlling the DORIS and Poseidon instruments, for processing data from DORIS and the TOPEX/Poseidon, Jason-1, Jason-2 and Envisat-1 altimeters, and for providing user services and expert altimetry support.

STCD

STation Coordinates Difference. Specific format for time series files of station coordinates (geodetic product)

STPSAT

US Air Force **Space Test Program SATellite.** The first satellite **STPSAT1** was launched in 2007 with a new DORIS receiver called CITRIS. This experiment is dedicated to global ionospheric measurements.

SWOT

Surface Water Ocean Topography. Name of a future CNES/NASA satellite mission.

TOPEX/Poseidon

Altimetric satellite (NASA/CNES).

USO

Ultra-Stable Oscillator

UTC

Coordinated Universal Time. Timekeeping system that relies on atomic clocks to provide accurate measurements of the second, while remaining coordinated with the Earth's rotation, which is much more irregular. To stay synchronized, UTC has to be adjusted every so often by adding one second to the day, called a leap second, usually between June 30 and July 1, or between December 31 and January 1. This is achieved by counting 23h59'59", 23h59'60" then 00h00'00". This correction means that the Sun is always at its zenith at noon exactly (accurate to the second).

VLBI

Very Long Baseline Interferometry.

ZTD

Zenith Tropospheric Delay

1 INTRODUCTION

As other space-techniques had already organized into services - the International GNSS Service (IGS) for GPS, GLONASS and, in the future, Galileo (Beutler et al. 1999), the International Laser Ranging Service (ILRS) for both satellite laser ranging and lunar laser ranging (Pearlman et al. 2002) and the International VLBI Service for Geodesy and Astrometry (IVS) for geodetic radio-interferometry (Schlueter et al. 2002) -, the IDS was created in 2003 as an IAG service to federate the research and developments related to the DORIS technique, to organize the expected DORIS contribution to IERS and GGOS (Rummel et al. 2005; Willis et al. 2005), and to foster a larger international cooperation on this topic.

At present, more than 50 groups from 35 different countries participate in the IDS at various levels, including 43 groups hosting DORIS stations in 32 countries all around the globe.

Two analysis centers contributed as individual DORIS solutions to ITRF2005 and in 2006 four analysis centers provided results for IDS. Since 2008, eight analysis groups have provided results, such as orbit solutions, weekly or monthly station coordinates, geocenter variations or Earth polar motion, that are used to generate IDS combined products for geodesy or geodynamics. All these centers have provided SINEX solutions for inclusion in the IDS combined solution that was submitted in 2009 to the IERS for ITRF2008. In 2009, a first IDS combined solution (Valette et al., 2010) was realized using DORIS solutions from 7 Analysis Groups for weekly station positions and daily Earth orientation parameters. In 2012, 6 analysis centers (ACs) provided operational products, which were combined in a routine DORIS combination by the IDS Combination Center in Toulouse.

This report summarizes the current structure of the IDS, the activities of the Central Bureau, provides an overview of the DORIS network, describes the IDS data centers, summarizes the DORIS satellite constellation and includes reports rom the individual DORIS ACs.

2 HISTORY

The DORIS system was designed and developed by CNES, the French space agency, jointly with IGN, the French mapping and survey agency, and GRGS the space geodesy research group, for precise orbit determination of altimeter missions and consequently also for geodetic ground station positioning (Tavernier et al. 2003).

DORIS joined the GPS, SLR and VLBI techniques as a contributor to the IERS for ITRF94. In order to collect, merge, analyze, archive and distribute observation data sets and products, the IGS was established and recognized as a scientific service of the IAG in 1994, followed by the ILRS in 1998 and the IVS in 1999. It is clear that DORIS has benefited from the experience gained by these earlier services.

There was an increasing demand in the late nineties among the international scientific community, particularly the IAG and the IERS, for a similar service dedicated to the DORIS technique.

On the occasion of the CSTG (Coordination of Space Technique in Geodesy) and IERS Directing Board meetings, held during the IUGG General Assembly in Birmingham in July 1999, it was decided to initiate a DORIS Pilot Experiment (Tavernier et al. 2002) that could lead on the long-term to the establishment of such an International DORIS Service. A joint CSTG/IERS Call for Participation in the DORIS Pilot Experiment was issued on 10 September 1999. An international network of 54 tracking stations was then contributing to the system and 11 proposals for new DORIS stations were submitted. Ten proposals were submitted for Analysis Centers (ACs). Two Global Data Centers (NASA/CDDIS in USA and IGN/LAREG in France) already archived DORIS measurements and were ready to archive IDS products. The Central Bureau was established at the CNES Toulouse Center, as a joint initiative between CNES, CLS and IGN.

The IDS Central Bureau and the Analysis Coordinator initiated several Analysis Campaigns.

Several meetings were organized as part of the DORIS Pilot Experiment:

- DORIS Days were held in Toulouse in May 2000 (see programme and contributions in http://ids-doris.org/report/meeting-presentations/doris-days-2000.html),

- an IDS Workshop was held in Biarritz in June 2002 (see programme and contributions in http://ids-doris.org/report/meeting-presentations/ids-workshop-2002.html),

- an IDS Analysis Workshop was held in Marne La Vallée in February 2003 (see programme and contributions in http://ids-doris.org/report/meeting-presentations/ids-workshop-2003.html).

The IDS was officially inaugurated on July 1, 2003 as an IAG Service after the approval of the IAG Executive Committee at the IUGG General Assembly in Sapporo.

The first IDS Governing Board meeting was held on November 18, 2003 in Arles, France.

Since then, each year, several IDS meetings were held:

2004 May	Plenary meeting http://ids-doris.org/report/meeting-presentations/ids-plenary-meeting-2004.html)	Paris France
2006 May	IDS workshop: http://ids-doris.org/report/meeting-presentations/ids-workshop-2006.html	Venice Italy
2008 March June Nov	Analysis Working Group Meetings http://ids-doris.org/report/meeting-presentations/ids-awg-03-2008.html http://ids-doris.org/report/meeting-presentations/ids-awg-06-2008.html IDS workshop http://ids-doris.org/report/meeting-presentations/ids-workshop-2008.html)	Paris Paris Nice France
2009	Analysis Working Group Meeting http://ids-doris.org/report/meeting-presentations/ids-awg-03-2009.html	Paris France
2010	Analysis Working Group Meeting http://ids-doris.org/report/meeting-presentations/ids-awg-03-	Darmstadt Germany

	2009.html IDS workshop & 20th anniversary of the DORIS system http://ids-doris.org/report/meeting-presentations/ids-workshop-2010.html	Lisbon Portugal
2011	Analysis Working Group Meeting http://ids-doris.org/report/meeting-presentations/ids-awg-05-2011.html	Paris France
2012	Analysis Working Group Meeting http://ids-doris.org/report/meeting-presentations/ids-awg-05-2012.html IDS workshop http://ids-doris.org/report/meeting-presentations/ids-workshop-2012.html	Prague Czech Venice Italy

In 2013, two DORIS Analysis Working Group meetings will take place: in May, in Toulouse (France), then in October, in Washington (USA).

3 ORGANIZATION

The IDS organization is very similar to the other IAG Services (IGS: International GNSS Service, ILRS: International Laser Ranging Service, IVS: International VLBI Service for Geodesy and Astrometry) and IUGG Service such as IERS (International Earth rotation and Reference system Service).

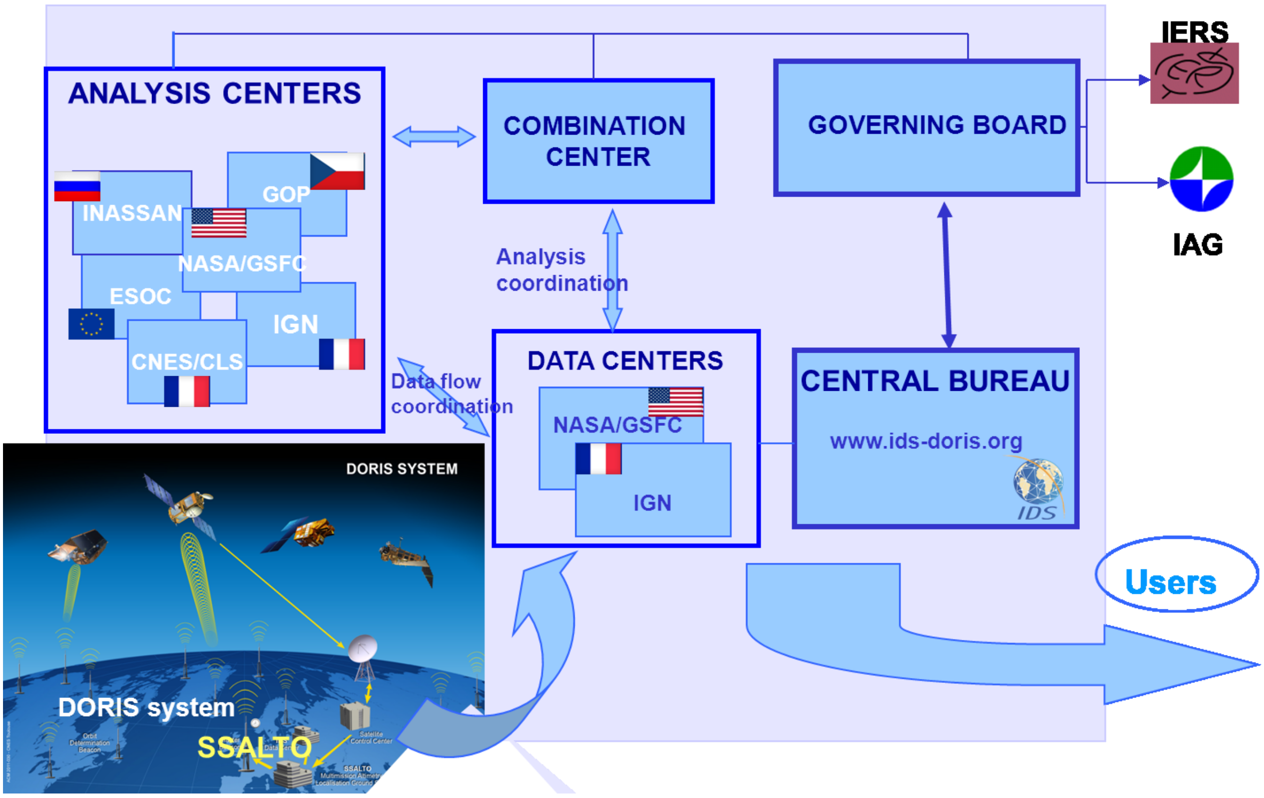

Figure 1 IDS organization

3.1 GOVERNING BOARD

In December 2012, a new Governing board was elected or appointed following the IDS terms of reference updated in 2011.

The 2013-2014 IDS Governing Board is:

Elected Members:

Elected by the associate members

- Pascal WILLIS (IGN/IPGP) **Chairperson**
  Analysis Centers' representative
- Carey NOLL (NASA/ GSFC)
  Data Centers' representative
- Richard BIANCALE (CNES/ GRGS)
  Member at large

Elected by the previous Governing Board

- Frank G. LEMOINE (NASA/GSFC)
  Analysis Coordinator
- John RIES (University of Texas/ CSR)
  Member at large

Appointed members:

- Pascale FERRAGE (CNES)
  DORIS System representative
- Jérôme SAUNIER (IGN)
  Network representative
- Laurent SOUDARIN (CLS)
  Director of the Central Bureau
- Guilhem MOREAUX (CLS)
  Combination Center representative

- Michiel OTTEN (ESA/ ESOC)
  Representative of the IAG

- Brian LUZUM (USNO) (substitute: TBD)
  Representative of the IERS

IDS representative to the IAG: Pascal WILLIS

IDS representatives to the IERS:

> Analysis Coordinator: Frank G. LEMOINE
> Network representative: Jérôme SAUNIER

IDS delegate for the GGOS Steering Committee: Pascal WILLIS (substitute: Frank G. LEMOINE)

IDS representatives to GGOS consortium: Pascal WILLIS, Laurent SOUDARIN

3.2 CENTRAL BUREAU

In 2012, the IDS Central Bureau is organized as follow :

- Laurent Soudarin CLS (Director)
- Pascale Ferrage CNES
- Jérôme Saunier IGN
- Guilhem Moreaux CLS
- Pascal Willis IGN/IPGP

4 THE CENTRAL BUREAU: IDS INFORMATION SYSTEM

Laurent Soudarin (1), Pascale Ferrage (2)

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(2) CNES, France

As in previous years, the Central Bureau maintained its support to the IDS components and continued to operate the IDS information system. We present here the main activities of 2012 and the new features brought to the IDS web and ftp sites. Plans for 2013 are also given. An overview of the IDS information system is given in the appendix to this report.

4.1 SUPPORT TO THE IDS COMPONENTS

4.1.1 ELECTION OF THE GOVERNING BOARD

The term of the Governing Board expired on December 31, 2012. The elections were held in the Fall in accordance with the new version of the Terms of Reference (ToR) and the procedures defined at the meeting of the Governing Board on June 1st, 2012 in Prague. Because of the set up of the GB partial renewal process with election every two years, only 3 elected positions were renewed this time:

Analysis Center representative,

Data Center representative,

1 member at large.

For the elections, the Central Bureau completed the following actions:

Define the agenda and the list of actions;

Create the appropriate mailing lists (associates, nominating committee, ballots);

Update the list of the IDS Associates and make it public on the website of the IDS (http://ids-doris.org/organization/associate-members.html) after approval by the GB;

Invite the Associates to submit names of candidates for each of the three positions open for election. A Call for Nominations was send on Nov. 8. Propositions were collected by the nominating committee (Bruno Garayt (IGN), chairman, Pascale Ferrage (CNES) and Laurent

Soudarin (CLS)) which also contacted the proposed candidates to obtain their application (CV and agreement) and establish a list of candidates to be presented to the GB;

Put on IDS web site the list of candidates with their applications.

Invite the Associates to vote by email between Nov. 22 and 26. The Call for vote was send on Nov. 22. The Associates were invited to send their ballots at ids.elections @ cls.fr.

Announce results of the vote

Update the GB page on the IDS web site with the list of the new GB (http://ids-doris.org/organization/governing-board.html)

4.1.2 IDS SURVEY

In 2012, the Central Bureau organized a survey to hear from its users about the IDS services. A dorismail (#786) was sent early January inviting users to give their satisfaction level by filling a form on the IDS web site at http://ids-doris.org/ids-survey.html

4.1.3 ORGANISATION OF IDS WORKSHOP IN VENICE

The Central Bureau participated to the organization of the IDS Workshop held in Venice in September. A page for the submission of abstract has been proposed on the IDS web site in February.

4.1.4 HY-2A DATA DISTRIBUTION

The Central Bureau worked on making available the meta-data and DORIS data of the HY-2A satellite. It coordinated the actions between SSALTO and the Data Centers.

4.1.5 PLOTTOOL: A FAMILY OF WEB TOOLS TO PLOT TIME SERIES

The CB implemented on the IDS web site new plot tools to provide time series browsing in an interactively way. This family of tools named Plottool is composed of:

- STCD tool for station position time series (North, East, Up residuals).

- POE tool for CNES/POE statistics time series (satellite orbit residuals, amount of station measurements).

STCD tool and POE tool contain utilities for selecting sites or satellites, displaying time series, editing data, changing plot appearance, specifying scaling, downloading data, plots and graph statistics in several formats. They are equipped with statistic tools for the calculation of mean, slope and weighted rms with respect to the slope (WRSD). Several series can be viewed and compared on the same graph. Complementary data about station and satellites events can also be displayed. A help online is available for both tools.

Station coordinates time series are generated from the STCD files provided by IDS Analysis Centers and available on the IDS Data Centers. STCD files and plots in gif format as well as the descriptions of the series can be found on the Time Series page.

Orbit performance time series are outputs of the CNES POE processing for the DORIS missions. Yearly plots per satellite and per station are available here.

Satellite events are extracted from the list of the main events that occurred on the DORIS system elements with the exception of the station network. This list can be seen here.

Station events are extracted from the list of the main events that occurred on the DORIS station network (new sites, new antennae, removed sites, failures...) with information on data gaps, invalidated data... This list can be seen here.

Information about recent earthquakes are also obtained from USGS survey service and added to the station events data available for the Plot tools.

4.2 IDS WEBSITE

Address: http://ids-doris.org

The main updates of 2012 are reported hereafter.

In February, a new set of tools, we called Plot tools, has been implemented on the IDS website to interactively build and display graphs of DORIS station coordinates time series and orbit residuals.

The presentations of the AWG meeting held on May 31 & June 1, 2012, in Prague, Czech Republic, were put on line on a dedicated page (http://ids-doris.org/report/meeting-presentations/ids-awg-05-2012.html).

The presentations of the IDS Workshop and of the AWG meeting held in Venice on September 2012 have been made available (http://ids-doris.org/report/meeting-presentations/ids-workshop-2012.html)

Several activity reports were added (IDS Activity report for 2011, 2010 and 2011 Reports for IERS) as well as the minutes of the IDS GB meetings held in 2012 (http://ids-doris.org/report/governing-board.html).

The list of the peer-reviewed publications related to DORIS has been enriched with 6 new references of articles published in 2012 (http://ids-doris.org/report/publications/peer-reviewed-journals.html#2012). With the exception of a few number of articles, they can be accessed directly or with their DOI link.

A new version of the site logs has been provided by IGN, with coordinates expressed in ITRF2008. They can be seen on the IDS website (http://ids-doris.org/network/sitelogs.html).

4.3 IDS FTP SERVER

Address: http://ids-doris.org/pub/ids

The new documents and files put on the IDS ftp site in 2012 are listed hereafter:

- updates of the history of events impacting the data (pdf :ftp://ftp.ids-doris.org/pub/ids/data/EventsImpactingDataHistory.pdf ; excel file ftp://ftp.ids-doris.org/pub/ids/data/EventsImpactingDataHistory.xls).
- version #3 of the document describing the DORIS satellite models implemented in CNES POE processing; it includes HY-2A. (ftp://ftp.ids-doris.org/pub/ids/satellites/DORISSatelliteModels.pdf)

4.4 FUTURE PLAN

In 2013, the Central Bureau will work on providing SARAL's data, meta-data and documentation as soon as they become available. On the web site, the list of station events will be enriched with information on beacon change. A list of Earthquakes with magnitude larger than 6 in the vicinity of DORIS sites (less than 500 km) since Dec. 2008 will also be added. The Central Bureau will work with the Combination Center to provide outputs from the combination on the web and ftp sites.

The Central Bureau will continue to support any new ACs as they join the service.

Early January, the DORIS users will be solicited to give their satisfaction level concerning the services provided by the IDS CB. They will be invited to fill in a survey form on the IDS website.

The Central Bureau will participate to the organization of the IDS Workshop in Venice. A page for the submission of abstract will be proposed on the IDS website in February.

By the end of the year, the CB will organize the elections for the renewal of the Governing Board. The new terms of reference established in 2011 will then be applied.

The Central Bureau will continue to support any new ACs as they join the service.

