IDS

Meeting minutes

IDS AWG - Greenbelt

Participants (*):

M. Ziebart (UCL), N. Zelensky (SGT), K. Le Bail (INC-NASA), C. Noll (NASA), D. Behrend (INC-NASA), D. Chinn (SGT), G. Moreaux (CLS), L. Soudarin (CLS), P. Willis (IGN), F. Lemoine (NASA), P. Stepanek (GOP), S. Rudenko (GFZ), E. Schrama (TU Delft), H. Capdeville (CLS), P. Ferrage (CNES) by Telecon

Distribution (*):

Liste AWG IDS

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1.1.1.1.1. Signature:		[Approver]
1.1.1.1.2.		

1. Context

Hereafter the minutes of the IDS AWG meeting held at NASA Goddard Space Flight Center (Greenbelt, Maryland) on October 15-16.

The main objectives of this meeting were:

- ACs and CC feedback on the ITRF2014 evaluation. To discuss about evaluation and potential problems of the ITRF2014 package provided by Z. Altamimi. Schedule on the ITRF2014 implementation in particular to take into account the post seismic models
- ACs status and schedule on the DORIS RINEX data processing.
- to discuss about the open issues following ITRF2014 realization
- to get back to routine processing and define the next Models/Standards to be used.

All the slides displayed during this meeting will be available at http://ids-doris.org/report/meeting-presentations.html#ids-awg-10-2015

2. Day 1 – October 16th

2.1. Latest results on the IDS contribution to ITRF2014 (By Guilhem Moreaux)

In comparison to the IDS contribution to ITRF2008 (ids 03), the IDS contribution to ITRF2014 (ids 09) presents 2 degradations in performances from 1993 to 2002:
- In terms of EOP differences wrt IERS C04 series (mainly in the X direction).
- In terms of station position residuals (mainly in the East direction).

Evaluation wrt ITRF2008 of single AC contributions to ITRF2008 and ITRF2014 showed so far no substantial degradation at the AC level for that time period.

Tests done by Zuheir Altamimi and IDS CC from GSC series 20 and 21 (==20 + PCVs) showed no impact of phase laws in station positioning ➔ PCVs is not at the origin of the degradation.

Different strategy for the estimation of the combined EOPs and rotation constraints have been tested in vain.

➔ New tests with different parameterizations for the combination of the single AC solutions have been undertaken.

The degradation of EOP may be due by the missing of the ESA solution. For the ITRF2008, the ESA solution was the best solution for the EOP and for the ITRF2014, the worse. Then, the EOP ESA solution does not contribute to the combination for the ITRF2014.

The degradation of WRMS may be due to a different strategy than that used for the realization of the ITRF2008.

2.2. ACs and CC Status

GOP (By Petr Stepanek)

Recent work:

Merging of the DORIS-Bernese and Bernese 5.2 (testing stage)
- consistency with official Bernese version
- measured satellite attitude

Implementations of the RINEX data processing
- Computation of PHC-COM correction
- Reconstruction of Doppler measurement
- Onboard clock modeling
- Phase processing?

Changes in SRP estimation: Could the SRP estimation problem indicate some abnormality?

Action 1 (Petr, other ACs): Check when GOP AC has problems in the SRP estimation (Saral and Cryostat-2) if it could be related to an event.

GSC (By Frank Lemoine)

The recent DORIS data have been processed until 2015/06.

The signatures in the OPR acceleration amplitudes are stronger for Cryosat-2 and HY-2A. For Saral, peak accelerations occur during eclipse periods (Nov-Dec) (for more details see Zelensky et al., submitted in Adv. Space Res.). For SPOT-5, there is possible signature of higher drag periods near solar maximum. There is a setup error after 2014/06 (omission of modeling of proper Solar array pitch bias).

When the HY-2A offset adjustment (Apriori Z=1.306, Adjusted Z=1.356) is applied the HY-2A scale is close to -0.11 mm (against 32 mm).

The sawtooth pattern in the SPOT-5 scale seems to disappear from 2012.

Future work:
- Resubmit updated paper to DORIS special issue.
- Update wd26 time series
  using updated values of Cgmass & Offsets for Saral
  update Jason-2 to include quaternions to model solar array motion
  correct SPOT-5 solar array pitch error (after july 2014)
  have a consensus for new offsets and/or CGmass for HY-2A
- Continue evaluations of ITRF2014P

IGN (By Pascal Willis)

Following problems found by Sergey Kuzin (INASAN) on the Cryosat-2/TRF scale, IGN by using phase center correction from CNES data files does not see the problem. For Cryosat-2 single satellite, IGN sees two scale jump, one in Jan-Feb 2012 and one other in Mar-Apr 2015.

Following problems detected by other groups at the last AWG on the HY-2A radial offset, IGN by using phase center correction from CNES data files find a significant offset (~30-40 mm) not yet corrected by CNES.

Following problems detected by other groups at the last AWG on the Saral cross-track offset, IGN by using phase center correction from CNES data files find an offset close to zero after 4 Nov. 2014 (date when a correction has been applied by CNES).

