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## The comparison of the station coordinates between SLR and GPS

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# SLR data: program GEODYN-II

SLR data from 1 January 1993 to 31 December 2003 (Eurolas Data Center)

## **main models and parameters:**

- Earth gravity field: EIGEN GRACE02S 20x20
- Earth and ocean tide model: EGM96
- polar motion: IERS C04
- arc length: 1 month
- satellites: LAGEOS-1 and LAGEOS-2
- 15 reference stations in ITRF2005 for orbit determination

## **estimated parameters:**

- satellite state vector
- station geocentric coordinates
- acceleration parameters along-track, cross-track and radial at 5 days intervals

# GPS data

- **Daily GPS Time Series in ITRF2005, epoch 2007.0 from JPL NASA**

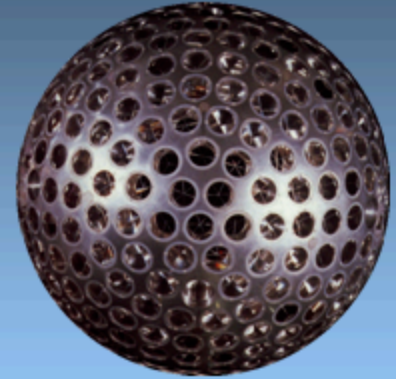
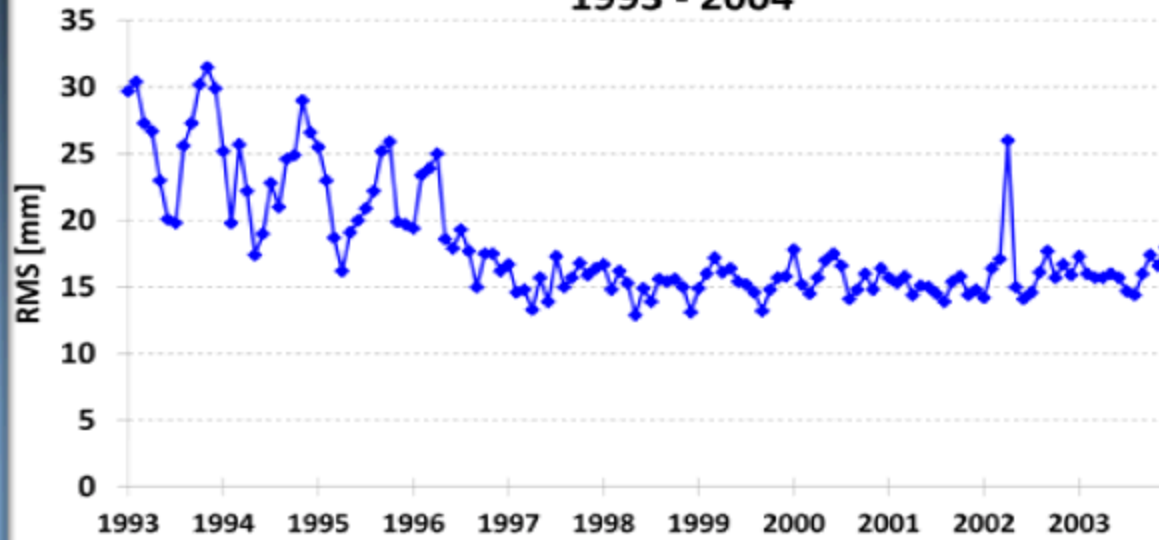
**Thank you Dr. Michael Heflin for results and explanation**

- **The ITRF2005 reference frame was realized each day through application of a 7-parameters Helmert transformation**
- **Transformation to epoch 2000.0 by JPL NASA station velocities**
- **Corrections to SLR reference point through local ties used in ITRF2005**
- **Data for epoch of the first day of each month**

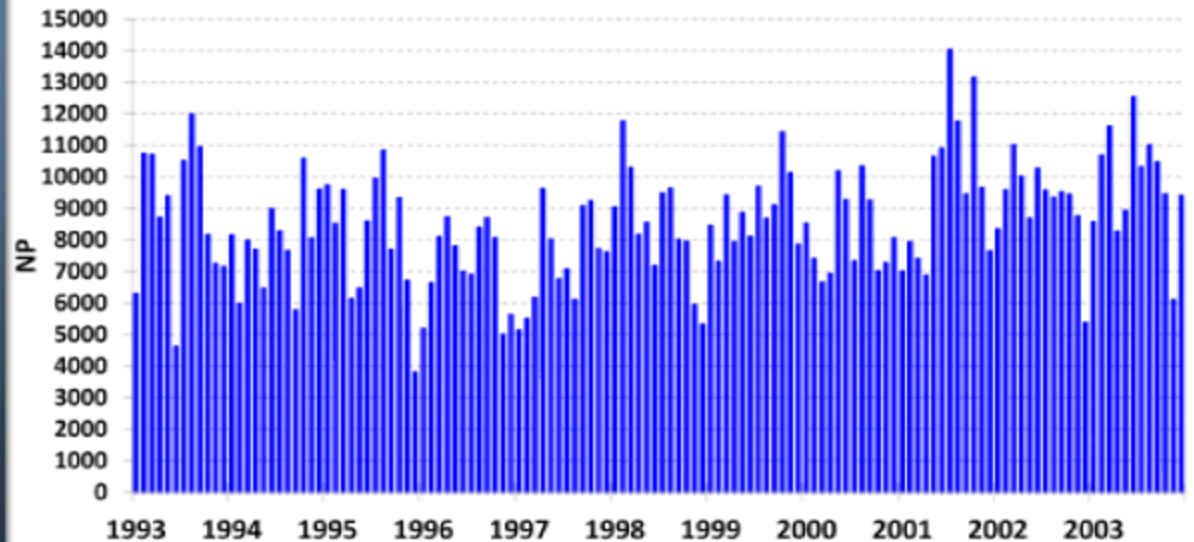
## List of the SLR-GPS stations in 1993.0-2004.0

STATION	SLR	GPS	NUMBER OF COMMON POINTS	PERIOD (months)	POSITION STABILITY [mm]	
					SLR	GPS
McDonald	7080	MDO1	111	125	8.4	8.2
Yarragadee	7090	YAR1	109	131	8.4	11.2
Monument Peak	7110	MONP	76	109	7.6	8.6
Beijing	7249	BJFS	34	45	31.6	6.7
Arequipa	7403	AREQ	70/56	117	10.0	10.0
Borowiec	7811	BOR1	96	111	17.0	6.4
Grasse SLR	7835	GRAS	68	94	10.5	5.9
Potsdam	7836	POTS	96	110	8.4	6.7
Shanghai	7837	SHAO	67	99	21.5	9.9
Graz	7839	GRAZ	116	132	11.7	7.2
Herstmonceux	7840	HERS	102	130	6.8	8.9
Wettzell	8834	WTZR	79	94	9.4	5.6

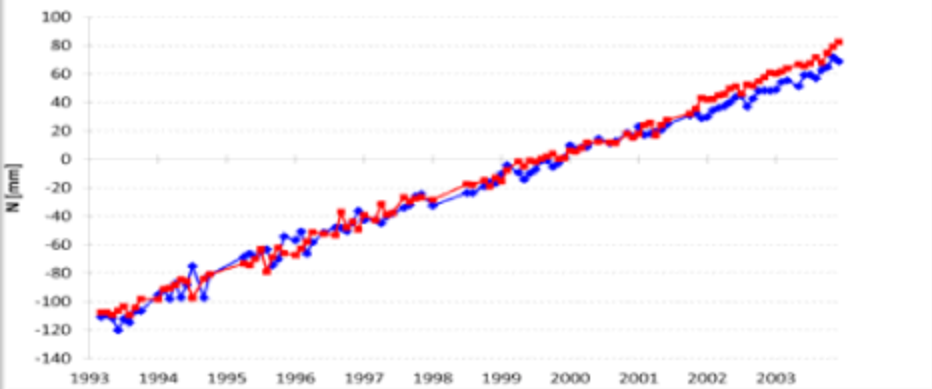
**Orbital RMS/arc**  
**LAGEOS-1 and LAGEOS-2**  
**1993 - 2004**



