LARES: Analysis of the first months of data

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Introduction

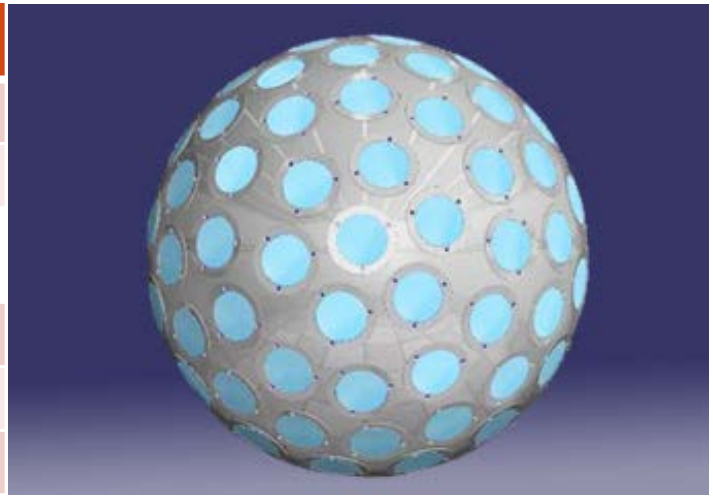
Can we assume the tentative COM correction for LARES to be appropriate?

→ Analysis of the estimated range biases for LARES

→ Comparison with estimated range biases for LAGEOS-1 and LAGEOS-2

LARES (LAser RElativity Satellite)

Mission Parameters		
Launch date	13-Feb-2012	
Sponsor	ASI/ESA	
Dimensions	Diameter	364 mm
	Mass	386.8 kg
	Number of CCR	92
Center-of-Mass	Correction	133 ± 5 mm
Orbit	Altitude	1450 km
	Inclination	69.5 degrees
	Eccentricity	0.0
	Period of revolution	114.8 min
	Revolutions per day	12.54



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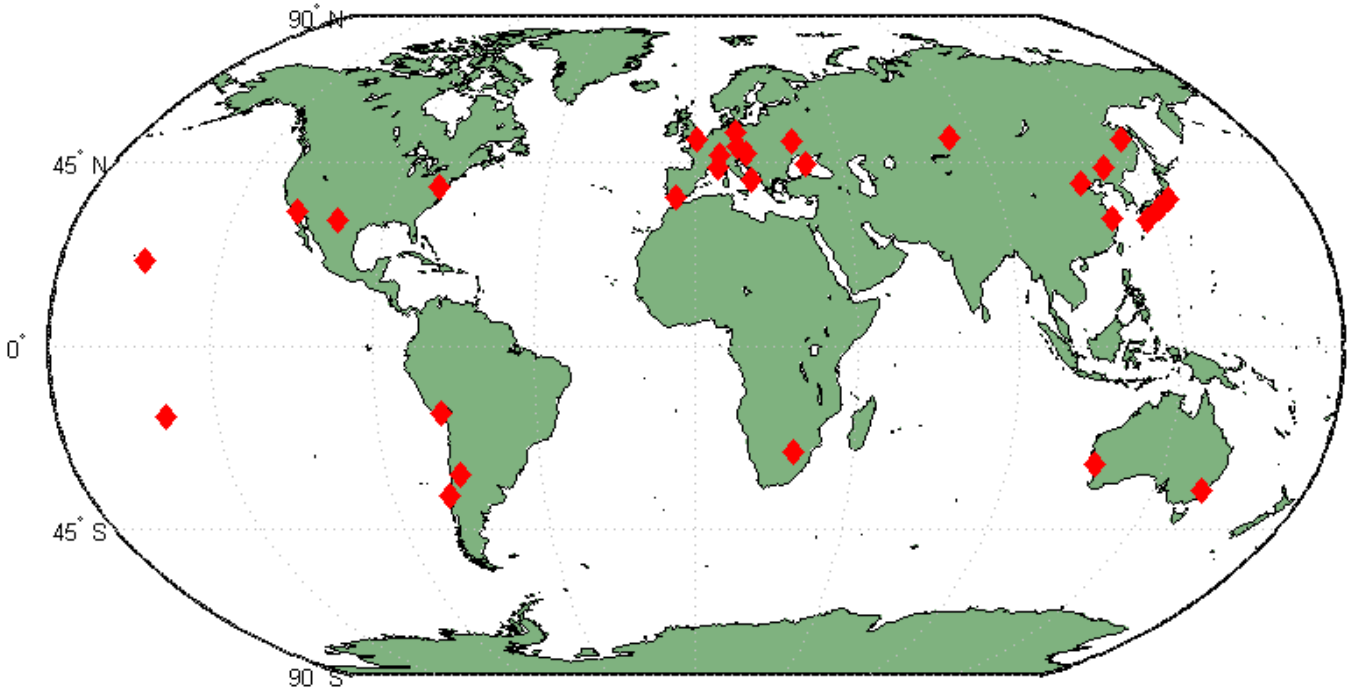
SLR tracking of LARES