Conclusions and Future work:
  Regular data processing:
- Regular data submission is up-to-date
  Main driver is availability of SPOT5 corrected files (and then AOD1B products). It can be done at weekly or daily basis.
- Need to update all derived products and on-line documentation for these products at CDDIS and IGN.
- Following recent problems (R_OFF, X_OFF), there might be a need for data reprocessing, as we are using phase center corrections from data files.
  Research activities
- RINEX data processing has now highest priority. Work is started but too preliminary. Approach is different from other ACs (modelling clocks with GIPSY/OASIS).

Action 2 (volunteer ACs): behavior of the Cryosat-2 scale factor, do they observe several jumps?

GRG (By Hugues Capdeville)

Status of the routine DORIS data processing
  GRG analyzed DORIS2.2 data from January 2015 to June 2015 with 3.5-day arcs and a cut-off angle of 12° in the ITRF2014 configuration. Satellites: SPOT5, JASON-2, CRYOSAT2, HY-2A, SARAL.
  They analyze also the positioning results by single satellite solution compared to ITRF2014P computed by CATREF. For SPOT-5 single satellite solution, after 2012, the scale is smoother when we compare to ITRF2014P, and as it also seen by GSC, the sawtooth pattern seems to disappear. For Jason-2, the scale jump in 2012 is not so obvious when we compare to ITRF2014P. For HY-2A, the scale is lowest when we compare to ITRF2014P (22.3 mm against 31.6 when compared to ITRF2008). Note that the HY-2A Tz is abnormally high (around 75 mm). For Saral single satellite solution, the scale is around 12 mm. For Cryosat-2, as it also seen by IGN, there is a clear scale jump in 2012.

CRYOSAT2 DORIS data processing by using quaternions from E. Schrama
GRG has compared DORIS data processing results from January 2014 to June 2015 by using nominal attitude law and by using quaternions from E. Schrama (including the 6° pitch in GINS software). The orbits results and positioning results are very similar. These results lead to validate the nominal law implemented in GINS software.

The higher DORIS residuals when we process RINEX files are now understood (see below, section 2.11).
Future work:
- Adjust an along-track acceleration for HY-2A, as it is done by GSC and CNES POD. See if there is an impact on Tz.
- Use of quaternions for Jason-2 to model bus and solar array motion
- For Cryosat-2, GRG will test the use of quaternions around the satellite maneuvers
- Continue evaluations of ITRF2014P with post seismic model
- Submit two papers to DORIS special issue (GRG AC contribution to ITRF2014 and GRG RINEX data processing)

Action 3 (GRG AC): Adjust an along-track acceleration for HY-2A, as it is done by GSC and CNES POD. See if there is an impact on Tz.

IDS CC (By Guilhem Moreaux)
Status of the routine combination
- GOP new SINEXs could not be evaluated due to later arrival.
- Evaluation of individuals solutions wrt ITRF2014P with not use of Post-Seismic Deformation corrections.
  For ESA, the Tz peak in 2011 is linked to the solar activity. There is a WRMS degradation in all the directions since end of SPOT4.
  For GRG, there is a Tx discontinuity while Saral is added. The Tz peak in 2011 is linked to the solar activity. There is a WRMS degradation in the East direction since last quarter of 2014.
  For GSC, there is a Ty negative linear trend since end of TOPEX. There are a WRMS degradation in North and Up since end of SPOT4 or late 2013 and in East since end of Envisat.
  For IGN, the Scale higher increase early 2012. There is a Tz discontinuity late 2014 – early 2015. There are a WRMS degradation in Up mid 2012 (Scale consequence ?) and in East since end of Envisat.
Conclusion and future work:
- Evaluation will be redone using PSD corrections and wrt IDS 09 cumulative solution.
- IDS CC will start the extension of combined series from 2014 doy 362 to 2015 doy 151/158 on October 26th.
- From these SINEX, IDS CC plans to compute its first DPOD solution including stations with C-beacons: ADHC, GONC, KEUC, OWEC, PDNC, and ROWC.
- The DPOD will not contain Post-Seismic Deformation correction!

2.3. ITRF2014P Evaluation

- GSC has tested ITRF2014P without post-seismic model for Jason-2 from 2008. When they consider the ITRF2014P rather than ITRF2008, the DORIS residuals are lower for all stations except for post-seismic stations.

- GRG has now tested ITRF2014P with post-seismic model applied for 3 satellites from 2012. For Jason-2, CRYOSAT-2, and HY-2A the DORIS residuals are slightly lower with ITRF2014P.

- CNES POD has tested ITRF2014P with post-seismic model for Jason-2 from 2012. They observe a very slight improvement in DORIS RMS residuals and the DORIS+SLR orbits closer to GPS-only orbits.

- IDS CC suggests to reconsider velocity constraints in Easter Island and Manila. IDS CC recalls that if you do not use the PSD corrections, you can have centimetric differences even several years after the Earthquake. So, IDS CC proposes to make available to the IDS ACs XYZ and NEU corrections in ASCII file. One file per station and one line per week until 2020.0.