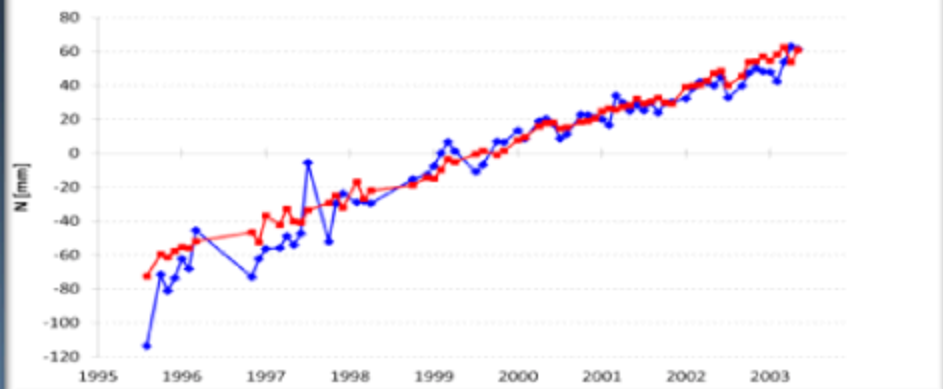
**Normal Points/arc**  
**LAGEOS-1 and LAGEOS-2**  
**1993 - 2004**



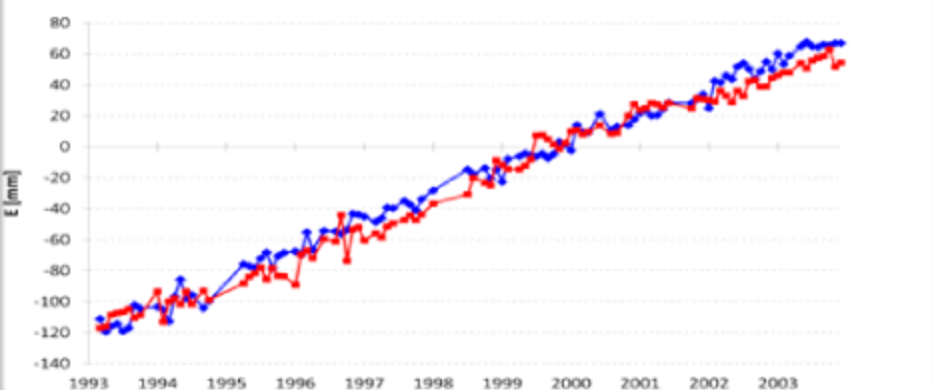
HERSTMONCEUX - 7840 - HERS



GRASSE - 7835 - GRAS



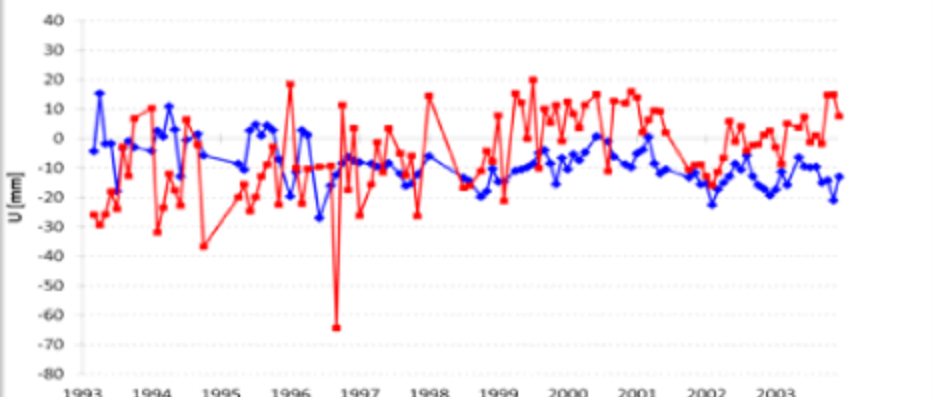
E-W



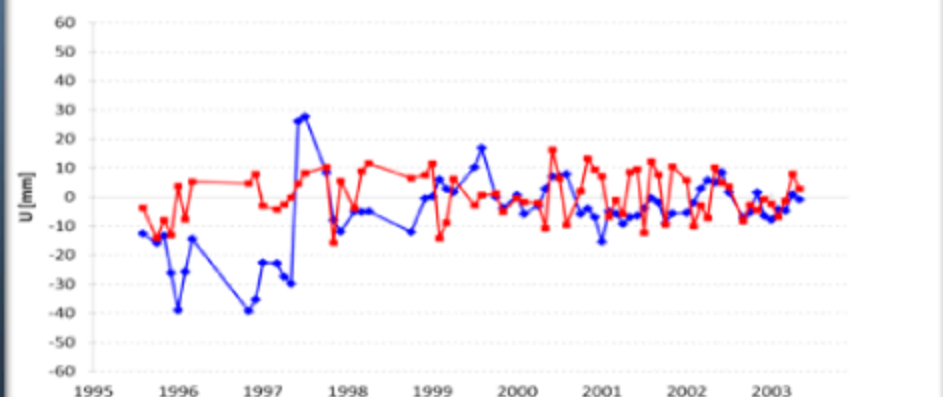
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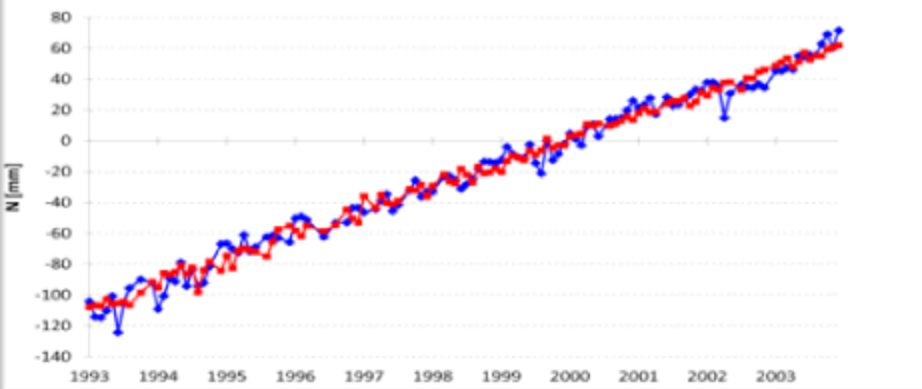
Up



