Quality assessment of SLR data-related products

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ITRFxxxx: From a meter to a millimeter accuracy

Weekly Orbital Fit [cm]

(Saunders, 2004)
Over the last few years

- Outline: as an analysis prior to ITRF2013
  - Methodological strategies
    - Bias or not bias estimation
    - a priori/a posteriori station coordinates / velocities
    - Other parameters (geocenter...)
  - Some features in SLRF2008
    - earthquakes
    - degradation with time of ITRF2008
    - station technological evolution
  - Possible improvements
    - one example
Followed Method

- LAG1 & LAG2 orbital arcs
- "Usual" dynamical modelling
- Data corrections provided by AWG (except CoM)
- Range bias estimated (weekly or 10-d)
- Last version of SLFR2008
- One set of coordinates over the whole period
- No velocity estimated
- Validation through the geocenter motion estimation

Geocenter (Annual : top, semi-annual : bottom)
Case: Zimmerwald station
Case: Yarragadee station
After new estimation of the station coordinates

Lageos1

Lageos2

SLRF2008
new network
ITRF2008, effect on an earthquake: Koganei

Station 7308 : Koganei (Domes 21704S002 )
v35, from 1998 to 2014

Coordinates (m)

ITRF2008, effect on an earthquake: Concepcion

Station 7405: Concepcion (Domes 41719M001)

v35, from 1998 to 2014
ITRF2008 features

- To be compared with other ACs, within the AWG
- Errors in position
  - horizontal: 7825 (Mount Stromlo), 7839 (Graz), 7845 (Grasse)
  - vertical: 7825 (Mount Stromlo), 7839 (Graz), 7845 (Grasse)
- Errors in velocity:
  - horizontal: 7110 (Monument P.), 7403 (Arequipa), 7405 (Concepcion), 7406 (San Juan)
  - vertical: 7403 (Arequipa), 7405 (Concepcion)
- Bias: 7308 (Konagei), 7110 (Monument P., 2008)
Suggestion for an improvement

- weight of a station following:
  \[ \sigma_{\text{station}} = \sqrt{\sigma_{\text{ITRF}}^2 + \Delta \sigma^2}. \]

  with

  - \[ \sigma_{\text{ITRF}} = \sqrt{\sigma_x^2 + \sigma_y^2 + \sigma_z^2} \]
  - \[ \Delta \sigma \] to over- or under-weight a station w.r.t. a typical well-known r.m.s., to correct operationally the ITRF fixed value.

  idea:

  - time dependency of the station quality
  - \[ \Delta \sigma \] time dependent
  - several iterations between \textit{a posteriori} and \textit{a priori} to derive an "optimum"
New results for Lageos-1
New results for Lageos-2

Orbit of LAG2
From 1998 to 2014

- a posteriori, iteration 0
- a posteriori, iteration 1
- a posteriori, iteration 2

rms (m)
Consequences for some stations

- Very small impact for good and stable stations
- Approach of interest for new or "unstable" stations

Station 1886, Orbit of LAG1
From 1998 to 2014
Consequences on LOD

L.O.D. wrt IERS C04

red: optimal weighting of the stations, black: $\Delta \sigma = 10\text{cm}$
Consequences on the scale
Conclusions

- ITRF2013
  - improvement of SLRF2008 required
  - preparation for ITRF2013 in progress
  - interest to get a time-dependency ponderation of the stations

- Lageos orbits
  - rise in the level of weekly residuals, due partly only to the degradation of ITRF2008
  - issues linked to NG effects affecting LAG1 & LAG2 should be investigated

- to be continued...