DORIS Simulations within Project GGOS-SIM

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Outline

- Project GGOS-SIM
- The DORIS part
  - Missions
  - Network
- DORIS orbit restitution
- Open work
- Summary

Project GGOS-SIM

- Objectives
  - How can the GGOS goals for the Terrestrial Reference Frame (1 mm and 0.1mm/a) be met?
  - Simulations of the 2008 - 2014 ground networks of all space-geodetic techniques close to reality
  - Effects of technical improvements of the space-geodetic techniques on the ITRF
    - F.i. new sites
  - Impact of ties on the ITRF
    - Number and accuracy of local ties
    - Global ties (EOPs)
    - Space ties
- Collaboration of TU Berlin and GFZ Potsdam/Oberpfaffenhofen
- Funded by the German Research Foundation
  - 2 researchers for 2 and 3 years re. (September 2014 to October 2017)

Project GGOS-SIM

- Schuh et al., 2017, http://link.springer.com/chapter/10.1007%2F1345_2015_217
- Achievements so far
  - Simulations of VLBI, SLR, GPS observations
  - Determination of single-technique solutions (Glaser et al., 2016, http://link.springer.com/chapter/10.1007%2F1345_2016_256)
  - Combination of SLR+VLBI using local and global ties (Glaser et al., 2017, http://link.springer.com/article/10.1007/s00190-017-1021-2)
  - Combination of SLR+VLBI+GPS using local and global ties
  - Extension of the current VLBI network

The DORIS Part

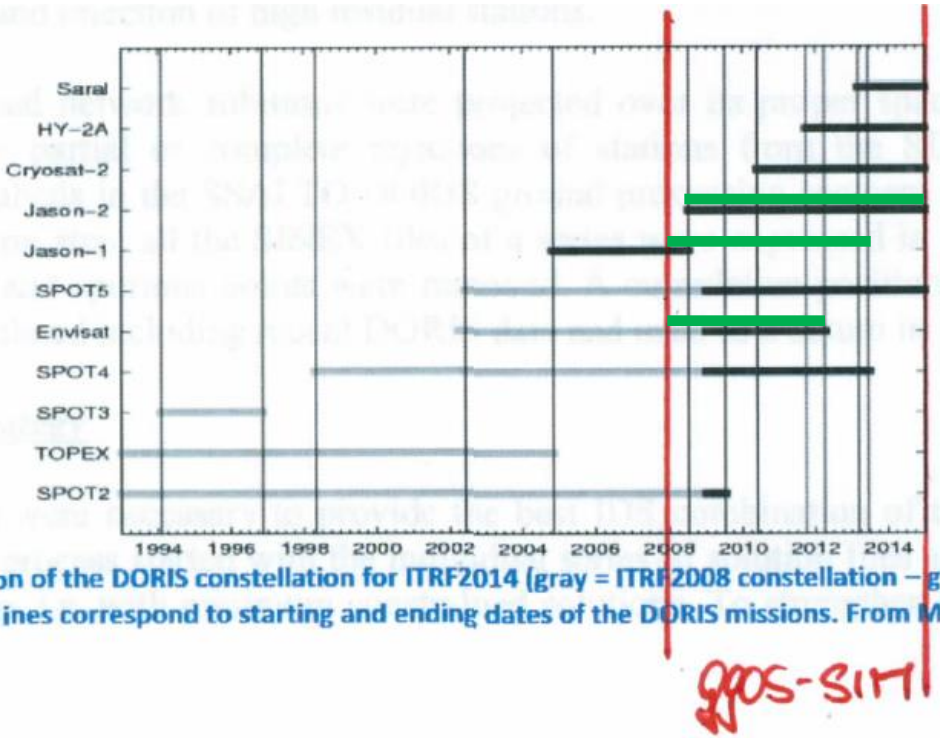


Figure 1 - Time evolution of the DORIS constellation for ITRF2014 (gray = ITRF2008 constellation – gray + black = ITRF2014 constellation). Vertical ines correspond to starting and ending dates of the DORIS missions. From Moreaux et al., 2016.

