
DORIS Time Series Analysis with the Gipsy-Oasis software Summary of station related problems

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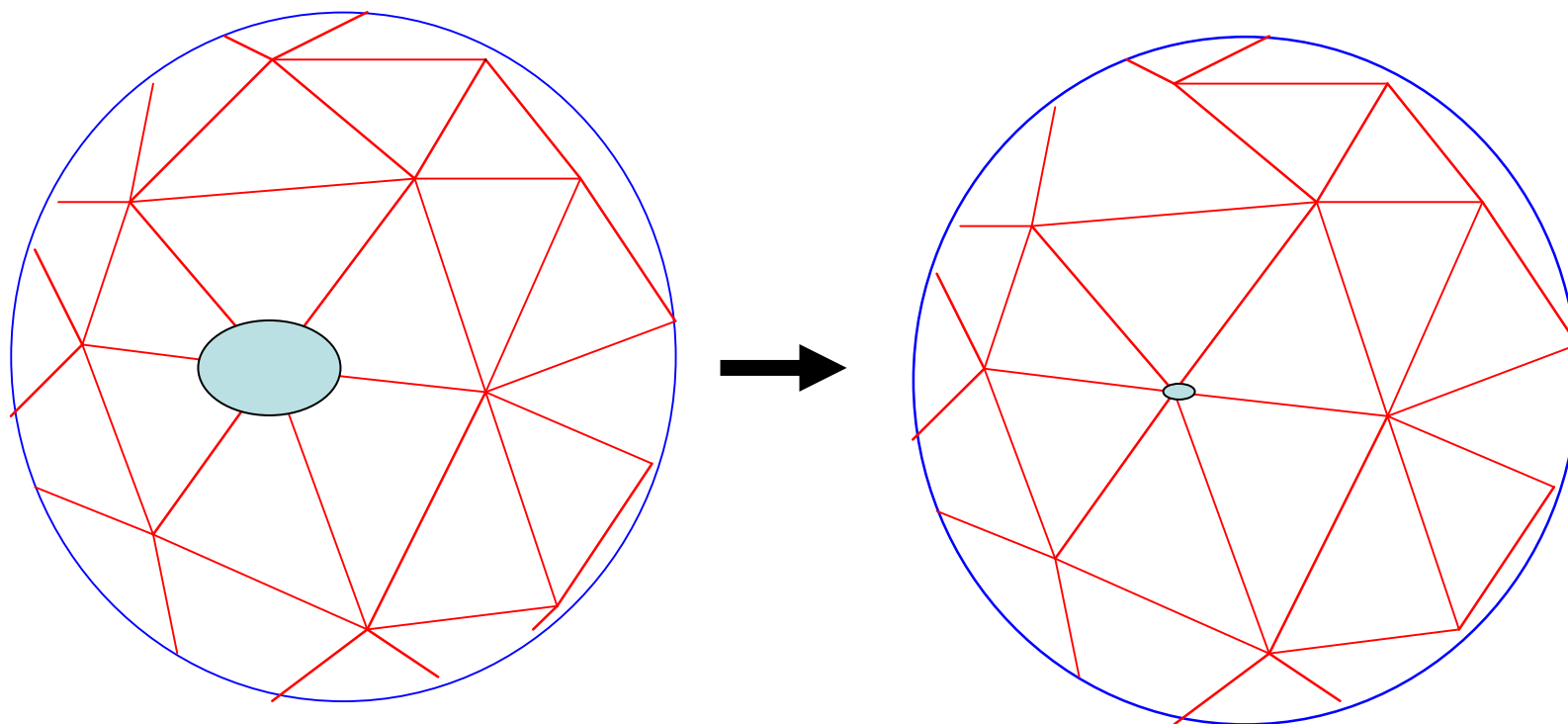
SUMMARY

- Free-network approach with GOA II
 - How does it work?
 - Advantages?
- Different types of products
 - Stations coordinates, geocenter, EOP,...
- DORIS Stations related problems (time series)
- DORIS local tie investigation
- Conclusions/Recommendations