- For ACs and IDS CC, after some minors corrections the ITRF2014P gives good results.

Action 4 (IDS CC): When the ITRF2014 will be available, IDS CC proposes to make available to the IDS ACs XYZ and NEU PSD corrections in ASCII file (One file per station and one line per week until 2020.0).

2.4. **The International VLBI Service for Geodesy and Astrometry** (by Dirk Behrend)

We took advantage to the proximity of the NASA Goddard Space Flight Center IVS team to have a presentation on the **International VLBI Service for Geodesy and Astrometry** given by Dirk Behrend.

2.5. **Improvements in precise orbit determination of DORIS satellites at GFZ** (Sergei Rudenko)

New orbits of new precise orbits of ERS-1 (1991-1996), ERS-2 (1995-2006), TOPEX/Poseidon (1992-2005), Envisat (2002-2012), Jason-1 (2002-2013) and Jason-2 (2008-2015) were computed at GFZ in the same ITRF realization (ITRF2008) using consistent, improved models for precise orbit determination for all six missions. The analysis of these orbits performed at GFZ shows improved orbit quality of the new (VER11) orbits computed within the UHR-GravDat project and the phase 2 of the ESA Sea Level project of the Climate Change Initiative (SLCCI), as compared to the previous (VER06) orbits derived within the phase 1 of the SLCCI project. The major improvement of the orbit quality was obtained for Jason-1, Jason-2, TOPEX/Poseidon and Envisat. Further improvement of the orbit quality is expected by using new, improved reference frame realizations, improved modeling of gravitational and non-gravitational forces acting on the satellites, using new improved DORIS models.

Action 5 (volunteer ACs): GFZ see an increase of the Jason-2 DORIS RMS since 2012. It is also seen by other ACs for Jason-2 and for other satellites. Give to Analysis Coordinators the temporal evolution of the DORIS RMS residuals for all satellites since 2011.0.

2.6. **Material on the Precision orbit determination of CryoSat-2 at the TU Delft** (Ernst Schrama)

Ersnt has completed the POD up to 11-September-2015. The quality is checked by internal consistency with tracking data, by analysis of the level empirical acceleration parameters and by external comparison with the CNES products.
DORIS 10s and SLR independently residuals of fit are respectively consistent at 0.402 mm/s and at 1.55 cm (median) (low weight with respect to DORIS).
As shown in Toulouse in May 2015, Ernst has tested 4 solar radiation pressure (SRP) macro models:

- Empirical accelerations improve for the 7 panel roof model
- Significant improvement visible in the cross-track accelerations
- Overall acceleration level goes from 6.65 down to 3.95 nm/s2 (cannonball vs 7 panel)
- 10s Doppler fits are not really affected
- SLR fits are clearly improved

He compared against Navigator orbits, rapid science MOE and the final solution POE orbits. The real-time DIODE Navigator data has been improved, since Aug 2012, he sees a radial consistency < 5 cm. The radial fit can be reduced to around 1.5cm relative to the POE product; results are affected by the empirical parameters set-up.
A Short arc vs Long arc strategy has been tested.

2.7. **Terrestrial** Reference **Frame investigations in preparation of GRASP, GPS and DORIS - PPP daily results and preliminary comparisons with geodetic local ties (Pascal Willis)**

The GRASP mission would include all 4 techniques and the GRASP Satellite orbit should be at mm-level. PPP solutions from GRASP could be done for GPS and DORIS, providing results in a unique TRF.
The goal here is to test this possibility using current Jason-2 satellite. The GPS and DORIS results refer to center of phase   geodetic local ties refer to monumentation.
The Data used are:
- GPS PPP solutions = standard JPL PPP solutions available at http://sideshow.jpl.nasa.gov/post/series.html
- DORIS PPP solutions = new results using JPL Jason-2 orbits (from GPS) + DORIS data in PPP mode (daily solution, 1 satellite)
- Geodetic local ties = as provided by IGN/SIMB

The tests were performed only for SANB/SANT (Santiago de Chili). Note the GPS/DORIS vector is not affected by Earthquake (velocity could be held fixed through Earthquake in IDS and ITRF solutions). Mean = 2 or 10??? cm, std = 4 cm (1 day, 1 satellite) (equivalent to 7 mm for 5 satellites @ 1 week)

The future work will be to do similar tests for weekly or monthly solutions

- 1 week 15 mm ???
- 1 month = 7 mm???   (GRASP results should be better)
- 3 month = 4 mm ???

And to do extensive tests (more DORIS stations) using all available local ties.

Since the Greenbelt AWG, in the case of Jason-2, P. Willis also detected a sensitivity to SAA with DORIS PPP results (Willis et al., submitted)".

Willis, P., Heflin, M.B., Haines, B.J., et al., submitted. Is the Jason-2 DORIS Oscillator also Affected by the South Atlantic Anomaly Effect ? Adv. Space Res.