Up



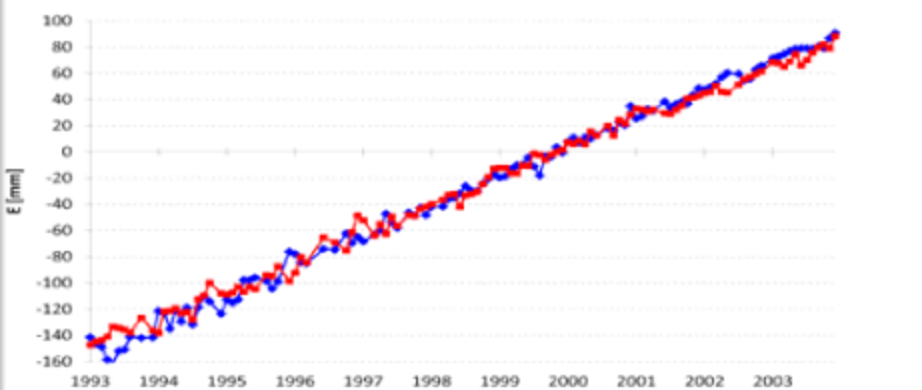
GRAZ - 7839 - GRAZ  
N-S



WETTZELL - 8834 - WTZR  
N-S



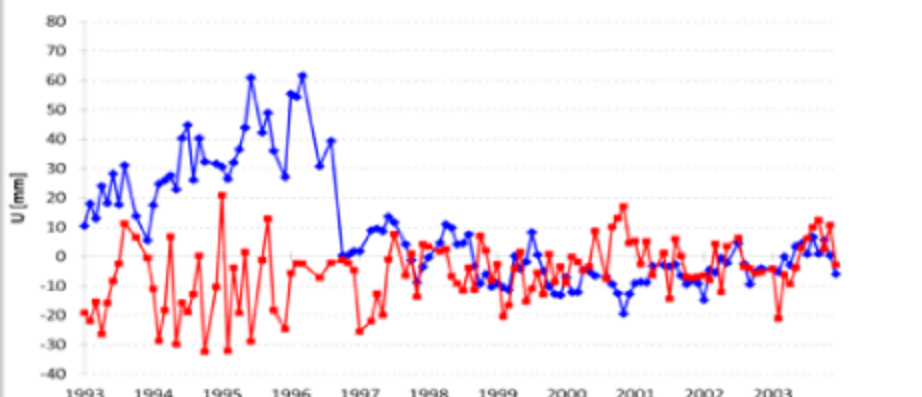
E-W



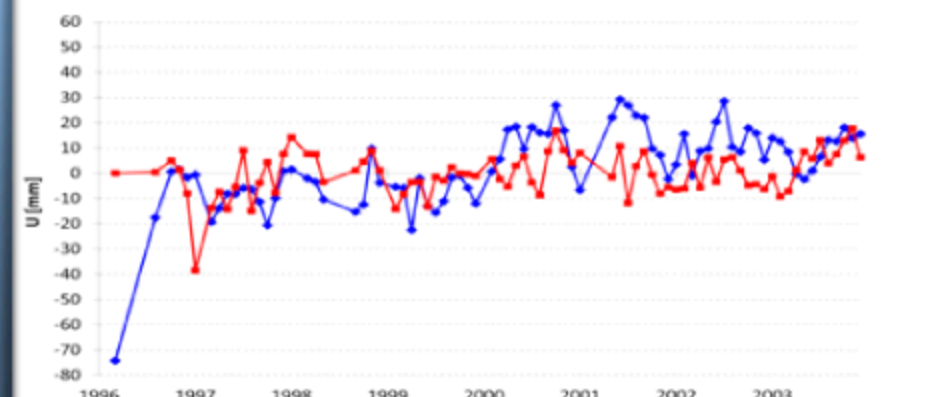
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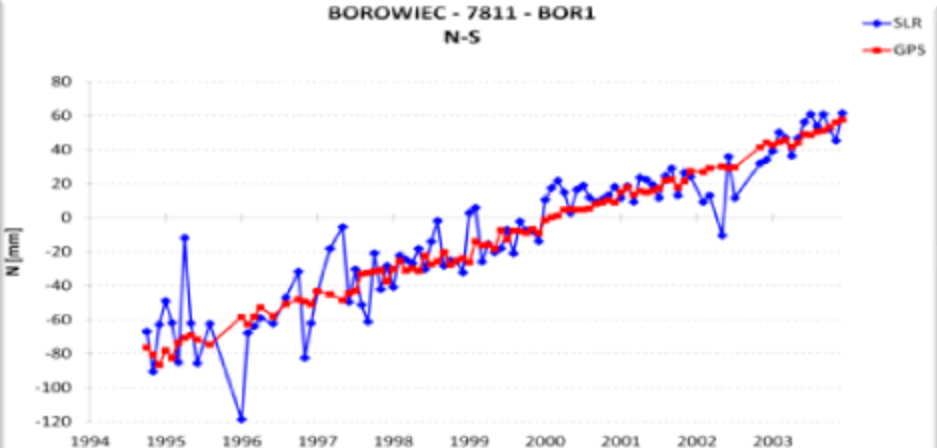
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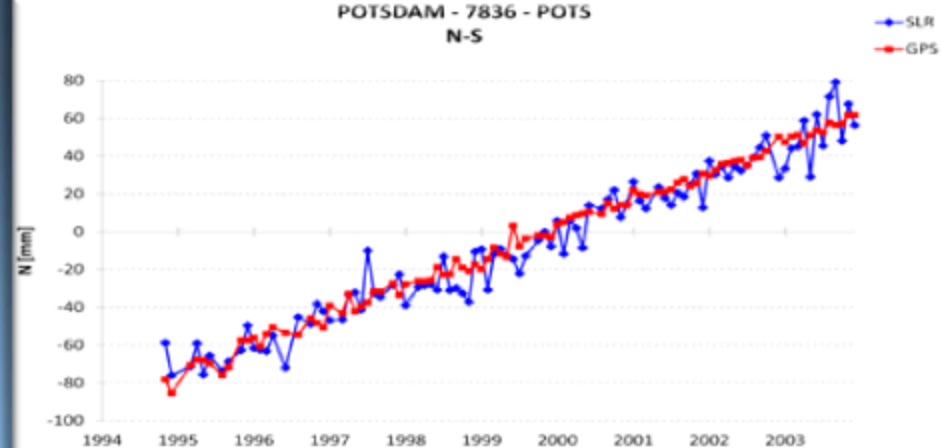
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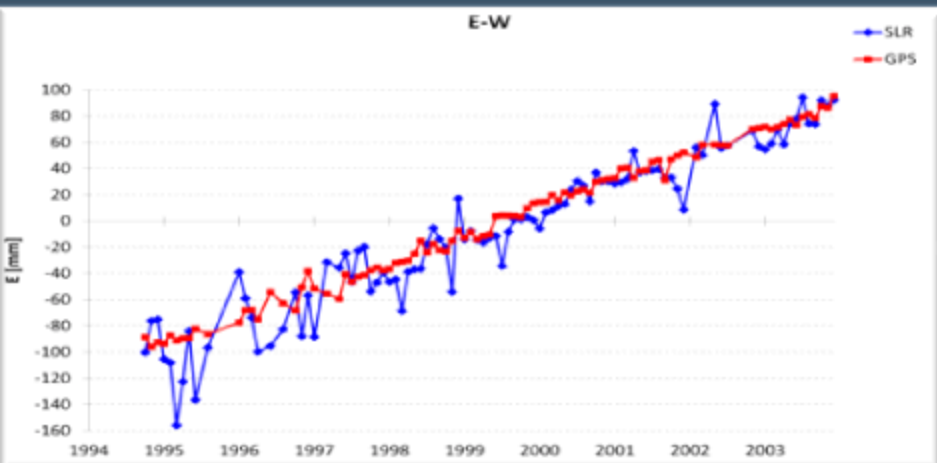
**BOROWIEC - 7811 - BOR1**  
**N-S**



