Quality assessment of SLR data-related products

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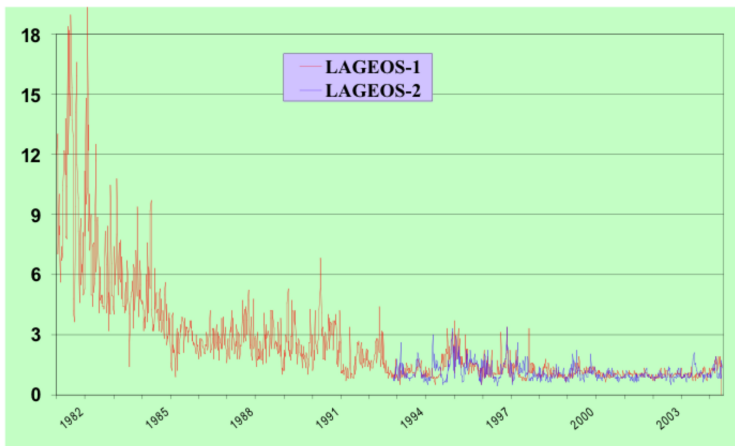[3] IGN/LAREG/GRGS, Université Paris Diderot, Paris
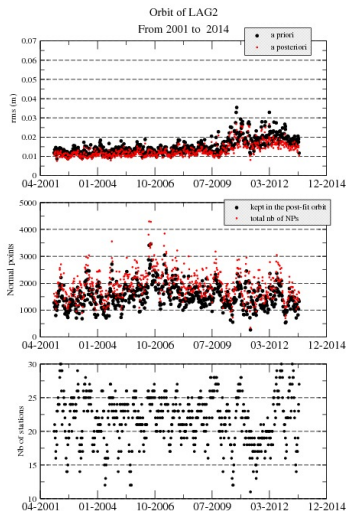
12th Nov. 2013

ITRFxxxx: From a meter to a millimeter accuracy

Weekly Orbital Fit [cm]

(Saunders,2004)

Over the last few years

Orbit of LAG2
From 2001 to 2014

- 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

Directory ILRS_AC (c) FD/GRGS, generated Thu Nov 7 07:07:47 CET 2013

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

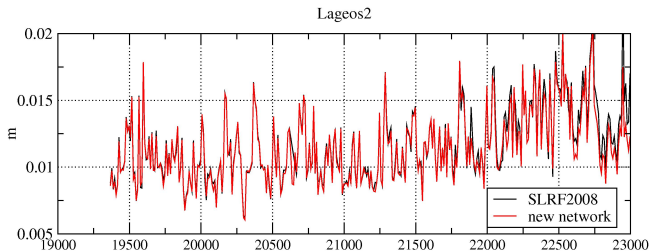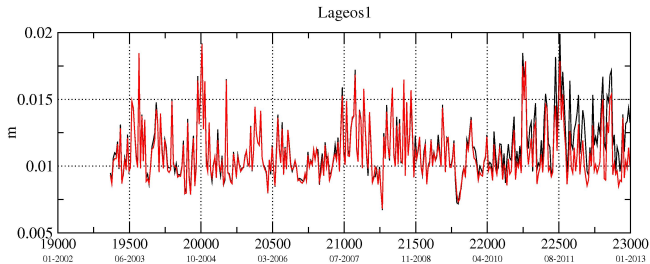- Validation through the geocenter motion estimation

Geocenter (Annual : top, semi-annual : bottom)
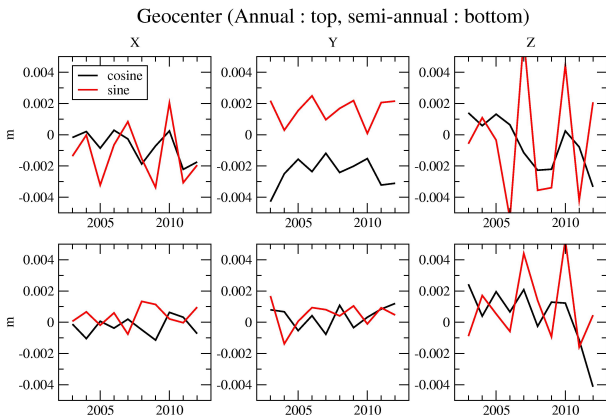
Case: Zimmerwald station

