DPOD2014

Guilhem Moreaux and IDS POD validation Group (P. Willis, F. Lemoine, A. Couhert, N. Zelensky, H. Ait Lakbir)

DPOD2014 – Main Features

- **DPOD2014 is mostly based on the latest DORIS position and velocity cumulative solution from the latest IDS combined series.**
- **DPOD2014 does not include Post-Seismic Deformation corrections. Pure piecewise linear displacement model.**

- **Stations not included in the DORIS cumulative solution**
  - **Mean positions and velocities of the very old stations (with short observation time span before 1993.0) are extracted from DPOD2008 v1.14.**
  - **Positions and velocities of the newest stations are deduced from either the DORIS local ties or the DORIS mails from IGN.**

- **After some preliminary validation tests by the IDS CC, the DPOD2014 solution is validated by the POD validation group (P. Willis, F. Lemoine, A. Couhert, N. Zelensky and Ait Lakbir Hanane).**

- **The DPOD2014 solution will be updated twice a year.**

DPOD2014 – Elaboration Scheme

The DPOD2014 construction consists of 5 main steps:

1. **Construction of the IDS combined series from the six IDS Analysis Center multi-satellite weekly solutions starting in 1993.0.**

2. **Update of the position discontinuity and velocity constraint files.**
   - These two files are updated after analysis of the station coordinate time series.
   - Velocity constraints are used to constrain velocities to the same value over multiple segments unless a velocity discontinuity was observed.

3. **Update of the DORIS-to-DORIS tie vector file from IGN.**
   The DORIS-to-DORIS tie vector is used to constrain station positions.

4. **Update of the DORIS core network used to align the solution on ITRF2014.**

5. **Computation of the cumulative solution by stacking of the weekly solution files with the IGN CATREF software.**