2.8. **Early results on the validation of the horizontal velocities from the cumulative solution based on the 1140 SINEXs if IDS 09 (Guilhem Moreaux)**

The construction of a cumulative position and velocity solution is part of the internal validation process of the IDS contribution to ITRF2014. In addition and in response to P. Willis during the last AWG in Toulouse, the IDS agreed to take over from Pascal the DPOD activities. Then, IDS CC has and will have to compute cumulative solutions. As it is a new task for the IDS CC, the very first solution must be validated by comparison to external models.

The IDS 09 horizontal velocities show good agreement (differences smaller than 5mm/yr) with the two models for most of the beacons. The larger differences occur at plate boundaries or in active seismic areas. Some differences can be explained and external comparisons show that IDS 09 estimations are realistic.

Next, the rotation parameters of some plates will be estimated when possible. The IDS 09 vertical velocities will be compared to GIA models and to GNSS ULR6 (La Rochelle University) estimations at coastal sites. Sites like Thule will be of special concern.

That study is planned to be published as a paper with Frank, Laurent, Pascal, Donald Argus, Alvaro Santamaría-Gómez and Médéric Gravelle as co-authors. The results have also been presented during the AGU as poster #64285 on December 15th in section G23B.

The IDS 09 velocities will be compared to ITRF2014 solutions from DGFI, IGN and JPL. The IDS 09 cumulative solutions will serve as reference for the future DPOD solutions.

2.9. **CNES/GRGS gravity field solutions from GRACE: RL03-v2 (Richard Biancale)**

The CNES/GRGS gravity fields from GRACE, called RL03-v2 is presented. The new RL03-v2 model reduces the geographically correlated radial orbit drift rate, from more than 1 mm/yr (for the RL02bis mean model) to less than 0.6 mm/y over ~7 years, with respect to Jason-2 GDR-E reduced-dynamic orbits (from GPS+DORIS). The Jason-2 SLR residuals are 1.36 for RL02, 1.29 cm for RL03-v2 and 1.27 cm for RL03-v2+C31 adjusted.

The next RL03-v3 model which should be ready for the end of 2015 will take into account the following points:

- Improving the inversion process (Cholesky + SVD in a 2-step procedure)
- Adapting the relative weights (between GPS and KBR)
- Using more satellite data (Starlette, Stella, Jason)
- Increasing the temporal resolution (back to 10-days?)
- Using improved dealiasing models such as ocean tides (FES2014)

The mean models could be updated each year. The mean RL02-v3 model will contain extrapolated terms from mid-2015. The completion (with adjusted terms) from 2015 till mid-2016 can be expected for end 2016

The updated mean models could be delivered annually at the end of year.

2.10. **Report on RINEX processing with Jason-2 (Nikita Zelensky)**

The Jason2 RINEX DORIS data are converted to range-rate and compared to V2.2 data processing over cycles 1-260. The quality of processing is at the same level when using DORIS RINEX data but the DORIS RMS of fit is slightly higher in the case of DORIS RINEX data (0.3959 mm/s against 0.3803 mm/s). There is an Along track Bias between the two orbits (~2.39 cm).

However there are two major problems. Isolated RINEX arcs can converge to degraded orbit solutions yet show normal DORIS residuals. And RINEX v10 data (from 2015) shows degraded POD.

Since this AWG, the POD degradation observed in the V2.2 and RINEX processing from end 2013 has been mainly explained by the missing of 10 recent stations in the DPOD2008 file used by GSC.

The next step is to test the next re-delivery of RINEX data files processed in a homogeneous context and taking into account the correction described in the next section (2.11).

2.11. **Explanation of the difference in RMS residuals between DORIS-2.2 and RINEX-PANDOR data (JM Lemoine)**

At the previous AWG GRG AC showed there was a good agreement between the RINEX DORIS data and DORIS2.2 processing. The quality of processing was at the same level when using DORIS RINEX data but the DORIS RMS of fit was slightly higher in the case of DORIS RINEX data, in particular for Jason-2. The goal here is to explain this difference in the RMS residuals between DORIS-2.2 and RINEX-PANDOR data.

Once the editing strategy has been harmonized between the DORIS-2.2 and the DORIS-RINEX measurements files, the difference in RMS between the two types of data files can be fully explained by a short-term noise present in the PANDOR-timed-tagged data, similar to a rounding error somewhere in the PANDOR process. This noise in the PANDOR time-tagging has an amplitude of some tenths of microseconds and results in an additional noise on the relative velocity measurement of +/- 0.1 mm/s for Jason-2. Apart from this short-term noise, the time-tagging is coherent between the POD processed data (DORIS-2.2) and PANDOR within ~ 0.5 microsecond.

For Jason-2 (in the GINS software at least…), there seems to be still an along-track bias of 1-2 cm between the DORIS and the SLR measurements, which needs to be investigated.

A paper on the GRG RINEX data processing will be submitted to ASR DORIS special issue.

As GSC AC, the next test will be to process the next re-delivery of RINEX data files processed in a homogeneous context and taking into account the correction mentioned in Action 6.

Action 6 (CNES, G. Moreaux, JM. Lemoine): To correct this time-tagging data error in the PANDOR software. Once implemented, CNES could re-delivery the RINEX data files.