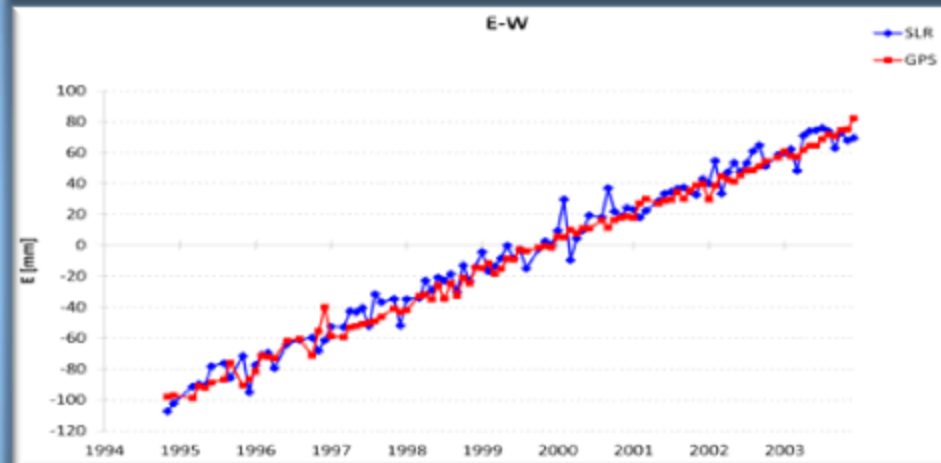
**POTSDAM - 7836 - POTS**  
**N-S**



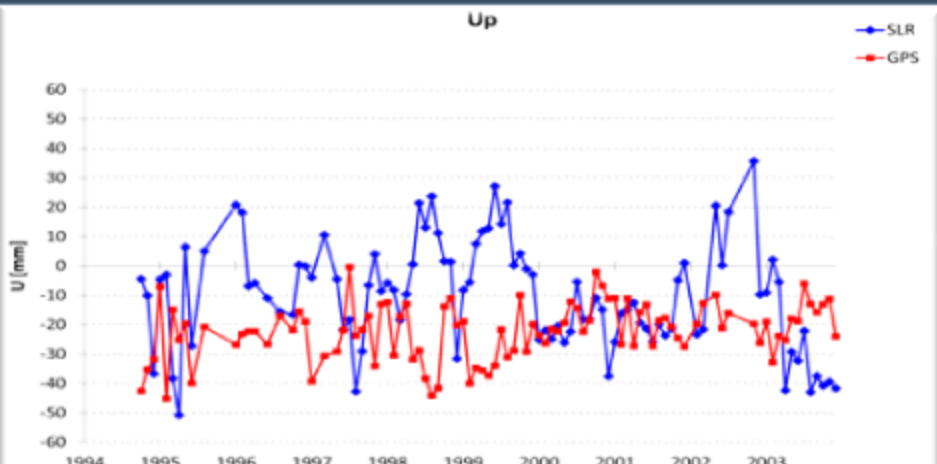
**E-W**



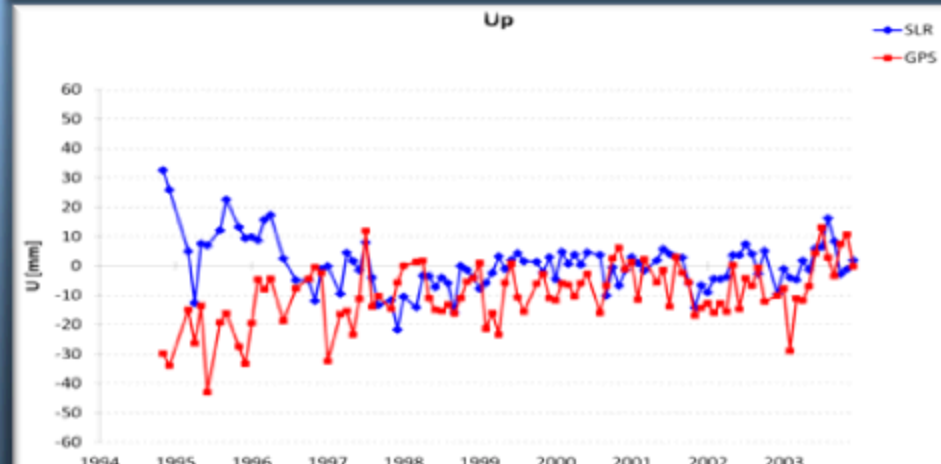
**E-W**



**Up**

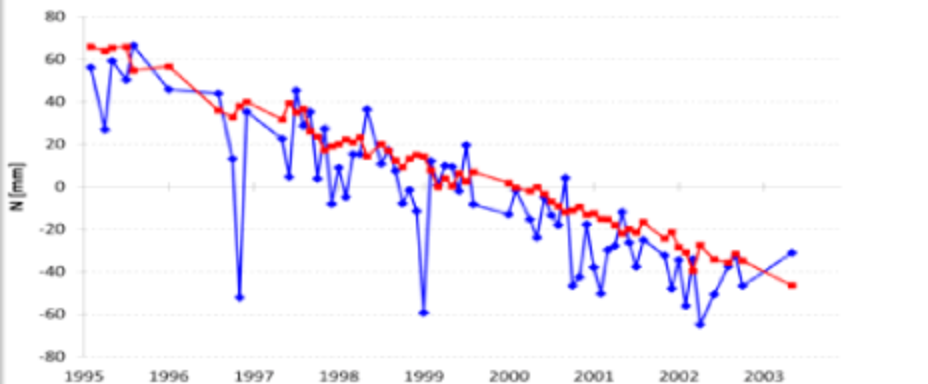


**Up**





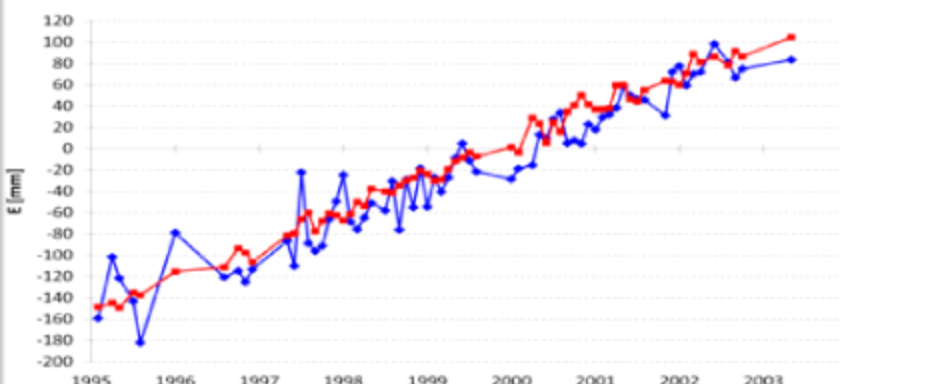
SHANGHAI - 7837 - SHAO  
N-S



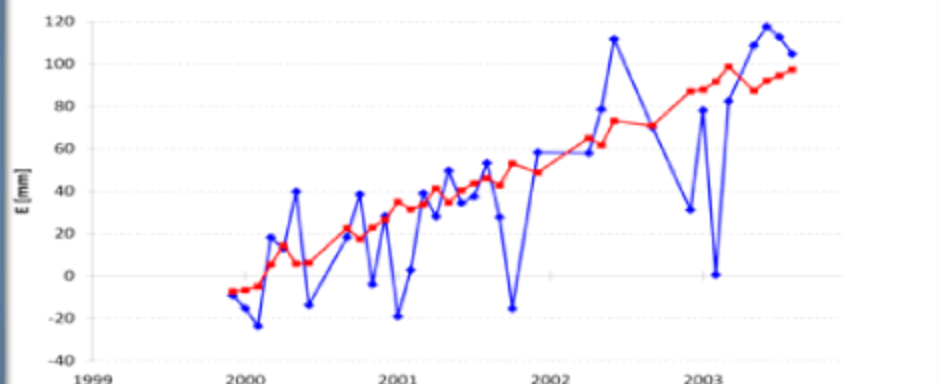
BEIJING - 7249 - BJFS  
N-S



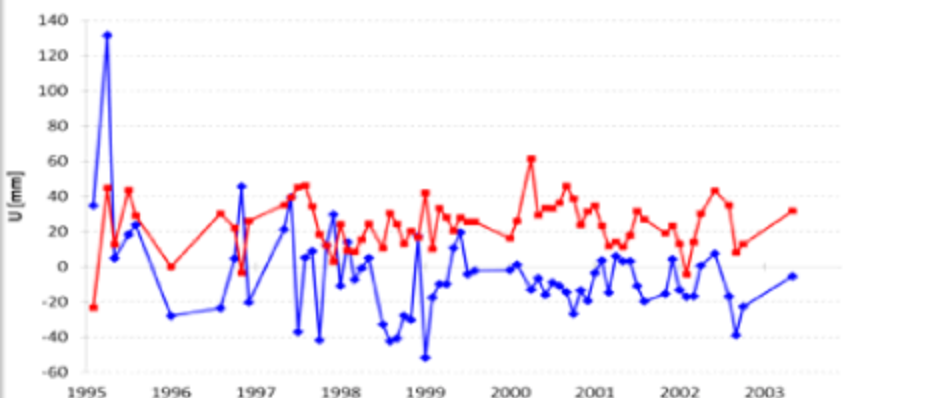
E-W



E-W



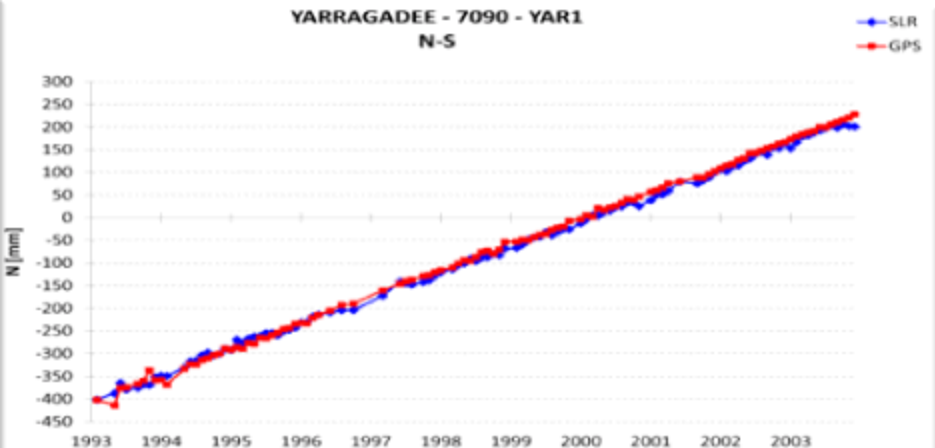
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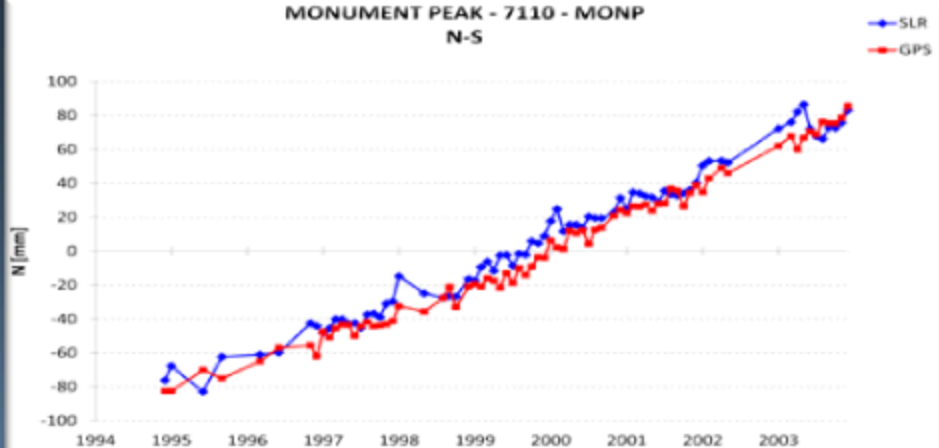
Up