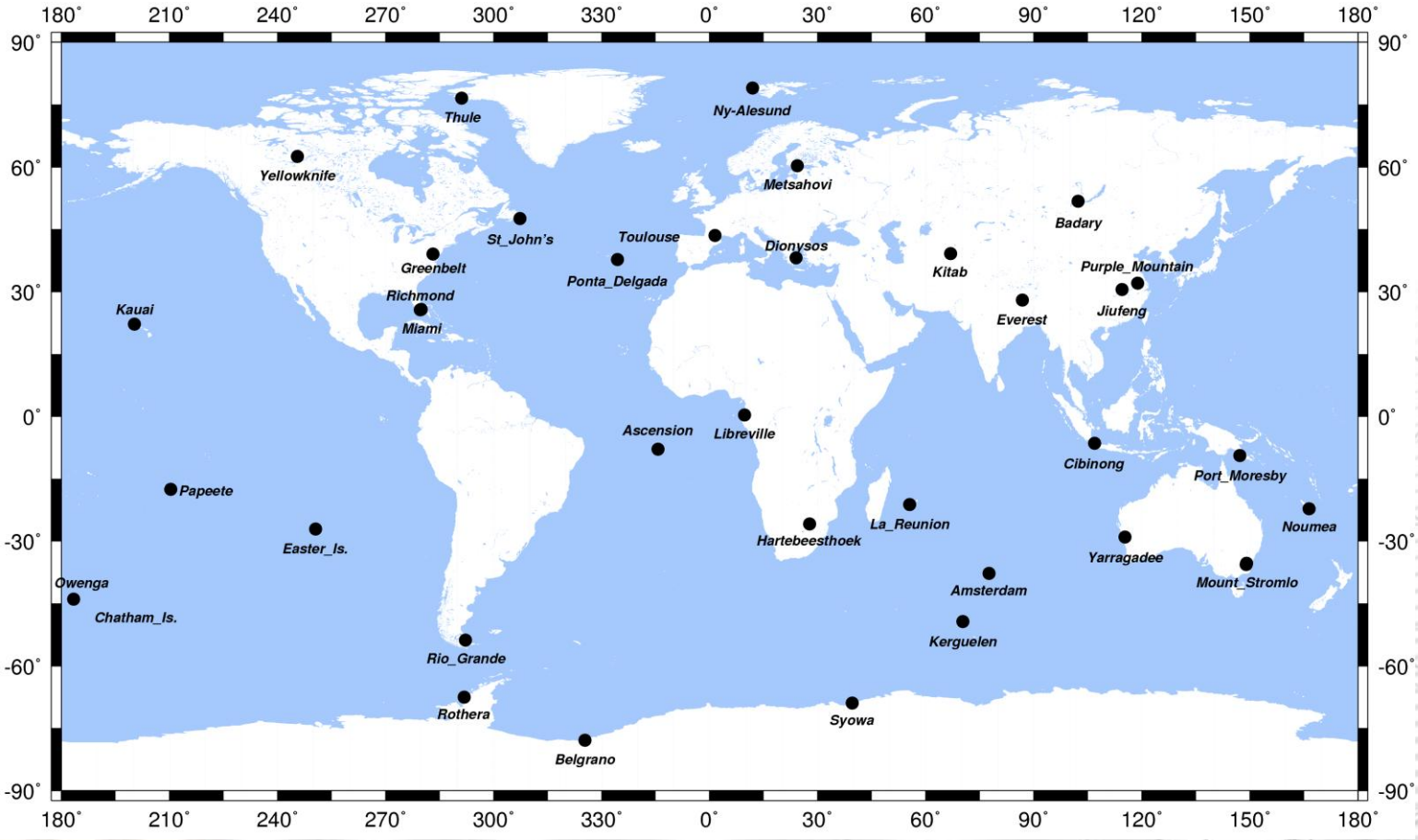
DORIS core network

http://ids-doris.org

To be a core site, a DORIS site must:

- Have more than 500 weeks of observations.
- Not be located in seismic zone.
- Be included in ITRF2014.

The network includes 36 sites with 17 sites in the northern hemisphere.



DPOD2014 – Internal Validation

The internal validation is a first quality check done by the IDS CC before delivering the DPOD solution to the validation team. The internal validation consists in looking at:

1. **The station position residuals.**

2. **The DORIS-to-DORIS tie vector residuals.**

   Differences between the DPOD2014 coordinates of 2 successive stations (at the starting date of the most recent station) and the IGN tie vector.

3. **The position and velocity differences with ITRF2014/DPOD2014vX/DPOD2008.**

   The position differences are estimated at the mean epoch of the observations.

4. **The DORIS-to-GPS tie vector discrepancies at co-located sites.**

   Differences between the DPOD2014 and the ITRF2014-IGS positions (at the starting date of the most recent station) and the IGN tie vector.

5. **The prediction and analysis of the position formal errors at T+3 years.**

DPOD2014 – External Validation

To validate the DPOD2014 for POD, an independent group was created. That group is composed by: P. Willis (chair), F. Lemoine, N. Zelensky, A. Couhert and H. Ait Lakbir.

The validation tests include to:

- ❑ **Verify that all DORIS stations are provided in the DPOD solution.**
- ❑ **Verify that the coordinates of the new stations are consistent with the latest available DORIS data.**
- ❑ **Verify that POD solutions are not degraded by looking at:**
  - ✓ **DORIS residuals and comparisons with ITRF2014 and DPOD2008 performances.**
  - ✓ **SLR residuals and comparisons with ITRF2014 and DPOD2008 performances.**
  - ✓ **Long term orbit drift as shown with the Mean Z ITRF2008 orbit differences.**
  - ✓ **JPL16a radial orbit differences.**
  - ✓ **…**

Delivery

- **The DPOD2014 solution will be updated twice a year.**
- **Version 1.0 was delivered on March 21, 2017.**
- **DPOD2014 is available in both SINEX and text format.**

- **The up-to-date versions are named dpod2014_current.snx.Z and dpod2014_current.txt.Z and available in the subdirectory dpod at the IDS Data Centers.**

- **The subdirectory dpod/dpod2014 contains the archive of the DPOD2014 solutions.**

- **More information on the DPOD2014 is available at new dedicated IDS webpage** (https://ids-doris.org/analysis-coordination/combination/dpod.html).

