

Recommendations of the 2014 Unified Analysis Workshop (UAW)

June 27-28, 2014 California Institute of Technology.

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Aims of the workshop and issues to be addressed

The following topics were the main ones to be addressed at the Unified Analysis Workshop. Papers were invited that would address these areas and follow-up after the workshop should lead to resolution or a better understanding of the issues. There is no specific order to the issues listed below but some are more critical to be addressed than others.

(1) ~1 ppb scale difference between VLBI and SLR. This issue is critical to the ITRF realization and should be addressed as thoroughly as possible.

(2) Antenna phase center models for DORIS systems. The recent implementation of phase center models for the DORIS ground transmitters has increased the scale difference between DORIS results and the ITRF2008 scale. It is likely this difference will persist with ITRF2013 as well

(3) Time variable gravity field effects (DORIS LEO satellites). Although the IDS raised this issue, it also has impacts on the ILRS and even GNSS orbits could be affected by time variable low degree gravity field coefficients.

(4) Sub-daily loading and S1/S2 loading. Two issues are involved here (a) the coefficients of the S1 and S2 loading signals and how they vary during the year and (b) the effects of any remaining sub-daily variations after the S1 and S2 terms are removed.

(5) Update time scales for atmospheric and hydrographic loading: Frequency dependence and signal to noise ratio of loading?

(6) Diurnal and Semidiurnal EOP variations. Impact of new models available from the IVS and how these model impact geodetic parameter estimates.

(7) EOP parameterization for high-time resolution representation: Is piece-wise linear adequate for current accuracies?

(8) Collocation issues: Ground and space based: Assessment of where we stand at the moment.

(9) Monument stability (Large and small, physical and electrical): UNAVCO and NASA SGP have been studying this issue and there are measurements that try to address this issue.

(10) Intersystem observations (e.g. VLBI of satellites, SLR of GNSS systems): Assessment of current status, future prospects and likely impacts on geodetic parameter estimates.

(11) Error models for data and parameter estimates: What are the impacts and best methods for determining correlations within and between geodetic systems and how do account for these correlations so that error estimates on geodetic parameters are more robust and realistic.

(12) Unification of gravity contributions: How do we start addressing the integration of gravity services with the geometric services to ensure consistent models and results?

(13) Combination at the Observation level (COL) results. Update on current status and long term impact of these approaches.

Schedule of Talks with links to presentations

Friday June 27	
Session 1: 14:00-15:30	VLBI/SLR scale I
Zuheir Altamimi (IGN)	Current estimates of scale differences between techniques
John Ries (UT)	The Scale of the Terrestrial Reference Frame from VLBI and SLR
Johannes Boehm, Hana Krana, Matt King	GIA effects on VLBI scale rate
Erricos C. Pavlis ¹ , V. Luceri ² , M. Kuzmich-Cieslak ¹ and K. Evans ¹ ¹ GEST/UMBC, Baltimore, MD, USA ² ASI/CGS, Matera, Italy	Modeling Changes for the ILRS Reanalysis for ITRF2013
Session 2: 16:00-18:00	VLBI/SLR scale II
Dan MacMillan (NVI)	VLBI Scale Effects
V. Luceri, B. Pace (e-GEOS S.p.A., ASI/CGS), E. Pavlis (GEST/UMBC), G. Bianco (Agenzia Spaziale Italiana, CGS)	SLR systematics and TRF scale
Graham Appleby, Jose Rodriguez (SGF Herstmonceux ILRS Analysis Centre)	Accuracy assessment of the ILRS network and potential impact on ITRF scale