5 THE NETWORK

Jérôme Saunier (1)

(1) Institut National de l'Information Géographique et Forestière, France

5.1 STATUS AND PERFORMANCE

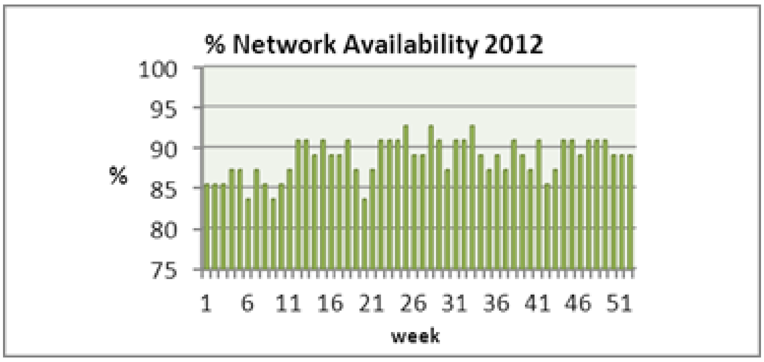
The key quality of the DORIS network is its homogeneous geographical distribution over the world. This specificity, placed from the beginning among the main system requirements, today is DORIS' pride and the envy of all other space geodetic technique.

But, this has a significant cost. The maintenance of all these remote stations is not an easy task. First, access times are not measured in hours but rather in days. Things are getting more and more complicated as the list of maintenance tasks to track gets longer: communication, negotiation, shipment, works monitoring, and the administrative tasks like customs clearance, agreement signatures, authorizations, and payments…

An important factor has also to be considered: human impact! In these remote areas, traditions, customs and rules, kept out of the way of globalization, are still deeply anchored to the land. Even if these differences can lead to misunderstanding or slow down actions, this cultural diversity is one of the great assets of the network.

And I would say: to cook up a good dish, one must start with quality ingredients and multiple flavors… I am not sure if people handling DORIS data are able to measure the value of each dataset coming from each station but I can assure you that their taste should be very different. Full data or data with small or big gaps have varied history and significance. We know that, we, field workers!

Anyway, despite all these difficulties, DORIS still provided this year a reliable service with an annual network availability mean of 89% of operating stations. This performance is the result of the joint effort of CNES, IGN and all the host agencies that I should therefore like to thank for their close and constant cooperation.



Last spring, we were very happy to announce that Futuna and Tristan da Cunha stations are back to operation after more than three years of inactivity! Two stations are still out of order for over two years now: Santa Cruz and Socorro and it is imperative that new sites replace Monument Peak and Yuzhno-Sakhalinsk.

5.2 EVOLUTION AND DEVELOPMENT

Being on the network side, 2012 was a very active year.

First, we provided and published a new set of site logs following a complete updating of our database with a new data set of stations coordinates and velocities derived from DPOD and ITRF solutions.

With a favorable context with REGINA (see IDS Activity Report 2011, section 5), we decided at the beginning of this year, during a DORIS GB meeting, to carry out from now, as far as possible, high precision local tie surveys, with the objective of sub-millimetric tie vectors.

This objective requires more means (equipment, time and transport). Many local ties were done in the past as convenience with GPS surveying method, quickest and easiest but less accurate.

Other action planned in the near future: equipping the DORIS sites with geodetic control points in order to monitor the monumentation stability. Grasse is the first site we will equip in 2013.

And as a background task, we will compute again all former tie vectors using absolute calibration models of GPS antennae.

On the field, we did many renovations in order to better meet the DORIS system requirements, taking advantage of the REGINA network deployment. Today, 79% of network stations comply with at least 80% of the DORIS system requirements.

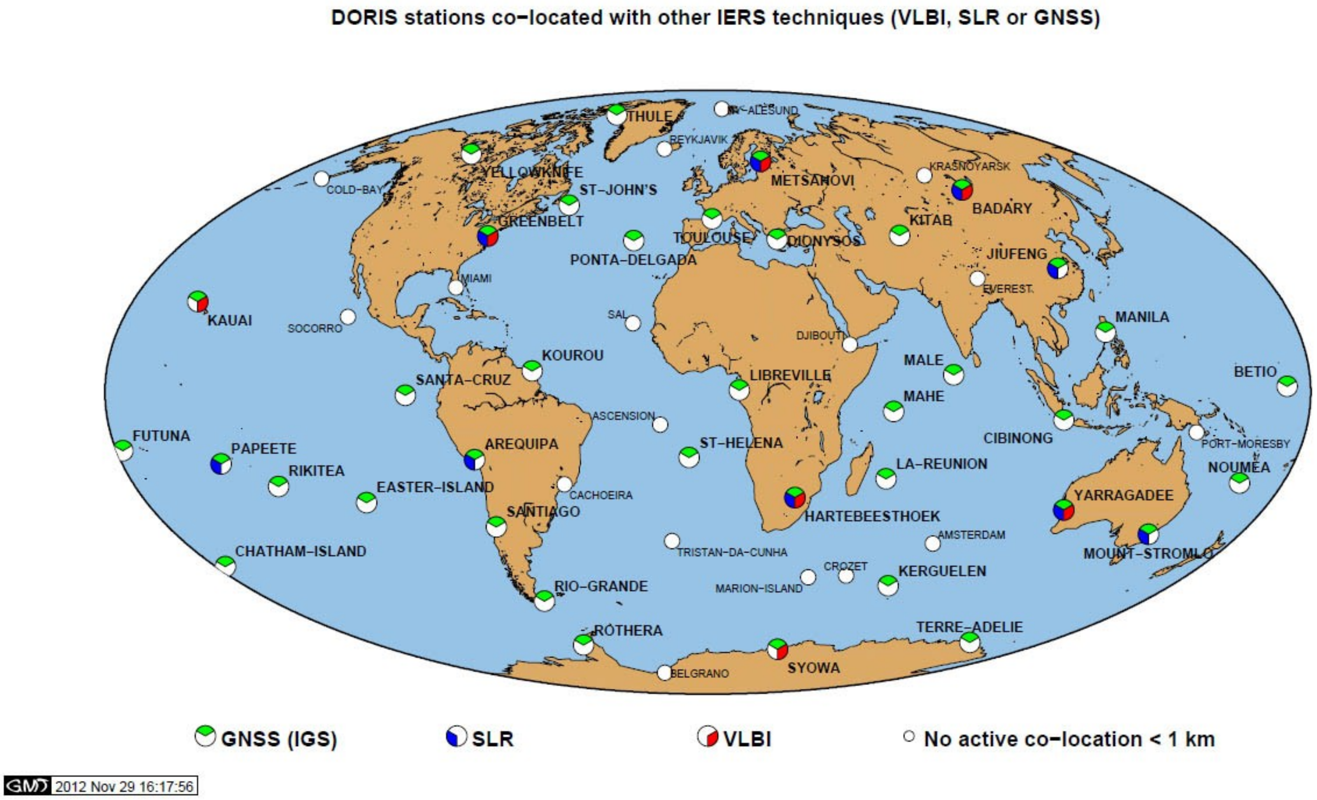
BEFORE AFTER

Metsähovi station, Finland

In 2012 the following sites were visited:

- French West Indies: reconnaissance in Guadeloupe, Martinique (IGS co-location)
- Rio Grande: antenna replacement (position unchanged)
- Futuna: major renovation and local tie survey (new REGINA station)
- Greenbelt: renovation (antenna raising and equipment replacement)
- Tristan da Cunha: major renovation and local tie survey
- Metsähovi: renovation and local tie survey (new REGINA station)
- Port-Moresby: renovation (antenna raising and equipment replacement)
- Jiufeng: renovation and local tie survey (new REGINA station)
- Mahé: antenna moving and local tie survey (new REGINA station)

In the very short term, the map of the network should be substantially modified: four stations have to move to other sites. This relates to the stations of California, Far East Russia, Florida, and New Zealand.



By 2013, we hope at last to install a new station in Goldstone, California, continue negotiation with Japan with the objective of installing a new station in Hokkaido (in place of Sakhalinsk), substitute Miami with the pair Martinique (installation planned in 2013) + Nicaragua (under negotiation).

Chichijima Island, Japan, is another densification project. The station installation should be carried out in 2013.

Finally, a major renovation is eagerly awaited in the Mexican island, Socorro.

With regard to the new IDS stations (in addition to the permanent network), negotiation continues with Korea in order to co-locate a DORIS station with GNSS, SLR and VLBI as a GGOS fundamental site and the Marshall Islands (with Wake as prime target).

The Riyadh and Tamanrasset projects are more or less abandoned.

6 THE SATELLITES WITH DORIS RECEIVERS

Pascale Ferrage (1)

(1) CNES, France

Initially conceived for the TOPEX/Poseidon mission, the first generation receivers were flown on four satellites:

- SPOT-2, a CNES remote sensing satellite which was launched in 1990 with the first DORIS receiver for a 6-month trial experiment. SPOT-2 was de-orbited in June 2009 (maneuvers were performed in order to lower the orbit so that the spacecraft will re-enter the Earth's atmosphere within 25 years). DORIS operated for more than 19 years on-board SPOT-2, far beyond the instrument and spacecraft nominal lifetime.

- TOPEX/Poseidon, a joint venture between CNES and NASA to map ocean surface topography, was launched in 1992. While a 3-year prime mission was planned, with a 5-year store of expendables, TOPEX/Poseidon delivered an astonishing 13+ years of data from orbit: the DORIS mission ended with the second receiver failure in November 2004 whereas the ocean surface topography mapping ended in October 2005,

- SPOT-3 (CNES) was launched in 1993; the spacecraft was lost in November 1996.

- SPOT-4 (CNES) was launched in 1998 and featured the first DORIS real time on-board orbit determination (DIODE).

In the mid-nineties, CNES developed a second-generation dual channel DORIS receiver that was subsequently miniaturized:

- Jason-1, the CNES/NASA TOPEX follow-on mission was launched on December 7, 2001 with a miniaturized second generation DORIS receiver. The receiver was switched on December 8. The orbit accuracy of Jason-1 has been demonstrated to be close to one cm in the radial component (*Luthcke et al. 2003; Haines et al. 2004*). At the present time, Jason-1 DORIS measurements are not used for geodesy, owing to the South Atlantic Anomaly (SAA) effect on the on-board Ultra Stable Oscillator (USO) (*Willis et al. 2004*), however a correction model has been developed (*Lemoine and Capdeville 2006*),

- Envisat, the ESA mission to ensure the continuity of the data measurements of the ESA ERS satellites was launched on March 1, 2002 with a second generation DORIS receiver

- SPOT-5 (CNES) was launched on May 4, 2002 with a miniaturized second generation DORIS receiver.

Then, a new generation DORIS receiver was developed starting in 2005. This receiver called DGXX, includes the following main new features:

1. The simultaneous tracking capability was increased to seven beacons (from only two in the previous generation of receivers)
2. The new generation USO design provides better frequency stability while crossing SAA, and a better quality of MOE useful for beacon location determination.
3. New DIODE navigation software (improved accuracy)

The following satellites have on board a DGXX receiver:

- OSTM/Jason-2 (CNES/NASA/EUMETSAT/NOAA), a TOPEX/Poseidon and Jason-1 follow-on ocean observation mission (same orbit), was launched on June 20, 2008. Jason-2 is based on the same PROTEUS platform as Jason-1, but carries the DGXX DORIS.

- Cryosat-2, the ESA mission dedicated to polar observation, was launched on April 10, 2010 with a DGXX DORIS receiver.

- HY-2A, a Chinese satellite (China Academy of Space) was launched on August 15, 2011 with a DGXX receiver.

- SARAL-AltiKA Indian-French satellite (ISRO/CNES) was launched on February 25 2012

Moreover, the satellite STPSAT1 (Plasma Physics and Space Systems Development Divisions, Naval Research Laboratory) with a CITRIS receiver to be used with the DORIS beacon network, was launched on March 9, 2007. This experiment was dedicated to global ionospheric measurements.

Figure 2 gives a summary of the satellites that provide DORIS data to the IDS data centers, as well as the evolution in time of the number of these satellites. Some of the early SPOT-2 data could not be recovered between 1990 and 1992, due to computer and data format limitations. With the exception of this time period, all DORIS-equipped satellites have provided continuous data to the IDS data centers. Please note the large increase in the number of DORIS satellites around mid-2002.

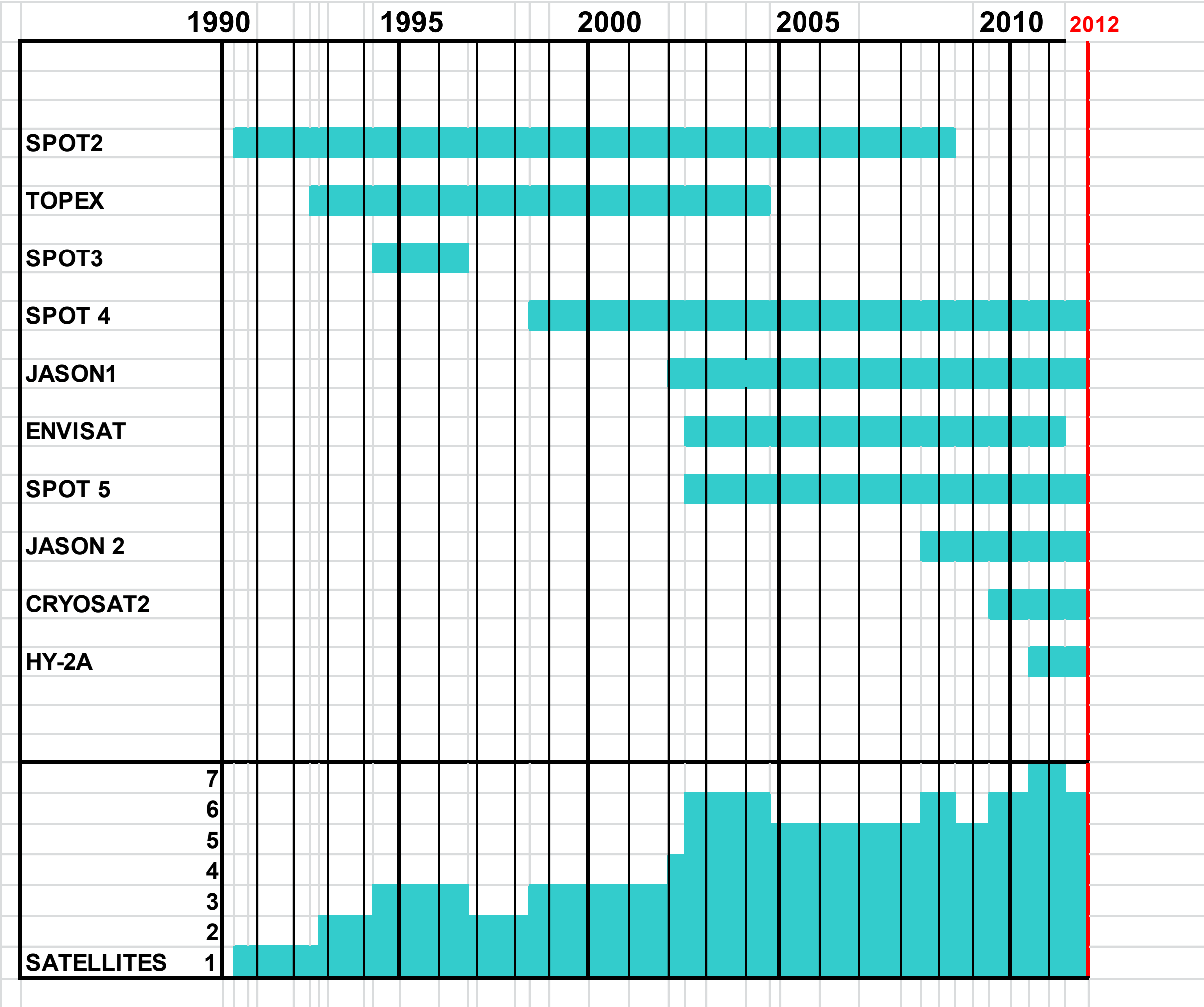


Figure 2 DORIS observations available at the IDS Data Centers (December 2011).

Some other DORIS missions are under development and should guarantee a constellation with at least 4 DORIS contributor satellites through 2028:

- **SENTINEL3A** (GMES/ESA) is planned for end 2014, then **SENTINEL 3B** 12 to 30 months later
- **Jason3** (EUMETSAT/NOAA/CNES) is foreseen for 2015
- **Jason CS** (Eumetsat/ESA/CNES) is expected from 2018
- **SWOT** is foreseen for 2020

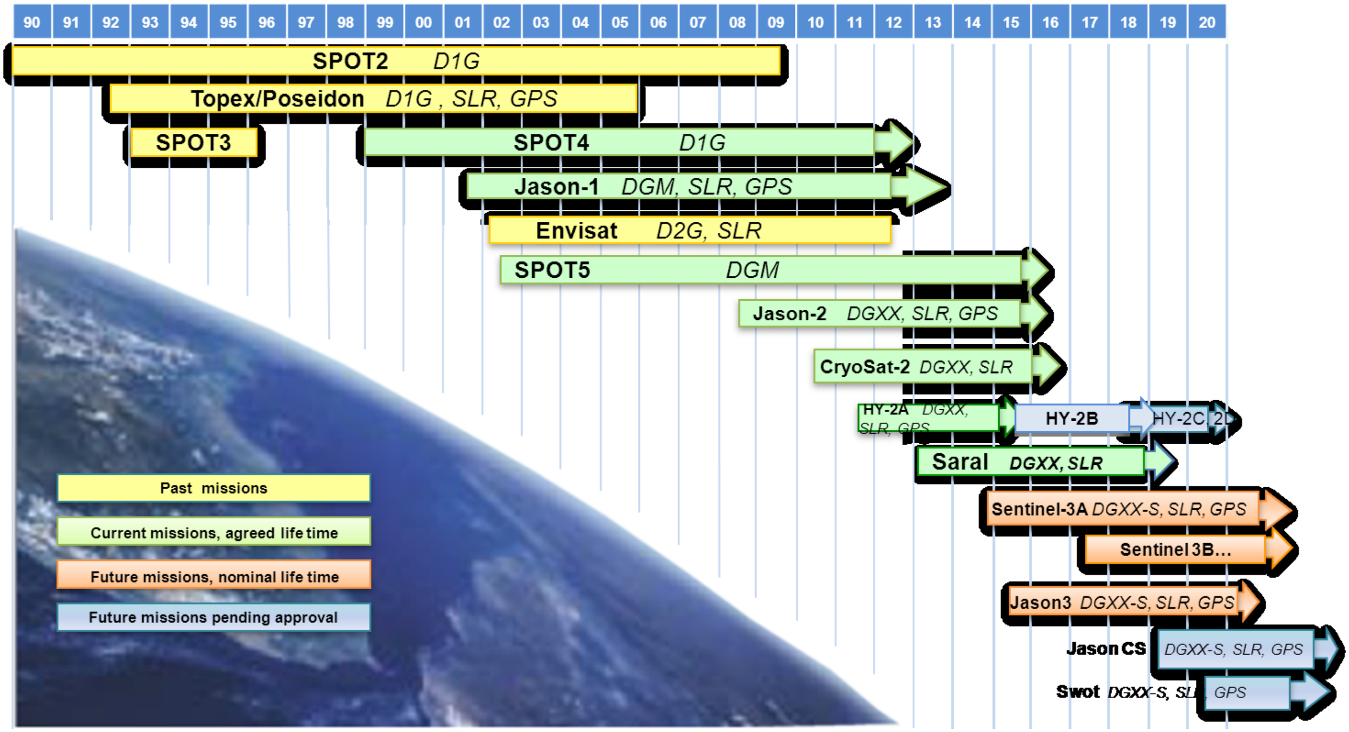


Figure 3 Current and future DORIS constellation (December 2012).