Zimmerwald (78106801)
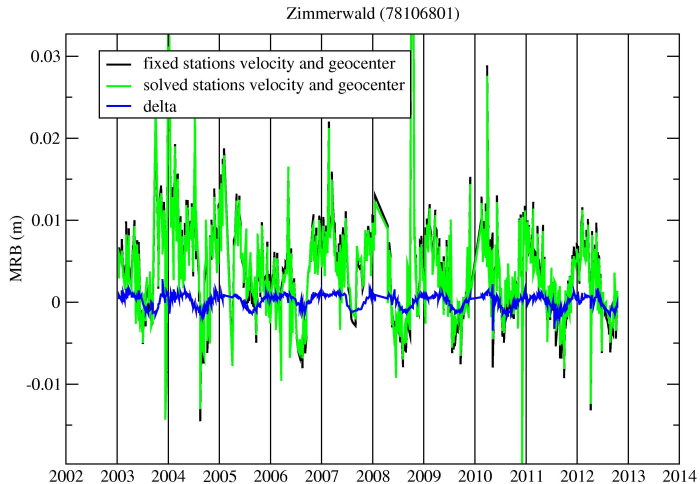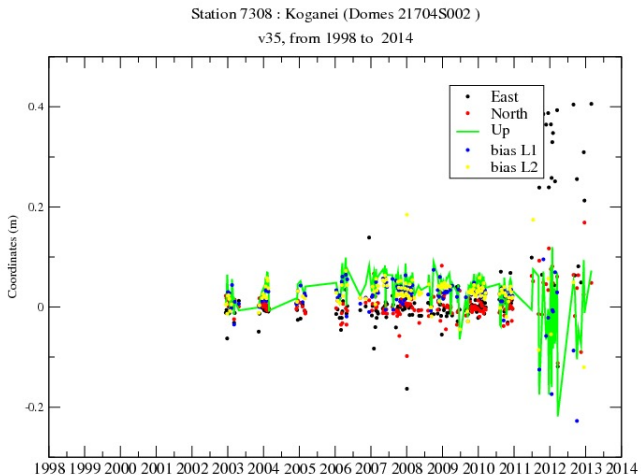
Case: Yarragadee station
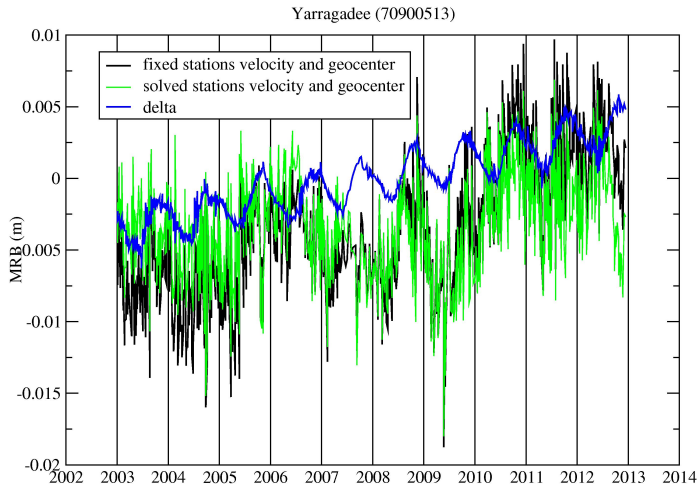
After new estimation of the station coordinates