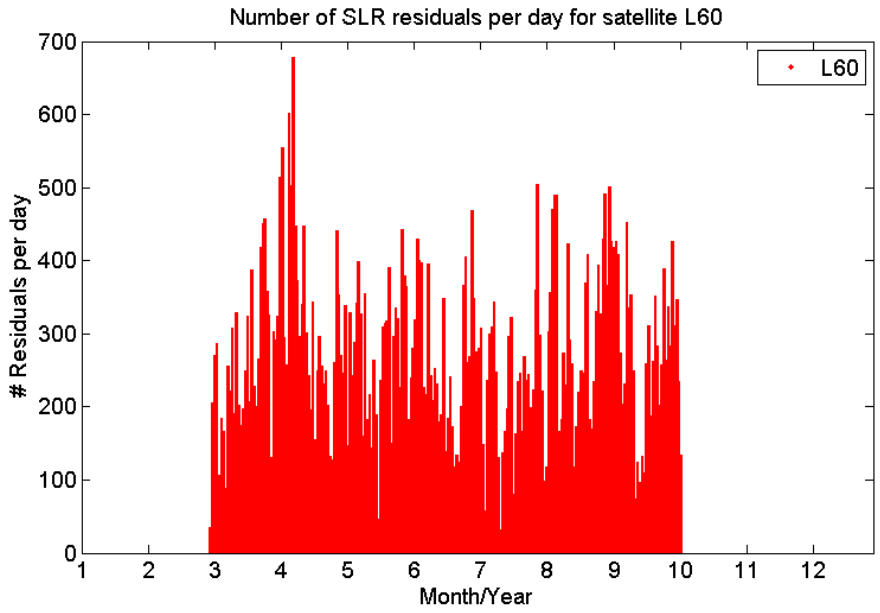


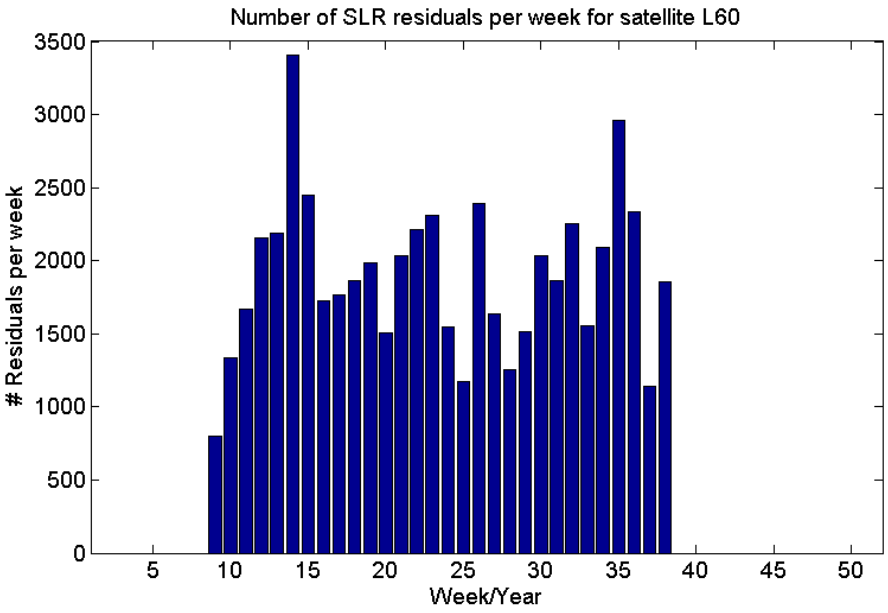
- **29 stations from 19. Feb. to 22. Sep. 2012** (12/050-12/266)
- **13-25 stations per week**
- 7-12 fix stations for datum definition per week

SLR tracking of LARES

Period : 19. Feb. to 22. Sep. 2012 (12/050-12/266)

→ 217 days with LARES observations
→ Mean number of SLR observations per day: 276 obs/day ≙ 1932 obs/week
→ **58'312 normal points**



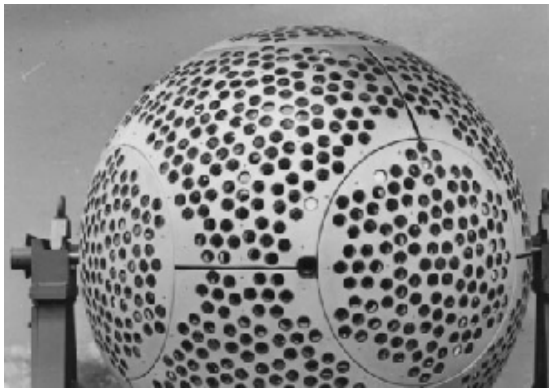


Combined solution

ILRS Analysis Working Group

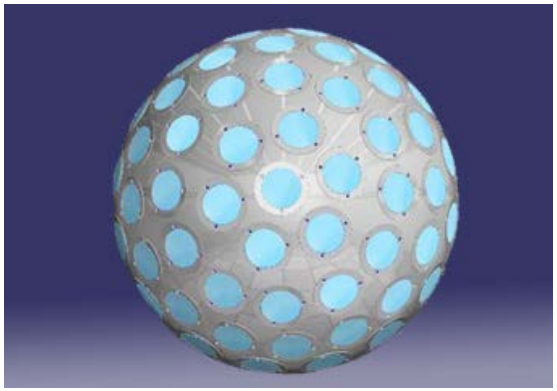
LAGEOS-1

LAGEOS-2



Etalon-1

Etalon-2



LARES

Combined weekly solution – Solution setup

- **Station coordinates**
- **Satellite orbits**: 1 arc per week
  - 6 osculating elements
  - Dynamic orbit parameters:
    - Constant acceleration in along-track
    - Once-per-rev in along-track
    - Once-per-rev in cross-track
  - LARES specific:
    - Air drag model: MSIS-E 00 with anomalous oxygen
    - Once-per-rev stochastic pulses along-track
- **Earth rotation**:
  - Polar motion (constant per day)
  - Length of Day LOD
- **Range biases**
  - for selected sites (LAGEOS and Etalon)
  - for every LARES station
- **Geocenter coordinates**