3. Day 2 – October 17th

3.1. **DORIS Network Status (Laurent Soudarin on behalf of Jerome Saunier)**

The Network Operational consists of 58 stations with 10 beacons out of order. And four beacons are out of order for over a year: Yuzhno-Sakhalinsk (11/2005); Santa Cruz (06/2009); Santiago (05/2013); Port-Moresby (06/2013)

About the Network Evolution:
- ➢ Recent Network events :
  - Jun. 2015: Chichijima & Hokkaïdo (JA) new stations project was abandoned
  - Jun. 2015: Port-Moresby (PNG) station was completely removed (site closure)
  - Jul. 2015: reconnaissance in Northern Australia (PNG station re-location)
  - Aug. 2015: reconnaissance at Ny-Ålesund, NO (new 4 techniques site)
  - Oct. 2015: antenna re-location at Sal, CV (to get better visibility)
- ➢ Short term (Next 6 Months):
  - Kitab, UZ: major renovation (station re-location to get better visibility)
  - Managua, Nicaragua: new station in place of Miami.
  - Wettzell, DE: new station installing (new 4 techniques site)
- ➢ Longer term:
  - San Juan, AR: new station installing in place of Santiago (3 techniques site)

- Katherine, AS: new station installing in place of Port-Moresby (3 techniques site)
- Easter Island, Chile: relocating to near IGS station, ISPA.
- Miami, FL: definitive shutdown (interference with mobile-TV relays).
- Guam, US: planning underway for new station, near IGS site.

The co-location with VLBI is a big challenge. For Wettzell site (GE) a reconnaissance has been done in December 2014 to propose 3 options for DORIS antenna. After some tests on real conditions performed by BKG and CNES last July, there is no satisfactory solution: parcel of land is too small; signal attenuation too low. So, further experiments with absorber material or look around (1km) for another location are scheduled.

IGN is involved in EURAMET program and contributes for DORIS to the GGOS Bureau of networks and observations.

The ITRF website is under revision and the new website is scheduled mid 2016.

There are several articles in preparation related to the Network in the next DORIS special issue (Adv. Space Res.):
- "DORIS Starec ground antenna characterization and impact on localization" C. Tourain (CNES), G. Moreaux (CLS), A. Auriol (CNES), J. Saunier (IGN).
- "Initiating an error budget of the DORIS ground antenna position – Genesis of the Starec antenna type C" J. Saunier (IGN), A. Auriol (CNES), C. Tourain (CNES).
- "Assessment of the DORIS Network Monumentation" J. Saunier (IGN)
- "VLBI/DORIS Compatibility tests at GGAO" (TBC) L. Hilliard (NASA), C. Beaudoin (MIT), B. Corey (MIT), C. Tourain (CNES), W. Petrachenko (NRCC).

3.2. DORIS mission & system news (Pascale Ferrage & JM Walter)

Today 4 satellites contribute to IDS: SARAL (February 2013-2018, DGXX+LR), HY2-A (August 2011-post 2014, DGXX+LRA+GPS), CRYOSAT-2 (April 2010 → end 2017, DGXX + LRA), JASON2 (June 2008 → 2017, DGXX+LRA+GPS). SPOT5 has just been de-orbited more than 13 years of service (end of DORIS data: November 2015).

At least, 7 Future missions are planned: JASON-3 (in Jan. 2016, 5 years), SENTINEL3A (Feb. 2016, 7.5 years + 5), Sentinel 3B (2017), HY2B (2017, 3 years), JASON-CS1/SENTINEL6A (post 2020, 7 years), JASON-CS2/SENTINEL6B (post 2020, 7 years), SWOT (post 2020, 3 years).

The fourth generation beacon B4G is designed to be operational up to 2030. In particular there are better masks clearance expected thanks to longer distance between beacon and antenna (up to 50 m). The first production units are scheduled by the end of 2017.

The goal of the radio frequency characterization of Alcatel DORIS ground antenna is to define the phase center and the dispersion of Alcatel Antennas and to determine the impact on the phase law. Five Alcatel ground antennas have been characterized at CNES compact antenna test range (CATR) and the report of results analysis is in progress.

CNES is working on the subject to improve the installation recommendations of the DORIS beacon on a VLBI site. A best fitting installation of the DORIS beacon with regards to the site topography is requested as far as possible from the VLBI antennas and as high as possible from the VLBI. The tests on the DORIS/VLBI compatibility are ongoing in Wettzell.

3.3. CDDIS Update - Web applications (Carey Noll)

Each of the IAG's geometric services has implemented a "site log" that is a key source for understanding how the station's configuration has changed over time. The CDDIS developed the Site Log Viewer web app to allow users to browse the contents of the contents of these site logs. Users need to query the logs for a particular system to understand station configuration and to determine which sites have equipment with a particular configuration. Through the SiteLogViewer application, users can:
– Display a complete site log, section by section
– Display contents of all site logs for a specified topic (site log section)
– Search the contents of all site logs for a specified parameter value

Automated procedures download and ingest IDS, IGS, and ILRS site logs into a database supporting the application. An example is shown in the presentation.