Header Information (1/2)

http://ids-doris.org

Update:

List the sources of the positions and velocities of the DORIS stations not included in the IDS cumulative solution.

```
%=SNX 2.01 IDS 17:017:00000 IDS 93:003:00000 15:361:00000 D 01488 2 X V
*-------------------------------------------------------------------------------
+FILE/COMMENT
* This file is the propagation of the DPOD2014 SINEX solution file
* at date 00:001:00000 by the IDS Combination Center.
* File created by CATREF software (Z.Altamimi)
* Contact: G. Moreaux (Guilhem.Moreaux@cls.fr)
*
* DPOD solution based on the DORIS cumulative position and velocity solution
* (obtained by stacking of IDS 12 combined series from 93:003 to 15:354) and
* augmented for stations observed before 1993.0 or after 2015.75 from either
* DPOD2008 v1.14 or DORISmails (expressed in ITRF2014).
*
* This file contains 2 un-official SINEX blocks:
*   SOLUTION/DISCONTINUITY: lists position discontinuities (breakes)
*   SOLUTION/DATA_REJECT  : lists periods of time rejected in the combination
*
* UPDATE 2017/01/17:
* FLOA: velocity from DPOD2008 v1.14 in ITRF2014
* SAKA: velocity continuity with SAKB added
* SANA: no more discontinuity in 1996/03/27
*
* ARLA: position and velocity deduced from ARMA with DORIS ties
* HVOA: position and velocity extracted from DPOD2008 v1.14 in ITRF2014
* KRUA: position and velocity extracted from DPOD2008 v1.14 in ITRF2014
* RICA: position and velocity deduced from RIDA with DORIS ties
* SOCA: position and velocity extracted from DPOD2008 v1.14 in ITRF2014
* TLIA: position and velocity deduced from TLHA (same domes nb)
* TROA: position and velocity extracted from DPOD2008 v1.14 in ITRF2014
*
* JIWC: position and velocity deduced from JIVB with DORIS ties
* KEVC: position and velocity deduced from KEUC with DORIS ties
* KIVC: position and velocity deduced from KIUB with DORIS ties
* MNAC: position and velocity extracted from DORISmail no 1020
* OWFC: position and velocity extracted from DORISmail no 1028
* PDOC: position and velocity deduced from PDNC with DORIS ties
* SAPC: position and velocity deduced from SALB with DORIS ties
* WEUC: position and velocity extracted from DORISmail no 1047
*
-FILE/COMMENT
*-------------------------------------------------------------------------------
```

Stations to Be Updated (1/2)

- **From DPOD2014 version 2, the solutions will contain a new section to identify either new stations or old stations with un-negligible position/velocity changes.**

- **Un-negligible ?**
  - **Station no more active: 3D position differences between 2 successive DPOD2014 solutions over the station time span larger than 2 cm.**
  - **Active station: 3D position differences between 2 successive DPOD2014 solutions in T_{last}+ 2 years larger than 2 cm (T_{last} = time of the last observation used in the latest DPOD2014 solution).**

Stations to Be Updated (2/2)

- **How the information will be given ?**
  - **SINEX format: new un-official « STATION/TO_BE_UPDATED » block.**

```
*-------------------------------------------------------------------------------
+STATION/TO_BE_UPDATED
CODE PT __DOMES__ _____________________COMMENTS_____________________________________
COND  A 99999S999 New discontinuity in 2050/12/365
LONC  A 77777S001 New site in UCL (London)
-STATION/TO_BE_UPDATED
-------------------------------------------------------------------------------
```

  - **Text format: new column 11.**

```
# column 5  : position X (ITRF2014 at epoch 2000.0), in m
# column 6  : position Y (ITRF2014 at epoch 2000.0), in m
# column 7  : position Z (ITRF2014 at epoch 2000.0), in m
# column 8  : velocity VX (ITRF2014), in mm/yr
# column 9  : velocity VY (ITRF2014), in mm/yr
# column 10 : velocity VZ (ITRF2014), in mm/yr
# column 11 : TBU means station to be     updated wrt previous DPOD solution
#             XXX means station to be not updated wrt previous DPOD solution
#
#    By convention, XXX means that this DORIS station should not be
#    used for POD during the considered period of time
#
#    By convention ........ means station still active and providing observations
#
###############################################################################################
ADEA 91501S001 03:01:93 29:03:98 -1941059.6233  1628659.2662 -5833613.5184    3.80  -14.13    -5.54 XXX
LONC 77777S001 01:01:50 ........ -9999999.9999  9999999;9999 99999999;9999    1.00    1.00     1.00 TBU
```