Datum definition:

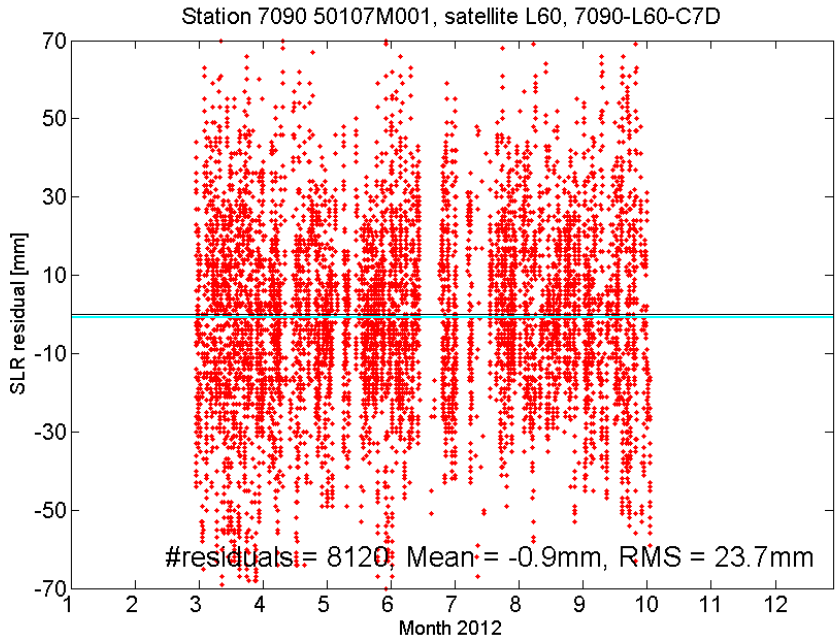
Minimal constraint solution with NNR + NNT on SLRF2008

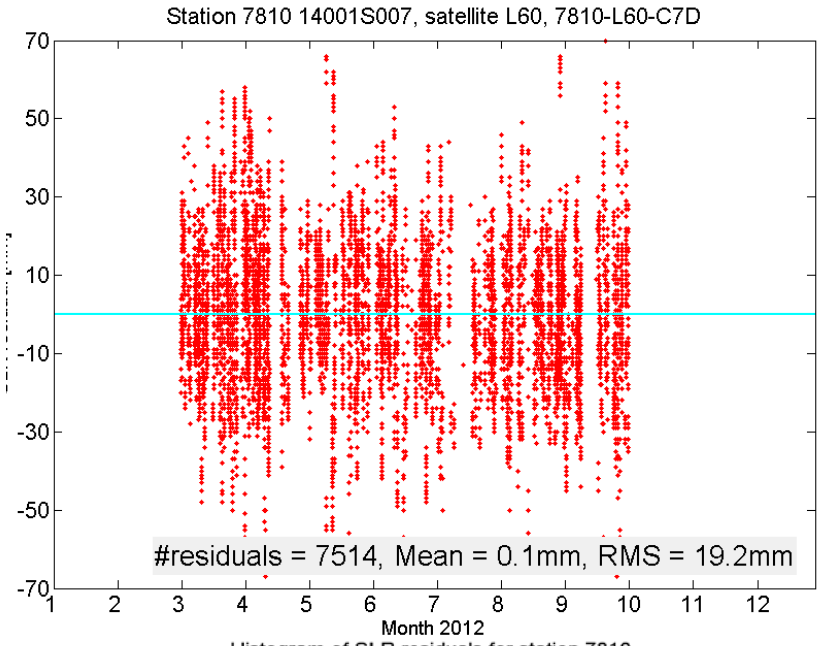
240-290 parameters / week

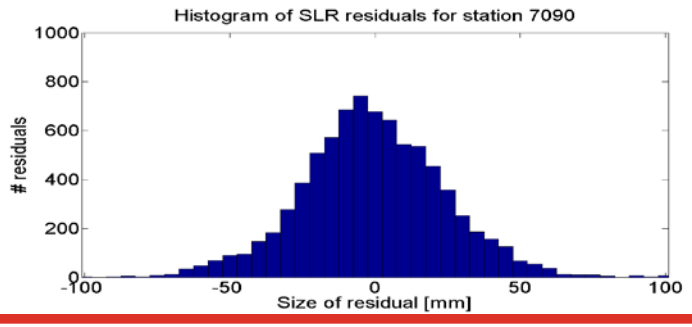
4'000-9'000 observations / week

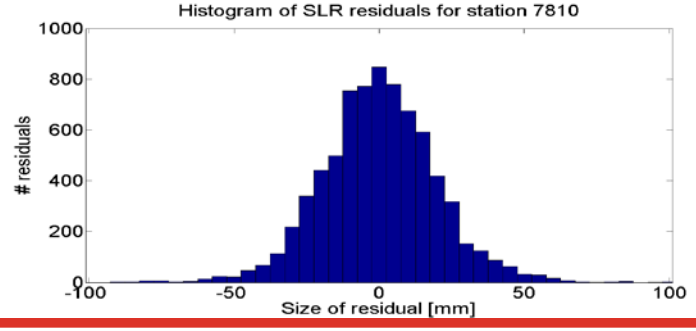
LARES residual analysis

- Overall statistics for total number of 58'312 observations:
  - Mean bias: -0.4 mm, RMS: 20.6 mm (combined solution)