Free-network approach

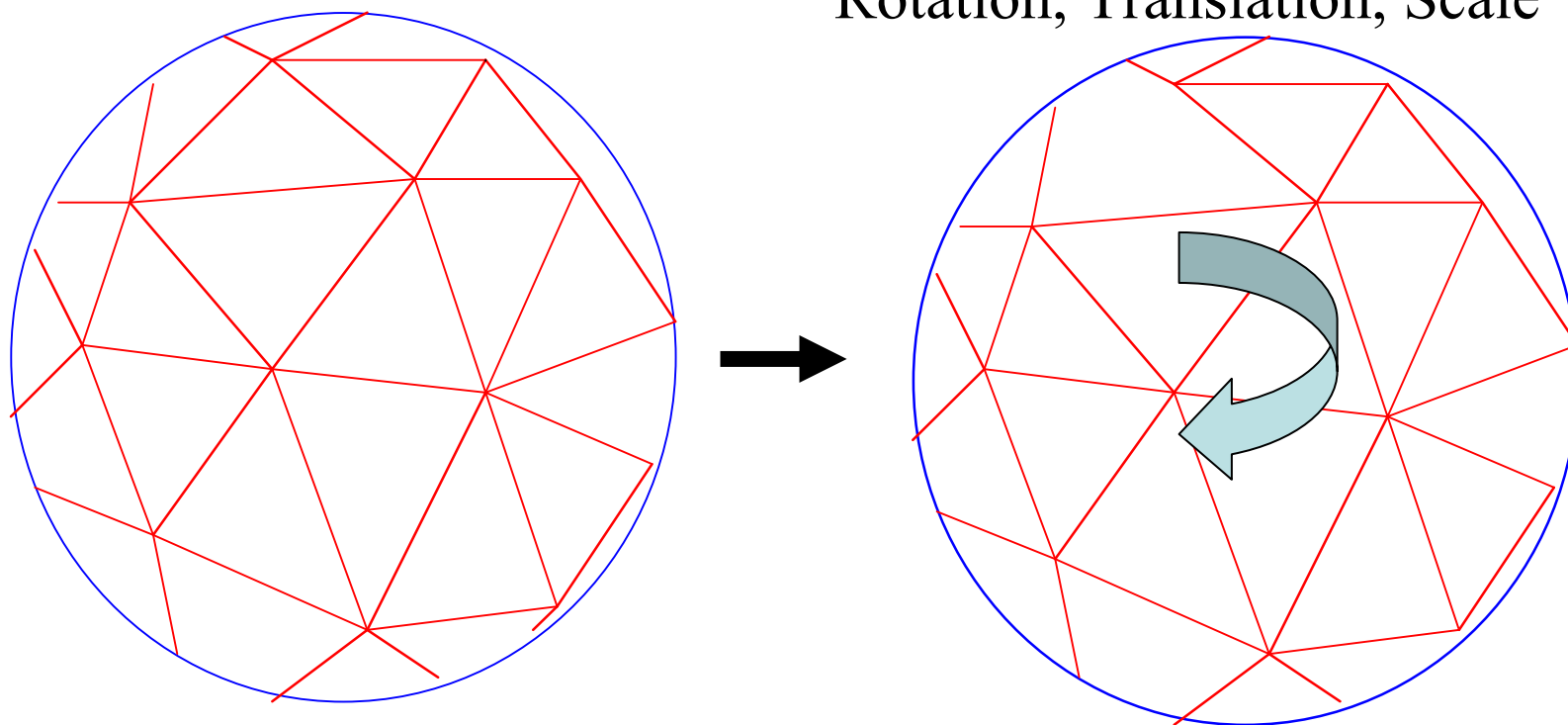
- DORIS data filtering
 - Estimating all parameters simultaneously
(stations, satellites, EOP, troposphere, clocks,...)
 - Loose constraints (100 m station, 1 km satellite)
 - Daily, weekly, monthly,...
- Projection
 - Coordinates unchanged, σ changed
- Transformation
 - Coordinates changed

