IGS Workshop Recommendations
Sydney 2016

Plenary #02:
Orbit Modelling
Rolf Dach and Marek Ziebart

Working program of the WG:
The IGS Space Vehicle Orbit Dynamics Group has much work still to do. Specific topics to be addressed:

- **On going efforts to collate SV structural, materials and attitude information**
- **Next generation Earth radiation flux modelling**
- **Creating a time series model of solar irradiance**
- **Generating surface force models for all space vehicles of concern to the IGS**
- **Carrying out proof of concept tests with selected partners prior to development of new standards**

Summary from the session

- **Different important developments have taken place in the field of orbit modeling within the last years**
  - **in the "Space Vehicle Orbit Dynamics" working group but also**
  - **in the IGS operational/reprocessing as well as in the IGS-MGEX solutions.**
- **Many promising models have been presented during the week and in the session in particular.**

Recommendation

1. **It is recommended to the IGS analysis center to evaluate the new orbit models and advance their processing scheme accordingly.**
2. **The IGS shall support the initiative to acquire access to relevant data for all systems from the ICG. The list of items of interest have to be consolidated and published at the IGS website.**

Workshop 2016 - Recommendations : Entry # 3629

Session/Splinter Meeting Title

P06 - Reference Frame

Rapporteur

Paul Rebischung

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Key Issues, Session / Discussion Highlights

Discussions were mostly focused on the new ITRF2014 realization and on the post-seismic deformation models coming along with it. The procedure for the preparation and implementation of its IGS realization have been defined. IGS14 is planned to be adopted in the second half of 2016, together with the updated ANTEX file igs14.atx.

Recommendation

Recommendation	Responsible to implement (first and last)	Email	Timeframe needed to accomplish this?
Prepare, implement, test and adopt the IGS14/igs14.atx framework	RFWG in collaboration with AWG, IC, ACC and ACs	paul.rebischung@ign.fr	7 months
Revisit the consistency of repro2 station position time series with loading models	RFWG	paul.rebischung@ign.fr	2 years

Workshop 2016 - Recommendations : Entry # 3621

Session/Splinter Meeting Title

SS01 - MGEX (Theatre A)

Rapporteur

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Key Issues, Session / Discussion Highlights

- MGEX network has been integrated into IGS network
- Currently six MGEX ACs, 3 offering 5-constellation products; can start to think about combination
- Modeling (SRP, attitude, antenna) remains a key issue for improved accuracy of products
- Ensure tansparencey of employed models (more important than strict harmonization)

Recommendation

Recommendations	Who is responsible to implement (first and last)?	Email	What timeframe is needed to accomplish this?
Introduce SP3d in MGEX products AND make ACC s/w SP3d tolerant	Steve Hille (publish format), MGEX ACs adopt, IGS ACC adopt		mid 2016
Adopt new product naming scheme within IGS	MGEX ACs		mid 2016
Promote use consistent (pilot-only) tracking modes and secondary-code phase by all receivers	MGEX, Bias, and RINEX/RTCM WG		end 2016
Promote robot calibration of receiver antennas for new constellations and signals	Antenna WG, Geo++, GA		end 2016
Update ANTEX with estimated PCOs for Galileo and BeiDou	MGEX and Antenna WG		mid 2016

Workshop 2016 - Recommendations : Entry # 3626

Session/Splinter Meeting Title

SS02 - TIGA (Theatre B)

Rapporteur

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Key Issues, Session / Discussion Highlights

- discussion about the extension of the TIGA-repro to end of 2014 for all TACs
- discussion about the the interaction with the radar altimetry community (TIGA primary adresses long-term trends)
- decline in the number of "active" contribution stations
- local ties (levelling) issues
- TIGA Combination by University of Luxembourg
- Priority Report to GLOSS by Matt King

Recommendation

Recommendation	Responsible to implement (first and last)	Email	Timeframe needed to accomplish this?
IGS encourages users and contributors to consider recommendations made in the report "Priorities for installation of continuous Global Navigation Satellite System (GNSS) near to tide gauges. Report to Global Sea Level Observing System (GLOSS)" by King, M.A. (2014) for the densification and extension of the TIGA Observing Network.		tschoene@gfz-potsdam.de	ongoing
IGS encourages the archiving of new and historic GNSS data and metadata near to tide gauges in international public archives.		tschoene@gfz-potsdam.de	ongoing
IGS encourages users and contributors to support the establishment and maintenance of local ties between GNSS and tide gauge benchmarks in support of GLOSS, GGOS, the GGOS Unified Height System Focus Area, the GGOS Sea-Level Rise and Variability Focus Area, and the Sea Level Community.		tschoene@gfz-potsdam.de	ongoing

Workshop 2016 - Recommendations : Entry # 3620

Session/Splinter Meeting Title

SS03 - Troposphere (Theatre C)

Rapporteur

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Key Issues, Session / Discussion Highlights

Tropo SINEX format finalization was discussed in the context of ACs submitting their tropo results to be included in the the comparison database. There was also interest in the ACs recieving a regular comparison email of the AC results to the the final tropo estimates as a method for feedback to the ACs in a similar vein to the feedback received via ACC combination emails and other other emails sent out by other working groups. The question of who downloads/uses the tropo file sent in by the individual ACs was raised since these results are not used in a combination product.