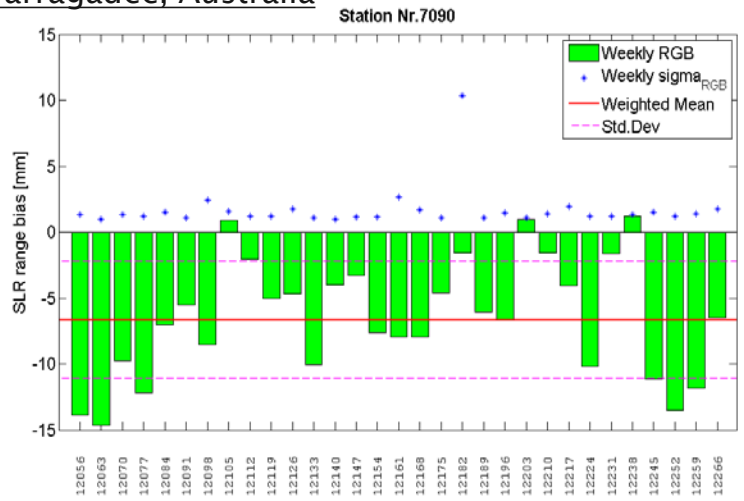




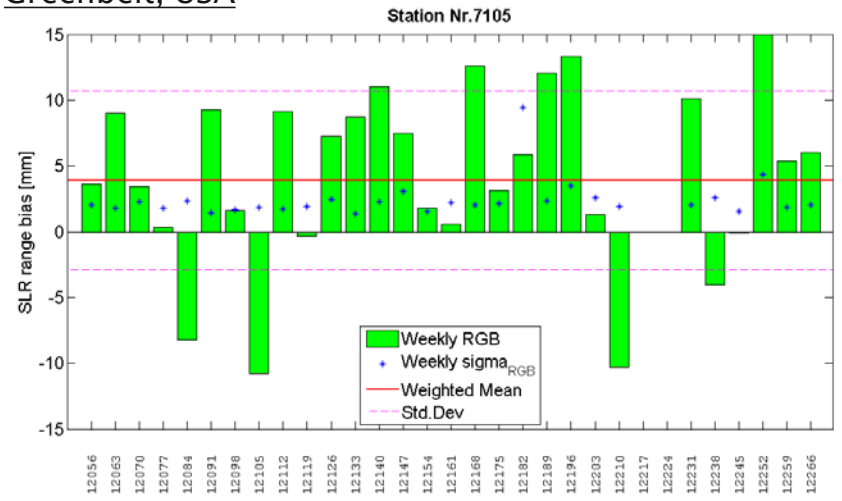


LARES Range Biases

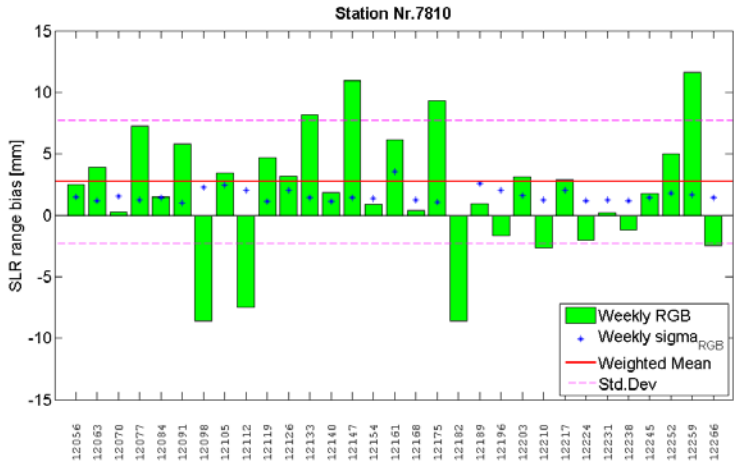
Yarragadee, Australia