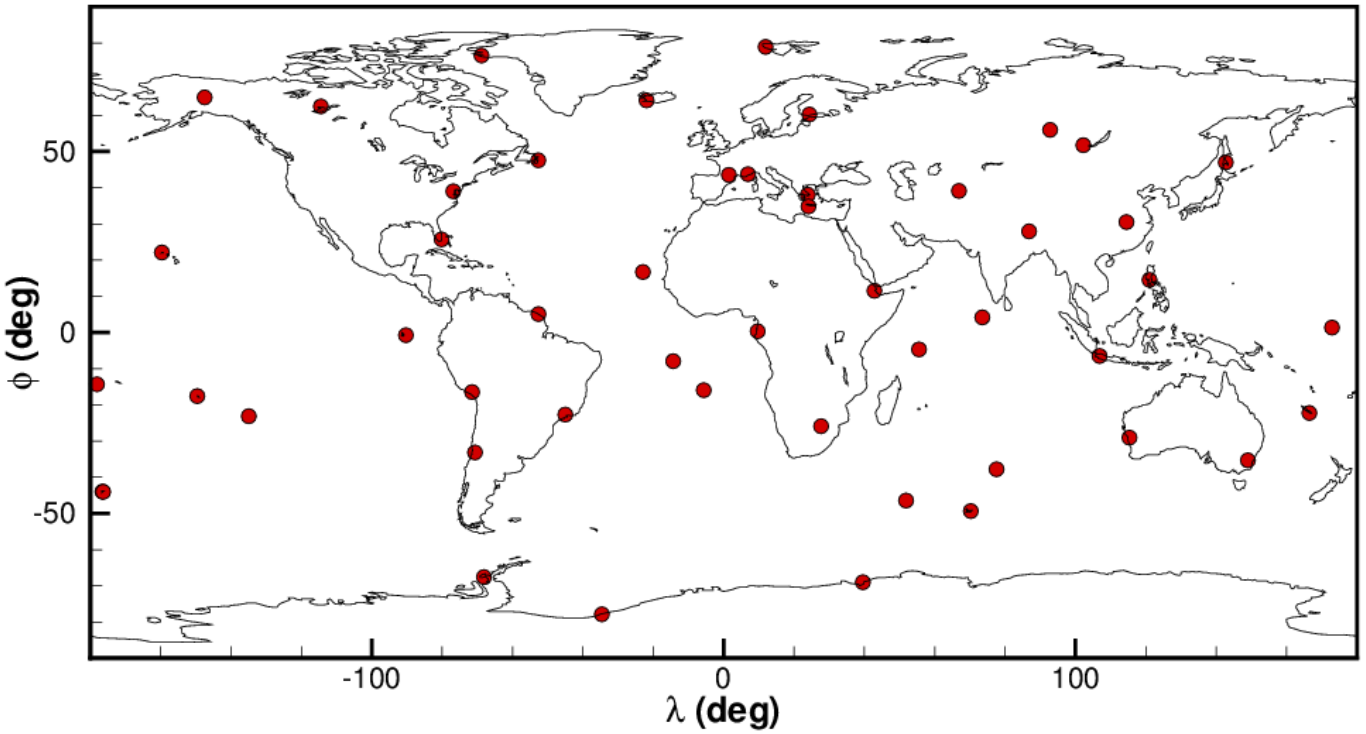
From: Moreaux, G., Lemoine, F.: The DORIS contribution to ITRF2014.

The DORIS Part

- Missions selected
  - JASON-1
    - JAN 2008 – JUL 2013
    - White noise 0.035 cm/s
  - JASON-2
    - JUL 2008 – DEC 2014
    - White noise 0.035 cm/s
  - ENVISAT
    - JAN 2008 – APR 2012
    - White noise 0.042 cm/s
- # observation 67,000,000