Discontinuity block (SINEX)

http://ids-doris.org

List the dates and origins of the station position discontinuities

```
*-------------------------------------------------------------------------------
+SOLUTION/DISCONTINUITY
*CODE PT SOLN T _DATA_START_ __DATA_END__ M A _________________COMMENTS__________
 ADEA  A    1 D 00:000:00000 98:084:11545 P - Earthquake 1998/03/25
 ADEA  A    2 D 98:084:11545 00:000:00000 P -
 ADGB  A    1 D 00:000:00000 14:161:00000 P - Beacon change 2014/06/10
 ADGB  A    2 D 14:161:00000 00:000:00000 P -
 AMTB  A    1 D 00:000:00000 05:327:00000 P - Antenna offset (2005/11/24)
 AMTB  A    2 D 05:327:00000 00:000:00000 P -
 AREA  A    1 D 00:000:00000 94:160:01996 P - Earthquake 1994/06/09
 AREA  A    2 D 94:160:01996 96:317:61184 P - Earthquake 1996/11/12
 AREA  A    3 D 96:317:61184 00:000:00000 P -
 ARFB  A    1 D 00:000:00000 07:227:85258 P - Earthquake 2007/08/15
 ARFB  A    2 D 07:227:85258 08:190:33187 P - Earthquake 2008/07/08
 ARFB  A    3 D 08:190:33187 10:126:09767 P - Earthquake 2010/05/06
 ARFB  A    4 D 10:126:09767 12:159:57780 P - Earthquake 2012/06/07
 ARFB  A    5 D 12:159:57780 00:000:00000 P -
 CADB  A    1 D 00:000:00000 08:215:00000 P - Beacon change 2008/07/01
 CADB  A    2 D 08:215:00000 11:355:00000 P - Unknown in 2011/12/21
 CADB  A    3 D 11:355:00000 00:000:00000 P -
 CHAB  A    1 D 00:000:00000 06:340:00000 P - Antenna pb
 CHAB  A    2 D 06:340:00000 00:000:00000 P -
 CICB  A    1 D 00:000:00000 02:290:00000 P - Unknown
 CICB  A    2 D 02:290:00000 06:198:29969 P - Earthquake 2006/06/17
 CICB  A    3 D 06:198:29969 00:000:00000 P -
 CIDB  A    1 D 00:000:00000 09:245:28501 P - Earthquake 2009/09/02
 CIDB  A    2 D 09:245:28501 00:000:00000 P -
 COLA  A    1 D 00:000:00000 94:318:69330 P - Earthquake 1994/11/16
 COLA  A    2 D 94:318:69330 00:000:00000 P -
 EASB  A    1 D 00:000:00000 08:196:00000 P - Unknown in 2008/07/14 - North
 EASB  A    2 D 08:196:00000 11:186:00000 P - Beacon change 2011/06/30
 EASB  A    3 D 11:186:00000 00:000:00000 P -
 EVEB  A    1 D 00:000:00000 02:075:00000 P - Unknown
 EVEB  A    2 D 02:075:00000 11:261:45651 P - Earthquake 2011/09/18
 EVEB  A    3 D 11:261:45651 15:115:22285 P - Earthquake 2015/04/25
 EVEB  A    4 D 15:115:22285 15:185:00000 P - Postseismic
 EVEB  A    5 D 15:185:00000 00:000:00000 P -
 FAIB  A    1 D 00:000:00000 02:307:79961 P - Earthquake 2002/11/03
 FAIB  A    2 D 02:307:79961 03:033:00000 P - Post seismic
 FAIB  A    3 D 03:033:00000 03:215:00000 P - Post seismic
 FAIB  A    4 D 03:215:00000 06:001:00000 P - Post seismic
 FAIB  A    5 D 06:001:00000 00:000:00000 P -
 GOMB  A    1 D 00:000:00000 99:289:35204 P - Earthquake 1999/10/16
```

DATA_REJECT block (SINEX)

List the periods of observations rejected while doing the combination.