The CDDIS Archive Explorer is a search/metadata interface tool for CDDIS to aid users in discovery of CDDIS data, products, and information, to aid staff in archive management and to promote CDDIS data holdings to a larger community (e.g., through metadata standards). Users can specify (any/all) temporal (Year, date/time, range),

spatial (Region, latitude/longitude, range), target (Satellite (SLR, DORIS)) and designation (Station name/number/code/DOMES number (future)). The results are:
–Map of sites satisfying specifications
–List of sites satisfying specifications
–List of data holdings satisfying specifications (future)
–Metadata relevant to selection
–Site log for site selection
This Application expected to be available through the CDDIS website in June 2015. An example is shown in the presentation.

3.4. **Status of the articles submitted to ASR (DORIS Special Issue) (Ernst Schrama & Frank Lemoine)**

DORIS Special Issue Paper Status (December 28, 2015)
Status Total Accept & online 5
Minor Revision 2
With Editor 2
Decision in Process 1
Major Revision (≥ 2nd cycle of review) 5
Reject 1
Reject (Resubmit as two papers) 1
Accepted manuscripts, available online:
Jayles, C., P. Exertier, N. Martine, P. Chauveau, E. Samain, C. Tourain, A. Auriol and P.Guillemot,
"Comparison of the frequency estimation of the DORIS/Jason2 oscillator thanks to the onboard DIODE and Time Transfer by Laser Link experiment", Adv. Space Res., doi:10.1016/j.asr.2015.08.033.
(In Press, Available online 5 September 2015).
Belli, A., P. Exertier, E. Samain, C. Courde, F. Vernotte, C. Jayles, A. Auriol,
"Temperature, Radiation and Aging Analysis of the DORIS Ultra Stable Oscillator by means of the Time Transfer by Laser Link Experiment on Jason-2", Adv. Space. Res., doi:10.1016/j.asr.2015.11.025, 2015.
(In Press, Available online 28 November 2015)
Bloßfeld, M., M. Seitz, D. Angermann, G. Moreaux,
"Quality assessment of IDS contribution to ITRF2014 performed by DGFI-TUM", Adv. Space Res., doi:10.1016/j.asr.2015.12.01.
(In Press, Available online 18 December 2015).
Zelensky, N.P., F.G. Lemoine, D.S. Chinn, B.D. Beckley, O. Bordyugov, X. Yang, J. Wimert, D. Pavlis,
"Towards the 1-cm SARAL orbit", Adv. Space Res., doi:10.1016/j.asr.2015.12.011.
(In Press, Available online 19 December 2015).
Moreaux, G., F.G. Lemoine, H. Capdeville, S. Kuzin, M. Otten, P. Stepanek, P. Willis, P. Ferrage,
"The International DORIS Service contribution to the 2014 realization of the International Terrestrial Reference Frame", Adv. Space Res., doi:10.1016/j.asr.2015.12.021.
(In Press, Available online 24 December 2015)

3.5. **IDS news (web site news)** (By Laurent Soudarin)

1. Data:
About the initial values of CoM, IDS BC proposes to remove initial values in the header of the *sat*mass.txt files and to create a new file with the list of initial values. This file contains only one type of data: the initial values and the *sat*mass.txt files will contain only one type of data: the variations.
CNES proposes to describe SARAL's maneuvers with 3 thrusts instead of 1 in the maneuver file srlman.txt. The format of the maneuver files allows this possibility (ftp://ftp.ids-doris.org/pub/ids/satellites/man.readme).
2. Products:
Sp3 orbits in the new GDR-E standards are flagged with a version number VV=10 in the file name delivery of GDR-E orbits. See file doris/products/orbits/ssa/README_SP3.txt.
3. Website
-3D satellite animations and new page « Missions » (in progress)

-new tables of Data and Products
-new page Documentation
-IDS Workshop and AWG presentations on one page
-new table members of Governing Board
4. Webservice
-new EOPtool
5. Ftpsite
-lists of Earthquakes, discontinuities ITRF2008, evolution of Constellation
6. Other: check ACs
AC summaries available in the Table on the IDS website at http://ids-doris.org/contribution-itrf2013.html are used as reference in several papers submitted for ASR's DORIS special issue. BC proposes to change the URL of the current page to combination/contribution-itrf2014.html (The current address can be keeped as an alias for the new URL).

Action 7 (all ACs): IDS BC invites ACs to check the information given in the Table on the IDS website at http://ids-doris.org/contribution-itrf2013.html. The table was filled in before it was decided to include year 2014 for the ITRF.

3.6. Discussions / Action Item Review

- **Routine production**
  ACs Status for the last delivery (from 2015-001 to 2015-157):
  Since this AWG all ACs have provided their solution to CC
  Increase the rate of production?
  As we no longer need to wait DORIS SPOT5 corrected by SAA model (end of the mission end 2015), is it relevant to increase the production rate.
  If there are no external needs, we keep a rate of 3 months.