Projection



Transformation

Rotation, Translation, Scale



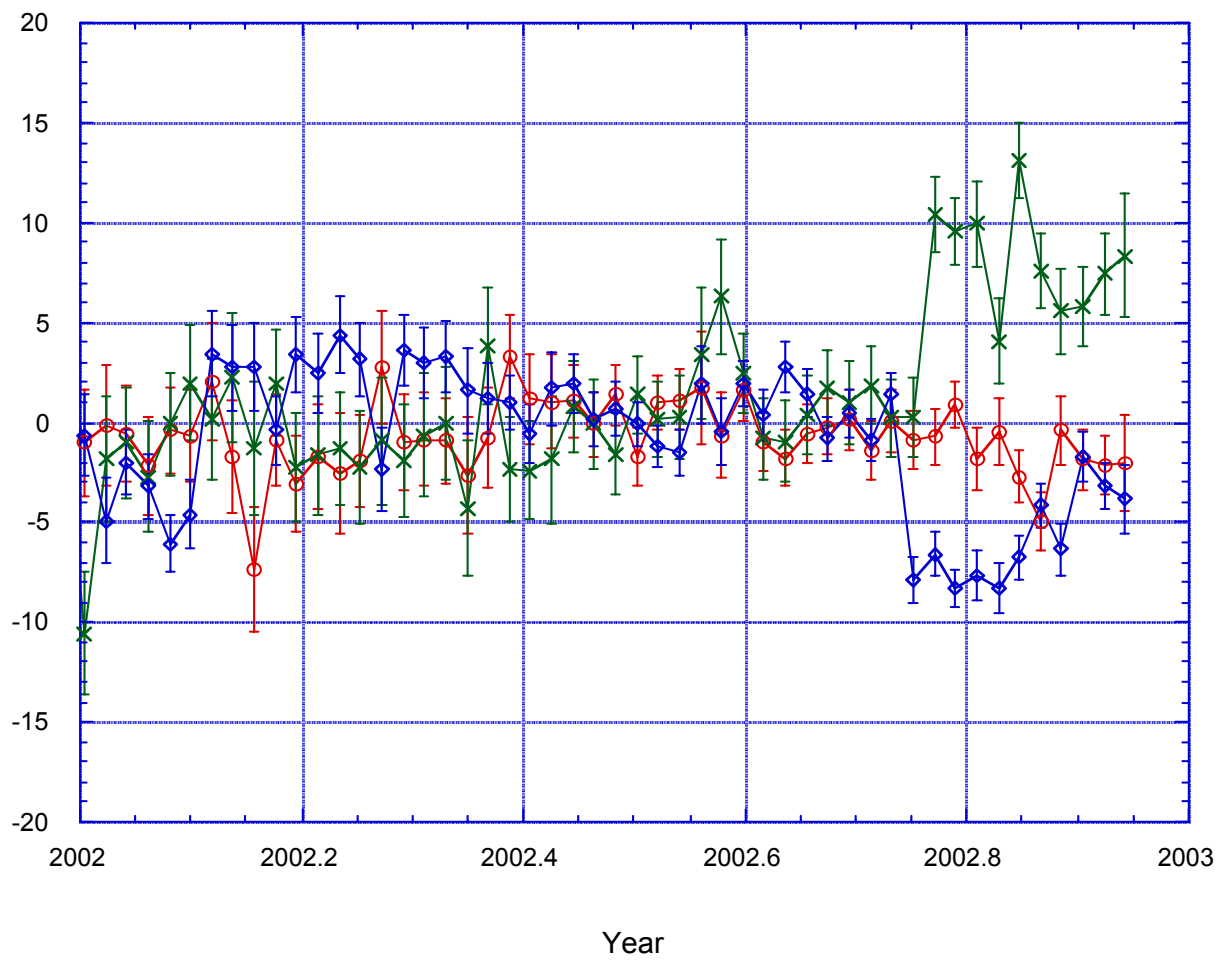
Problems found

Acronym	Station	DOMES	Problem	Comment
OTTA	Ottawa	40102S005 40102S007	No data used For these periods	Antenna fall DORISMail #0062
AMSA	Amsterdam	91401S001	No data used after Jan 1, 1996 (lon -6.5 cm)	Antenna fall DORISMail #0114 +0128
AMSB	Amsterdam	91401S002	Data not used (lon -6.5 cm)	(same)
SODA	Socorro Is.	40503S003	No data used before Jan 1, 1996 (rad -3 cm/yr)	Volcano depletion (Willis, 1998) (Cazenave, 1999)
AREA	Arequipa	42202S005 Pt#2	Break on June 23, 2001 (lat -34cm, lon -46 cm, rad -1 cm)	Earthquake June 23, 2001
SODB	Socorro Is.	40503S004 Pt #2	Break on Oct 3, 2002 (lat -5 cm, lon +8 cm, rad -3 cm)	Earthquake Oct 3, 2002