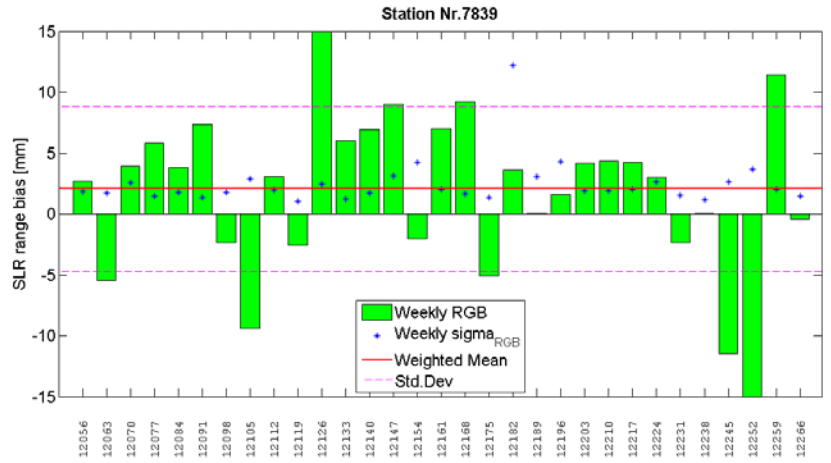
Greenbelt, USA



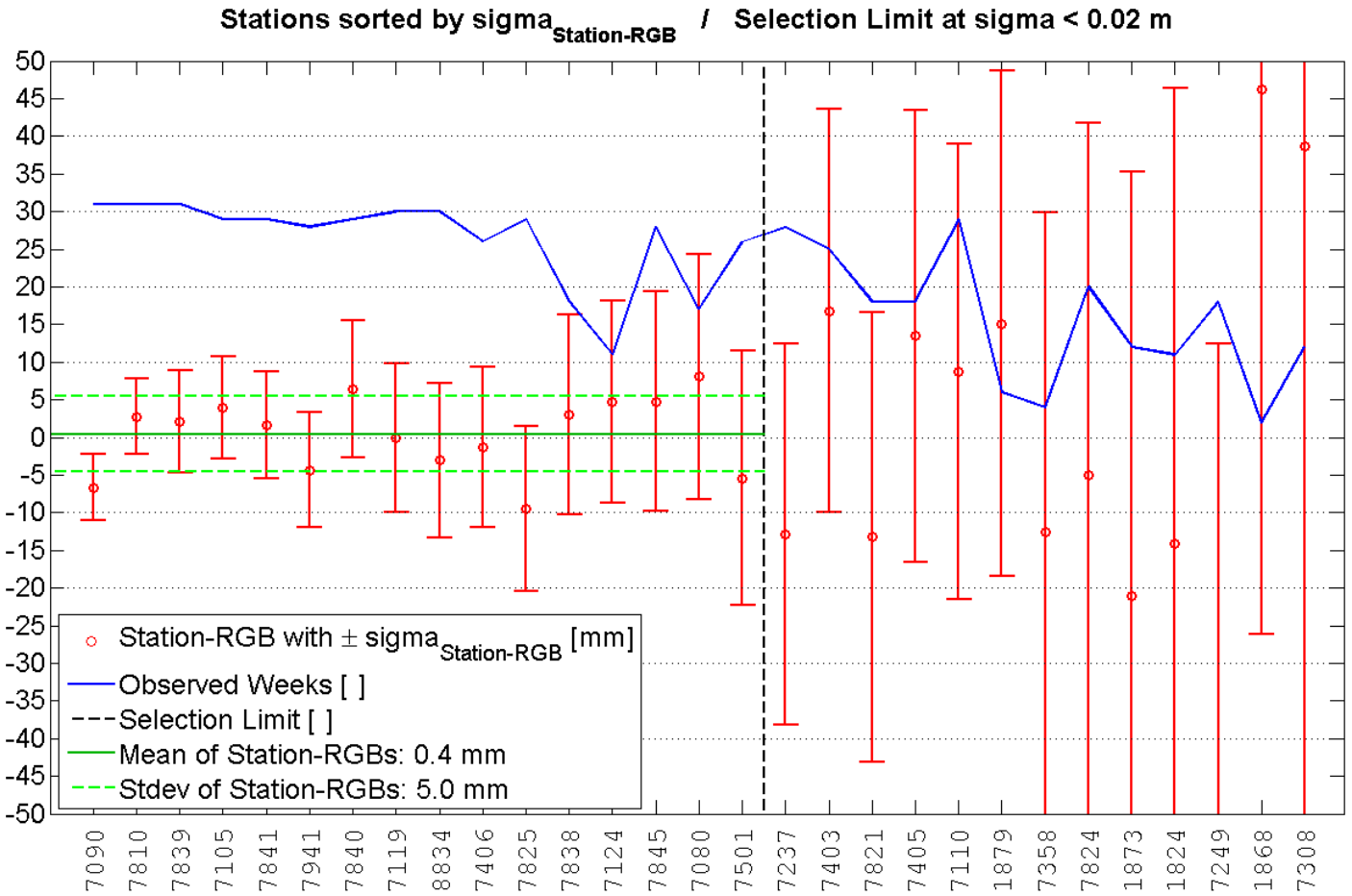
Zimmerwald, Switzerland



Graz, Austria



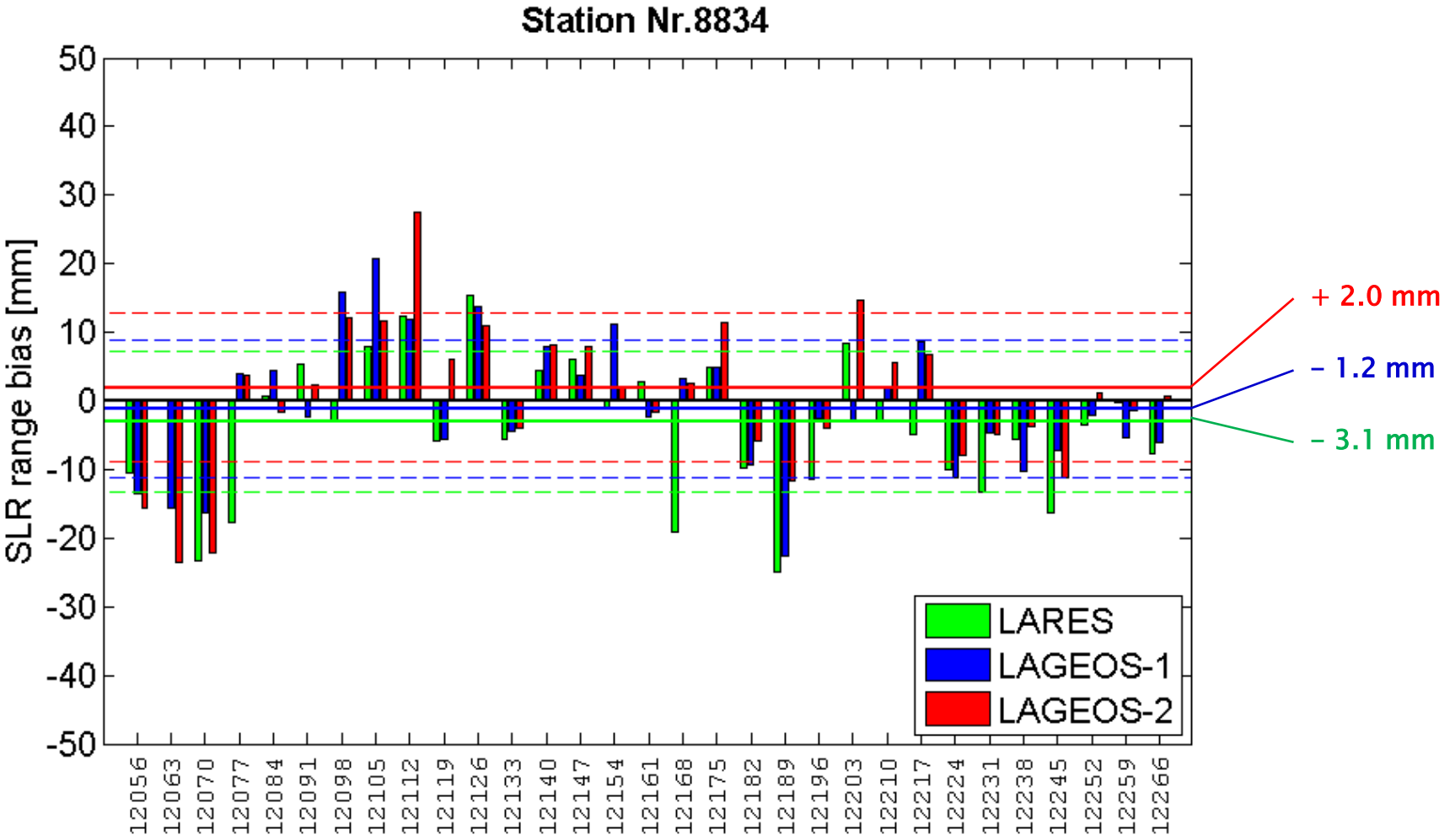