The DORIS Part

- Sites 62
- Stations 85

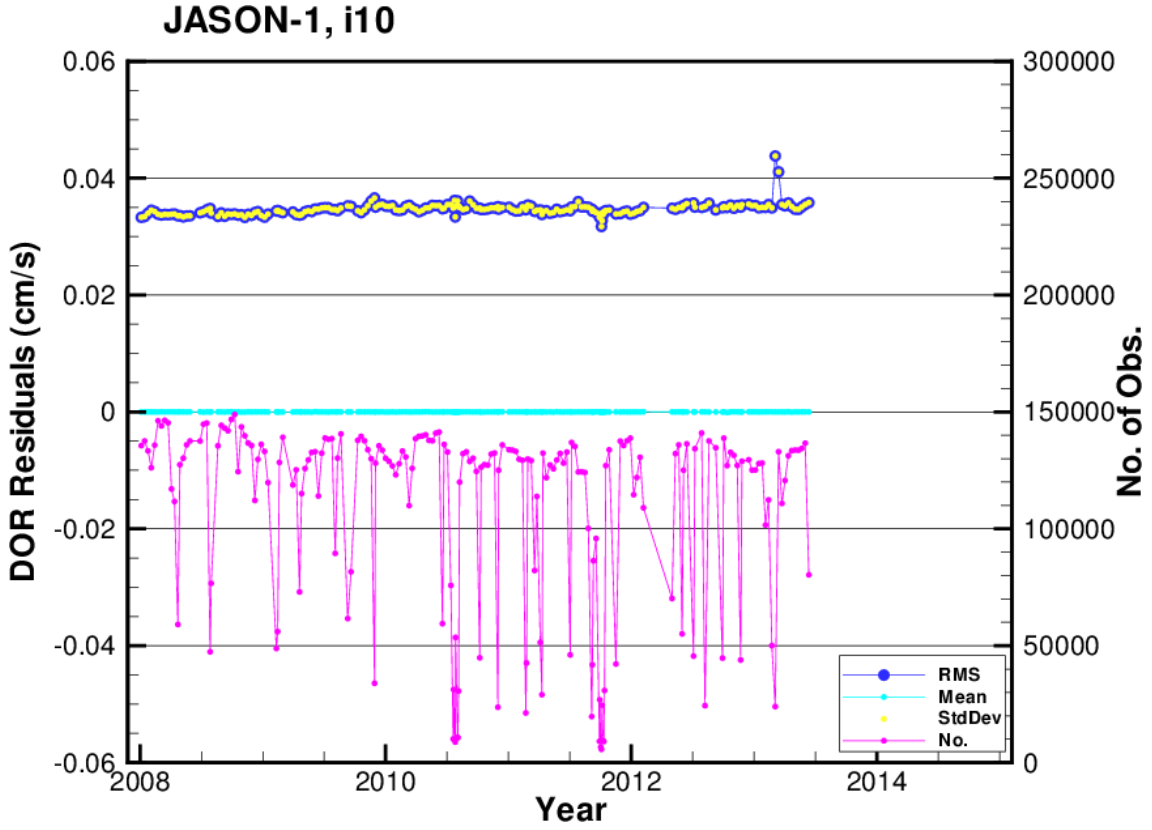


DORIS Orbit Restitution

- POD starting point
  - GFZ VER11 precise orbits
    - Time variable gravity EIGEN-GRGS.RL03.v2…
    - Atmospheric loading
  - Arc length
    - Mostly driven by altimetry view on repeat cycles
      - JASON-1/-2: 10 days plus 2 days overlap
      - ENVISAT: 5 days plus 2 days overlap
      - ITRF2014: 7 days, strict
  - Integrated processing of DORIS and SLR and altimetry XO when needed
- GGOS-SIM standards
  - EIGEN-6C static
  - No atmospheric loading