- **RINEX data processing**
  ACs status:
  - IGN AC: in progress
  - GRG AC: awaiting re-delivery of RINEX PANDOR for new tests
  - GSC AC: awaiting re-delivery of RINEX PANDOR for new tests
  - GOP AC: in progress, scheduled at the end of 2015
  - INA AC: depends of IGN
  - ESA AC: in progress, deadline for Sentinel-3A launch

- **Open points following ITRF reprocessing**
  1. **Jump in DORIS scale (2012 and later)**
     All the DORIS Analysis Centers observe the jump in scale. Presently the only substantive clues are that the jump seems more prominent for the DORIS analysis centers that use the data-supplied corrections and that although Cryosat-2, Jason-2 and HY-2A seem implicated, it is HY-2A that seems to cause the largest jump in scale. The scale jump in 2012 is also seen when GRG AC uses DORIS RINEX data. They also showed that there is no scale jump for HY-2A but the scale value is high and increases clearly the multi-satellite scale jump. The scale jump in 2012 is less prominent when we compare to the ITRF2014P and less clear for Jason-2 than Cryosat-2.
     Still under investigations
  2. **HY-2A results**
     We have a radial offset of ~3 cm (visible in the HY-2A scale factor)
     GRG AC has also a high Tz value
     Is it also seen by others ACs? What about an HY-2A test campaign?

Action 8 (P.Ferrage and L. Soudarin): CNES has to contact Chinese agency to have information in particular for the CoP DORIS position. The goal is to obtain information by showing results of HY-2A of scale factor for example.

Action 9 (volunteer ACs): provide a HY-2A single satellite solution to IDS CC at least one year (5 years [2011-2015] in the best case).

3. **Scale issues on SPOT-5 (sawtooth pattern) / SPOT attitude**
    The SPOT-5-only scale clearly showed a sawtooth pattern with breaks. The discontinuities are of the order of -20 mm, so they are significant. Although no obvious cause has been found, efforts to understand these variations should continue, in particular to understand if something intrinsic to the SPOT-5 DORIS USO might be the cause.
    Note for GRG single satellite solution, after 2012, the scale is smoother when we compare to ITRF2014P against ITRF2008.
4. Center of Mass of Saral.
    The initial center of mass position in Z (along cross-track) for Saral was estimated using DORIS data: the pre-launch position in the +Z direction was -0.6583m. The estimated initial position is now -0.6105m. This new value is the one implemented in CNES POE processing since Nov. 6, 2014 and in geometrical correction in the DORIS 2.0 files.
    The document describing the satellite models implemented in POE processing
    ftp://ftp.ids-doris.org/pub/ids/satellites/DORISSatelliteModels.pdf has been updated and The Z value of the initial center of gravity in the header of the "mass and center of mass" history file of Saral has also been updated.
    L. Soudarin has proposed to IDS a file containing the CoM initial values and a file of mass history wo information of CoM position (see before).
    Re-delivery of the doris2.2 data taking into account the new value of CoM from the beginning of mission to Nov. 6, 2014 by CNES POD team?
    There is no particular urgency, that could be done at the end of Saral mission for example.

Action 10 (P.Ferrage and L. Soudarin): CNES has to contact Indian agency to have information. The goal is to obtain information by showing results.

- **ITRF2014 point**
  Implementation of ITRF2014P
  If ACs need help to implement in their POD software the post-seismic models they can contact those that have already done (GSC AC, GRG AC, IDS CC, CNES POD team). Discussions are underway on this topic.
  IDS CC (G. Moreaux) proposes to give to ACs the temporal series of stations impacted by post-seismic model ITRF2014. (Action 4)
  Evaluation of ITRF2014P
  See above, section 2.3.
  Since this AWG, the DGFI (M. Seitz) asked to the IDS Analysis Coordinators to propose to IDS CC, ACs and associates to evaluate their solution available since mid-December. GSC and GRG ACs, IDS CC and CNES POD team will make that evaluation. DGFI do not give deadline, however a feedback before EGU would be fine.
  Z. Altamimi (IGN) has announced that the ITRF2014 will be available at the end of January 2016.
  The JPL will provide his solution for evaluation at the end January 2016.

Action 11 (ACs and associates, CC, CNES POD team): evaluate the DTRF2014 (DGFI solution). No deadline, however a feedback before EGU would be fine.

- **Next Models/Standards**
  Gravity field:
  See presentation of R. Biancale and JM. Lemoine
  Dealiasing products:
  If you use the CNES/GRGS gravity field as EIGEN-6S2.extended.v2, you can ask to CNES/GRGS team which dealiasing product to be used if TUGO products are not available (for example AOD1B products). A possible

way is to do like the CNES POD team who uses a mean gravity field as EIGEN-GRGS.RL03-v2.MEAN-FIELD without dealiasing products.

To try to understand the outstanding points following the ITRF reprocessing, IDS Analysis Coordinators ask to IDS ACs to provide a single satellite solution for all satellites to IDS CC over 5 years [2011-2015]. So we propose to change the action 9:

Action 9 (volunteer ACs): provide a HY-2A single satellite solution to IDS CC at least one year (5 years [2011-2015] in the best case).