LARES Range Biases – Overview



→ No systematic range bias for LARES

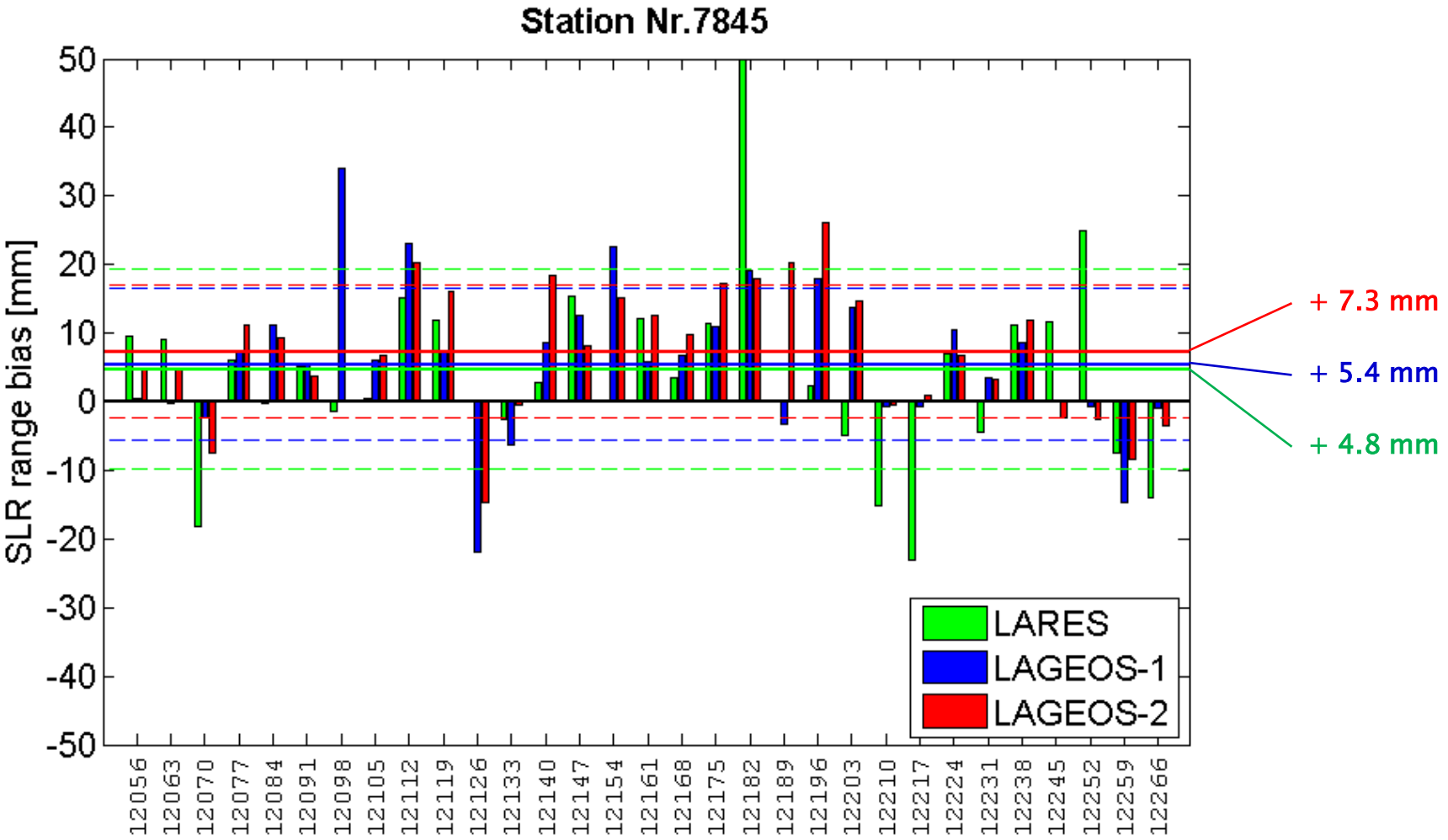
LARES Range Biases – Comparison with LAGEOS-1 and LAGEOS-2