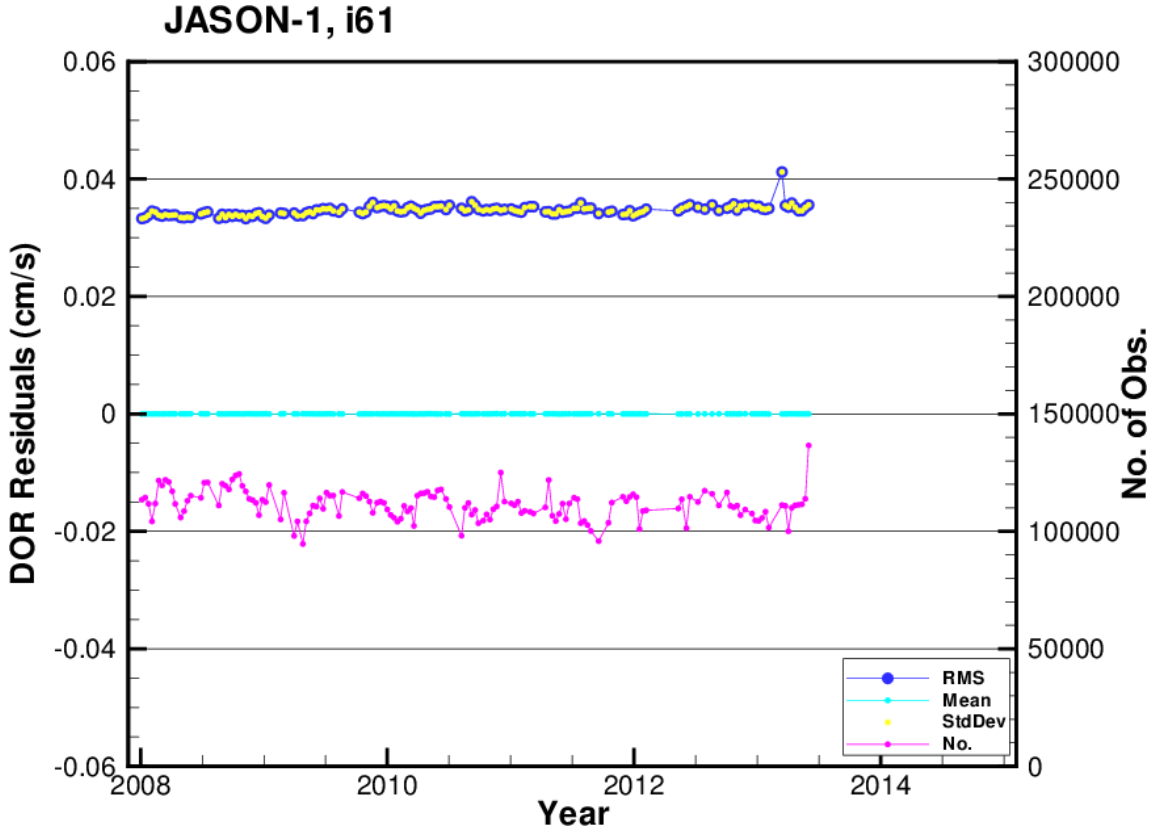
DORIS Orbit Restitution

- POD: GFZ VER11 precise orbits



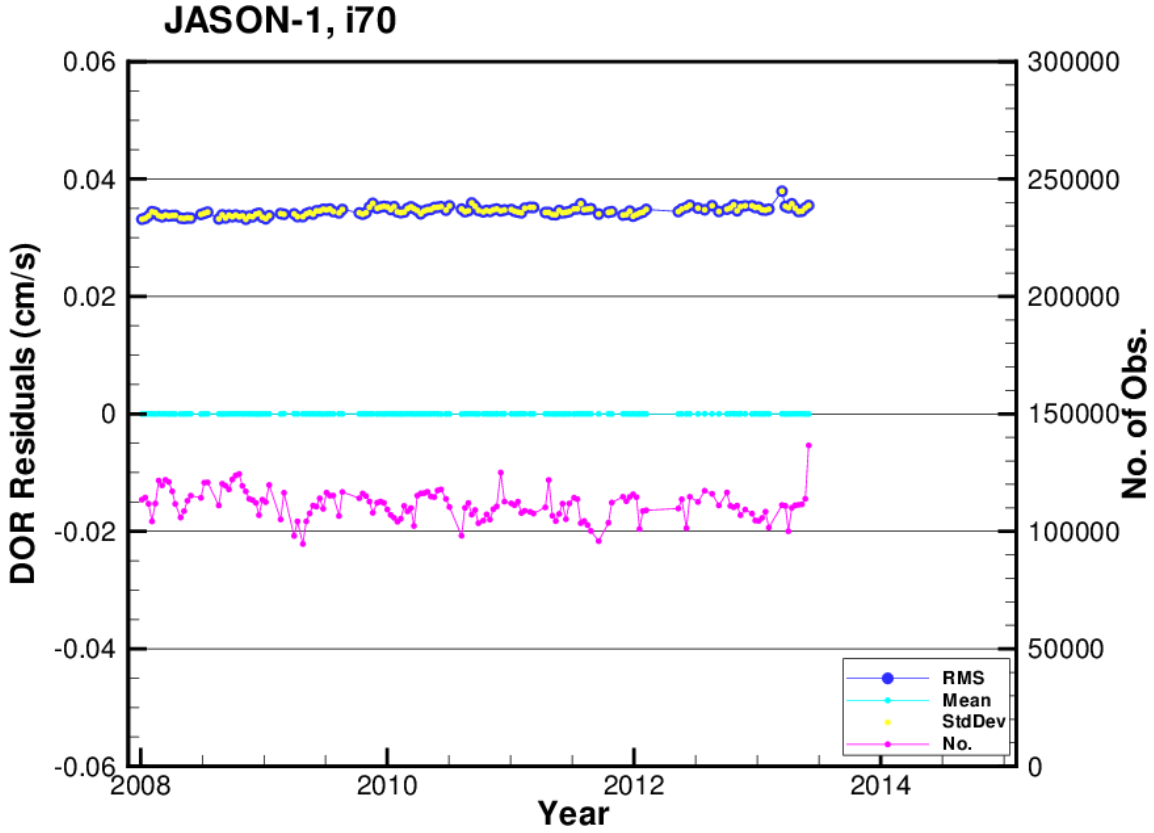
DORIS Orbit Restitution

- POD: Long arcs only, GGOS-SIM standards



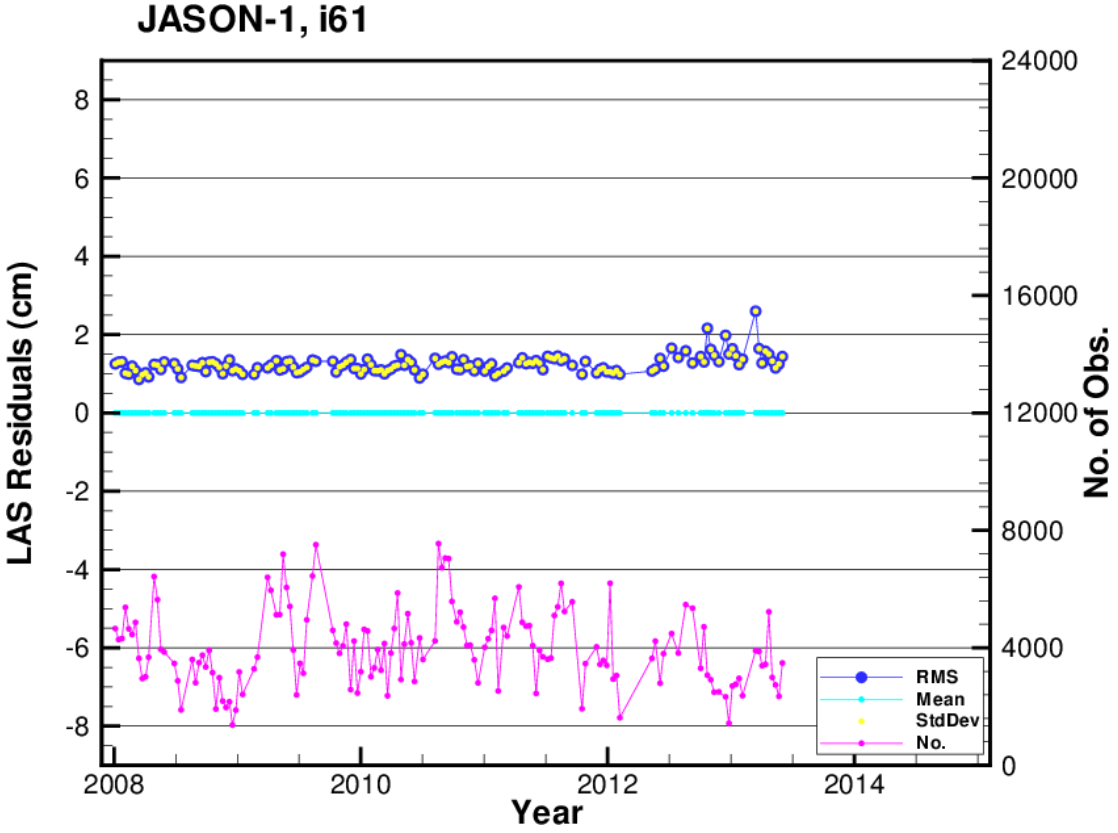
DORIS Orbit Restitution

- POD: DORIS only



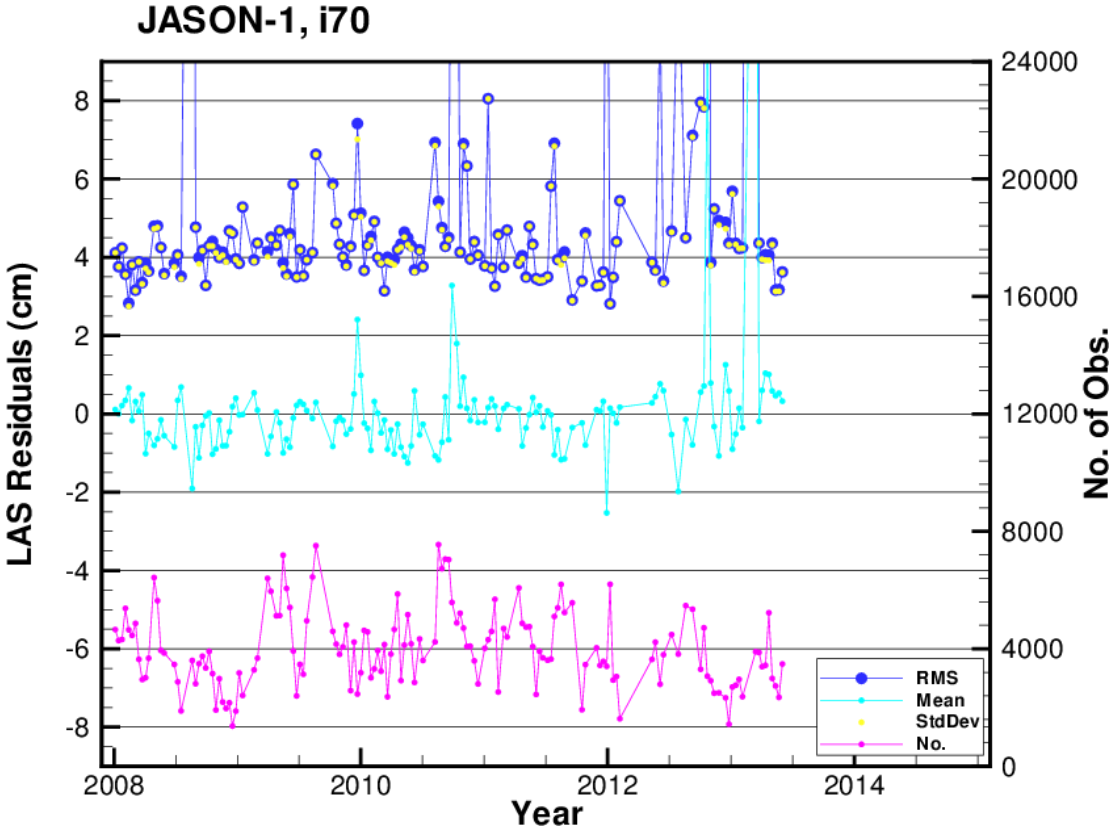
DORIS Orbit Restitution

- POD: Long arcs only, GGOS-SIM standards



DORIS Orbit Restitution

- POD: DORIS only



Open Work

- Switch to 7-day arcs
  - According GPS weeks ?
  - Fully covered with DORIS data ?
- Add solve-for parameters
  - Station coordinates and velocities
  - Polar motion, ?LOD?
- Generate DORIS-only TRF
- Combine with GPS, SLR, and VLBI

Summary

- The GGOS-SIM project generated a tool to simulate the space-geodetic techniques for assessing strategies and approaches how the GGOS network goals can be met
- Realistic, representative GPS, SLR, VLBI simulations are done
- DORIS simulations are on the way