7 IDS DATA FLOW COORDINATION

Carey Noll (1)

(1) NASA/GSFC, USA

7.1 INTRODUCTION

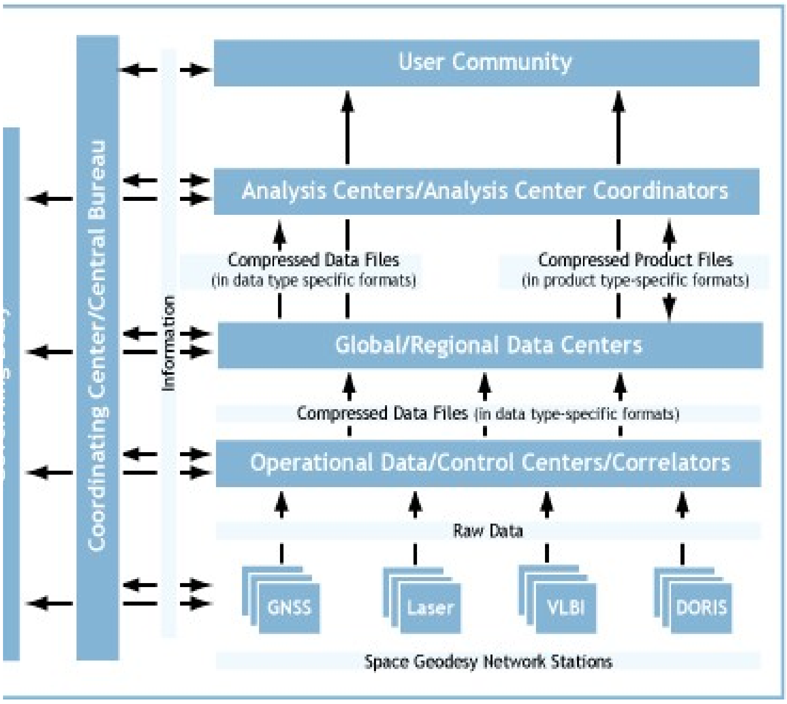
Two data centers currently support the archiving and access activities for the IDS:

- Crustal Dynamics Data Information System (CDDIS), NASA GSFC, Greenbelt, MD USA
- Institut Géographique National (IGN), Saint Mandé France

These institutions have archived DORIS data since the launch of TOPEX/Poseidon in 1992.

7.2 FLOW OF IDS DATA AND PRODUCTS

The flow of data, products, and information within the IDS is analogous to what is used in the other IAG geometric services (IGS, ILRS, IVS) and is shown in Figure 4. IDS data and products are transmitted from their sources to the IDS data centers. DORIS data are downloaded from the satellite at the DORIS control and processing center, SSALTO (Segment Sol multi-missions d'ALTimétrie, d'Orbitographie et de localisation précise) in Toulouse, France. After validation, SSALTO transmits the data to the IDS data centers. IDS analysis centers, as well as other users, retrieve these data files from the data centers and produce products, which in turn are transmitted to the IDS data centers.



Network Stations
Continuously operational
Timely flow of data

Data Centers
Interface to network stations
Perform QC and data conversion activities
Archive data for access to analysis centers and users

Analysis Centers
Provide products to users (e.g., station coordinates, precise satellite orbits, Earth orientation parameters, atmos. products, etc.)

Central Bureau/Coordinating Center
Management of service
Facilitate communications
Coordinate activities

Governing Body
General oversight of service
Future direction

Figure 4 Routine flow of data and information for the IAG Geodetic Services

The IDS data centers use a common structure for directories and filenames that was implemented in January 2003. This structure is shown in and fully described on the IDS Central Bureau website at *http://ids-doris.org/analysis-documents/struct_dc.html*. The main directories are:

- */pub/doris/data* (for all data) with subdirectories by satellite code
- */pub/doris/products* (for all products) with subdirectories by product type and analysis center
- */pub/doris/ancillary* (for supplemental information) with subdirectories by information type
  /pub/doris/cb_mirror (duplicate of CB ftp site) with general information and data and product documentation (maintained by the IDS Central Bureau)

SSALTO and the analysis centers deliver data and products to both IDS data centers (CDDIS and IGN) to ensure redundancy in data delivery in the event one data center is unavailable. The general information available through the IDS Central Bureau ftp site are mirrored by the IDS data centers thus providing users secondary locations for these files as well.

Directory	File Name	Description
Data Directories		
/doris/data/*sss*	*sss*data*MMM*.*LLL*.Z	DORIS data for satellite *sss*, cycle number *MMM*, and version *LLL*
	sss.files	File containing multi-day cycle filenames versus time span for satellite *sss*
/doris/data/*sss*/sum	*sss*data*MMM*.*LLL*.sum.Z	Summary of contents of DORIS data file for satellite *sss*, cycle number *MMM*, and file version number *LLL*
/doris/data/*sss*/yyyy	*sss*rx*YYDDD*.*LLL*.Z	DORIS data (RINEX format) for satellite sss, date YYDDD, version number *LLL*
/doris/data/*sss*/yyyy/sum	*sss*rx*YYDDD*.*LLL*.sum.Z	Summary of contents of DORIS data file for satellite *sss*, cycle number *MMM*, and file version number *LLL*
Product Directories		
/doris/products/orbits/	*ccc*/*cccsssVV*.*bXXDDD*.*eYYEEE*.sp1.*LLL*.Z *ccc*/*cccsssVV*.*bXXDDD*.*eYYEEE*.sp3.*LLL*.Z	Satellite orbits in SP1 or SP3c format from analysis center *ccc*, satellite *sss*, solution version *VV*, start date year *XX* and day *DDD*, end date year *YY* and day *EEE*, and file version number *LLL*
/doris/products/sinex_global/	*cccWWuVV*.snx.Z	Global SINEX solutions of station coordinates for analysis center *ccc*, year *WW*, content *u* (d=DORIS, c=multi-technique), and solution version *VV*
/doris/products/sinex_series/	*ccc*/*cccYYDDDtuVV*.snx.Z	Time series SINEX solutions for analysis center *ccc*, starting on year *YY* and day of year *DDD*, type *t* (m=monthly, w=weekly, d=daily) solution, content *u* (d=DORIS, c=multi-technique), and solution version *VV*
/doris/products/stcd/	*cccWWtu*/*cccWWtuVV*.stcd.*aaaa*.Z	Station coordinate time series SINEX solutions for analysis center *ccc*, for year *WW*, type *t* (m=monthly, w=weekly, d=daily), content *u* (d=DORIS, c=multi-technique), solution version *VV*, for station *aaaa*
/doris/products/geoc/	*cccWWtuVV*.geoc.Z	TRF origin (geocenter) solutions for analysis center *ccc*, for year *WW*, type *t* (m=monthly, w=weekly, d=daily), content *u* (d=DORIS, c=multi-technique), and solution version *VV*
/doris/products/eop/	*cccWWtuVV*.eop.Z	Earth orientation parameter solutions for analysis center *ccc*, for year *WW*, type *t* (m=monthly, w=weekly, d=daily), content *u* (d=DORIS, c=multi-technique), and solution version *VV*
/doris/products/iono/	*sss*/*cccsssVV*.*YYDDD*.iono.Z	Ionosphere products for analysis center *ccc*, satellite *sss*, solution version *VV*, and starting on year *YY* and day of year *DDD*
/doris/products/2010campaign/	*ccc*/*cccYYDDDtuVV*.*sss*.Z	Time series SINEX solutions for analysis center *ccc*, starting on year *YY* and day of year *DDD*, type *t* (m=monthly, w=weekly, d=daily) solution, content *u* (d=DORIS, c=multi-technique), and solution version *VV* for satellite *sss*
Information Directories		
/doris/ancillary/quaternions	*sss*/qbody*YYYYMMDDHHMISS_yyyymmddhhmiss*.*LLL*	Spacecraft body quaternions for satellite *sss*, start date/time *YYYYMMDDHHMISS*, end date/time *yyyymmddhhmiss*, and version number *LLL*
	sss/qsolp*YYYYMMDDHHMISS_yyyymmddhhmiss*.*LLL*	Spacecraft solar panel angular positions for satellite *sss*, start date/time *YYYYMMDDHHMISS*, end date/time *yyyymmddhhmiss*, and version number *LLL*
/doris/cb_mirror		Mirror of IDS central bureau files

Table 1 Main Directories for IDS Data, Products, and General Information

7.3 DORIS DATA

SSALTO deposits DORIS data to the CDDIS and IGN servers. Software at the data centers scans these incoming data areas for new files and automatically archives the files to public disk areas using the directory structure and filenames specified by the IDS. The IDS data centers currently archive DORIS data from six operational satellites (SPOT-4, -5, Jason-1, -2, CryoSat-2, and HY-2A); data from future missions (e.g., SARAL, etc.) will also be archived within the IDS. Historic data from SPOT-2, SPOT-3, TOPEX/Poseidon, and Envisat (mission ended in April 2012) are also available at the data centers. A summary of DORIS data holdings at the IDS data centers is shown in Table 2. The DORIS data from all satellites are archived in multi-day (satellite dependent) files using the DORIS data format 2.1 (since January 15, 2002). This format of DORIS data files is on average two Mbytes in size (using UNIX compression). SSALTO issues an email notification through DORISReport once data are delivered to the IDS data centers. The number of days per file and average latency in 2012 of data availability after the last observation day satellite specific are shown in Table 3. The delay in data delivery to the data centers (in days by satellite) in 2012 is shown in Figure 5.

Satellite	Time Span
CryoSat-2	30-May-2010 through present
Envisat	13-Jun-2002 through 08-Apr-2012
HY-2A	01-Oct-2011 through present
Jason-1	15-Jan-2002 through present
Jason-2	12-Jul-2008 through present
SPOT-2	31-Mar through 04-Jul-1990
	04-Nov-1992 through 14-Jul-2009
SPOT-3	01-Feb-1994 through 09-Nov-1996
SPOT-4	01-May-1998 through present
SPOT-5	11-Jun-2002 through present
TOPEX/Poseidon	25-Sep-1992 through 01-Nov-2004

Table 2 DORIS Data Holdings

Satellite	Number of Days/ Multi-Day File	Average Latency (Days)	Average File Size (Mb)
CryoSat-2	7	25	2.7
Envisat	6	26	1.9
HY-2A	7	29	3.1
Jason-1	11	27	3.5
Jason-2	11	28	6.1
SPOT-4	10	19	1.5
SPOT-5	10	19	2.6

Table 3 Data File Information (V2.1 format)

DORIS phase data from Jason-2, CryoSat-2, and HY-2A are also available in RINEX (Receiver Independent Exchange Format), version 3.0. These satellites have the newer, next generation DORIS instrumentation on board, which is capable of generating DORIS data in RINEX format; future satellites will also utilize this type of DORIS receiver. These data are forwarded to the IDS data centers in daily files prior to orbit processing within one day (typically) following the end of the observation day. The average file size of the RINEX data files is 1.6 Mbytes, 1.8Mbytes, and 2.5 Mbytes for CryoSat-2, HY-2A, and Jason-2 respectively.

In the fall of 2012, the IDS Analysis Working Group requested a test data set where data from stations in the South Atlantic Anomaly (SSA) were reprocessed by applying corrective models. Data from 2011 in DORIS V2.2 format from the Jason-1 satellite (cycles 331 through 368) were submitted to the IDS data centers in late 2012; a set of 2011 SPOT-5 data (cycles 322 through 358) will be provided in early 2013. These files were submitted to the IDS data centers and archived in dedicated directories, e.g., at CDDIS:

ftp://cddis.gsfc.nasa.gov/pub/doris/campdata/ssacorrection/ja1

ftp://cddis.gsfc.nasa.gov/pub/doris/campdata/ssacorrection/sp5

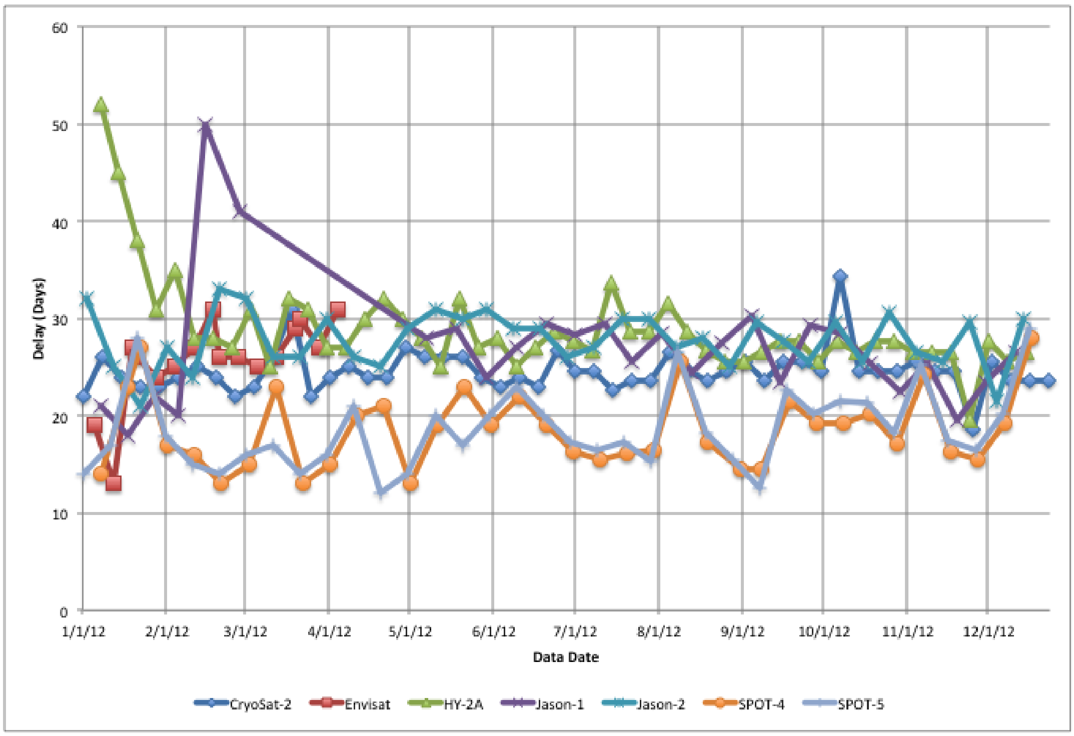


Figure 5 Delay in delivery of DORIS data to the CDDIS (all satellites, 01-12/2012)

7.4 DORIS PRODUCTS

IDS analysis centers utilize similar procedures by putting products to the CDDIS and IGN servers. Automated software detects any incoming product files and archives them to the appropriate product-specific directory. The following analysis centers (ACs) have submitted products on an operational basis to the IDS; their AC code is listed in ():

- European Space Agency (esa), Germany, M. Ottens
- Geoscience Australia (gau), R. Govind
- Geodetic Observatory Pecny (gop), Czech Republic, P. Stepanek
- NASA Goddard Space Flight Center (gsc) USA, F. Lemoine
- Institut Géographique National/JPL (ign) France, P. Willis
- INASAN (ina) Russia, S. Kuzin
- CNES/CLS (lca) France, L. Soudarin
- CNES/SOD (sod) France, L. Cerri
- SSALTO (ssa) France, S. Houry

A solution (designated "ids") produced by the IDS combination center from the individual IDS AC solutions started production in 2012. IDS products are archived by type of solution and analysis center. The types and sources of products available through the IDS data centers in 2005-2012 are shown in Table 4. This table also includes a list of products under evaluation from several DORIS analysis centers.

Type of Product	**ACs/Products**									
	ESA	**GAU**	**GOP**	**GSC**	**IDS**	**IGN**	**INA**	**LCA**	**SOD**	**SSA**
Time series of SINEX solutions (*sinex_series*)	X	X	X	X(	X	X	X	X	X	X
Global SINEX solutions (*sinex_global*)						X		X		
Geocenter time series (*geoc*)						X	X	X		
Orbits/satellite (*orbits*)				X				X		X
Ionosphere products/satellite (*iono*)										X
Time series of EOP (*eop*)						X	X			
Time series of station coordinates (*stcd*)					X	X	X	X		X
Time series of SINEX solutions (2010campaign)		X	X	X		X	X	X		

Table 4 Product Types and Contributing Analysis Centers

7.5 SUPPLEMENTARY DORIS INFORMATION

In 2009 an additional directory structure was installed at the IDS data centers containing ancillary information for DORIS data and product usage. Files of Jason-1 and -2 satellite attitude information were made available through the IDS data centers. Two types of files are available for each satellite: attitude quaternions for the body of the spacecraft and solar panel angular positions. The files are delivered daily and contain 28 hours of data, with 2 hours overlapping between consecutive files. Analysts can use these files in processing DORIS data to determine satellite orientation and attitude information.

7.6 FUTURE PLANS

The CDDIS and IGN provide reports that list holdings of DORIS data in the DORIS format. Daily summary reports of data in RINEX format will be drafted and posted at the data centers in the coming months. The IDS data centers will also investigate procedures to regularly compare holdings of data and products to ensure that the archives are truly identical.

8 IDS DATA CENTERS

Carey Noll (1), B. Garayt (2)

(1) NASA/GSFC, USA

(2) IGN, France

8.1 CRUSTAL DYNAMICS DATA INFORMATION SYSTEM (CDDIS)

The CDDIS is a dedicated data center supporting the international space geodesy community since 1982. The CDDIS serves as one of the primary data centers for the following IAG services:

- International GNSS Service (IGS)
- International Laser Ranging Service (ILRS)
- International VLBI Service for Geodesy and Astrometry (IVS)
- International DORIS Service (IDS)
- International Earth Rotation and Reference Frame Service (IERS)

The CDDIS automated software archives data submitted by SSALTO and performs minimal quality-checks (e.g., file readability, format compliance) resulting in a summary file for each data file. Software extracts metadata from all incoming DORIS data. These metadata include satellite, time span, station, and number of observations per pass. The metadata are loaded into a database and used to generate data holding reports on a daily basis. Approximately 55 Gbytes of CDDIS disk space is devoted to the archive of DORIS data, products, and information.

In the spring 2012 the CDDIS began operations on an enhanced, robust, distributed server system. Both users and data/product suppliers continue to access the CDDIS as before. The structure of the DORIS data and product archive remained unchanged in this new system configuration.

During 2012, user groups downloaded approximately 406 Gbytes (500K files) of DORIS data, products, and information from the CDDIS.

8.1.1 FUTURE PLANS

The CDDIS staff will continue to interface with the IDS CB, SSALTO, and IDS analysis centers to ensure reliable flow of DORIS data, products, and information. Enhancements and modifications to the data center will be made in coordination with the IDS CB.