Wettzell, Germany



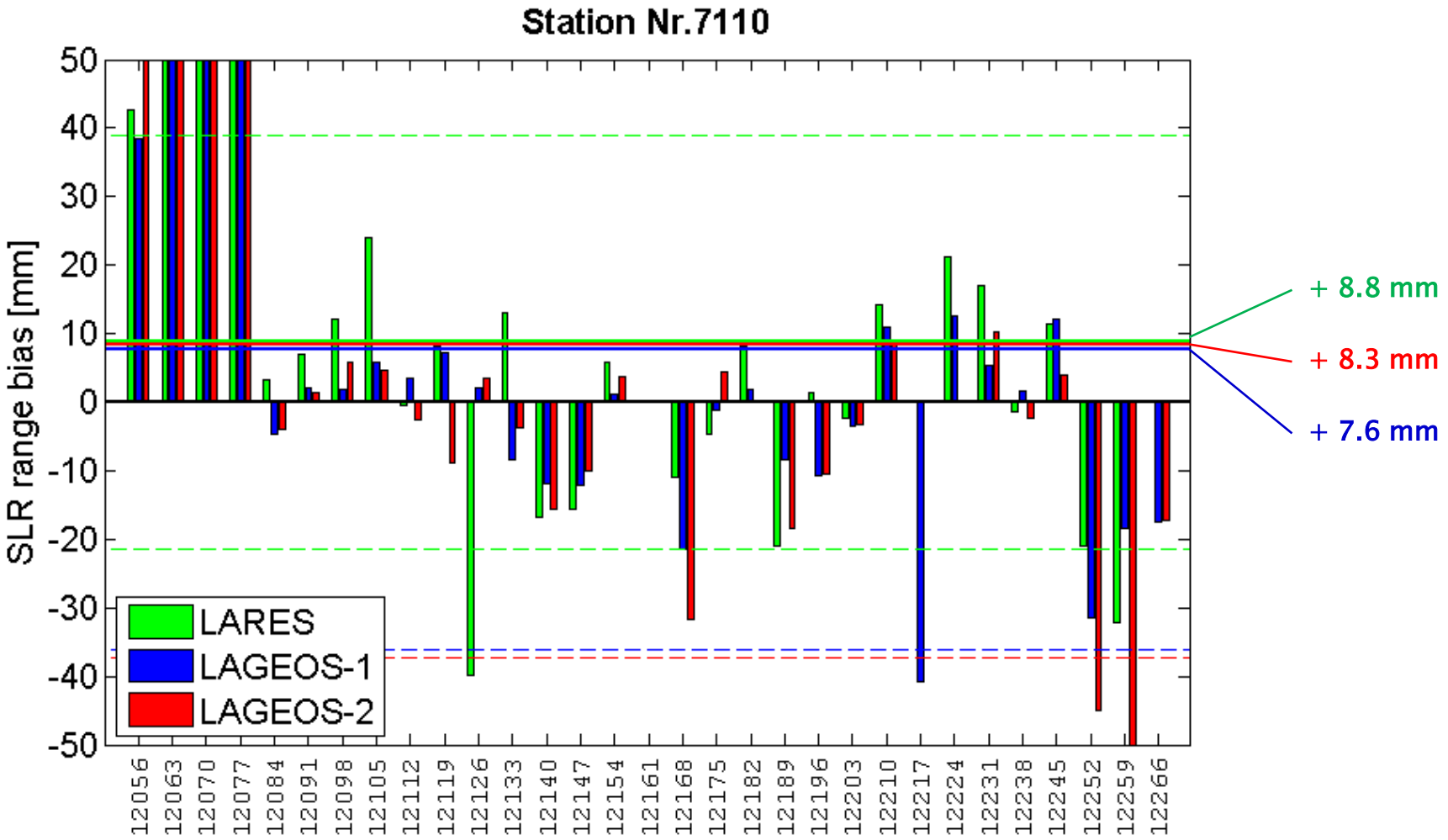
LARES Range Biases – Comparison with LAGEOS-1 and LAGEOS-2