Recommendation 1

Distribute the final tropo SINEX format once it is finalized (waiting on finalization)

Who is responsible to Implement?

Sharyl Byram

Email

sharyl.byram@usno.navy.mil

What timeframe is needed to accomplish this?

Hoping for finalization this year. Will distribute when finalized.

Recommendation 2

Look into AC tropo comparison report as next step to the tropo comparison database implementation.

Who is responsible to Implement?

Sharyl Byram

Email

sharyl.byram@usno.navy.mil

Workshop 2016 - Recommendations : Entry # 3628

Session/Splinter Meeting Title

SS04 - Bias and Calibration (Theatre A)

Rapporteur

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Key Issues, Session / Discussion Highlights

The main focus was on the finalized proposal for the Bias-SINEX Format Version 1.00. Recently added features and a number of technical issues could be introduced, discussed, and clarified.

Recommendation

Recommendation	Responsible to implement (first and last)	Email	Timeframe needed to accomplish this?
The Bias-SINEX Format Version 1.00 shall be considered for tentative approval by the IGS.	Stefan Schaer	stefan.schaer@aiub.unibe.ch	-
Test implementations have to be carried out by the IGS MGEX analysis community using this format update (V1.00).	Stefan Schaer	stefan.schaer@aiub.unibe.ch	1 year
After satisfying comparisons of GNSS bias product files generated following the new standards, the Bias-SINEX Format Version 1.00 shall be finally approved.	Stefan Schaer	stefan.schaer@aiub.unibe.ch	-

What timeframe is needed to accomplish this?

First step is to guage interest from the ACs (by the end of the year). The reporting requirements will then need to be determined if there is enough interest of using this as an additional feedback tool.

Recommendation 3

n/a

Who is responsible to Implement?

n/a n/a

Email

sharyl.byram@usno.navy.mil

What timeframe is needed to accomplish this?

n/a

Workshop 2016 - Recommendations : Entry # 3624

Session/Splinter Meeting Title

SS05 - Antenna Calibration (Theatre B)

Rapporteur

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Key Issues, Session / Discussion Highlights

also applies for antenna part of P07!

Recommendation

Recommendation	Responsible to implement (first and last)	Email	Timeframe needed to accomplish this?
Geoscience Australia is accepted to serve as an IGS antenna calibration facility.	Ralf Schmid	schmid@tum.de	1 month
In order to guarantee unique IGS space vehicle numbers for GLONASS, GLONASS numbers "701..." (GLONASS-K) and "750..." (GLONASS-M) are converted to "R801..." and "R850...", respectively.	Ralf Schmid	schmid@tum.de	1 month
The IGS starts to collect individual calibrations of antennas installed in the IGS network and makes them available for validation. The IGS encourages studies assessing their potential benefit for multi-year time series and products.	IGS CB		open end

SS06 – Real-Time

Axel Rülke

Recommendation 1
Work to provide validated real-time navigation message streams for: GPS, GLONASS, Galileo, BeiDou and QZSS

Recommendation 2
Communicate with station operators and encourage them to adopt MSM type 7 types (also meta data types and output frequency)

Recommendation 3
Review and optimize the observation and correction data collection and distribution caster architecture to optimize performance and improve redundancy

Recommendation 4
Work with RT-ACC and RT-ACs to reduce combination latency from ~25 seconds to less than 10 seconds

Recommendation 5
Support the new IGMA constellation monitoring project

Workshop 2016 - Recommendations : Entry # 3623

Session/Splinter Meeting Title

SS07 - AC + Reference Frame (Theatre A)

Rapporteur

Thomas Herring

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Key Issues, Session / Discussion Highlights

In general, implementation of ITRF2014 to replace current IGb08 system.
Adoption of postseismic deformation models in ITRF2014
Re-computation of phase center offsets (PCO) values to bring GNSS scale into consistency with ITRF2014 scale. Average scale difference is -0.5 pub (GNSS-ITRF2014).
Development of the list of preferred IGS sites for IGS AC to include processing and the list of core sites.

Recommendation

Recommendation	Responsible to implement (first and last)	Email	Timeframe needed to accomplish this?
The IGS combination center should recompute the phase center offsets (PCO) values of the GNSS satellites to bring the GNSS scale into consistency with the ITRF2014 scale. The IGS ACs should implement mechanisms that allow them to incorporate the post-seismic deformation model components of ITRF 2014 in their processing. The new PCO model, list of preferred IGS sites and the list of core sites should be ready for evaluation by June 2016 with a possible switch over time in September 2016. The official switch over date will be coordinated with the IERS.	Thomas/Michael Herring/Moore	acc@igs.org	June 2016 for initial evaluation with adoption possible in September 2016 coordinated with the IERS.