8.1.2 CONTACT

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WWW: http://cddis.gsfc.nasa.gov

8.2 IGN DORIS DATA CENTER

To ensure a more reliable data flow and a better availability of the service, two identical configurations have been setup in two different locations at the IGN: (1) Marne-la-Vallée and (2) Saint-Mandé. Each configuration has:

- a FTP deposit server for data and analysis centers uploads, requiring special authentication
- a free FTP anonymous access to the observations and products
- fully independent Internet links.

All the data and products archived and available at IGN GDC may be access through:

- ftp://doris.ensg.eu for the Marne-la-Vallée site
- ftp://doris.ign.fr for the Saint-Mandé site

Plans for some data flow statistics have been postponed to the next year.

8.2.1 CONTACT

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9 IDS ANALYSIS COORDINATION

Frank G. Lemoine (1)

(1) NASA/GSFC, USA

The IDS held Analysis Working Group (AWG) meetings in Prague (Czech Republic, May 31-June 1, 2012), and in Venice (Italy, September 26, 2012). The meeting in Prague was hosted by the Czech Office for Surveying, Mapping, and Cadastre (COSMC), while the AWG meeting in Venice took place at the conclusion of the bi-annual DORIS workshop which was associated with the NASA ESA conference on satellite altimetry. At both meetings, the overarching concern was the planning for the data reprocessing to take place for the next ITRF. It is anticipated that the IERS will release a call for submissions in early 2013, with submission of the final SINEX files by the technique centers in early 2014. This would require the IDS ACs to finish their reprocessing of most of the 20-years of DORIS data by the end of 2013. Therefore, the decision on the models to use and what improvements to make in the modelling standards and analysis procedures was a constant theme in both meetings.

The Prague AWG included 15 participants from the CNES, GFZ, GOP, GSFC, IGN, IPGP, LCA and the University of Luxembourg. The primary issues discussed included: (1) A review of the first orbit determination results with HY-2A; (2) A report on the ground calibration of the Starec DORIS antennae; (3) updates on the SAA models for SPOT-5 and Jason-1; (4) A presentation of the results of a comparison campaign between the analysis centers for orbits and the values of the empirical accelerations; (5) A review of the effect of atmospheric loading and its impact on geodetic data, and a discussion of a call to DORIS analysis centers to participate in an IERS analysis campaign to apply atmospheric loading at the observation level. The standard suite of analysis center reports was presented. AC updates were also provided by ESA, GAU, and INA. The IDS Combination Center (Guilhem Moreaux) presented the latest results concerning analysis of the contributions from the analysis centers, and the production of the operational combination. Concerning the DORIS satellite constellation, the AWG noted with regret the demise of Envisat in April 2012, after 10 years of operation (since March 2002). This means that the DORIS operational combination relies on four satellites (SPOT-4, SPOT-5, Jason-2, and Cryosat-2) after April 2012, pending the assessment of the utility of the HY-2A DORIS data.

Guilhem Moreaux (CLS) presented the Combination Center report regarding the analysis of the recent SINEX series delivered by the different analysis centers. While Jason-2 has previously been shown to make a substantial contribution to the DORIS weekly solutions due to the quantity of the data provided and the stabilizing influence on the TZ component of geocenter, Cryosat-2 has only a small albeit beneficial influence. This can be ascribed to the lower altitude (720 km compared to 1336 km for Jason2) and the fact that the polar-orbiting satellite has a similar observation geometry to the other sun-synchronous DORIS satellites.

At both AWG meetings, updates were presented on the ground antenna calibration of the Starec antenna. The reports, presented by Cédric Tourain (CNES) showed that based on actual measurements of multiple Starec antennae in an anachoeic chamber, the actual 2 Ghz phase center differed from the phase center stipulated in the documentation by 17 mm. In addition the phase law – or phase variation vs. elevation was measured and also compared with manufacturer specifications. All previous DORIS analyses have used the old specification of the phase center and have not applied a phase law. Cédric Tourain reported that there were not sufficient models of the Alcatel antennae available to do a similar analysis. The implications of this drastic change are unclear – and it seems that testing is required by the DORIS analysis centers. Although the DORIS scale did not contribute to the ITRF2008, a discrepancy of 17 mm (~3ppb) was not observed between DORIS and the other geodetic techniques.

Petr Stepanek (GOP) has previously identified that an SAA effect is present in the SPOT-5 data. The effect is smaller than on the Jason-1 DORIS oscillator, but still at level that noticeably affects the data. The stations that are most affected include: Cacheoira Paulista, Santiago, and Arequipa. The SAA effect also impacts SPOT-5 data from the following stations, but to a lesser extent: Kourou, Easter Island, Ascension, and St. Helena. Presentations and discussions in Prague and Venice centered on how to correct the DORIS data from SPOT-5 to mitigate this effect. Both GOP and H. Capdeville (showed) that a model could be derived that would attenuate this effect. Action items from the IDS AWG (Sept. 26, 2012) requested that SAA-corrected data for SPOT-5 be produced for 2011 by H. Capdeville (CLS), and that the DORIS ACs do comparative tests with the standard (uncorrected) data, and the SAA-corrected data.

An important intercomparison was carried out that analyzed the orbit differences, and the magnitude of the empirical accelerations between the analysis centers for each DORIS satellite in 2010. For this comparison exercise, the CNES GDRC orbits were selected as a reference. In the radial direction, the agreement for all satellites and all AC's was 0.95 to 1.83 cm. In total position the RMS differences ranged from 3-8 cm. These results are summarized in Table 1. For the analysis campaign of the empirical accelerations, the AC's were requested to furnish the magnitude of their daily adjusted empirical accelerations along-track and cross-track to the orbit. The purpose was to look for AC's with large values of the empirical accelerations as a test of the fidelity of their force modelling. This is intended to be a diagnostic tool to identify where improvements need to be made in the modelling for the each ACs.

The summary of this empirical acceleration comparison campaign is as follows:

Cryosat2: IGN, INA and LCA had the largest median along-track acceleration amplitudes (14.03, 13.86 and 7.61 nm/s^s, respectively), larger than the other ACs by 2-3 X.

Envisat: GAU, GSC, and LCA had the largest median along-track acceleration amplitudes (37.88, 9.42, 16.46 nm/s^2, respectively), larger than the other ACs by 20X, 6X, and 10X).

Jason2: IGN, INA had the largest median along-track acceleration amplitudes (11.88 and 11.96 nm/s^2, respectively), larger than CNES or GSC by 10X.

SPOT4: ESA, GAU had the largest median along-track acceleration amplitudes (9.38 and 9.90 nm/s^2), larger than the best results from GSC or LCA by ~9X.

SPOT5: GAU, INA had the largest median along-track acceleration amplitudes (12.50, 14.11 nm/s^2), larger than the best results (by ESA and CNES) by ~9-10X.

This comparison of the empirical acceleration points to specific modelling improvements that are necessary for each analysis center prior to initiating recomputations for the next ITRF. Large values of the empirical accelerations are prima facie evidence of mismodelling of the nonconservative forces and indicate a problem with the parameters of the macromodel, or in the attitude law that controls the macromodel orientation in inertial space. It is strongly recommended that this comparison campaign of the empirical accelerations be repeated prior to initiating recomputations for the next ITRF to confirm that the ACs have successfully addressed the modelling issues identified above.

In terms of other preparations for the next ITRF one important action item concerned a decision to review the Jason-1 data, and re-assess whether these data could be included in the next ITRF. The Jason-1 data, even though they are heavily affected by the SAA, might still be beneficial in the period after the demise of the second DORIS TOPEX receiver (November 2004) and the first use of Jason-2 DORIS data by the IDS (July 2008). As a second action item, the AC's were requested to submit combination and single-satellite SINEX files for 2011, and 1995 to the IDS combination center as a preliminary validation and analysis exercise, to prepare submissions for the next ITRF.

C2	En	J2	S4	S5
GAU 4.58	LCA 3.41	JPL 3.21	GSC 3.72	GSC 3.37
ESA 4.61	GSC 3.44	GSC 4.56	GAU 4.12	LCA 3.64
GSC 4.71	GAU 3.59	GAU 4.59	LCA 4.94	GAU 3.66
LCA 4.88	ESA 4.16	ESA 4.95	ESA 5.51	ESA 4.72
INA 5.52	INA 4.43	LCA 6.68	INA 6.14	INA 5.18
IGN 5.95	IGN 5.52	INA 6.86	IGN 7.41	IGN 7.16
GOP 7.12	GOP 6.00	GOP 7.01	GOP 8.46	GOP 7.54
		IGN 8.01		

Table 5 Total RSS orbit differences by satellite from IDS Analysis Center orbits, using CNES_GDR-C orbits as a reference, for 2010 (units are cm). The CNES_GDR-C orbits are SLR+DORIS for Cryosat-2 and Envisat, and SLR+DORIS+GPS for Jason-2. The JPL GPS-only Jason-2 orbits are shown for comparison as a further extern test. The differences are order in each column from smallest difference to largest.

10 IDS COMBINATION

Guilhem Moreaux (1)

(1) CLS, France

10.1 ACTIVITY SUMMARY

IDS combination activities in 2012 were devoted to i) the pursuit of the IDS combination and the improvement of the operational chain, ii) preliminary studies for ITRF2013, iii) the analysis of first series including HY-2A and iv) communications at EGU, AGU meetings and IDS Workshop.

10.2 IDS ROUTINE COMBINATION

The main 2012 evolution of both the evaluation and combination chains concerns the inclusion of EOPs. Therefore, every three months, in addition to stations positions, IDS CC evaluates single ACs EOPs (X and Y pole as well as LOD). EOPs are evaluated with respect to 2 criteria: a) differences between DORIS EOPs and IERS C04 series and b) in terms of EOPs formal errors.

	Pole	Pole rates	UT	LOD	LODR
ESA	***Yes***	***Yes***	No	***Yes***	No
GAU	***Yes***	No	No	***Yes***	No
GOP	***Yes***	***Yes***	No	No	No
GSC	***Yes***	No	No	No	No
IGN	***Yes***	***Yes***	***Yes***	No	***Yes***
INA	***Yes***	***Yes***	***Yes***	No	***Yes***
LCA	***Yes***	No	No	No	No

Table 6 EOPs products per AC.

Due to the fact that to include a product in the combination process we need that this product is present in more than 3 AC single solutions, only XPO and YPO products are in the combined solution. Pole rates have not been included based on the ITRF2008 studies.

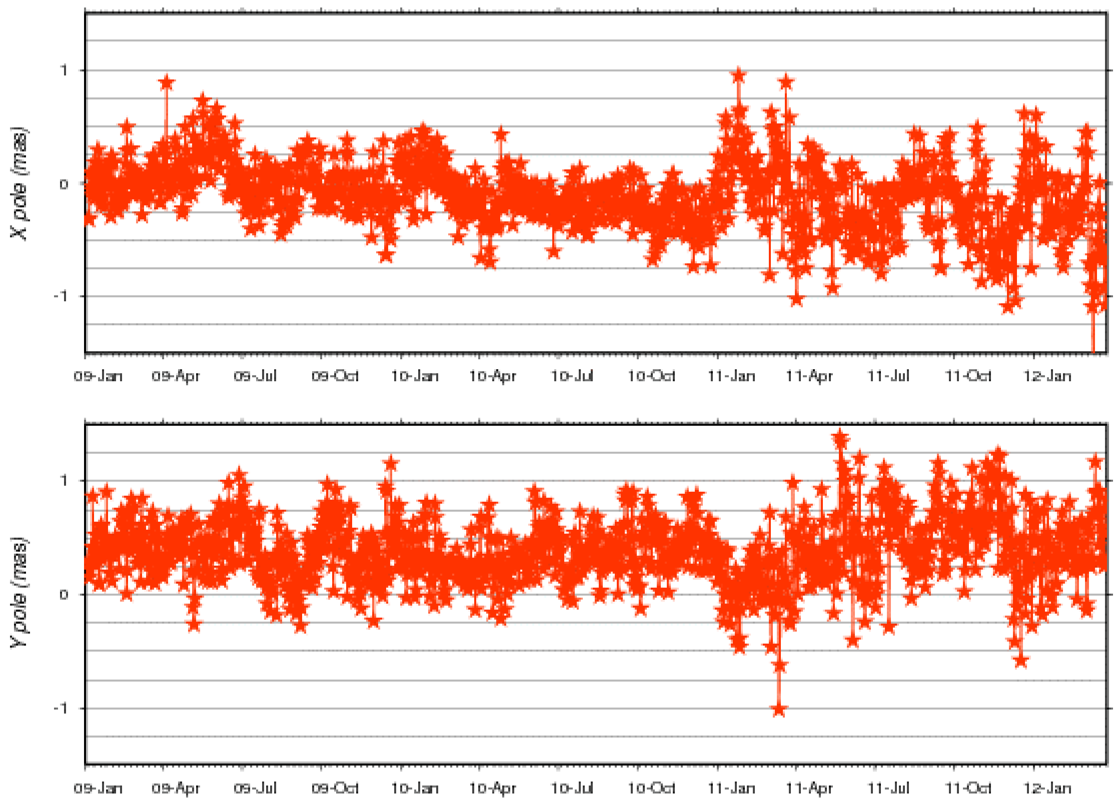

Figure 6 IDS combined EOPs differences with respect to IERS C04 series over time period 2009-2012

The last quarter of 2012 was also devoted to the elaboration of a stacking chain to produce mean station positions and velocities over a time period. Some validation tests still remain, especially to check that internal tides are correctly handled.

In the context of the oral presentations for IDS Workshop and AGU Fall Meeting, the IDS CC has delivered to IDS Data Centers both weekly combined SINEX files over the time period 1993-mid 2012 and corresponding STCDs files.

10.3 PRELIMINARY STUDIES FOR ITRF2013

In preparation to the next ITRF (2013), we have decided to evaluate for each AC the most complete time series. Thus, 6 series (see Table 7) have been evaluated over the time period 1993-2012 and one from 2002 to 2012. The objectives of this exercise were to functionally test the new evaluation and combination chains with data before 2008, to size memory and CPU for ITRF2013 and to give first feedbacks to all the ACs.

AC	Series	Time period	# SINEXs	# SINEXs as output of the evaluation	# SINEXs used in the combination	Remarks
ESA	06	93003-12141	1000	985	981	Inversion not possible for 4 SINEXs
GAU	08-09-10	02020-12232	552	545	543	
GOP	31-32-33-24	93003-12085	992	972	968	
GSC	10-11-12	92306-12176	1021	984	980	Inversion not possible for 28 SINEXs
IGN	08	93003-12253	1028	1022	1019	
INA	07	93003-12183	1018	1008	1006	
LCA	30	93003-12225	1022	1016	1016	Decompression not possible for of 1 SINEX

Table 7 Evaluation results of historical series

From Table 7, we notice that evaluation and combination scripts work nominally even with old data and some observations have been addressed to the ACs.

Looking at time evolution of Helmert parameters we observe an interesting change early 2002 (while including Envisat and Spot-5) for ESA and GSC scales (see Figure 7-Figure 9) which could be part of the explanation that ESA, GAU and GSC have negative scales.

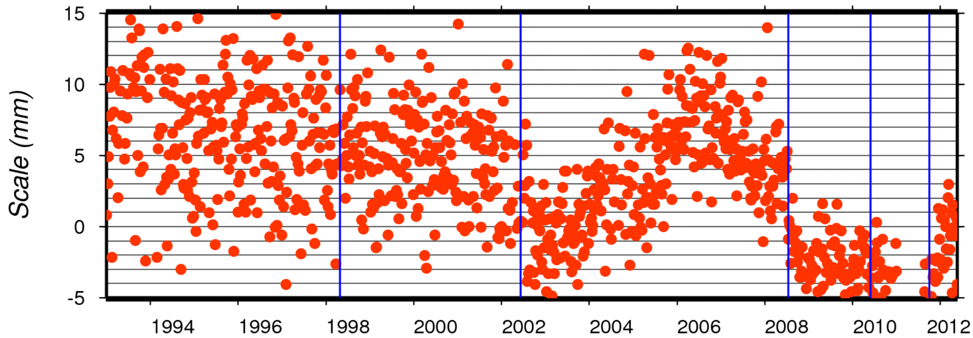

Figure 7 Time evolution of ESA 06 scale.

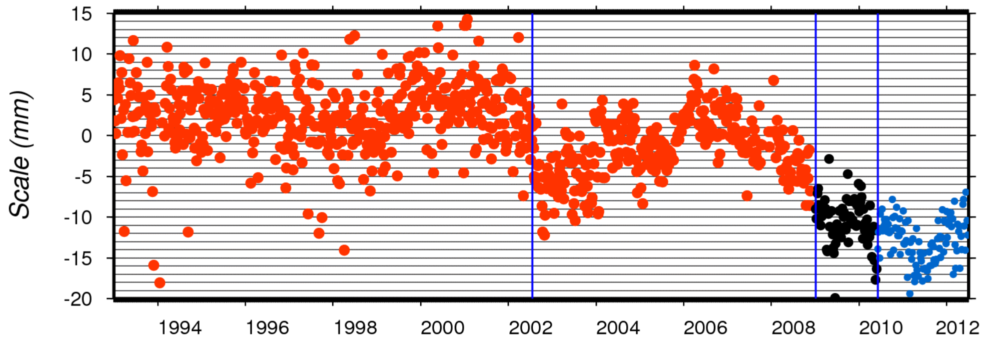

Figure 8 Time evolution of GSC scale.

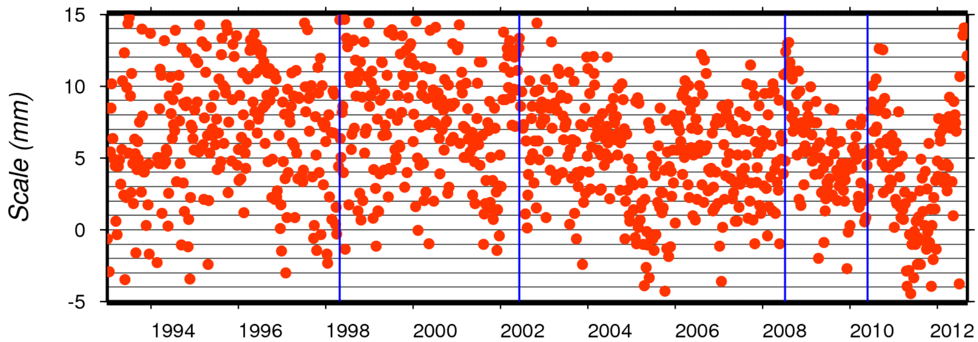

Figure 9 Time evolution of IGN scale.

Including these 2 satellites has also an impact on Tz and introduces for some ACs periodic signals on Tx and Ty.

The main observation concerning EOPs analysis is that more satellites we have and better are the results (both differences wrt C04 and formal errors). The best improvement occurs early 2002 when Envisat and Spot-5 are included and so when the maximum of DORIS satellites is reached. Nevertheless, counter to formal errors, we do not see any impact of including Jason-2 and Cryosat-2 on differences wrt C04.