Grasse, France



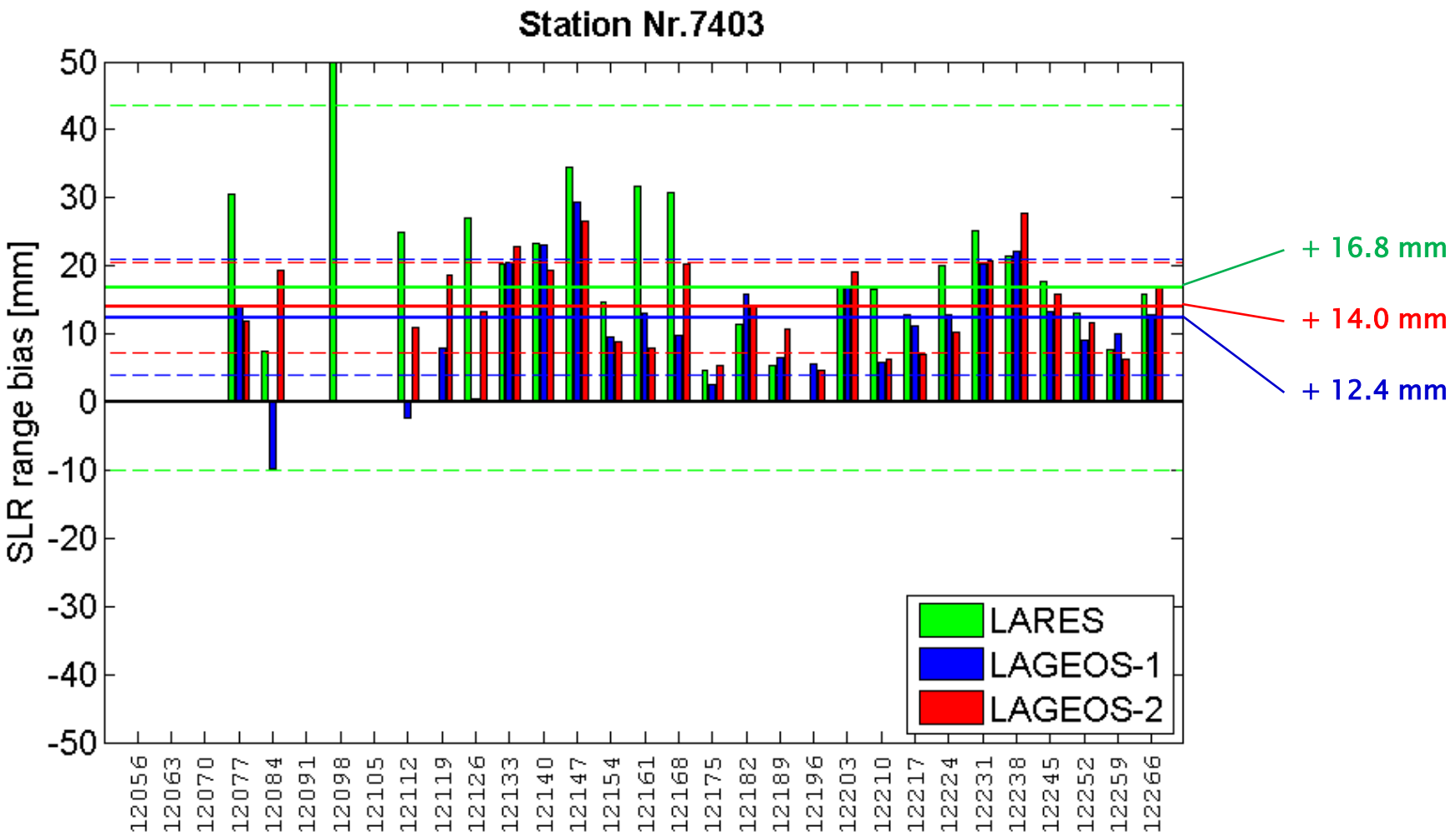
LARES Range Biases – Comparison with LAGEOS-1 and LAGEOS-2

Monument Peak, USA



LARES Range Biases – Comparison with LAGEOS-1 and LAGEOS-2

Arequipa, Peru



Summary

- Analysis of the range biases for LARES only
  - → Estimated range bias over all stations: 0.4 ± 5.0 mm (1σ)
- Comparison with estimated range biases for LAGEOS-1 and LAGEOS-2
  - → No systematic offset between the three satellites
  - → Range biases due to station specifics and not due to inaccurate COM correction

→ The tentative COM correction of 133 ± 5 mm is appropriate.