ITRF2008, effect on an earthquake: Koganei

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

ITRF2008, effect on an earthquake: Concepcion

Station 7405 : Concepcion (Domes 41719M001)
v35, from 1998 to 2014
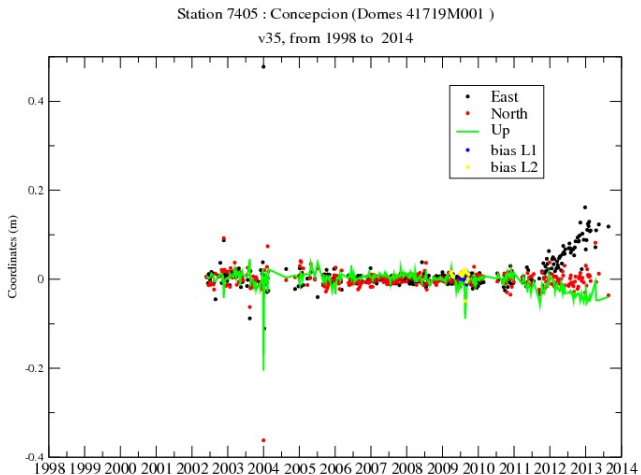
ITRF2008 features

- To be compared with other ACs, within the AWG
- Errors in position
    - horizontal:
    - 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
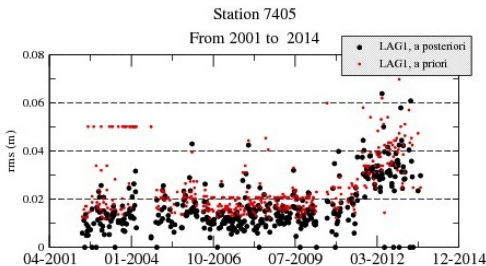
- weight of a station following:
  $\sigma_{\text{station}} = \sqrt{\sigma_{\text{ITRF}}^2 + \Delta\sigma^2}.$
  with
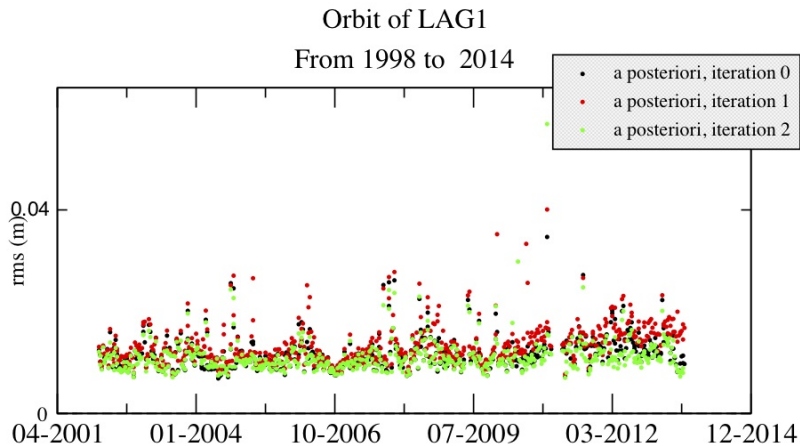 - $\sigma_{\text{ITRF}} = \sqrt{\sigma_x^2 + \sigma_y^2 + \sigma_z^2}$
  - $\Delta\sigma$ to over- or under-weight a station w.r.t. a typical well-known r.m.s., to correct operationally the ITRF fixed value.
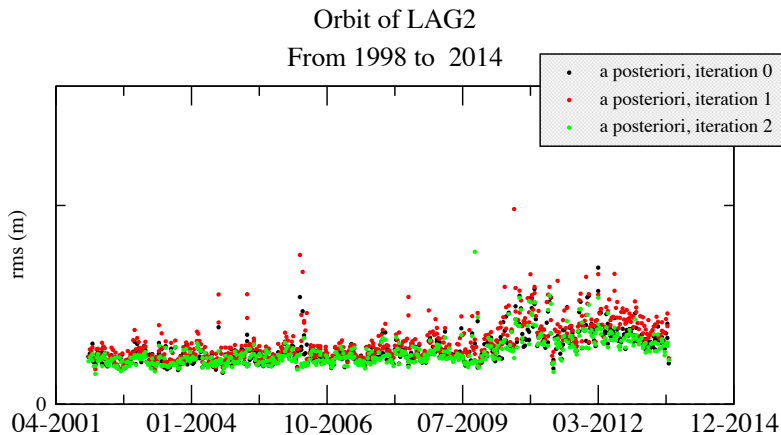

