



COL Working Group Meeting

21-22 November 2011, Observatoire de Paris



Combination at the
Observation Level
IERS Working Group

Agenda, 21 November

13:00 *welcome*

13:30 *introduction and reminder of actions decided at the last meeting, R. Biancale*

13:45 *Status on software and activities in the COL Analysis Centres (15 mn each)*

1. *AIUB / BKG, D. Thaller DGFI, M. Seitz*
2. *ESOC, T. Springe*
3. *GFZ, R. Koenig*
4. *GRGS, R. Biancale*
5. *(ASI, C. Sciaretta)*
6. *GSFC, F. Lemoine*
7. *TUW, H. Spicakowa*
8. *other*

15:30 *pause*

16:00 *continuation AC*

16:30 *activities in the COL Combination Centres (15 mn each)*

1. *DGFI, M: Seitz*
2. *GRGS, D. Gambis, J.-Y. Richard*

17:00 *discussion on test period and data, a priori models and parameters, SINEX files compatibility/comparison strategy and results*

17:30 *adjourn*



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09:00 *discussion on roadmap (tasks and sequence)*

09:30 *proposal on test reiteration:*

1. *standards*
2. *data sets*
3. *parameter sets*
4. *SINEX evolutions*

10:30 *discussion on combination*

1. *strategy and methods*
2. *objectives to be reached*
3. *planning of work*

11:30 *activity report*

12:00 *summarizing next actions and schedule*

12:30 *end of meeting*

COL history

2008 – proposal for creating a WG on Combination at observation level

2009 (21-22 October) – kickoff meeting of the COL-WG / Warsaw

2010 (3 June) – intermediate meeting / Vienna

2010 (9-10 December) – 2nd COL meeting / Munich

2011 (5 April) – intermediate meeting / Vienna

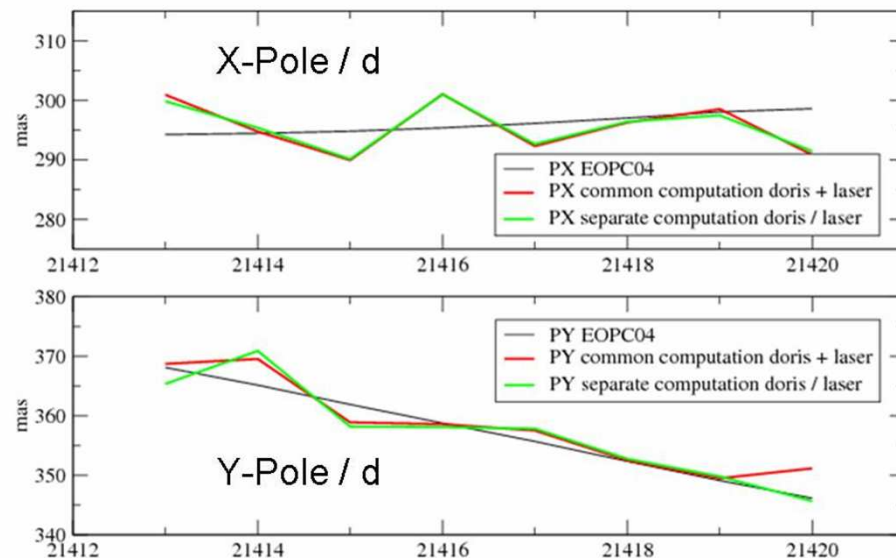
2011 (21-22 November) – 3rd COL meeting / Paris

COL objectives

COL-WG major tasks will be **to study methods and advantages of combining techniques at the observation level**, searching for an optimal strategy to solve for geodetic parameters.

Demonstration is based on **weekly combined modified SINEX files** (actually containing **unconstrained normal equations** of station coordinates, Earth rotation parameters, nutation parameters and quasar coordinates) from all space geodetic techniques together (SLR/LLR, GNSS, VLBI, DORIS).

Combination at the observation level can be equivalent to the normal equation level under the condition that **all common parameters must be combined together** (like tropospheric parameters).



Adjusted PM from combined DORIS-SLR data on a Jason2 7-day arc in August 2008

COL Roadmap (from the charter)

1) review the approach of the various groups

and their capability to process two or more techniques.

2) elaborating benchmarks

to intercompare results between groups from the same data set.

3) insuring SINEX compatibility

between techniques and with the international technique services and IERS.

4) establishing common processing standards

for all techniques in order to guarantee homogeneity and consistency.