A. Auriol, F. Boldo, C. Jayles, C. Tourain (CNES) (Frank Lemoine)	DORIS Ground Antenna Characterization
Saturday June 28	
Session 3: 09:00-10:30	Geophysical Fluids I EOP and Loading
Daniela Thaller, Ole Roggenbuck, Gerald Engelhardt, Sonja Geist (BKG)	Geophysical fluids: Models and their impact on space-geodetic solutions
John Gipson (NVI)	High Frequency Tidal EOP from Space Geodesy and Ocean Modeling
J.M. Hagedoorn ^{1,4} , H. Schuh ^{1,4} , M. Madzak ² , W. Bosch ³ ¹ Department 1: Geodesy and Remote Sensing, GFZ Potsdam German Research Center for Geosciences ² Research Group Advanced Geodesy, Department of Geodesy and Geoinformation, Vienna University of Technology ³ DGFI German Geodetic Research Institute, Munich ⁴ Satellite Geodesy, Department for Geodesy and Geoinformation Sciences, Technical University of Berlin (Harald Schuh)	Short Period Ocean-Tidal variations in Earth rotation
Session 4: 11:00-12:30	Geophysical Fluids II S1/S2
Shailen Desai ¹ , Willy Bertiger ¹ , Bruce Haines ¹ , and Richard Ray ² ¹ Jet Propulsion Laboratory, California Institute of Technology ² NASA Goddard Space Flight Center	Self-Consistent Treatment of Tidal Variations in the Geocenter for Satellite Geodesy

Johannes Böhm, Hana Krásná, Michael Schindelegger	S1/S2 Loading Effects
Saturday June 28	
Session 5: 14:00-15:30	Analysis methods
R. Biancale (CNES), D. Gambis (OP), M. Seitz (DGFI)	After 4 years of COL activities
Frank G. Lemoine (GSFC)	Time-variable gravity effects on LEO satellites
John Gipson (NVI)	What Do Our Time-Tags Refer to?
<i>Break 15:30-16:00</i>	
Session 6: 16:00-17:00	Monument Stability
Jérôme Saunier (IGN, service de géodésie et nivellement) (Frank Lemoine)	Monument Stability: DORIS Network Experience Feedback
Thomas Herring (MIT)	UNAVCO/GGAO monument study

UAW Recommendations

Draft of resolutions

- VLBI/SLR/DORIS scale differences
 - There should be a re-assessment of the relativist formulations for VLBI and satellite based systems. (Explore LLR and interplanetary tracking “scale differences”)
 - IVS: Explore possible systematic height errors from radio telescope deformations.
 - ILRS: Explore impact of range biases on SLR height estimates and the potential impact of blue sky (high atmospheric pressure) ranging
 - IDS: Explore antenna phase center model for satellite receiving antennas.
 - Re-accounting of atmospheric delay effects and pressure sensors.
 - Exam the temporal behavior of the scale behavior within each technique to assess the variability of the scale estimates.
 - Chair of the IERS Convention Center should have a sub-group reassess the relativity models being used by the techniques.

- Geophysical Fluid I EOP
 - Assessment of empirical and tide based models for diurnal and semidiurnal EOP variations.
 - Assess non-tidal, high frequency EOP variations. Exam hourly estimates of EOP estimates from VLBI and GNSS after removal of tide models to assess the magnitude and consistency between the techniques.
- Geophysical Fluid I Loading
 - Development of models for consistent deformation and gravity for atmosphere, hydrology and non-tidal ocean.
 - Assessment of error models of different loading models as a function of type and frequency. If possible, error estimates for the “signals” missing from the models should be determined. For example, hydrologic models often have 1-month time resolutions. What could be the magnitudes the sub-monthly variations that are averaged by the models?
- Analysis methods
 - Determine the impacts of time variable gravity of the satellite based techniques and make recommendations on how to best implement these types of models for operation data processing.
 - Re-assess the solid-Earth pole tide model being used in operational processing and make recommendations on how to best implement and update these models in the future.
 - Gather analysis evidence for the impact of the ocean pole tide on satellite and geometric systems. For the satellite systems, make the assessment as a function of the altitude of the satellites being tracked.
- Monument stability
 - Develop a list of monument site issues from the operators. Collocation and reference frame sites should be highest priority. Repeated site surveys (bar code leveling instrumentation and possibly tilt meter installation) if possible.