Lessons from ITRF2008 and future considerations

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Lessons from ITRF2008

- **Technical Considerations:**
  - **Impact and usage of local ties in ITRF combination**
  - **ITRF2008 accuracy**

- **Structural Considerations**
  - **Schedule to be agreed upon and respected for next ITRF solution**
  - **ITRF PC role**

Consistency btw local ties and space geodesy estimates

- GPS is linking SLR, VLBI & DORIS because
  - VLBI-SLR alone: 8 co-locations only
  - VLBI or SLR-DORIS alone : 10 co-locations only
- Tie discrepancies < 6 mm for:
  - 47% GPS-VLBI
  - 43% GPS-SLR
  - 34% GPS-DORIS
- Tie discrepancies > 10 mm for:
  - 30% GPS-VLBI
  - 30% GPS-SLR
  - 54% GPS-DORIS

Scale and weighting of local ties

Scales with respect to VLBI (ppb) at 2005.0

Case	SLR	DORIS	GPS	VF[1]	Tie handling
ITRF2008	-1.05 ±0.13	0.18 ±0.20	0.67 ±0.10	0.90	All tie SINEX files, weighted
ITRF2008 without EOPs	-1.11 ±0.26	0.04 ±0.31	0.41 ±0.19	1.66	All tie vectors, weighted
Case-1	-1.20 ±0.16	-0.31 ±0.34	0.49 ±0.14	4.00	Selection of local ties, $\sigma = 1$ mm
Case-2	-1.02 ±0.31	-0.30 ±0.84	0.52 ±0.31	31.70	Selection of local ties, $\sigma = 0.1$ mm
Case-3	0.0 [2]	0.48 ±0.32	1.28 ±0.08	4.28	Same as Case-1

[1] Variance Factor
[2] parameter eliminated from the normal equation; assumed to be equal to VLBI scale

Accuracy of ITRF2008 Origin

- Defined by SLR only
- Agreement with ITRF2005
  - 4.7 mm in Z-translation at epoch 2005
  - 0.3 mm/yr drift in X-translation

- ==> "Accuracy": 1 cm over the time-span of SLR observations

Accuracy of ITRF2008 Scale

- Defined by the average of VLBI and SLR
- Difference btw the two technique solutions:
  - 1.05 ppb at epoch 2005.0
  - 0.049 ppb/yr

- ==> "Accuracy": 1.2 ppb (8 mm) over the common time-span of VLBI and SLR observations

Uncertainties of the Transfer of SLR origin and SLR&VLBI mean scale to GPS frame

Ties used	TX mm	TY mm	TZ mm	Scale mm
Ties – SG Discrepancies < 6 mm	2.5	2.5	2.5	1.4
Ties – SG Discrepancies < 10 mm	1.4	1.1	1.2	1.2
All – SNX ITRF2008	0.6	0.5	0.6	0.6

Conclusion of Technical Considerations

- **Local ties:**
  - **All available ties should be used with proper weighting**
  - **The more ties used the more precise is the estimation**
- **Accuracy of ITRF2008 origin&scale: ~ 1 cm**
  - **Origin: ~ 1 cm**
  - **Scale : 1.2 ppb**
- **Technique-specific systematic errors**
  - **GPS uncalibrated radome**
  - **VLBI antenna gravitational deformations**
  - **SLR range/timing biases**
  - **DORIS beacon reference point behavior ?**

Structural Considerations (1/2)

- **Avoid repeating the ITRF2005 and ITRF2008 dilemma:**
  - **Harmful for IERS and the Technique Services**
  - **Users are confused and get less confident on IERS/ITRF**

- **Given the estimated ITRF2008 accuracy (~1 cm):**
  - **difference between IGN and DGFI solutions is less than 1 cm**
  - **despite DGFI unrealistic assumptions**

Structural Consideration (2/2)

- **IERS should take its responsibility and decide according to the agreed structure:**
  - **IERS has a mission of providing unique set of reference products**
  - **Reasonable and agreed schedule should be observed and respected for next ITRF solutions**
  - **Avoid soliciting the technique services to decide instead of IERS**
  - **Enforce the ITRF PC role ==> will improve the IERS image**
  - **ITRF PC solution is the official IERS standard solution, unless DGFI (or other groups) demonstrate something superior, but this did not happen for two times in the past**
  - **Encourage DGFI (& other groups) to do combinations**
  - **ITRFyy should reflect an IERS label and be unique**

    ==> request that DGFI names its TRF solutions differently, e.g. DGFI2008 or something similar