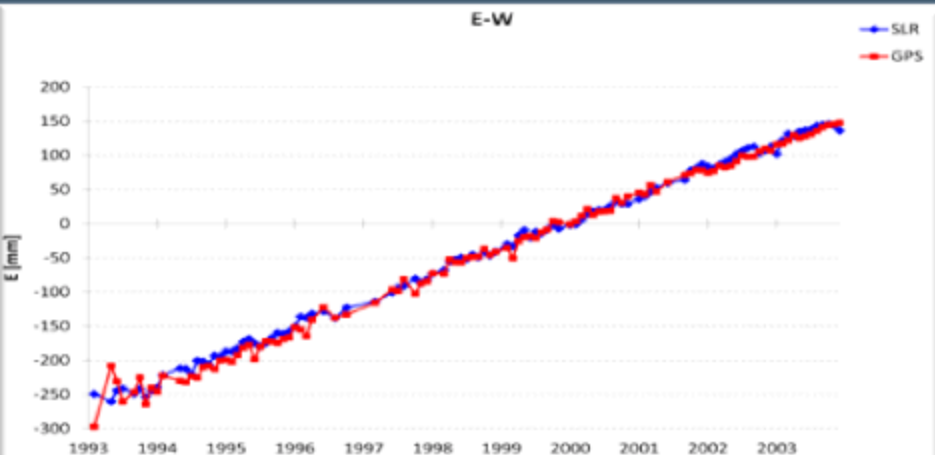
**YARRAGADEF - 7090 - YAR1**  
**N-S**



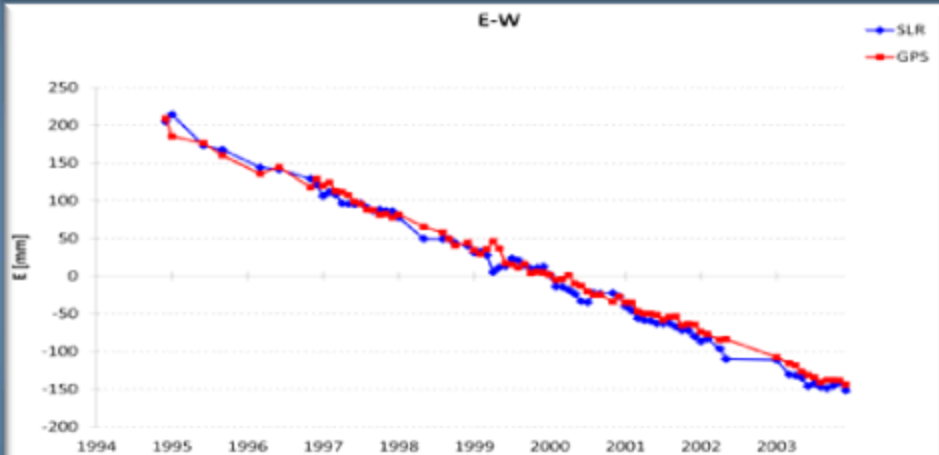
**MONUMENT PEAK - 7110 - MONP**  
**N-S**



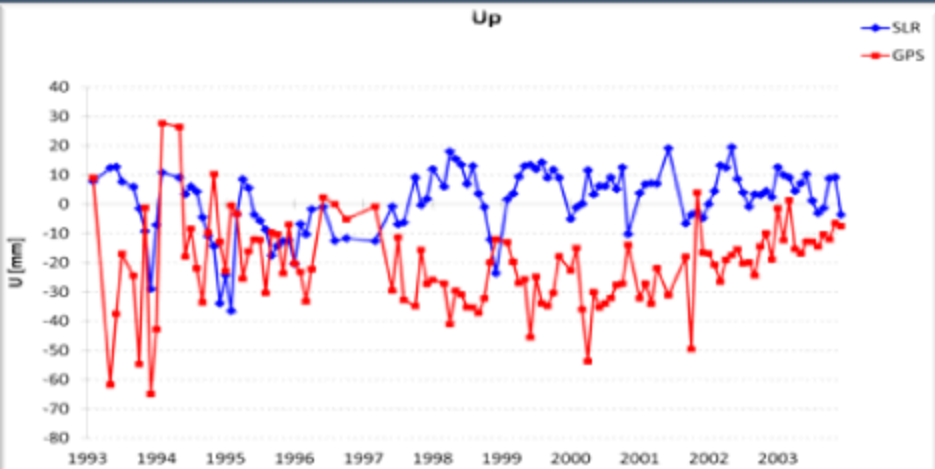
**E-W**



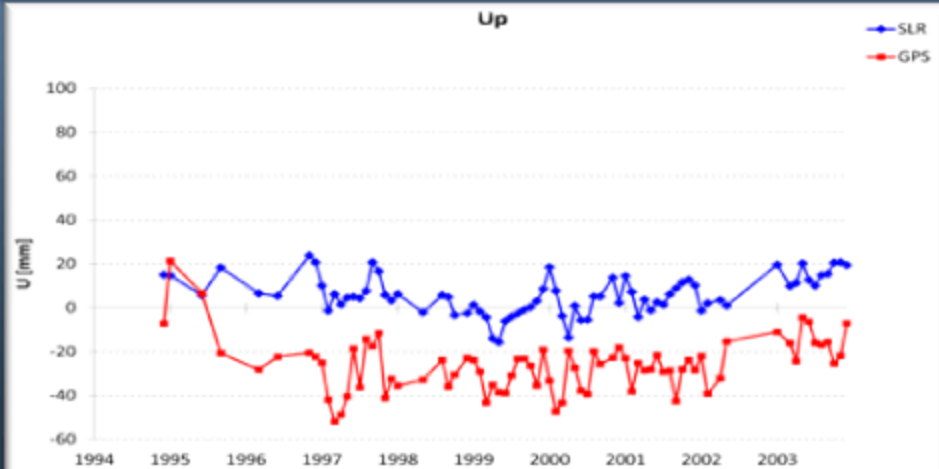
**E-W**



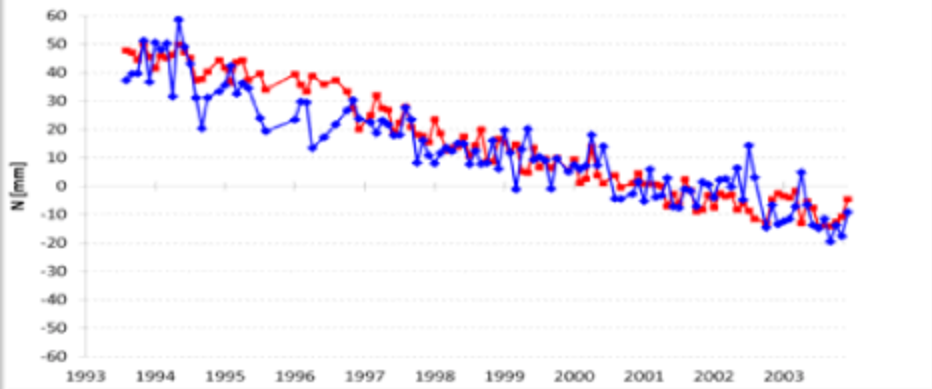
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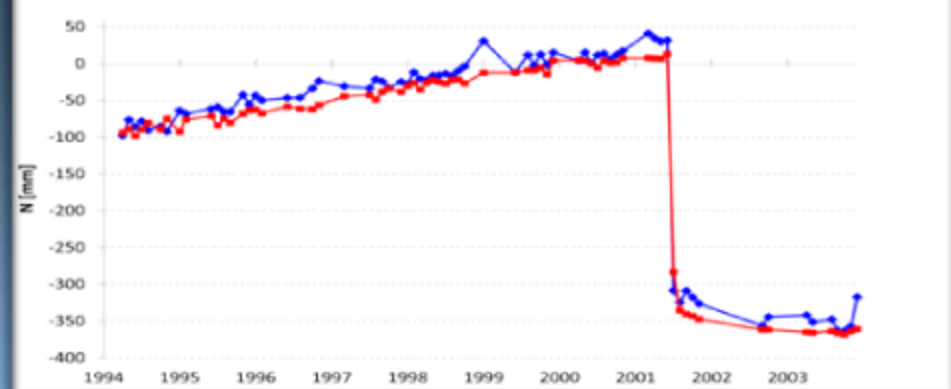
**Up**