Analysis of DORIS stations positions time series from IDS combined solution over time period 2000-2012 has revealed discontinuities linked not with geophysical phenomenon, but correlated with beacons frequency shifts. This result was the consequence of assuming the nominal frequency in the measurement model, and not accounting for beacon frequency shifts during an arc or over time. This affected the DORIS data analysis for the software at the ESA, GSC, LCA, and GAU analysis centers. The GYPSY analysis centers (IGN, INA) were unaffected since they model DORIS as a difference in two phase measurements and they estimate ground frequency drift for the station clock. This mismodelling affected the DORIS contribution to ITRF2008. As soon as this mismodelling will be corrected (already done by ESA and LCA), we will compute mean stations positions and velocities over the time period 1993-2008 with the original (uncorrected) and new SINEX files to estimate impact of this miss modeling on the IDS contribution to ITRF2008.

10.4 FIRST HY-2A ANALYSES

At the end of 2012, 3 ACs (esa, gop and lca) deliver muti satellites solutions including HY-2A. HY-2A which was launched on August 15th 2011 is the third DORIS satellite with the new DGXX DORIS receiver onboard (the first one was Jason-2 and second one Cryosat-2). The analyses of these new series shown that adding HY-2A has no major impact on the series in terms of transformation parameters as well as on EOPs.

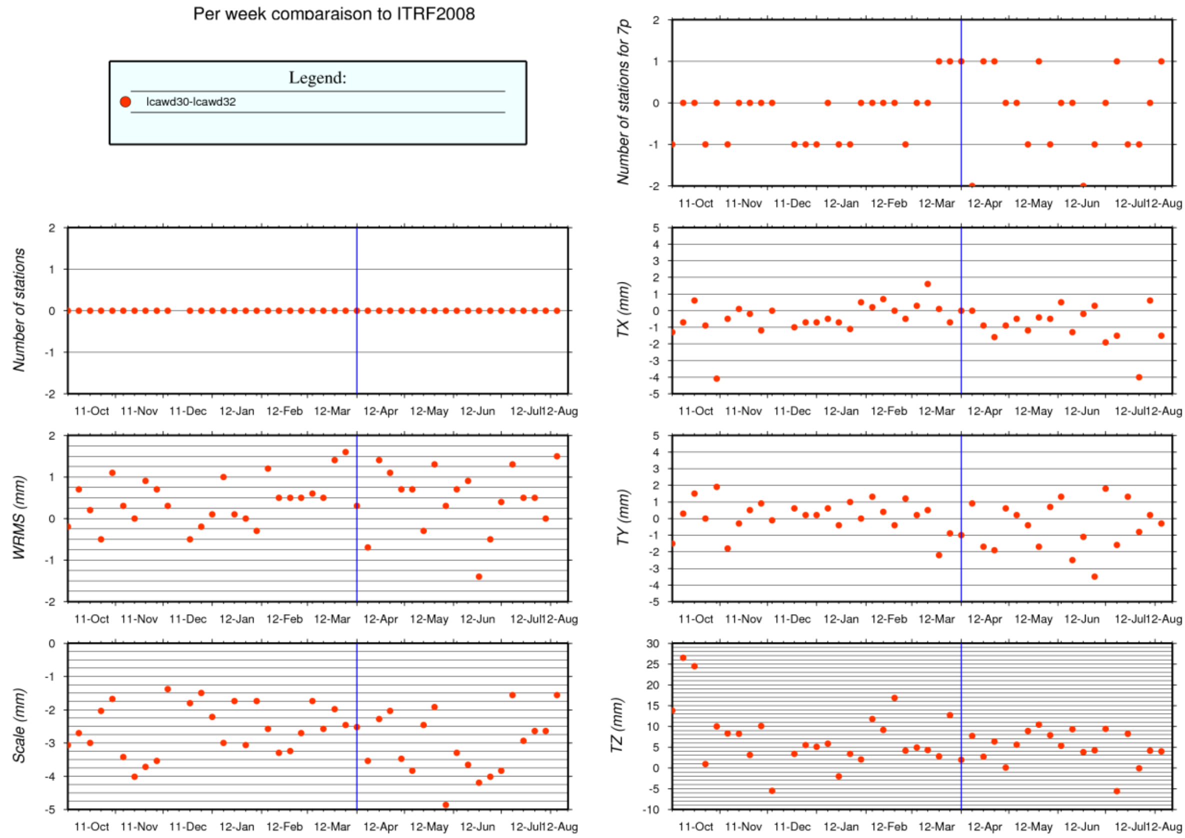

Figure 10 Evaluation results of differences between LCA series 30 (without HY-2A) and 32 (with HY-2A).

10.5 COMMUNICATIONS

The IDS Combination Center joined both EGU and AGU fall meetings where it presented, respectively, oral presentations titled "Research activities for the DORIS contribution to the next International Terrestrial Reference Frame" (Session G2.3) , and "Preliminary work on the DORIS contribution to the next International Terrestrial Reference Frame" (Session G51C). IDS CC also gave an oral presentation "Research activities at the IDS Combination Center" during IDS Workshop in Venice.

10.6 FUTURE PLANS

The activity of the IDS Combination Center in 2013 will be mainly devoted to the elaboration of the DORIS contribution to the next ITRF (2013).

11 REPORT OF THE ESA/ESOC ANALYSIS CENTER (ESA)

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11.1 INTRODUCTION

The activities in 2012 of the European Space Operation Centre focused on the preparations for the ITRF2013. As a result of various test performed throughout the year we have generated a new ESA IDS solution (esawd07). This solution has been first made available to the combination centre and in early 2013 to CDDIS. This solution goes back to 1993 and thus covers the complete IDS processing period.

11.2 TESTING FOR ITRF2013 AND THE NEW ESAWD07 SOLUTION

The esawd06 solution released in 2011 contained major improvements to our modeling has been the routine ESA solution for 2012. Below are listed again the major changes of this solution compared to esawd05:

- Tropospheric gradients in North and East (daily)
- Usage of low elevation data (up to 5 degrees) mainly impacts the newer satellites with the DGXX receiver
- Switch to GFZ-GRGS EIGEN-6C model for gravity
- Including of Atmospheric Tides (Ray-Ponte 2003)
- IERS 2010 conventions instead of IERS 2003
- Inclusion of HY-2A

In 2012 we continued testing different models and processing strategies and the following changes have been included in esawd07:

- Update of the EIGEN-6C model to correct the C20 term including a 18.6 year correction as proposed by GRGS
- Updated tide model to EOT11a

- Elevation dependent weighting of low elevation data and change to use data from 7 degrees upwards (after 2002) and 10 degrees upwards (before 2002) was 5 degrees
- Proper handling of station frequency bias

This updated solution covers the entire IDS processing period from 1993 onwards and has been delivered to CDDIS. This solution (esawd07) will form the basis of our ITRF2013 solution.

Further we will continue to participate in the combination on the observation level campaign (COL) and as part of these activities have generate a ESA solution in which we have combined all space born geodetic data (SLR, DORIS and GNSS) on the observation level.

11.3 FUTURE ACTIVITIES

The Navigation Support Office plans for 2013 to switch to processing the DORIS RINEX data for Jason-2, Cryosat-2 and HY-2A instead of the older DORIS Data Exchange Format.

For the COL activities we plan to extend the ESA solution beyond the CONT08 and CONT11 periods and will evaluate to possibility to complement our technique specific solutions with this combined solution.

12 REPORT OF THE GEODETICAL OBSERVATORY PECNY ANALYSIS CENTER (GOP)

Petr Stepanek (1)

(1) Geodesy Observatory Pecný, Research Institute of Geodesy, Czech Republic

12.1 SUMMARY OF ACTIVITIES

This Section summarizes the activities of the analysis center Geodetic Observatory Pecný (GOP). There are two major of the interests, routine data processing including the delivery of the products to the data centers and the additional experiments/development. The activity of GOP focused on the study of SAA impact on the SPOT-5 oscillator as well as on the development and testing of the dynamical orbital modeling (in cooperation with Technical University München).

The data from the last quarter of 2011 and from the three quarters of 2012 were processed and the corresponding sinex files were delivered to data centers. The processing strategy remained the same as in the past, the only improvement of the solutions was based on the introduction of the new satellite HY-2A in the combination.

12.2 SOUTH ATLANTIC ANOMALY AND SPOT-5

The main goal was to prove that the most of the disturbing SAA effect on the SPOT-5 DORIS oscillator can be eliminated by the observation corrections. We developed an empirical corrective model, based on the application of the frequency drift derived from the previously created grid map, based on the post-fit residuals. The impact of the data corrective model was confirmed analyzing the post-fit residuals, zenithal tropospheric delay (ZTD) and station coordinate bias. The ZTD bias was reduced at least by 80% for the SAA stations. The station vertical bias was reduced by 74-94% for the most corrupted stations Cachoeira Paulista, Arequipa and Santiago. The horizontal bias decreased by 50% or more for all the SAA stations except Cachoeira Paulista.

Another goal was to study the long-term changes of the SAA effect. It was proven that the oscillator frequency drift doubled its size during the period 2008.0-2012.0. The detail study can be found at Štěpánek et al. (2013).

12.3 COMPARISON OF THE EARTH RADIATION MODELS

In the cooperation with TUM München, the comparative study of the Earth radiation models was performed. The three different models were compared: Analytical model (dependent on time), Knocke model (dependent on time and latitude) and CERES model (dependent on time, latitude and longitude). The analyses found a mean radial orbit differences 3.3 – 5.7 mm, between the orbits estimated with and without a priori Earth radiation model. However, the mean differences between different Earth radiation models were only around 1 mm or even lower. The RMS with respect to the CNES orbit as well as the RMS of the internal orbit overlaps was comparable for all the three models. The significant impact of more complex Earth radiation models in comparison to a simple analytical model was then not found. Detail results can be found at http://ids-doris.org/images/documents/report/ids_workshop_2012/IDS12_s2_Rodriguez_EarthRadiationPressureModels.pdf

12.4 DORIS RINEX FORMAT

The reading tools of the DORIS RINEX format were implemented in the data processing software (DORIS modification of Bernese GPS software). However, we are not yet able to process these data.

12.5 TESTING THE DYNAMICAL ORBIT MODEL

A complex set of the test has been performed. The first testing campaign was based on a month of the data for all the available DORIS satellites. The goal of the campaign was to find an optimal drag estimation strategy. Therefore, the orbits were repeatedly estimated with different drag settings (number of parameters per day, value of relative or absolute constraints). As the results of the short orbit campaign, the drag settings were optimized to be adjusted each 4 hours and with the absolute constraints 0.1. The tests also confirmed the necessity of the additional harmonic empirical parameters.

In the second step, an annual orbit campaign (2011) was processed. The mean and RMS with respect to the external multi-technique CNES orbit was calculated, as well as internal orbit overlaps. The 4 hours interval for drag parameters was well suited for the most of the processed arcs, except the days with geomagnetic storms (for lower satellites with altitude around 800 km). Geomagnetic storms occurred almost in the second half of the year and thus this fact was not found during the initial short campaign (February 2011). For these days, much better accuracy was achieved by the setting only half hour interval for each drag parameter. For the days with moderate or strong geomagnetic storm, the orbits, estimated applying the old reduced dynamic model, were the most accurate. On the other hand, for the days without geomagnetic storm, dynamical orbits were more accurate than the reduced-dynamical orbits.

Štěpánek P., Douša j., Filler V. SPOT-5 DORIS oscillator instability due to South Atlantic Anomaly: mapping the effect and application of data corrective model, submitted to Advances in Space Research, 2013

13 REPORT OF THE GSFC/NASA ANALYSIS CENTER (GSC)

Frank G. Lemoine (1), Nikita P. Zelensky (2), Karine Le Bail (1,3), Douglas S. Chinn (2), J. W. Beall (4,1)

(1) GSFC/NASA, USA
(2) SGT/NASA, USA
(3) NVI Inc., Greenbelt, Maryland, U.S.A
(4) Mission Operations and Services, Riverdale, Maryland, U.S.A

13.1 SINEX SERIES

We have routinely processed the data to the following DORIS satellites: SPOT4, SPOT5, Envisat, Jason-2 and Cryosat-2. In addition, we have initiated an effort to reanalyze all available DORIS data in preparation for the next ITRF (ITRF2013). On September 27, 2012 we made the last delivery with the wd12 operational series. The wd13 series was delivered for the last quarter of 2012. In addition SINEX files were delivered with this series from 2006 to 2012.

As preparation for ITRF2013, the following modeling changes were implemented in the wd13 series:

1. New Gravity Model (Static): GOCO2S (Goiginger et al., 2011) instead EIGEN-GL04S1 (Förste et al., 2008)

2. New Gravity Model (Time-Varying)

At GSFC we have developed a 4x4 time series from SLR & DORIS tracking to up to ten satellites. We have done harmonic fits to this time series adjusting coefficients as appropriate (rates, annual, semiannual). This "fit" model now represents a conventional model we can apply in the DORIS processing. The C21/S21 terms are represented according to IERS conventions.

3. Troposphere.

-The GMF (Boehm et al., 2006a) mapping function is used instead of Niell.

-The Saastomoinen troposphere model is used instead of Hopfield.

-GPT is used for the *a priori* met data (no change from gscwd11, gscwd12) (Boehm et al., 2007)

-Only the wet troposphere delay scale factor is adjusted.

4. Update of Ocean Tide and Loading Model: GOT4.8 instead of GOT4.7. The only change between GOT4.7 and GOT4.8 involved an update of the S2 harmonic.

5. More rigorous editing is applied at the SINEX formation level.

We have edited stations with fewer than 1250 observations in a given week, because we found in our inversion tests, these perturbed unreasonably the weekly set of estimated Helmert parameters.

6. The SPOT5 attitude modeling after January 2008 has been updated to model explicitly the pitch of the solar array (-40°). This obviates the necessity to "tune" the SPOT5 Cr after that date, as was done in the previous series.

A companion series was developed as part of the IERS call to test the application of atmospheric loading at the observation level. This series was provided to the IDS combination center and to the IERS (Zuheir Altamimi and Xavier Collilieux).

Table 8 summarizes the POD Performance for the various satellites in 2006-2011.0 for the gscwd13

Satellite	Narcs	Avg Obs per arc	Avg. DORIS RMS
			(mm/s)
Envisat	338	47572	0.4750
SPOT2	192	23886	0.4330
SPOT4	290	33188	0.4485
SPOT5	287	56286	0.4203
Envisat	338	47572	0.4750
Cryosat2	36	53332	0.4106
Jason2	135	110419	0.3819

Table 8 GSCWD13 DORIS Satellite POD Results (2006-2011.0)

13.2 TESTS WITH DORIS DATA

In view of improving the DORIS processing, we conducted several tests to evaluate potential improvements. The first involved the application of atmospheric loading at the observation level; the second test involved testing of the implementation of the Vienna Mapping Function (VMF1) with special reference to Jason-2 (Boehm et al., 2006b).

The motivation to test the application of atmospheric loading arose because of a call from the IERS to test its impact on the derivation of the terrestrial reference frame. The IERS supplied a special ECMWF-6hr derived time series. The DORIS data were processed with and without this correction. The gscwd13 series referred to above was the baseline series without the application of the correction. At the Greenbelt station location, the atmospheric loading corrections reach up to 4 mm in amplitude in the north and vertical directions, and up to 2 mm in amplitude in the east direction. Evaluated over the ensemble of DORIS stations, the loading correction amounts to between 1 – 5 mm RMS.

The first evaluation involved the application to Jason-2 orbit determination. With respect to the orbit statistics, the RMS of fit to the DORIS data did not change. There was a slight reduction in the mean SLR residuals from 0.044 to 0.040 cm over the arcs from July 2008 to December 2011. The average RMS of fit was reduced from 1.069 cm to 1.060 cm. In terms of actual impact to the orbits, there was a radial RMS orbit difference of 0.8 to 1.0 mm due to the application of the atmospheric loading. The Z coordinate of the orbit however displayed a non-stationary annual pattern with a peak-to-peak amplitude of -1.2 to 2.0 mm.

The next step was to test the application of atmospheric loading in the context of the generation of weekly solutions for station coordinates and EOP. What we specifically evaluated were the differences in the Helmert transformation patterns occasioned by the application of the atmospheric loading. The differences in the Helmert transformation parameters toward the reference station set (DPOD2008) had distinct and clear patterns. The differences amount to ±2 mm in Tx, -2 to +3 mm in Ty, generally ±5 mm in Tz, and 0.4 mm in scale. The Helmert Ty differences presented a clear and distinct annual pattern, whereas the patterns in the Tx and Tz series were less distinct. We conclude that the DORIS data are sensitive to this crustal loading correction. The Helmert transformation differences in Ty and Tz are shown in **Figure 11** and **Figure 12.**

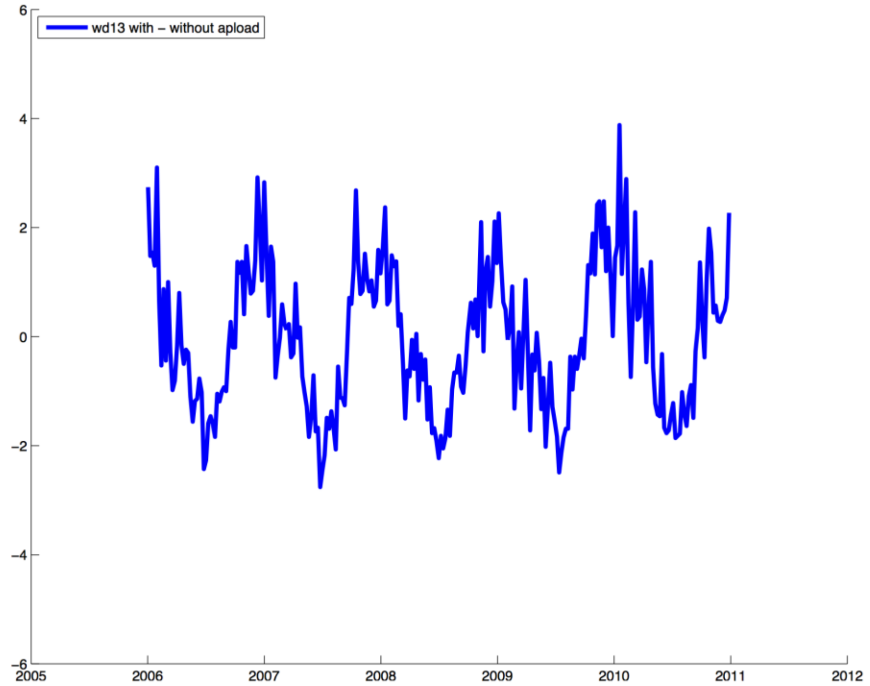

Figure 11 Ty Difference in Helmert parameters between gscwd13 series (atmospheric loading not applied) and gscwd14 series (atmospheric loading applied) for 2006.0 to 2011.0. The units are mm.