Replaced by:

Action 9 (volunteer ACs): provide a single satellite solution for all satellites to IDS CC over 5 years [2011-2015].

4. Actions review

4.1. **Actions in progress**

Here, we give the list of the previous actions. We write in red italics the closed actions.

Action 1 (Pascal Willis): check Jason-2 scale with PPP solution

Action 2 (all ACs): adjust Zoffset over one year 2014

(closed and replaced by the new Action 3, see below)

Action 3 (all ACs): HY-2A test campaign, provide one year of single satellite solution to IDS CC (2014 for example)

(closed and replaced by the new Action 8, see below)

Action 4 (F. Lemoine): provide the list of suspect attitudes for SPOT satellites (apart from 2011).

Action 5 (all ACs): plot histogram of residuals for SPOT-4/5, JASON-2 and CRYOSAT-2. See if the center moves according to the elevation.

Action 6 (A. Couhert & P. Ferrage): Provide in the official documentation the 2 values for the COM offset: one from Frank (used also by GRG), the other one from CNES POD team (A. Couhert), to inform IDS AWG when CNES POD has changed the COM value in the DORIS data.

(closed, it was decided that only the CNES POD team value is written in the official documentation)

Action 7 (GOP AC): check strange Tz behavior of CRYOSAT-2

Action 8 (GRG AC): test CRYOSAT-2 quaternions from Ernst Schrama (TU Delft). Before, we have to take into account the last exchanges between Ernst and Frank about quaternions of Cryosat-2. Indeed, the quaternions do not include the 6 deg pitch. It means we need to do an additional quaternion multiply or matrix multiply to correctly represent the orientation of the s/c - w.r.t. J2000.

(closed)

Action 9 (Z. Altamimi): provide an example of file with the new parameterization, including post-seismic deformation at sites with large earthquakes and annual and semi-annual signals. ACs need examples and documentation in order to begin planning implementation.

(closed, PSD implementation has been done by some ACs, CNES POD team and IDS CC)

Action 10 (IDS CC, CNES POD team, GFZ, GSC AC, and GRG AC): to evaluate ITRF2014 when it will be provided by ZA

(closed, the evaluation has been done by some ACs, CNES POD team and IDS CC, see above)

Action 11 (G. Moreaux): continue POD activity (in progress)

Action 12 (all ACs): to provide orbits in SP3 format at Data Centers

Action 13 (J-M. Lemoine): he is supposed to examine the different products of dealiasing available and report ASAP.

(closed)

Action 14 (J-M. Lemoine): make a model in which the extrapolation is based on the slope of the 3 last years of data (by opposition to the zero-slope used in the current model)

(closed)

Action 15 (Analysis Coordinators): Ask Michiel whether he does multi-sat or single-satellite gradient estimation.

Action 16 (CNES team): give the results of Alcatel antenna tests when available

4.2. **New actions**

We give here the list of the news actions:

Action 1 (GOP, other ACs): Check when GOP AC has problems in the SRP estimation (Saral and Cryostat-2) if it could be related to an event.

Action 2 (volunteer ACs): Behavior of the Cryosat-2 scale factor, do they observe several jumps?

Action 3 (GRG AC): Adjust an along-track acceleration for HY-2A, as it is done by GSC and CNES POD. See if there is an impact on Tz.

Action 4 (IDS CC): When the ITRF2014 will be available, IDS CC proposes to make available to the IDS ACs XYZ and NEU PSD corrections in ASCII file (One file per station and one line per week until 2020.0).

Action 5 (volunteer ACs): GFZ see an increase of the Jason-2 DORIS RMS since 2012. It is also seen by other ACs for Jason-2 and for other satellites. Give to Analysis Coordinators the temporal evolution of the DORIS RMS residuals for all satellites since 2011.0.

Action 6 (CNES, G. Moreaux, JM. Lemoine): To correct this time-tagging data error in the PANDOR software. Once implemented, CNES could re-delivery the RINEX data files.

Action 7 (all ACs): IDS BC invites ACs to check the information given in the Table on the IDS website at http://ids-doris.org/contribution-itrf2013.html. The table was filled in before it was decided to include year 2014 for the ITRF.

Action 8 (P.Ferrage and L. Soudarin): CNES has to contact Chinese agency to have information in particular for the CoP DORIS position. The goal is to obtain information by showing results of HY-2A of scale factor for example.

Action 9 (volunteer ACs): provide a single satellite solution for all satellites to IDS CC over 5 years [2011-2015].

Action 10 (P.Ferrage and L. Soudarin): CNES has to contact Indian agency to have information. The goal is to obtain information instrument positions.

Action 11 (ACs and associates, CC, CNES POD team): Evaluate the DTRF2014 (DGFI solution). No deadline, however a feedback before EGU would be fine.

5. Next Meeting

5.1. **Next AWG**

IDS AWG in May 26-27 2016 in DELFT (Holland), hosted by TU Delft (E. Schrama).

5.2. **Next IDS Workshop**

IDS WS in October 31-November 01 2016 in La Rochelle (France).