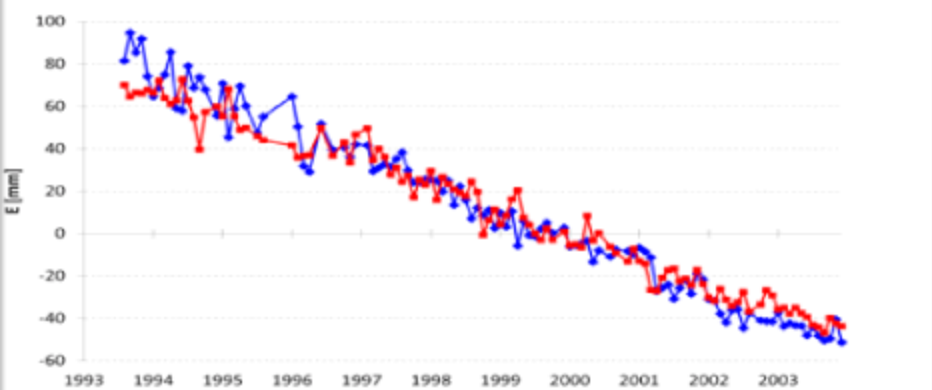
McDonald -7080-MDO1  
N-S



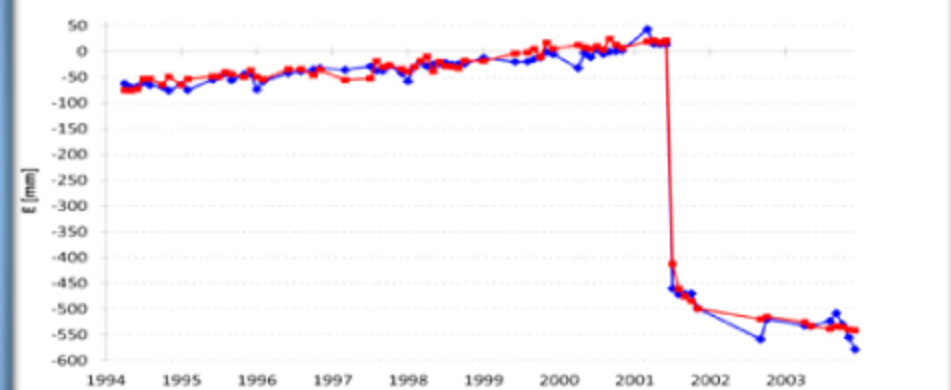
AREQUIPA -7403 - AREQ  
N-S



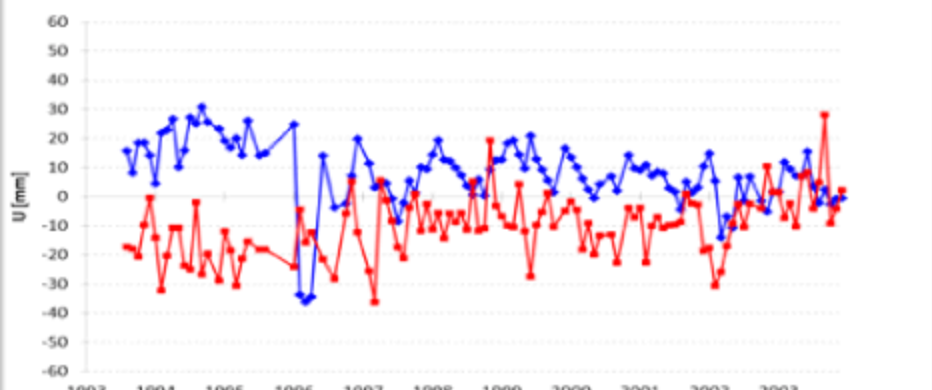
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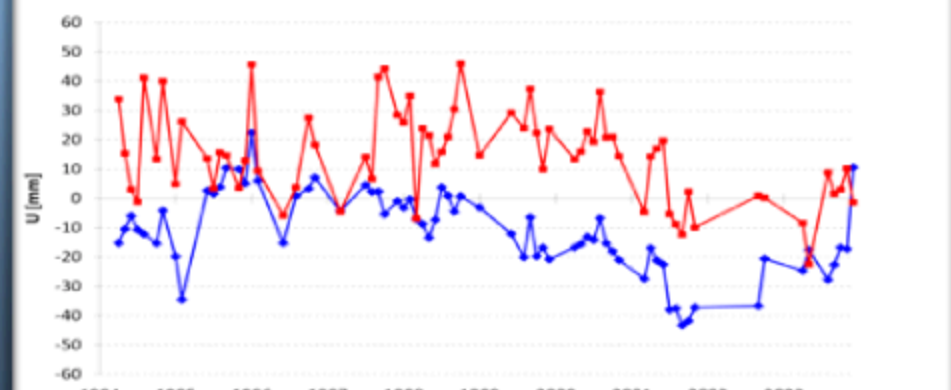
E-W