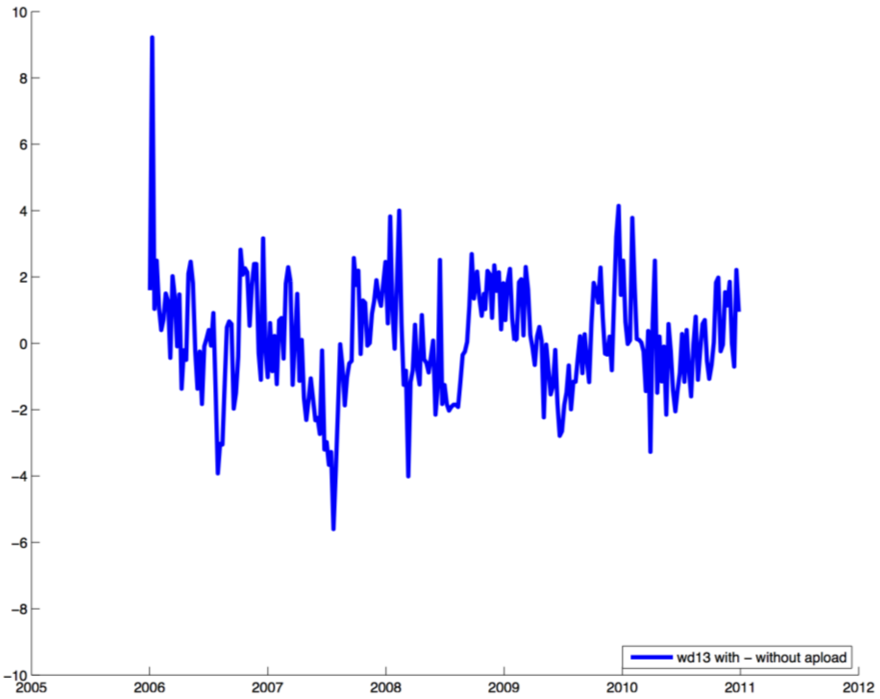

Figure 12 - Tz Difference in Helmert parameters between gscwd13 series (atmospheric loading not applied) and gscwd14 series (atmospheric loading applied) for 2006.0 to 2011.0. The units are mm.

In addition to the test with atmospheric loading, we evaluated the application of the Vienna Mapping Function (VMF1) in GEODYN. GEODYN has been upgraded with respect to the ITRF2008 submission (Le Bail et al., 2010) to apply the GMF mapping function. In 2012, work was initiated to apply VMF1 and preliminary tests were performed on Jason-2 (Pavlis et al., 2012). In our application, the gridded dry/wet zenith delay heights are reduced to the station height following Kouba (2007). As a validation, we first compared the VMF1 total zenith delay to estimates obtained from GPS. Second, we tested the application of VMF1 in Jason-2 POD. The GPS-DORIS comparisons were made at a number of sites with colocations, including Greenbelt, Kauai, Yarragadee and Syowa. In general the estimates between the individual DORIS satellites (Envisat, Spot-4, Jason-2) followed closely the GPS-derived curves. The GPS-derived troposphere estimates are provided by the IGS and were downloaded from the CDDIS (Noll, 2010). The SPOT-4 derived estimates were somewhat noisier and the agreement with GPS was rougher than those obtained from the other satellites.

In the second set of tests, the VMF1 mapping function was applied to Jason-2 SLR/DORIS orbit determination. A RMS radial difference of 1 mm in the orbits was observed when VMF1 was used in lieu of GMF/GPT. An annual signal was observed in the Z orbit differences with a peak-to-peak amplitude of 3-4 mm (See **Figure 13**). We will continue testing the implementation of GEODYN and evaluate its performance for use in the determination of the next ITRF. The use of the gridded VMF1 data affords some benefits in that the ECMWF-derived data would provide a better *a priori* troposphere model (both for the dry and wet corrections) then what is used with the combination of GMF and GPT.

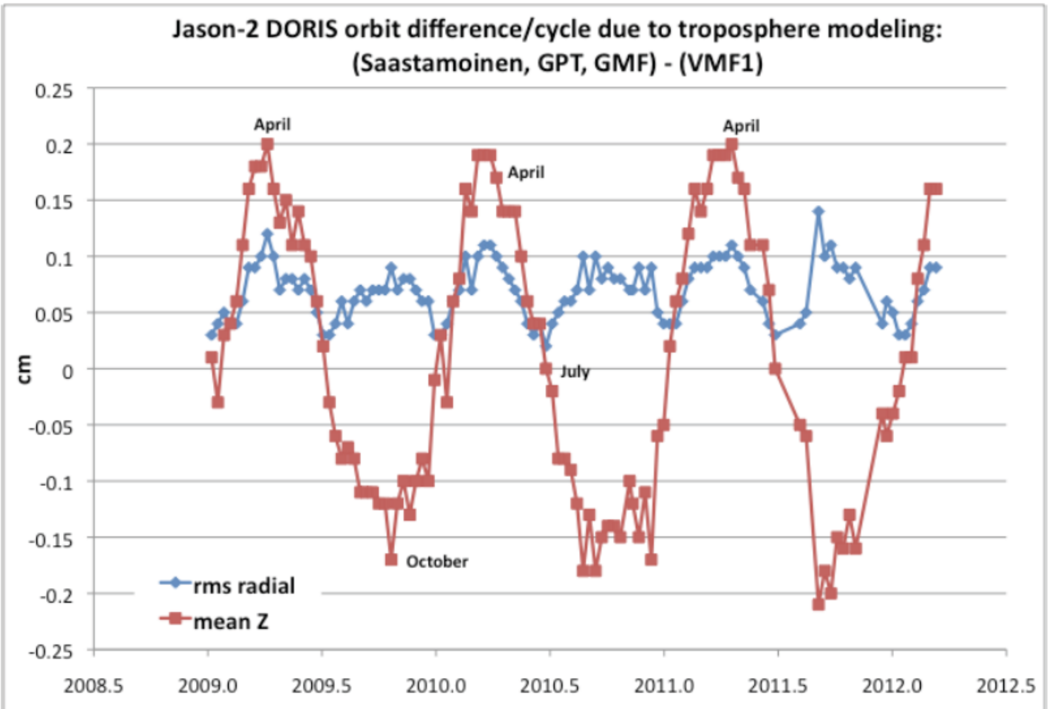

Figure 13 - Jason-2 DORIS orbit difference per cycle due to troposphere modeling (Sasstamoinen/GPT/GMF vs. VMF1). The RMS radial orbit difference is 1 mm. Peak-to-peak differences in the Z orbit coordinate amount to 3-4 mm.

REPORT OF THE IGN/JPL ANALYSIS CENTER (IGN)

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13.3 CONTEXT

The IGN uses the GIPSY/OASIS software package (developed by the Jet Propulsion Laboratory, Caltech, USA) to generate all DORIS products for geodetic and geophysical applications. In 2011, IGN used the most recent versions (GOA 6.1 and successive development versions). This software package is installed on both sites at IGN in Saint-Mandé and at IPGP in Tolbiac. In 2012, all results were generated to IDS by the IPGP site. Computations are done routinely on a daily basis using a crontab command launching several scripts successively, first checking for new DORIS data availability. New solutions are then submitted simultaneously to both IGN and NASA/CDDIS data centers. Internal validation is done after the facts using an internal Web site available at IPGP, eventually leading to a few resubmissions of weekly SINEX solutions. In 2012, a new 64-bit computer was purchased by IPGP and preliminary tests were conducted using this new architecture (vs. older 32-bit computer).

13.4 PRODUCTS DELIVERED IN 2012

The latest delivered IGN weekly time series is still ignwd08 (in free-network). However, in parallel, another set of weekly solutions (ignwd10, projected from ignwd08 and later transformed into ITRF2008) are also submitted simultaneously. This is the solution that was used in preparation of ITRF2008 and available for combined solutions IDS-1, IDS-2 and IDS-3. It is the one still used by the IDS Combination Center. Models and strategy estimation remain unchanged but new SINEX solutions are generated every week (on average). Furthermore, new satellites have been incorporated in the solutions (Jason-2). However, solutions, including the more recent Chinese HY-2A satellite, were computed for internal tests but not yet submitted. This should be done in early 2013. Following the delivery of the ignwd10 solution, all derived products were also updated every week to be compatible with ITRF2008. Newly resubmitted Envisat data were reprocessed for internal tests but are not part of the current results at the end of 2012. A significant improvement was obtained when using the new data from CNES (more numerous and profiting from a better time tagging procedure).

Products relying on ITRF2005 were discontinued in 2011, while products relying on ITRF2008 keep being submitted every week (see Table 9)

Product	Latest version	Update	Data span	Number of files
Weekly SINEX				
- free-network	ignwd08	Weekly	1993.0-2011.9	1042
- inITRF2005	ignwd09	Weekly	1993.0-2011.4	962 - stopped
- in ITRF2008	ignwd10	Weekly	1993.0-2011.9	1042
- summary files	ignwd08	Weekly	1993.0-2011.9	1042
STCD	ign09d01	Weekly	1993.0-2011.4	157 – stopped
	ign11d01	Weekly	1993.0-2011.9	163
Geocenter	ign09d01	Weekly	1993.0-2011.4	1 – stopped
	ign11d01	Weekly	1993.0-2011.9	1
EOPs	ign09d01	Weekly	1993.0-2011.4	1 –stopped
	ign11d01	Weekly	1993.0-2011.9	1

Table 9: IGN products delivered at the IDS data centers in 2012. As of January 29, 2013

Besides these IDS products, several IGN results were also provided to the Analysis Coordinator for test purposes: satellite orbits in sp3 format, weekly SINEX solution by satellites, multi-satellites weekly SINEX solutions with or without Jason-2 data, satellites orbits for all satellites.

Comparisons of DORIS-derived tropospheric zenith delays were also performed towards GPS PPP solutions (Willis et al., 2012a) and a more complete investigation is still undergone (Bock et al., in preparation), including DORIS results since January 1993. For test purposes, VMF-1 mapping function was also used during all recent CONT campaigns leading to tropospheric comparisons toward VLBI and GPS estimates (Teke et al., in preparation). Systematic comparisons of horizontal tropospheric gradients were also generated with regards to GPS PPP solutions provided by Jet Propulsion Laboratory for the International GPS Service (Willis et al., 2012b).

In 2012, new work was conducted toward the realization of a new DPOD2008 solution (terrestrial reference frame for precise orbit determination derived from ITRF2008), for which several updates were delivered and are still available at the following Web site : http://www.ipgp.fr/~willis/DPOD2008/. Version 1.11 is available at the end of 2012.

While no new velocity field solution was provided in 2012, a regional study was done for geodetic and geophysical consideration in Africa (Saria et al., under revision), within the scope of the AFREF project. The same is also true for the Gavdos calibration site for satellite altimeter calibration purposes (Willis et al., in press).

13.5 MAJOR IMPROVEMENTS IN 2012

No major improvement was done for the ignwd08 solution. Previous improvements done in 2011 include:

- Use of the more recent GGM03S gravity field (still without taking into account seasonal variations).
- Rescaling of the solar radiation pressure models using an empirical coefficient determined using a large DORIS data set for each satellite (Gobinddass et al., 2009). This mitigates errors in the Z-geocenter at periods of 118 days and 1 year and also improve vertical component of high latitude stations.
- Hourly estimation of drag coefficient for lower DORIS satellites at 800 km (Gobinddass et al., 2010). This avoids problem related to high geomagnetic activity (geomagnetic storm and maximum of 11-year solar cycle around 2001).
- Use of GMF mapping function for tropospheric correction

13.6 NEW DEVELOPMENTS

A specific study of Cryosat-2 and Hy-2 macoo-model was done by Jordane Strittamatter (trainee from ESGT, France for 6 months) and demonstrated possible improvements in satellite physical models, mainly due to previous bugs in the software package for these satellites (Strittmatter, 2012; Strittmatter, submitted). Better residuals are now obtained, but main improvement was detected in the orbit overlaps as in a significant decrease of the amplitude of the empirical parameters of the orbital period. New reprocessing based on these improvements in planned in early 2013.

Early developments in view of the future ITRF2013 solution have been conducted in 2013: using more recent gravity field (eg. EGM2008), or better a priori for station positions (eg. DPOD2008, version 1.11). New developments were also realized in order to use more recent tropospheric mapping function and ZTD a priori (GPT and GPT2). However, these tests are still under investigation and the current products delivered in 2012 do not profit from these improvements.

14 REPORT OF THE INASAN ANALYSIS CENTER (INA)

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14.1 INTRODUCTION

In 2012, INASAN (ina) DORIS Analysis Center continued routine processing DORIS data using GIPSY-OASIS II software developed by JPL with DORIS part of GIPSY developed by IGN/JPL. Next table shows current products delivered by INASAN to the IDS.

Product	Latest version	Span
Sinex weekly free-network solutions	inawd07	1993.0 - 2012.8
Geocenter time series	ina10wd01	1993.0 - 2012.8
EOP time series	ina10wd01	1993.0 - 2012.8
STCD time series	ina12wd01	1993.0 - 2012.8

Table 10: INASAN products provided to the IDS (January 2013).

The files with the product description can be found at:

1) sinex series

ftp://cddis.gsfc.nasa.gov/pub/doris/products/sinex_series/inawd/inawd07.snx.dsc

2) geocenter

ftp://cddis.gsfc.nasa.gov/pub/doris/products/geoc/ina10wd01.geoc.dsc

3) EOP-series

ftp://cddis.gsfc.nasa.gov/pub/doris/products/eop/ina10wd01.eop.dsc

4) STCD-series

ftp://cddis.gsfc.nasa.gov/pub/doris/products/stcd/ina.stcd.readme

It should be noted that new station coordinates differences (STCD) time series [ina12wd01] were obtained using ITRF2008 (more exactly DPOD2008_1.7.snx).

14.2 SOFTWARE UPDATE AND ANALYSIS RESULTS DESCRIPTIONS

During 2012 the GIPSY-OASIS software had minor updates and currently we use 6.1.2 Linux version. These updates connected with the six bugs fixed from previously used 6.1.1 release. The all models and processing strategies are identical to those reported in IDS_Report_2011.pdf.

An attempt to compare DORIS and GLONASS station positions for the collocated sites was made. One year data (2011) for 14 collocated sites (from IDS and IGS networks) were chosen for comparison. GIPSY-OASIS II software was used for data processing. Differences of station coordinates, derived with the use of satellite geodesy methods, were compared with local geodetic ties (between reference points of DORIS and GLONASS antennas). Mean (GLONASS-DORIS) – (local ties) differences estimated as 4.10 – 101.00, 14.42 – 137.08, 36.90 – 153.10 mm for X, Y and Z components correspondingly. Mean (GPS-DORIS) – (local ties) differences estimated as 0.58 – 66.65, 2.02 – 38.10, 2.10 – 61.00 mm for X, Y and Z components correspondingly. The largest differences are relevant to the METZ (IGS) [METB (IDS)] Kirkkonummi, Finland site, which was renovated not long ago. For the rest collocated sites these differences are considerably lower and are in the limit of a few cm. The more great mean differences (GLONASS-DORIS) – (local ties) compare to mean (GPS-DORIS) – (local ties) ones could be partly explained by the fact that GLONASS solutions do not resolve ambiguity resolutions and did not use satellite antenna PCV. It is important to estimate local ties for all collocated sites with higher accuracy using space geodesy techniques. For more details see:

http://ids-doris.org/images/documents/report/ids_workshop_2012/IDS12_s5_Kuzin_ComparisonDORISGLONASS.pdf.

Estimated annual geocenter variations for 1993.0-2012.8 were derived by least squares method and evaluated as 5.4±0.2 mm, 4.4±1.3 mm, 2.9±1.2 mm for X, Y and Z components, respectively (respect to ITRF2005, more exactly respect to ign09d02 - global Doris solution). The same values obtained for the IGN geocenter time series for the time period 1993.0-2012.8 are 4.7±0.2 mm, 4.6±2.4 mm, 1.7±0.7 mm for X, Y and Z components.

15 REPORT OF THE CNES/CLS ANALYSIS CENTER (LCA)

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15.1 INTRODUCTION

The CNES and CLS participate jointly to the International DORIS Service (IDS) as an Analysis Center. The processing of the DORIS data is performed using the GINS/DYNAMO software package developed by the GRGS.

The main activity during 2012 was to carry on the routine production of the lcawd30 series and its associated products, to take into account HY-2A in the data analysis, to test the new radio-frequency characterization of the STAREC antennas, to update the SAA corrective model for Jason-1 and to start the development of a SAA corrective model for SPOT-5.

15.2 DATA PROCESSING AND PRODUCTS DELIVERED TO IDS

In 2011, a complete reprocessing has been done to take into account upgrades brought to the software and the modeling, since the configuration set-up for IDS-3 (IDS solution contributing to ITR2008 computation). The GINS 11.2d1 version we used includes revised attitude laws for TOPEX/JASON-1/JASON-2, Envisat and Cryosat-2 (see below). A bug related to the frequency bias was also fixed (cf 15.3)

Changes were brought to the set of models. Compared to the previous series lcawd20, 24, 26, 28, we use:

-DPOD2008 as a priori instead of DPOD2005

-IERS EOP series aligned on ITRF2008

-GMF/GPT tropospheric model instead of zenith delay derived from ECMWF meteorological model and Guo&Langley mapping function

-EIGEN-6S gravity model instead of EIGEN-GL04S

The products of the reprocessing (weekly sinex, sp3c orbits, STCD) were provided to IDS Data Centers in January 2012. Then, the production has been restarted routinely, in the continuity of the reprocessing, leading to homogeneous series of products from 1993 to 2012.

The new series of SINEX solutions is lcawd30. When HY-2A data were made available, a second series, lcawd32 (the same as lcawd30 but with HY-2A in addition), has been generated and delivered to IDS in order to assess the contribution of HY-2A to the multi-satellite solutions by comparing the two series (10-month overlapping). From September 2012, only lcawd32 SINEX are provided to IDS.

Orbits files in sp3c format are available at the IDS Data Centers for each DORIS mission since their beginning, including Jason-1. These are DORIS+SLR mixed orbits for ENVISAT, Topex/Poseidon, Cryosat-2, HY-2A and the two Jason satellites, and DORIS-only orbits for the SPOT satellites. The generic name of these series is lca02.sp3.

Coordinates time series of each station expressed in ITRF2008 are available in STCD format and as GIF plots at IDS Data Centers. They also can be seen with the web tool of the IDS at http://ids-doris.org/plottool/stcd/stcdtool.php. They are updated approximately every 3 months.

Description files can be found at CDDIS (ftp://cddis.gsfc.nasa.gov/) and IGN (ftp://doris.ensg.ign.fr/). For the data analysis summary, see in particular pub/doris/products/sinex_series/lcawd/lcawd30.snx.dsc

Product	Series	Data span	
SINEX files of free-network solutions of weekly station coordinates and daily EOP	lcawd30 (including Jason2 and Cryosat2) lcawd32 (+ HY-2a)	1993/01/03 – 2012/08/18 2011/10/02 - ...	
STCD files of time series of station coordinates	lca11wd02	1993 - ...	
SP3c files of orbit	lca02.sp3	TOPEX: 1993 – 2004 SPOT-3: 1993 – 1996 SPOT-5: 2002 - ... JASON-1: 2001 - ... CRYOSAT-2: 2010 - ...	SPOT-2: 1993 – 2009 SPOT-4: 1998 - ... ENVISAT: 2002 - 2012 JASON-2: 2008 - HY-2A : 2011 -

Table 11. List of the CNES/CLS products supplied in 2012, and the total data span of each series

15.3 STATION VERTICAL COMPONENT CORRECTED

In our previous release of the station coordinate time series, some jumps were observed on the vertical components. We found that they are correlated to large frequency jumps, mainly caused by beacon changes and reflecting the fact that the emitted frequency may significantly differ from nominal frequency. Finally, we identified a misapplication of the frequency offset estimation in our processing, with the consequence that any variation of the emitted frequency (biais, drift, …) w.r.t. the nominal frequency induces a signature in the vertical component of the station. This is now corrected in the new processing, as shown on Figure 14.