Periods recommended to be rejected while doing POD, positioning.

```
-SOLUTION/DATA_REJECT
*CODE PT T _DATA_START_ __DATA_END__ M A _____________COMMENTS_____________
 ADEB  A D 02:059:00000 04:075:00000 X - Strange behavior in up
 ADFB  A D 10:245:00000 49:365:86480 X - Maser pb 20100901-20110529
 AMSA  A D 96:001:00000 49:365:86480 X - Antenna tilt
 AMSB  A D 90:001:00000 49:365:86480 X - Antenna tilt
 AMTB  A D 05:250:00000 05:327:00000 X - Lack of data 20050907-20051203
 AMTB  A D 05:327:00000 05:337:00000 X - Lack of data 20050907-20051203
 AMUB  A D 08:257:00000 08:339:00000 X - Lact of data 20080913-20081203
 AMUB  A D 09:098:00000 49:365:86480 X - End of station
 AMVB  A D 10:195:00000 10:260:00000 X - Beacon failure 20100714-20100916
 AREA  A D 01:174:00000 01:323:00000 X - Earthquake on 20010623
 AREB  A D 06:215:00000 49:365:86480 X - After station end
 ARFB  A D 90:000:00000 06:215:00000 X - Before station start
 ARFB  A D 09:038:00000 09:063:00000 X - Data corrupted 20090207-20090302
 ASDB  A D 02:052:00000 02:103:00000 X - Antenna corrosion
 ASDB  A D 05:011:00000 05:117:00000 X - Lack of data 20050111-20050426
 ASDB  A D 07:007:00000 07:107:00000 X - Data corrupted 20070107-20070416
 ASDB  A D 09:094:00000 09:176:00000 X - Antenna problem 20090404-20090624
 ASEB  A D 10:164:00000 10:215:00000 X - Data gap until 20100802
 BADB  A D 05:018:00000 09:252:00000 X - Lack of data 20050118-20090908
 BEMB  A D 06:211:00000 07:049:00000 X - Lack of data 20060730-20070217
 BETB  A D 08:067:00000 08:143:00000 X - Lack of data 20080307-20080521
 BETB  A D 12:224:00000 13:250:00000 X - Data gap 20120811-20130906
 CACB  A D 93:001:00000 93:310:00000 X - Unknown
 CADB  A D 06:155:00000 06:204:00000 X - Lack of data 20060604-20060722
 CADB  A D 11:121:00000 12:074:00000 X - Lack of data 20110501-20120313
 CHAB  A D 05:036:00000 05:305:00000 X - Data corrupted 20050205-20051031
 CHAB  A D 06:216:00000 07:042:00000 X - Antenna pb 20060804-20070210
 CHAB  A D 09:346:00000 10:075:00000 X - Data gap 20091212-20100315
 CICB  A D 06:044:00000 06:156:00000 X - Lack of data 20060213-20060604
 CIDB  A D 09:315:00000 10:345:00000 X - beacon failure 20091111-20101210
 CROB  A D 07:095:00000 49:365:86480 X - After end of station
 CRPB  A D 90:000:00000 07:098:00000 X - Before start of station
 CRPB  A D 09:084:00000 49:365:86480 X - After end of station
 CRQB  A D 90:000:00000 09:088:00000 X - Before start of station
 DIOA  A D 90:001:00000 94:090:00000 X - noisy data
 DIOA  A D 05:273:00000 49:365:86480 X - Lack of data 20050920
 DJIA  A D 98:328:00000 49:365:86480 X - Antenna corrosion
 DJIB  A D 98:328:00000 06:178:00000 X - Bad data until 20060626
 DJIB  A D 12:198:00000 12:258:00000 X - Data gap 20120716-20120913
```

What's next ?

- **Second version of the DPOD2014 is on the way (will be available in July).**
  - **From the IDS cumulative solution over 1993.0-2017.0.**
  - **New discontinuities for Santiago.**
  - **…**

- **Further versions:**
  - **Extension of the IDS combined series to prior 1993 (AC contributions needed).**
  - **New combined series with no contribution of Jason-2 and Jason-3 to the SAA stations.**
  - **New combined series with AC solutions with reduced scale jump in 2012.**