Up

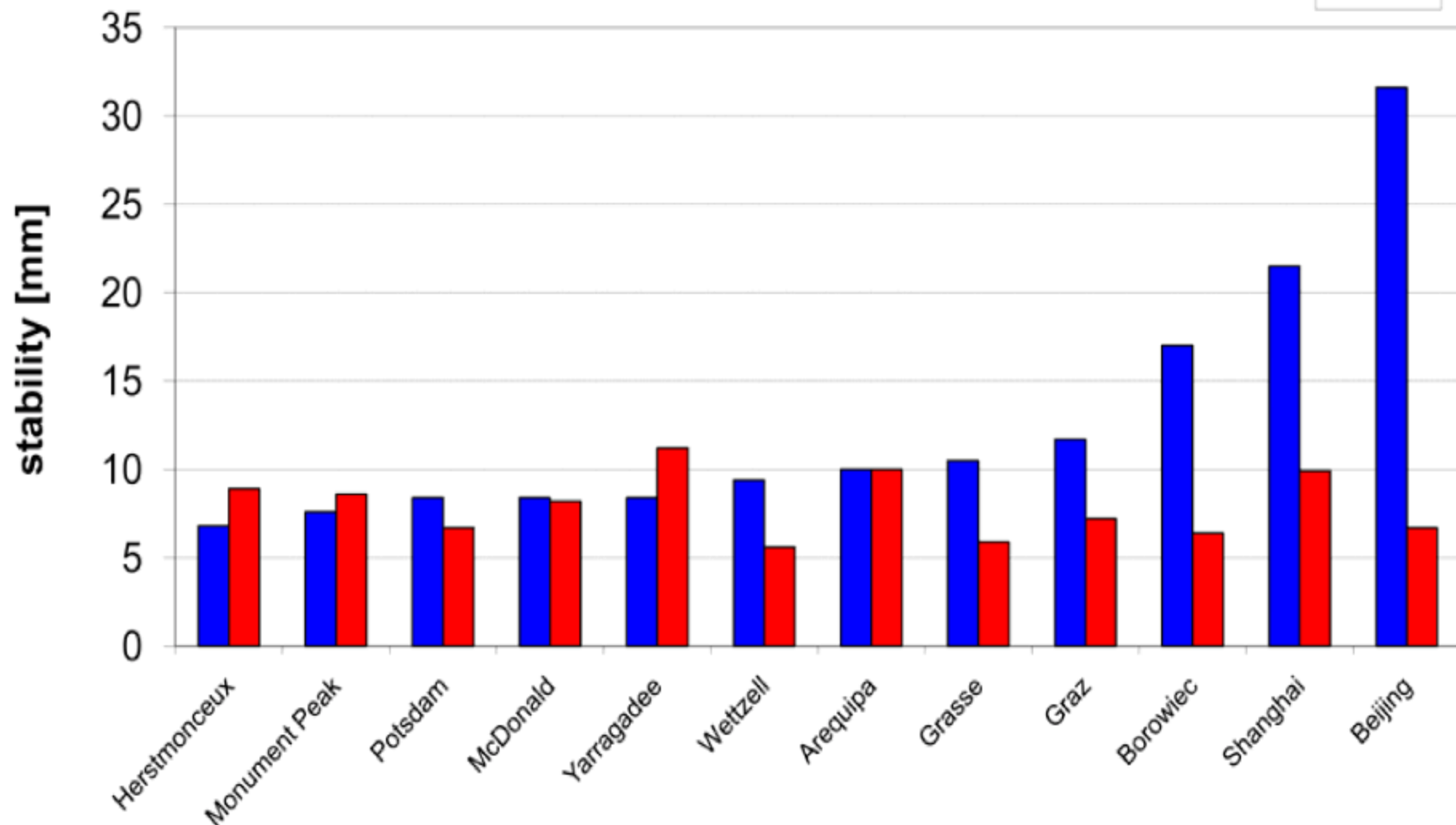


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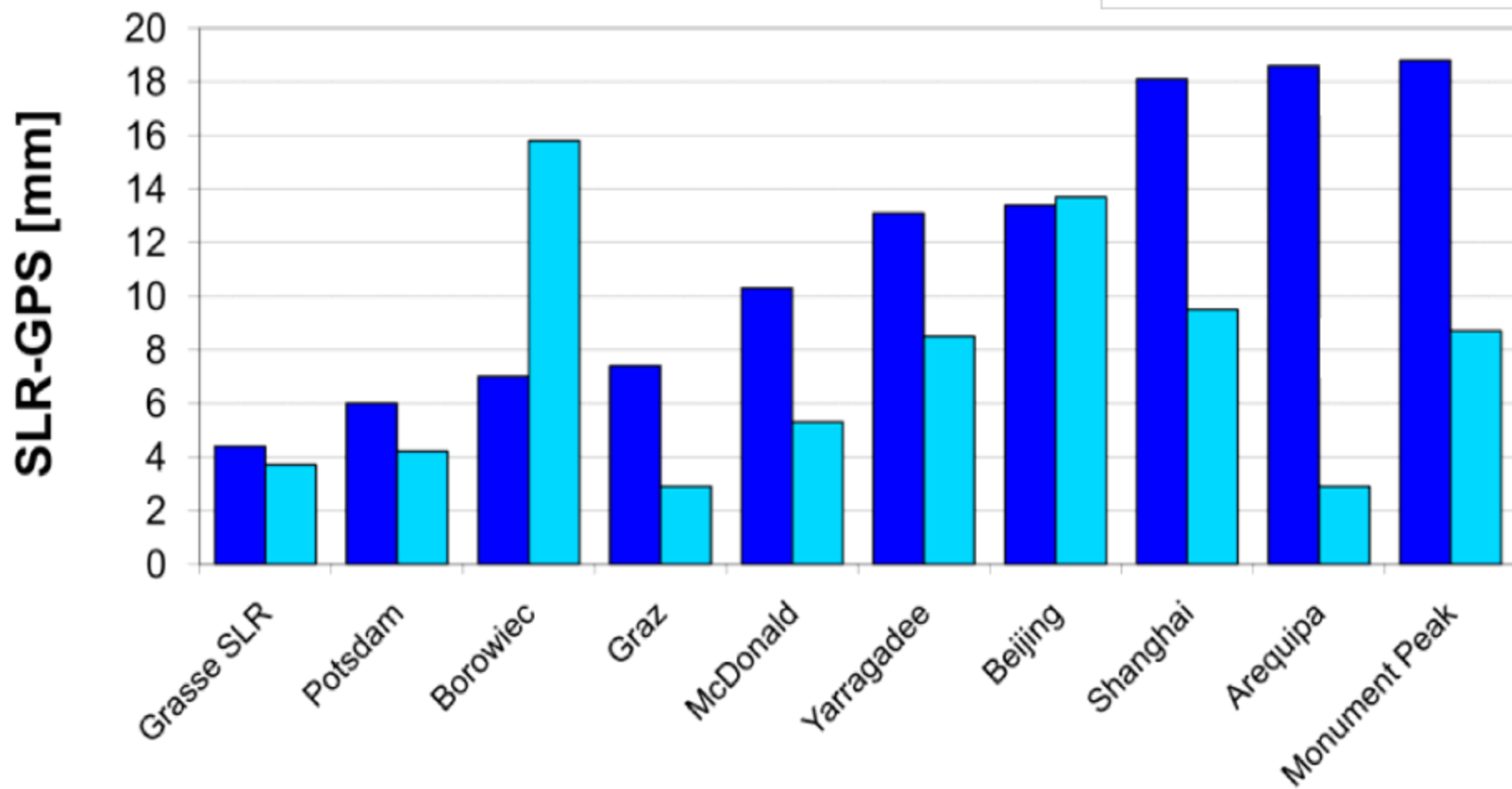
# STATION POSITIONS Coordinates Stability