Workshop 2016 - Recommendations : Entry # 3622

Session/Splinter Meeting Title

SS08 - Ionosphere (Theatre B) Splinter Groups

Rapporteur

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Key Issues, Session / Discussion Highlights

This Plenary Session has been a forum for discussing possible improvements of IGS ionospheric products by incorporating 3 new VTEC GIMs which performance is compared performances jointly with the existing 4 VTEC GIMs in the IGS context, empirical models such as IRI model and diagnosing the Impact of GLONASS observables on receiver bias estimates

The Splinter session has also included a summary of the activities of the IGS Ionosphere Working Group, updates and future plans especially for introducing GIMs from 3 new IGS Ionosphere Analysis Centers: NRCan,Canada, CAS-IGG, China and WHU, China. Moreover the possibility of adopting the new proposed IONEX format has been discussed. The Ionospheric WG has been informed as well on the ongoing activities characterizing ionospheric variations at different scales from IGS data (such as UWM ROTI polar maps, UPC Solar EUV flux rate proxy).

Recommendation

Recommendation	Responsible to implement (first and last)	Email	Timeframe needed to accomplish this?
To accept CAS-IGG, NRCan and WHU as new Ionospheric Analysis Centers, contributing to the IGS combined VTEC GIMs,.	Andrzej Krankowski	kand@uwm.edu.pl	3 months
The IONEX format shall be updated in order to accommodate contributions from multiple constellation and adequately describe the associated differential code biases.	Andrzej Krankowski	kand@uwm.edu.pl	1 year
Cooperation with IRI COSPAR group for potential improvement of both IRI and IGS TEC.	Andrzej Krankowski	kand@uwm.edu.pl	2 years
Cooperation with International LOFAR Telescope (ILT) for potential synergies	Andrzej Krankowski	kand@uwm.edu.pl	2 years

Workshop 2016 - Recommendations : Entry # 3625

Session/Splinter Meeting Title

SS09 - IC+DCWG+RINEX (Theatre A)

Rapporteur

Carey Noll

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Key Issues, Session / Discussion Highlights

The IGS DCWG splinter meeting was held in conjunction with the IGS Infrastructure Committee (IC) and RINEX Working Group. The DCWG portion of the splinter meeting reviewed recommendations from the 2014 workshop, of which all three were completed. The main issues discussed at the splinter meeting revolved around supporting the integration of RINEX V3 data into the operational IGS archive, mainly by accepting data using the new RINEX V3 filename format.

The current parallel structure found at the DCs supporting MGEX limits the motivation of the ACs to switch to the RINEX V3 format. Integration of the two data archives promotes use of multi-GNSS data and the new format. The IGS IC developed the transition plan to accomplish the integration and the IGS DCs (CDDIS and IGN) began integration of RINEX V3 data using the V3 filenaming convention into the operational archives in early 2016.

The DCWG will work with the IC on using new tools such as Anubis to QC RINEX V3 data and supply the QC information at the data centers in summary/status files as has been done for RINEX V2 data.

Questions to be addressed include how to handle RINEX V3 data not supplied in the new filename convention. DCs could use tools such as gfzrnx to create these files with long filenames at the DCs but getting the files from the station operators is preferred.

Recommendation

Recommendation	Responsible to implement (first and last)	Email	Timeframe needed to accomplish this?
Encourage providers of RINEX V3 data to submit files (daily/hourly/high-rate) using V3 filename conventions to IGS data centers by the end of 2016. Until this task is implemented by the stations, GDCs should create the files using the V3 naming conventions.	DCWG/IC	carey.noll@nasa.gov	2016

ACs and users in general should begin utilizing RINEX V3 data in the V3 filename format.	ACs/Users		2016
Encourage DCWG to strive for implementation of XML Site Log Metadata System. In addition, encourage stakeholders to submit use cases (examples of the required interactions with the system) for XML Site Log Metadata System.	DCWG	fboler@unavco.org	2016

Workshop 2016 - Recommendations : Entry # 3630

Session/Splinter Meeting Title

SS09 - IC+DCWG+RINEX (Theatre A)

Rapporteur

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Key Issues, Session / Discussion Highlights

Navigation bit network and data gathering and storage for long term discussed and agreed as support to the RO community.

Rinex 3 transition to continue to be supported in-line with the approved transition plan

Station network to continue to be extended by multi-GNSS area after good progress in AsIa try to make progress with multi-GNSS in US and Mexico.

Rinex 3 evolution (3.04) discussed and agreed ; CNAV will be included, some Beidou changes will be included when new Beidou ICD is released, etc.

Data Center issues where submitted independently

Recommendation

Recommendation	Responsible to implement (first and last)	Email	Timeframe needed to accomplish this?
IC-01 ; Establish an NBS (nav bits) data product in the IGS	Infrastructure Committee	Ignacio.Romero@esa.int	2 years
IC-02 ; Continue to support the implementation of the RINEX 3 transition Plan	Infrastructure Committee	Ignacio.Romero@esa.int	1 year
IC-03 ; Continue to support the NC in the expansion of the IGS station network	Infrastructure Committee	Ignacio.Romero@esa.int	2 years