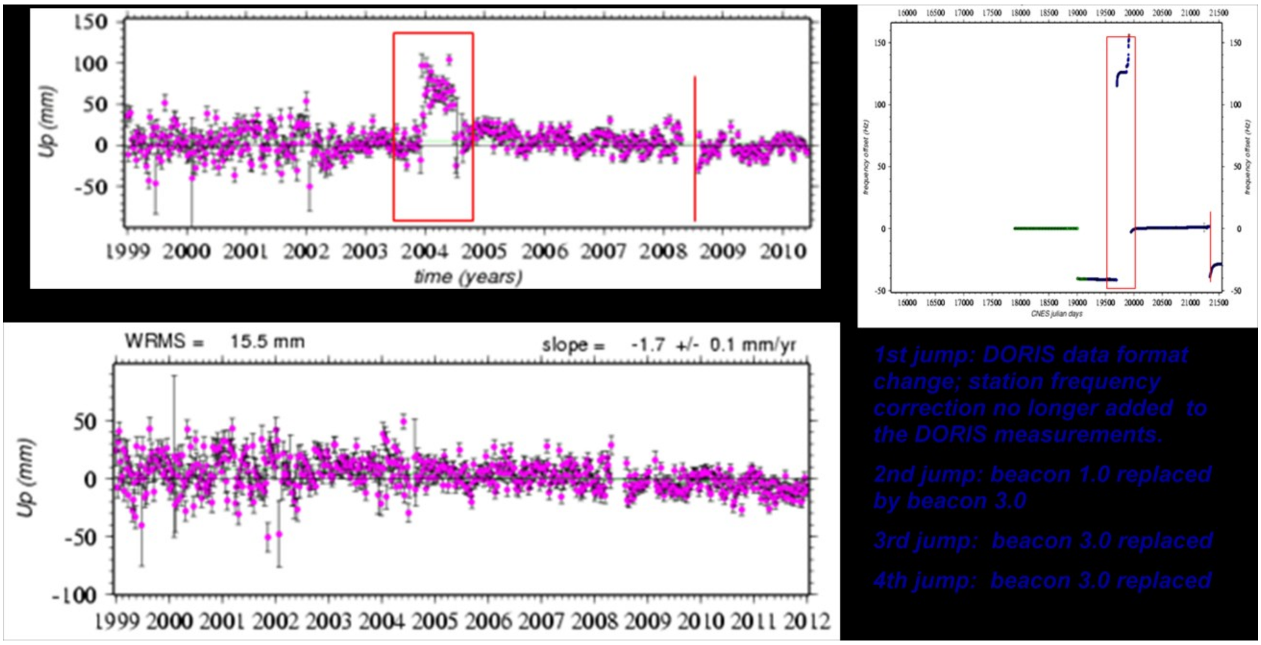

Figure 14. Results for the station in La Réunion

(Top right) Station frequency offset. 4 jumps are observed.

(Top left) Time series of the vertical component as obtained from our previous processing. Jumps are observed at the same periods as the beacon is changed.

(Bottom left) Time series of the vertical component as obtained from our new processing.

15.4 ANALYSIS OF THE DORIS HY2A DATA

In 2012, GINS was upgraded to take into account HY-2A. For this satellite, the data available at IDS Data Centers start on Oct. 1 2011.

The analysis of the first 5 months of the mission has been presented at EGU, in April, in Vienna: "Recent improvements in DORIS orbit determination and station coordinates estimation at CNES/CLS Analysis Center" (L. Soudarin, H. Capdeville, J.M. Lemoine, P. Schaeffer)

The data have been processed on 3.5-day arcs using the macromodel provided by CNES. Post-fit residuals are around 0.33 mm/s for DORIS and 1.15 cm for SLR.

Results show that they are less data for Oct. 2011. The evolution of the drag coefficients (Figure 15) lets suggest also that HY-2A has reached a stable configuration (nominal attitude) only in November. Over the first month, the drag coefficients vary indeed between from -1 to 1. Then they stabilized around 1. The average of the SRP coefficients is 1.13. We use now this value in our routine processing to constrain the SRPs (see also LCA status report, AWG Prague May 2012, http://ids-doris.org/images/documents/report/AWG201205/IDSAWG1205-Soudarin-LCA-StatusReport.pdf)

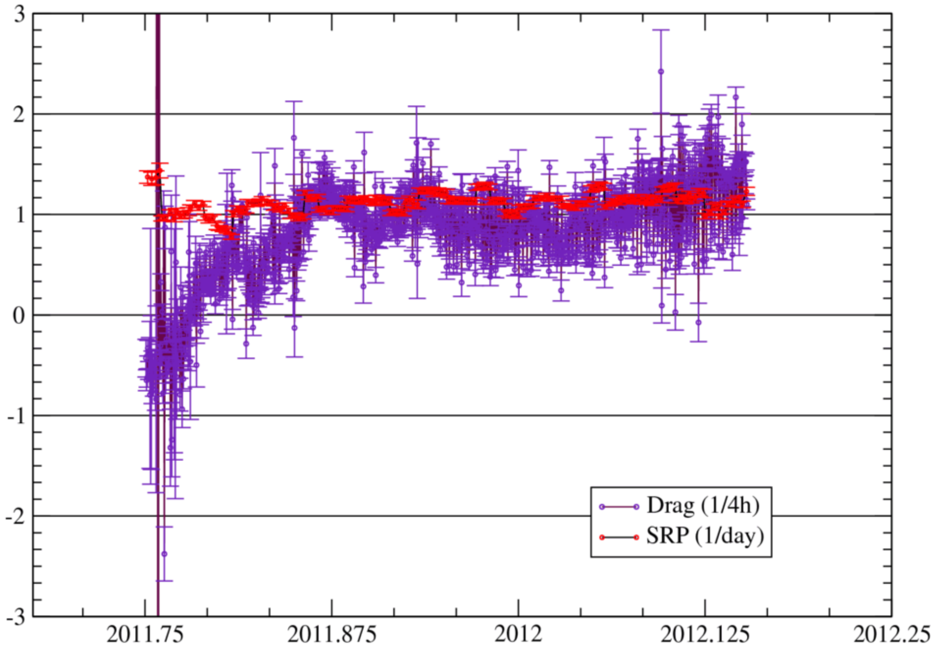

Figure 15. Drag and SRP coefficients estimated for HY-2A over 5 months

HY-2A is now included in the routine analysis and in the multi-satellite combination (series lcawd32).

15.5 NEW STAREC PHASE LAW

In 2012, CNES performed radio frequency characterization of the STAREC antennas and determined new positions of the phase centers and new phase laws. According to this new characterization, the 2GHz phase center is located 470 mm above the DORIS reference point (red-painted ring on the STAREC antennas), instead of 487 mm as given by the manufacturer.

The new proposed phase law has been implemented in GINS. A study was done to assess the impact of the new characterization on our data processing. The results were presented to the AWG meeting, in Venice, Sep. 2012 (http://ids-doris.org/images/documents/report/AWG201209/IDSAWG1209-Soudarin-2GHzPhaseCenterAndLawSTAREC.pdf).

15.6 UPDATE OF SAA CORRECTIVE MODEL FOR JASON-1

In 2012, the corrective model for Jason-1 has been updated to take into account the new orbit of Jason-1. Since May 4th 2012, the satellite Jason-1 has been moved indeed to a geodetic orbit and then the mean ground track of Topex (determined over a 7-year period) cannot be considered anymore. For the new orbit, since it is drifting, another capability had been added in the model: the use of an external orbit in sp3 format.

The software included in the model offers now 4 options, two options (3 and 4) added by the new feature:

1) Input file measurement CDDIS (DORIS 2.2)

2) Input file measurement in free format (DATES in TAI)

3) Input file measurement CDDIS (DORIS 2.2) and use sp3 orbit

4) Input file measurement in free format (DATES in TAI) and use sp3 orbit

Moreover, the model parameters have been updated, taking into account 3 years additional DORIS data. The amplitude parameter has been found constant and equal to -14.6 over 2009-2011.

The corrective model for Jason-1 DORIS Doppler data is available on the CB ftp site under: ftp://ftp.ids-doris.org/pub/ids/satellites/CORRECTIVE_MODEL_JASON1

In 2013, the use of maps of energetic particles obtained by the dosimeter CARMEN on board Jason2 will be investigated to improve the model and to update it regularly.

15.7 PRELIMINARY SAA CORRECTIVE MODEL FOR SPOT5

At the IDS workshop in Lisbon in October 2010, Petr Stepanek (GOP) has shown that the USO of DORIS/SPOT-5 is sensitive to the SAA effect, leading to a significant degradation of the positioning since 2007 for Cachoeira, Santiago and Arequipa.

The method set up to build SAA corrective model for Jason-1 has been used to create such a model for SPOT-5. In a first step, a preliminary model has been designed based on the SAA map of Jason-1. This first version allowed reducing the orbit residuals and the number of edited data for the stations of the SAA.

Collaboration was initiated with Petr Stepanek (GOP) to elaborate and evaluate the final model. SAA maps at the altitude of SPOT-5 (830 kms) have been performed. They will be used to estimate the parameters of the model.

In 2013, this work will be carried on to propose a corrective model for SPOT-5. DORIS 2.2 files of data corrected with the model will be created for the year 2011 and be made available at the Data Centers for assessment by the analysis Centers.

15.8 CONTRIBUTION TO IDS AWG MEETINGS AND IDS WORKSHOP

The Analysis Center's representatives participated to the IDS workshop 2012 and to the AWG meetings in Prague and Venice. They presented the following works:

AWG Prague

LCA status report

http://ids-doris.org/images/documents/report/AWG201205/IDSAWG1205-Soudarin-LCA-StatusReport.pdf

Impact of Phase Wind-Up on Processing

http://ids-doris.org/images/documents/report/AWG201205/IDSAWG1205-LemoineJM-DORISPhaseCorrectionAndPWU.pdf

Update of the SAA corrective model for Jason-1

http://ids-doris.org/images/documents/report/AWG201205/IDSAWG1205-LemoineJM-SAAmodel.pdf

IDS Workshop Venise

Update of the SAA corrective model for Jason-1 DORIS data and discussion about a SAA corrective model for Spot5

http://ids-doris.org/images/documents/report/ids_workshop_2012/IDS12_s3_Capdeville_SAAmodel.pdf

DORIS positioning : performance assessment from the last data processing at CNES/CLS Analysis Center

http://ids-doris.org/images/documents/report/ids_workshop_2012/IDS12_s5_Soudarin_PositioningPerformance.pdf

AWG Venise

New radio frequency characterization of the STAREC antennas - Application in DORIS data processing

http://ids-doris.org/images/documents/report/AWG201209/IDSAWG1209-Soudarin-2GHzPhaseCenterAndLawSTAREC.pdf

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17 PUBLICATIONS (2012)

Here is below the list of DORIS publications in international peer-reviewed journals for 2012.

The complete list is available on the IDS website:
http://ids-doris.org/report/publications/peer-reviewed-journals.html#2012

Khelifa, S.; Kalhouche, S.; Belbachir, M.F., 2012. Signal and noise separation in time series of DORIS station coordinates using wavelet and singular spectrum analysis, COMPTES RENDUS GEOSCIENCE, 344(6-7):319-376, DOI: 10.1016/j.crte.2012.05.003.

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Seitz, M.; Angermann, D.; Blossfeld, M.; Drewes, H.; Gerstl, M., 2012. The 2008 DGFI realization of the ITRS: DTRF2008, JOURNAL OF GEODESY, 86(12):1097-1123, DOI: 10.1007/s00190-012-0567-2

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APPENDIX 1: THE IDS INFORMATION SYSTEM

1 WHAT AND WHERE

IDS has three data/information centers:

CB: the Central Bureau web and ftp sites at CLS

DC: the Data Center(s): * CDDIS: web and ftp sites * IGN: ftp site

AC: the Analysis Coordinator webpages on the CB website

The baseline storage rules are as follows:

DC store observational data and products + formats and analysis descriptions.

CB produces/stores/maintains basic information on the DORIS system, including various standard models (satellites, receivers, signal, reference frames, etc.).

AC refers to CB and DC information on the data and modeling, and generates/stores analyses of the products.

Two criteria are considered for deciding where files are stored/maintained:

1. the responsibility on their content and updating,

2. the easiness of user access.

Data-directed software is stored and maintained at the CB, analysis-directed software is stored/maintained, or made accessible through the AC webpages.

To avoid information inconsistencies, duplication is minimized. Logical links and cross referencing between the three types of information centers is systematically used.

A description of the data structure and formats is available at:

http://www.ids-doris.org/analysis-documents/struct-dc.html

2 WEB AND FTP SITES

2.1 IDS WEBSITE

address : http://ids-doris.org (or http://www.ids-doris.org)

The IDS website gives general information on the Service, provides access to the DORIS system pages on the AVISO website, and hosts the Analysis Coordination pages.

It is composed of three parts:

- "IDS" describes the organization of the service and includes documents, access to the data and products, event announcements, contacts and links.
- "DORIS System" allows to access general description of the system, and gives information about the system monitoring and the tracking network.
- "Analysis Coordination" provides information and discussion areas about the analysis strategies and models used in the IDS products. It is maintained by the Analysis Coordinator with the support of the Central Bureau.
- It is supplemented by a site map, a glossary, FAQs, a history of site updates, news on the IDS and news on DORIS.

The main headings of the "IDS" parts are:

- Organization: structure of the service, terms of reference, components
- Data and Products: information and data center organization, access information to the IDS Data Centers and to the Central Bureau ftp site.
- Meetings: calendars of the meetings organized by IDS or relevant for IDS, as well as links to calendars of other international services and organizations.
- Reports and Mails: documents of the IDS components, DORIS bibliography including DORIS-related peer-reviewed publications and citation rules, meeting presentations, mail system messages, etc.
- Contacts and links: IDS contacts, directory, list of websites related to IDS activities
- Gallery (photo albums from local teams and IDS meetings).

The headings of the "DORIS system" part are:

- Official website: a description of the DORIS system on the AVISO website
- Network: Site logs, station coordinate time series, maps, network on Google Earth.
- System monitoring: DORIS system events file, station events file, station performance plots from the CNES MOE and POE processing, list of events impacting the data.

The headings of the "Analysis Coordination" part are:

- Documents: about the DORIS system's components (space segment, ground segment, stations, observations), the models used for the analysis, the products and their availability. A direct access to this regularly-visited page is also given in the "IDS" part.

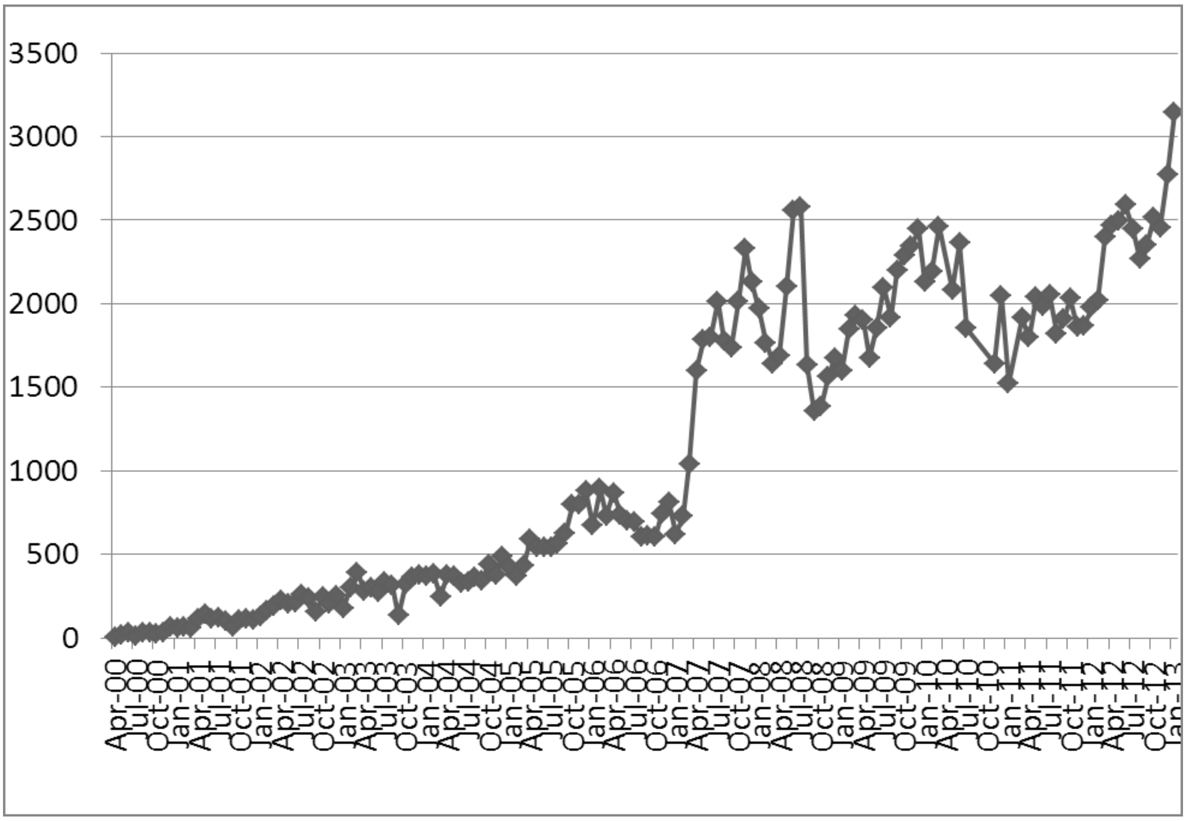
- DORIS related events: history of the workshops, meetings, analysis campaigns, etc.

- Discussion: archive of the discussions before the opening of the forum.

- Software: a couple of software provided by the Analysis Coordinator.

DORIS and IDS news as well as site updates are accessible from the Home page. Important news is displayed in the new box "Highlights". The lists of news about the DORIS system and IDS activities (also widely distributed through the DORISmails) are resumed respectively in the two headings "What's new on DORIS" (http://ids-doris.org/doris-news.html) and "What's new on IDS" (http://ids-doris.org/ids-news.html). The history of the updates of the website is given in "Site updates" (http://ids-doris.org/site-updates.html).

The IDS website is maintained by the Central Bureau.



IDS website number of access per month (CNES and CLS excluded).

2.2 IDS FTP SERVER

address: ftp://ftp.ids-doris.org/pub/ids

The IDS ftp server gives information on the DORIS system, and provides analysis results from the Analysis Coordination's combination center.