■ SLR  
■ GPS

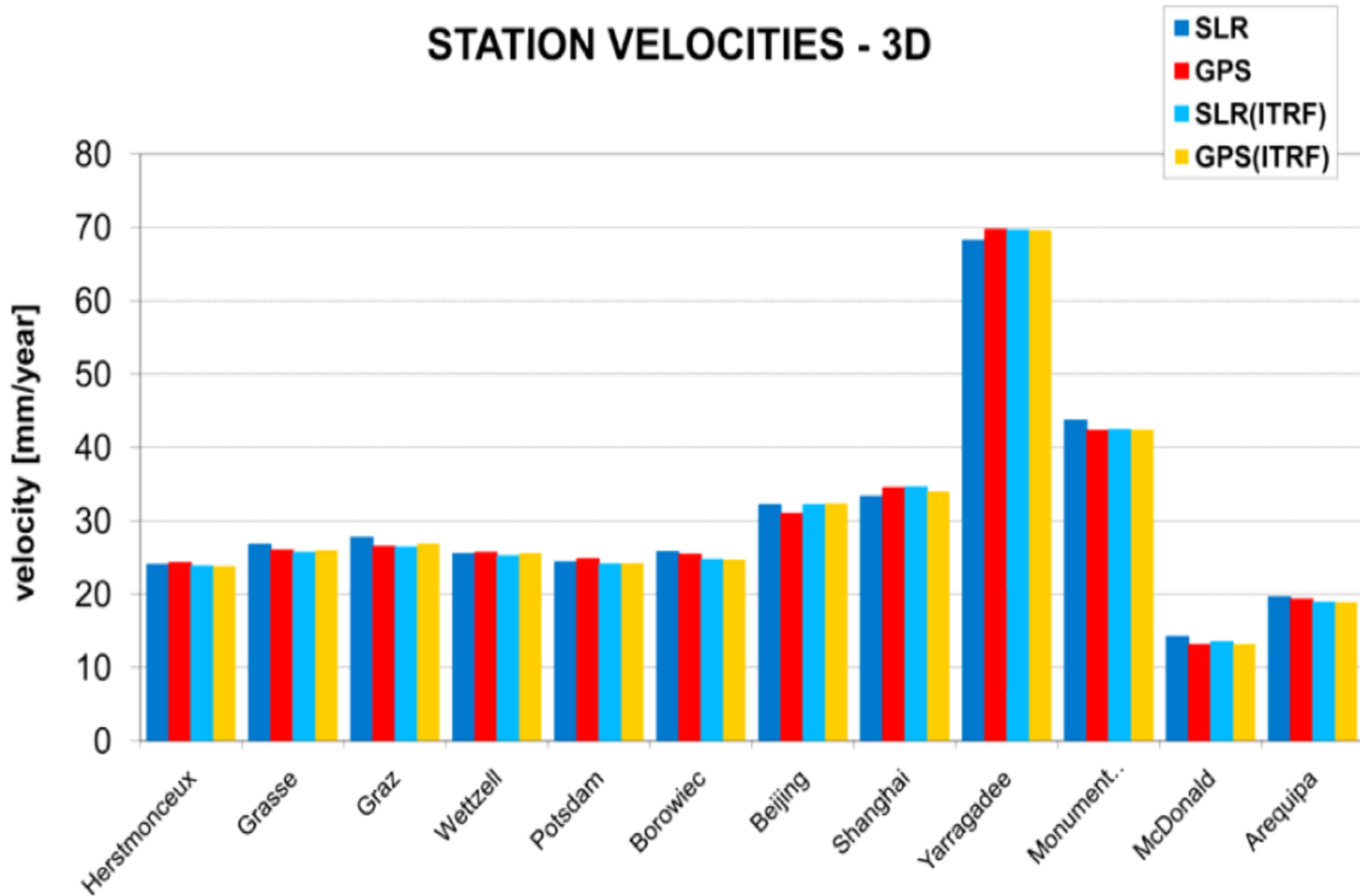


# STATION COORDINATES SLR - GPS 3D

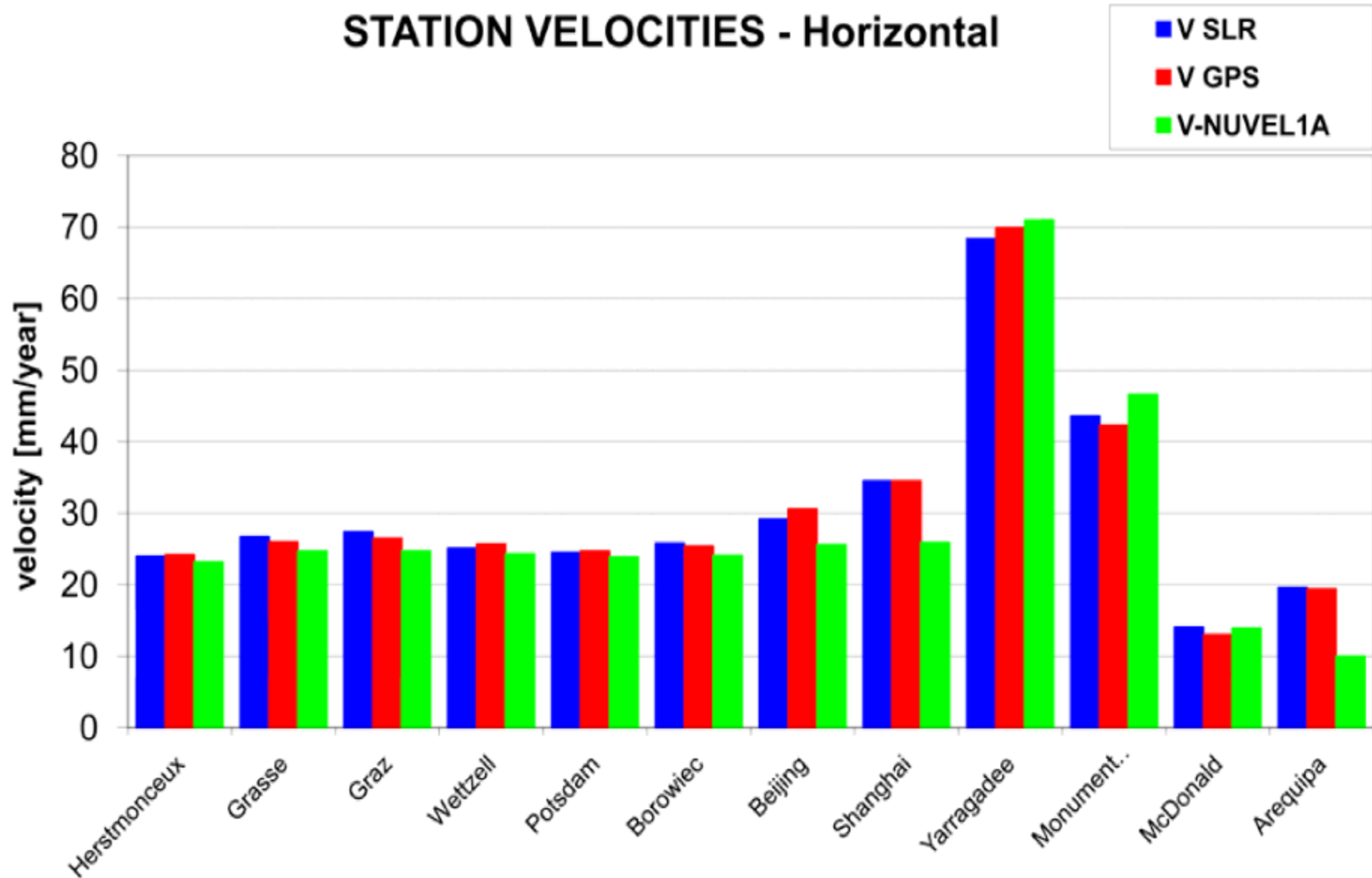
■ SLR-GPS  
■ SLR-GPS (ITRF2005)



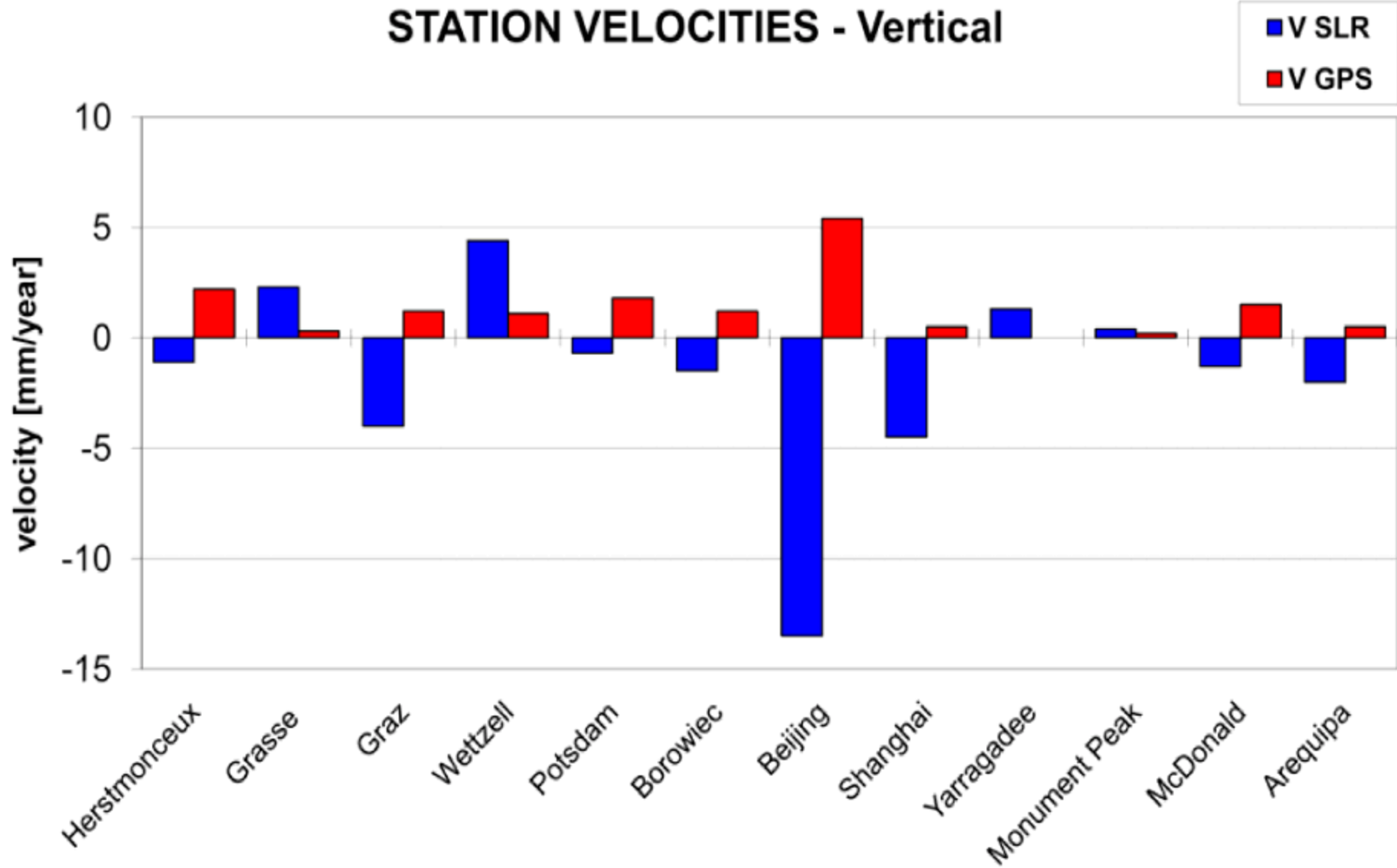
# STATION VELOCITIES - 3D



# STATION VELOCITIES - Horizontal



# STATION VELOCITIES - Vertical





# CONCLUSIONS

**horizontal components - good agreement of station positions for GPS and SLR**

**vertical component - too large differences for several stations, up to 3 cm**

**stability of GPS positions are significantly better than SLR positions**

**several the best SLR stations are little better than GPS**

**differences between GPS and SLR velocities are on the level 1 mm (also ITRF2005), we don't observe any systematical shift between both techniques**

**station velocities are in good agreement with tectonic plate model NNR-NUVEL1A, with exception Chinese stations and Arequipa**

**future task: what to do for elimination of 2-3 cm differences between SLR and GPS in vertical positions?**

# ACKNOWLEDGEMENTS

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**Dr. Michael Heflin and JPL NASA for GPS Time Series  
NASA GSFC for consent to use GEODYN-II program  
ILRS and IGS stations for their continuous efforts to provide  
high-quality SLR and GPS data.**

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