Station 7405
From 2001 to 2014

- idea:
  - time dependency of the station quality
  - $\Delta\sigma$ time dependent
  - several iterations between *a posteriori* and *a priori* to derive an "optimum"

New results for Lageos-1

Orbit of LAG1
From 1998 to 2014

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

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)

0
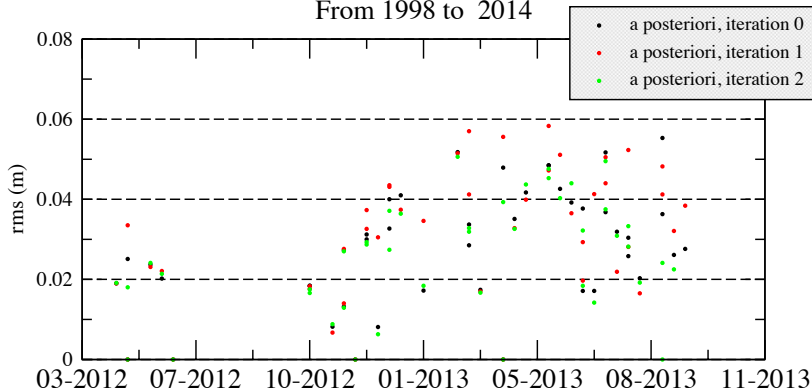04-2001   01-2004   10-2006   07-2009   03-2012   12-2014

Consequences for some stations

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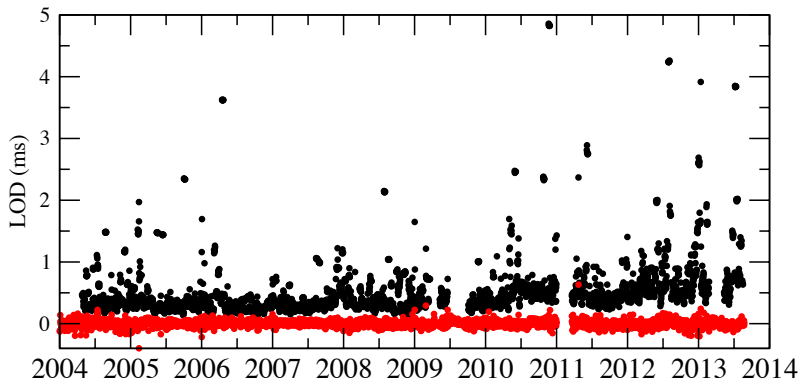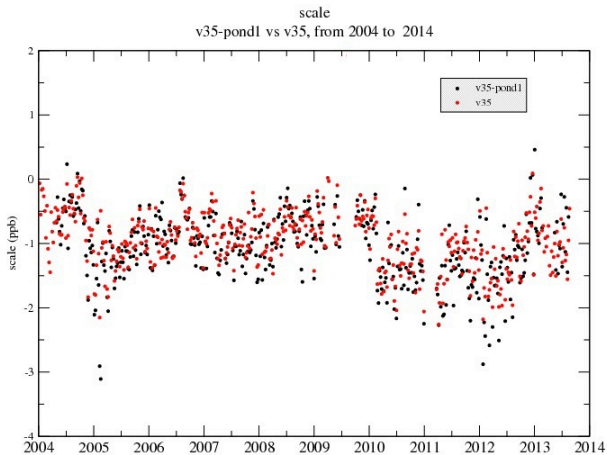- Approach of interest for new or "unstable" stations

Station 1886 , Orbit of LAG1

Consequences on LOD

L.O.D. wrt IERS C04

red: optimal weighting of the stations, black: $\Delta\sigma = 10cm$

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...