5) optimizing and unifying parameterization

for instance for tropospheric parameters in order to minimize globally the degree of freedom of the whole inverse system and to reach consistency.

6) studying the appropriate weighting between techniques

and the use of local ties or identical satellites tracked by several techniques.

7) studying stabilization methods

and looking for high temporal resolution of parameters.

8) evaluating and comparing results

to search for compatibility between groups.

9) organizing routine operations

for a new TRF realization, either in the framework of the next ITRF or as ITRF assessment.

COL-WG participants and software packages

Analysis Centres	Techniques	Software
AIUB/BKG DGFI ESOC GFZ GRGS ASI TUW GSFC	SLR, GNSS SLR VLBI SLR+GNSS, +DORIS SLR+GNSS SLR,GNSS,VLBI,DORIS SLR VLBI SLR,GNSS, DORIS VLBI	Bernese 5.1 DOGS 5.0 OCCAM 6.1 LSM NAPEOS EPOSOC 06.61 GINS/DYNAMO GEODYN/SOLVE VieVS GEODYN/SOLVE CALC-SOLVE
Combination Centres		
DGFI GRGS		DOGS-CS DYNAMO

Discussion on models

- **Gravity field:** GRGS will provide the gravity field model computed from a GRACE-GOCE time variable model centered over the 3-week test period. This model will include averaged atmosphere and ocean current gravity variations.
- **Ocean tides :** FES2004 is consensus. Loading displacement for a few collocated sites (e.g. Greenbelt) should be check between groups. List of proper triple co-location sites during CONT08:
 - GPS-VLBI-SLR: Hartebeesthoek (30302), Concepcion (41719)
 - GPS-SLR-DORIS: Washington (40451), Mount Stromlo (50119), Tahiti (92201)
 - GPS-VLBI-DORIS: Kokee Park (40424), NyAlesund (10317)
- **Elevation cut-off angles** are different according to centers, although they are generally 10 degrees. No consensus.
- **Different weighting** are no problem for individual techniques (because they can be re-weighted) except for the combined techniques where the ratio cannot be changed.
- **Tropospheric delay :** GPT+GMF should be adopted among all groups except for SLR (Mendes-Pavlis). Horizontal gradients shall be estimated. Zenithal tropo delay and gradients should be included in the SINEX files (for co-location sites only).
- To simplify comparisons it is agreed that **no atmospheric loading** will be used.
- **Station coordinates :** ITRF2008.
- **EOP :** EOPC04_08 consistent with ITRF2008 (available beginning from January 2011).
- **GPS antenna phase centre (station and satellite) :** igs08*.atx (as soon as provided by IGS)

Discussion on parameters

- The high density of observations obtained during the CONT08 campaign allows to specifically study the sub-diurnal EOP variations. For this it is necessary to derive **hourly or 2-hour estimates**. This should be done by the various centers **in a second step** after those first results obtained for daily EOP estimations be consistent one to another.

- **Pole/UT1**: either piecewise linear (PWL) at 0h or offset+drift (OD) at 12 h, at the choice of the groups; the OD approach can be easily converted in PWL for combination. The interpolation between reference points is kept linear.

- For groups who can do **multi-technique processing** on **Jason-2, ENVISAT or GRACE** (LEO and GNSS processed together), satellite phase center coordinates in the satellite reference frame should appear in the NEQ as additional parameters.

-**Implementation of X/Y nutation parameters** (with partial derivatives) is now recommended. Only available presently in TUW.

M. Gerstl will provide a short paper on interpolation methods. There is in particular a need for adopting a reference procedure for the interpolation of the a priori EOPC04 for the data epoch. Paris Observatory will conduct some tests and propose a method of interpolation.

New tasks

- **Processing with updated and homogenized standards and parameters** to be finalized over the same 3-weeks period (10-30 August 2008 / CONT08)
- Extension to the **CONT11** campaign (15-29 September 2011)?
- Provide on the forum the **list of stations** used (for DORIS, VLBI, SLR, and GNSS)
- **New set of data** : LEO satellites, in particular Jason-2 with multi-technique (SLR, DORIS, GPS) or GRACE-A/B (SLR, GPS). To be provided by some groups on a volunteer basis
- Include LLR for dynamic realization of the celestial reference frame, complementary to kinematic realization of VLBI to contribute to long-term monitoring of nutation as well as pole and UT
- Increase EOP parameterization frequency