The documents available concern:

- the centers: presentation and analysis strategy of the ACs;
- the DORIS data: format description 1.0,2.1, 2.2, and RINEX, POE configuration for GDRB and GDRC altimetry products from Jason-1 and Envisat, on-board programming and POE pre-processing history;
- the DORISmails and DORISreports: archive of the messages in text format, and indexes;
- the products: format of eop, geoc, iono, snx, sp1, sp3, stcd;

- the satellites: macromodels, nominal attitude model, center of mass and center of gravity history, maneuver history (including burn values), instrument modeling, corrective model of DORIS/Jason-1 USO frequency, plots of the POE statistics of all the stations for each satellite;
- the stations: ties, seismic events around the DORIS station network, ITRF2000, antennas description, beacon RF characteristics, information about the frequency shifts of the 3rd generation beacon, IDS recommendations for ITRF2005, Jason and Spot-4 visibility, station events, plots of the POE statistics of all the satellites for each station, document about the interface specification between the DORIS Network beacons and the onboard instrument;
- the combinations: analysis results from Analysis Coordination's combination center (internal validation of each individual Analysis Center time series, weekly combination), IDS combination for the DORIS contribution to ITRF2008.
- ancillary data such as bus quaternions and solar panel angles of Jason-1 and Jason-2

The IDS ftp site is maintained by the Central Bureau.

There is a mirror site at CDDIS: ftp://cddis.gsfc.nasa.gov/pub/doris/cb_mirror/

and at IGN: ftp://doris.ensg.ign.fr/pub/doris/cb_mirror/

2.3 DORIS WEBSITE

Address: http://www.aviso.oceanobs.com/en/doris/index.html

The official DORIS website is hosted by the Aviso website which is dedicated to altimetry, orbitography and precise location missions. The DORIS pages present the principle of the system, its description (instruments onboard, ground beacons, control and processing center, system evolutions, Diode navigator), the applications and the missions. The site is maintained by the Aviso webmaster with the support of the IDS Central Bureau.

2.4 DATA CENTERS' WEBSITES

Data and products, formats and analysis descriptions are stored at the CDDIS and IGN Data Centers. A detailed description is given in the report of the Data flow Coordinator.

Address of the CDDIS website: http://cddis.gsfc.nasa.gov/doris_summary.html

Address of the CDDIS ftp site: ftp://cddis.gsfc.nasa.gov/pub/doris/

Address of the IGN ftp site: ftp://doris.ensg.ign.fr/pub/doris/

3 THE MAIL SYSTEM

The mail system of the IDS is one of its main communication tools. Depending on the kind of the information, mails are distributed through the DORISmail, DORISreport, DORISstations or IDS.analysis.forum. The mails of these four lists are all archived on the mailing list server of CLS. Back-up archives of the text files are also available on the Central Bureau ftp server for the DORISmails and the DORISreports.

A description of the mailing lists can be found on the IDS website on the page: http://ids-doris.org/report/mails.html

Dedicated mailing lists were also created for the Central Bureau, the Governing Board and the Analysis Working Group, but without archive system.

3.1 DORISMAIL

e-mail: dorismail@ids-doris.org

The DORISmails are used to distribute messages of general interest to the users' community (subscribers). The messages concern:

- Network evolution: installation, renovation…
- Data delivery: lack of data, maneuver files
- Satellite status
- Status of the Data Centers
- Meeting announcements
- Calls for participation
- delivery by Analysis Centers
- etc.

The messages are moderated by the Central Bureau.

They are all archived on the mailing list server of CLS at the following address: http://lists.ids-doris.org/sympa/arc/dorismail

They are also available in text format on the IDS ftp site:

ftp://ftp.ids-doris.org/pub/ids/dorismail/

3.2 DORISREPORT

e-mail : dorisreport@ids-doris.org

This list is used for regular reports from Analysis Centers, from the Analysis coordination and from the CNES POD team. The DORISReport distribution list is composed by Analysis Centers, Data Centers, IDS Governing Board and Central Bureau, CNES POD people delivering data to the Data Centers (subscribers).

They are all archived on the mailing list server of CLS at the following address:

http://lists.ids-doris.org/sympa/arc/dorisreport

They are also available in text format on the IDS ftp site:

ftp://ftp.ids-doris.org/pub/ids/dorisreport/

The list is moderated by the Central Bureau and the CNES POD people.

3.3 DORISSTATIONS

e-mail : dorisstations@ids-doris.org

This mailing list has been opened to distribute information about station events (data gap, positioning discontinuities).

The messages are archived on the mailing list server of CLS at the following address:

http://lists.ids-doris.org/sympa/arc/dorisstations.

The archive contains also the mails distributed on the analysis forum before the creation of the dedicated list.

3.4 IDS ANALYSIS FORUM

e-mail : ids.analysis.forum@ids-doris.org

In order to share in the present, and secure for the future, information, questions and answers on the problems encountered in the DORIS data analysis, the Analysis Coordinator with the support of the Central Bureau initiated the IDS Analysis Forum. This a list for discussion of DORIS data analysis topics (stations, satellites, DORIS instruments, data, analysis, orbits, EOP, products) moderated by the Analysis Coordination.

The messages are all archived on the mailing list server of CLS at the following address:

http://lists.ids-doris.org/sympa/arc/ids.analysis.forum

Previous to the creation of forum, the Analysis Coordinator has collected 68 messages of conversion between analysts in an archive that can be viewed at http://www.ids-doris.org/analysis-discussion.html

3.5 OTHER MAILING LISTS

ids.central.bureau@ids-doris.org: list of the Central Bureau

ids.governing.board@ids-doris.org: list of the Governing Board

ids.cbgb@ids-doris.org: common list for the Central Bureau and the Governing Board. This list is private.

ids.awg@ids-doris.org: list of people who attend the AWG, and/or analysis center representatives.

4 HELP TO THE USERS

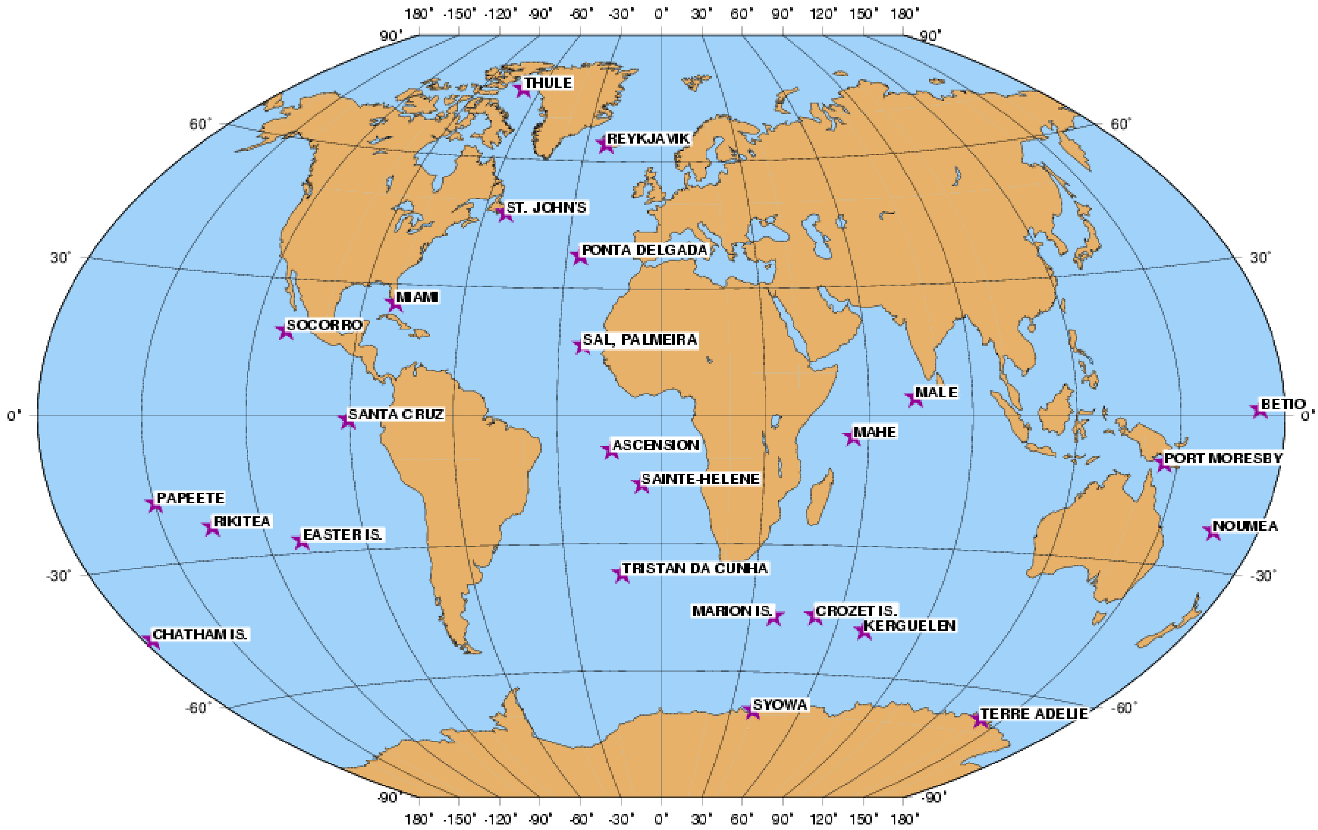
e-mail : ids.central.bureau@ids-doris.org

The contact point for every information requirement is the Central Bureau. It will find a solution to respond to user's need. A list of contact points has been defined for internal use depending on the kind of questions.

APPENDIX 2: DORIS STATIONS COLOCATION WITH TIDE GAUGES

The table and the figure below are courtesy provided by the « Système d'Observation du Niveau des Eaux Littorales » (SONEL, Université de La Rochelle, France). They are regularly updated at the following address:

http://www.sonel.org/stations/cgps/survey/survey.doris.html



	DORIS Name	Longitude	Latitude	Country	Start date	Distance	GLOSS id	PSMSL id
1	ASCENSION	-14.33	-7.92	UK	1997-02-28	6500	263	402001
21	BETIO	172.92	1.35	KIRIBATI	2006-10-22	1600	113	730009
2	CHATHAM ISLAND	-176.57	-43.96	NEW ZEALAND	1999-02-28	1200	128	------
3	COLOMBO	79.87	6.89	SRI LANKA	1991-06-06	5000	033	520001
6	CROZET ISLAND	51.85	-46.43	FRANCE	2003-12-21	850	21	433001
6	EASTER ISLAND	-109.38	-27.15	CHILI	1988-11-17	7000	137	810003
8	KERGUELEN	70.26	-49.35	FRANCE	1987-01-28	3300	023	434001
14	MAHE	55.53	-4.68	SEYCHELLES	2001-06-20	300	273	442007
22	MALE	73.53	4.20	MALDIVES	2005-01-15	500	28	454011
9	MARION ISLAND	37.86	-46.88	SOUTH AFRICA	1987-05-15	1000	020	------
23	MIAMI	-80.17	25.73	USA	2005-02-10	180	---	960001
10	NOUMEA	166.41	-22.27	FRANCE (CALEDONIA)	1987-10-20	3600	123	740001
11	PAPEETE	-149.61	-17.58	FRANCE (POLYNESIA)	1995-07-27	7000	140	780011
12	PONTA DELGADA	-25.66	37.75	PORTUGAL (AZORES)	1998-11-02	1500	245	36002
18	PORT MORESBY	146.18	-9.43	PAPUA NEW GUINEA	1988-03-29	6000	---	670012
13	REYKJAVIK	-21.99	64.15	ICELAND	1990-07-04	2500	229	010001
24	RIKITEA	-134.97	-23.13	FRANCE (POLYNESIA)	2006-09-23	800	138	808001
5	SAINTE-HELENE	-5.67	-15.94	UK	1989-06-01	4000	264	425001
19	SAL	-22.98	16.78	CAPE VERDE	2002-12-15	7000	329	380021
25	SANTA CRUZ	-90.30	-0.75	ECUADOR	2005-04-01	1600		845031
15	SOCORRO	-110.95	18.73	MEXICO	1989-06-09	400	162	830062
7	ST. JOHN'S	-52.68	47.40	CANADA	1999-09-27	4000	223	970121
16	SYOWA	39.58	-69.01	JAPAN (ANTARCTICA)	1993-02-10	1000	095	A--041
4	TERRE ADELIE	140.00	-66.67	FRANCE (ANTARCTICA)	1987-02-05	500	131	------
20	THULE	-68.83	76.54	DENMARK (GREENLAND)	2002-09-28	300	---	------
17	TRISTAN DA CUNHA	-12.31	-37.07	UK	1986-06-10	2000	266	------

APPENDIX 3: DORIS STATIONS / HOST AGENCIES

The high quality of the DORIS network and its continuously improved robustness and reliability, is due, for a big part to the skill and to the efficiency of the local teams which take care of these DORIS stations.

The following table gives the list of the DORIS stations, and the institutes involved as DORIS host agencies.

Station name	Institute	City, Country
Amsterdam	Institut Polaire Paul Emile Victor (IPEV)	Base Martin-de-Viviès, île Amsterdam, Sub-Antarctica, FRANCE
Arequipa	Universidad Nacional de San Agustin (UNSA)	Arequipa, PERU
Ascension	ESA Telemetry & Tracking Station	Ascension Island, South Atlantic Ocean, UK
Badary	Badary Radio Astronomical Observatory (BdRAO, Institute of Applied Astronomy)	Republic of Buryatia, RUSSIA
Belgrano	Instituto Antártico Argentino (DNA)	Buenos Aires, ARGENTINA
Betio	Kiribati Meteorological Service	Republic of KIRIBATI
Cachoeira Paulista	Instituto Nacional de Pesquisas Espaciais (INPE)	Cachoeira Paulista, BRAZIL
Chatham Island	MetService	Chatham Island, NEW ZEALAND
Cibinong	BAKOSURTANAL	Cibinong , INDONESIA
Cold Bay	National Weather Service NOAA	Cold Bay, Alaska, USA
Cold Bay	US Coast Guard Navigation Center (NAVCEN)	Alexandria, Virginia, USA
Crozet	Institut Polaire Paul Emile Victor (IPEV)	Base Alfred Faure, archipel de Crozet, Sub-Antarctica, FRANCE
Dionysos	National Technical University Of Athens (NTUA)	Zografou, GREECE
Djibouti	Observatoire Géophysique d'Arta (CERD)	Arta, Republic of DJIBOUTI
Easter Island	SSC Chile S.A.	Santiago, CHILI

Station name	Institute	City, Country
Everest	Comitato Ev-K2-CNR	Bergamo, ITALY
Futuna	Météo-France	Malae, Wallis-et-Futuna, FRANCE
Grasse	Observatoire de la Côte d'Azur (OCA)	Grasse, FRANCE
Gavdos	Technical University of Crete (TUC)	Chania, Crete, GREECE
Greenbelt	NASA / GSFC / GGAO	Greenbelt, Maryland, USA
Hartebeesthoek	HartRAO, South African National Space Agency (SANSA)	Hartebeesthoek, SOUTHAFRICA
Jiufeng	Institute of Geodesy and Geophysics (IGG)	Wuhan, CHINA
Kauai	Kokee Park Geophysical Observatory (KPGO)	Kauai Island, Hawaï, USA
Kerguelen	Institut Polaire Paul Emile Victor (IPEV)	Base de Port-aux-Français, archipel de Kerguelen, Sub-Antarctica, FRANCE
Kitab	Department of geodynamics of Astronomical Institute	Kitab, UZBEKISTAN
Kourou	Centre Spatial Guyanais (CSG)	Kourou, FRENCH GUYANA
Krasnoyarsk	Siberian Federal University (SibFU)	Krasnoyarsk, RUSSIA
La Réunion	Observatoire Volcanologique du Piton de La Fournaise (IPGP)	Ile de la Réunion, FRANCE
Libreville	ESA tracking station	N'Koltang, GABON
Mahé	Seychelles National Meteorological Services	Mahé Island, Republic of SEYCHELLES
Male	Maldives Department of Meteorology	Male, Republic of MALDIVES
Manille	National Mapping and Ressource Information Authority (NAMRIA)	Republic of the PHILIPPINES
Marion	Antartica & Islands Department of Environmental Affairs(DEA)	Marion Island Base, SOUTH AFRICA
Metsahovi	Finnish Geodetic Institute (FGI)	Masala, FINLAND
Miami	Rosenstiel School of Marine and Atmospheric Science (RSMAS)	Rickenbacker Causeway, Florida, USA
Mount Stromlo	SLR Observatory, Geoscience Australia (GA)	Mount Stromlo, AUSTRALIA
Nouméa	Direction des Infrastructures, de la	

Station name	Institute	City, Country
	Topographie et des Transports Terrestres (DITTT)	Nouméa, NEW CALEDONIA
Ny-Alesund	Institut Polaire Paul Emile Victor (IPEV) Geodesiobservatoriet (Statens Kartverk)	Base Charles Rabot, Ny-Ålesund, NORWAY
Papeete	Observatoire Géodésique de Tahiti (OGT / UPF)	Fa'a, Tahiti, FRENCH POLYNESIA
Ponta Delgada	Universidade dos Açores	Ponta Delgada, Azores, PORTUGAL
Port Moresby	National Mapping Bureau (DLPP)	Port-Moresby, PAPUA NEW GUINEA
Reykjavik	Landmælingar Islands (LMI)	Reykjavik, ICELAND
Rikitea	Météo-France	Archipel des Gambier, Polynésie Française, FRANCE
Rio Grande	Estacion Astronomica Rio Grande (EARG)	Rio Grande, ARGENTINA
Rothera	British Antarctic Survey (BAS)	Rothera Research Station, Adelaide Island, Antarctica, UK
Sal	Instituto Nacional de Meteorologia e Geofisica (INMG)	Sal Island, CAPE VERDE
Santiago	Santiago Satellite Station SSC Chile S.A.	Santiago, CHILI
Santa Cruz	Charles Darwin Foundation (AISBL)	Santa Cruz Island, Galapagos, ECUADOR
Socorro	Instituto Nacional de Estadistica y Geografia (INEGI) Secretaría de Marina Armada (SEMAR)	Aguascalientes, MEXICO Socorro Island, MEXICO
St John's	Geomagnetic Observatory , Natural Resources Canada (NRCan)	St. John's, CANADA
St-Helena	Meteorological Station	St Helena Island, South Atlantic Ocean, UK
Syowa	National Institute of Polar Research (NIPR)	Syowa Base, Antarctica, JAPAN
Terre Adélie	Institut Polaire Paul Emile Victor (IPEV)	Base de Dumont d'Urville, Terre-Adélie, Antarctica, FRANCE
Thule	US Air Force Base National Survey and Cadastre (KMS)	Pituffik, Greenland, DENMARK Copenhagen, DENMARK
Tristan da Cunha	Telecommunications Department of TDC	Tristan da Cunha Island, South Atlantic Ocean, UK
Yarragadee	MOBLAS 5 SLR Station, Geoscience Australia (GA)	Yarragadee, AUSTRALIA

Station name	Institute	City, Country
Yellowknife	Natural Resources Canada (NR Can)	Yellowknife CANADA
Yuzhno-Sakhalinsk	Institute of Marine Geology & Geophysics (IMGG)	Yuzhno-Sakhalinsk, RUSSIA

INTERNATIONAL DORIS SERVICE

IDS

www.ids-doris.org

DORIS

Contacts

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Analysis coordinator

Frank Lemoine (NASA/GSFC) frank.g.lemoine@nasa.gov

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