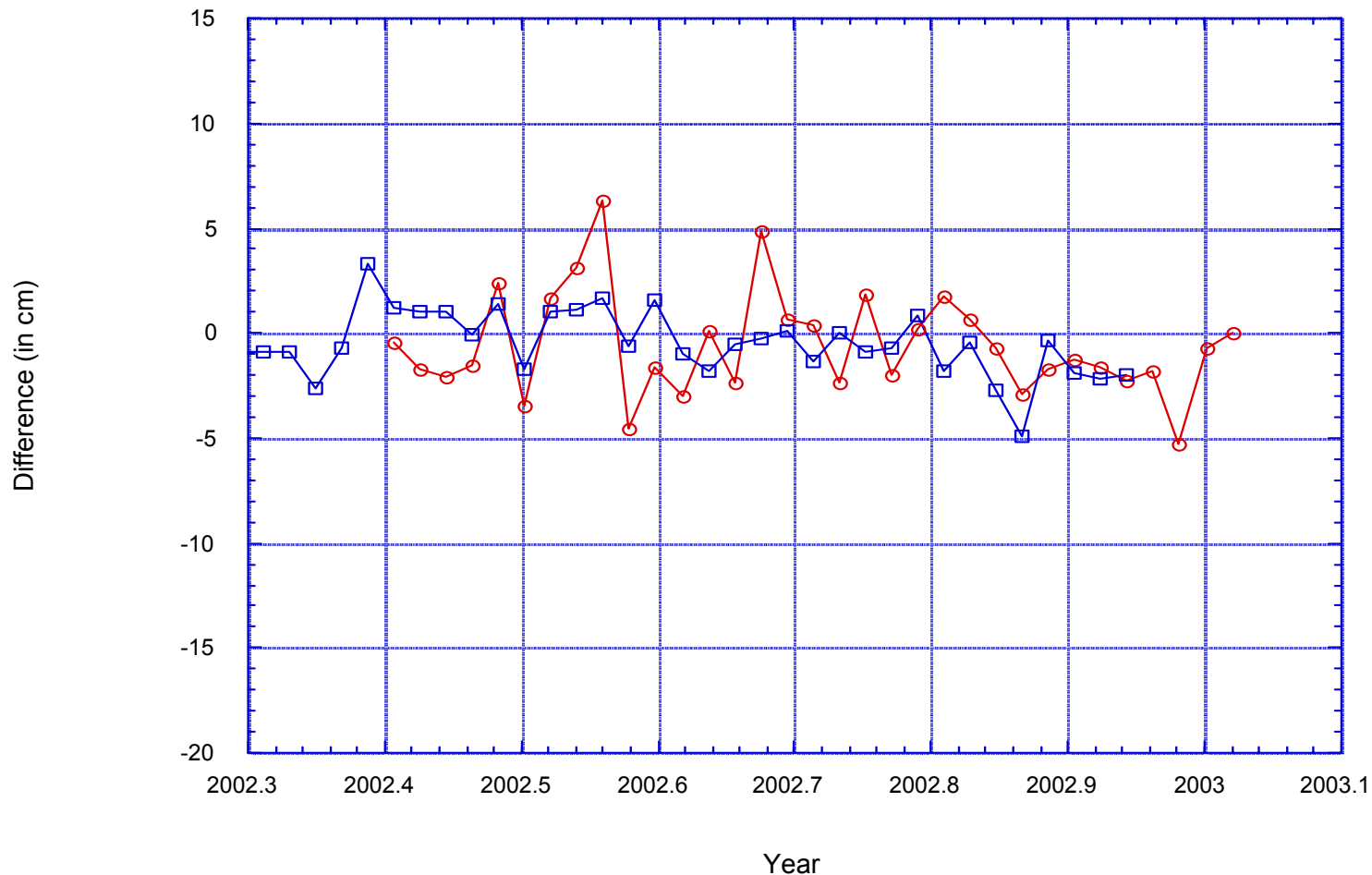
DORIS-5 satellites weekly point positioning station Socorro Island (SODB)

Latitude: -5 cm
Longitude: +8 cm
Altitude: -3 cm



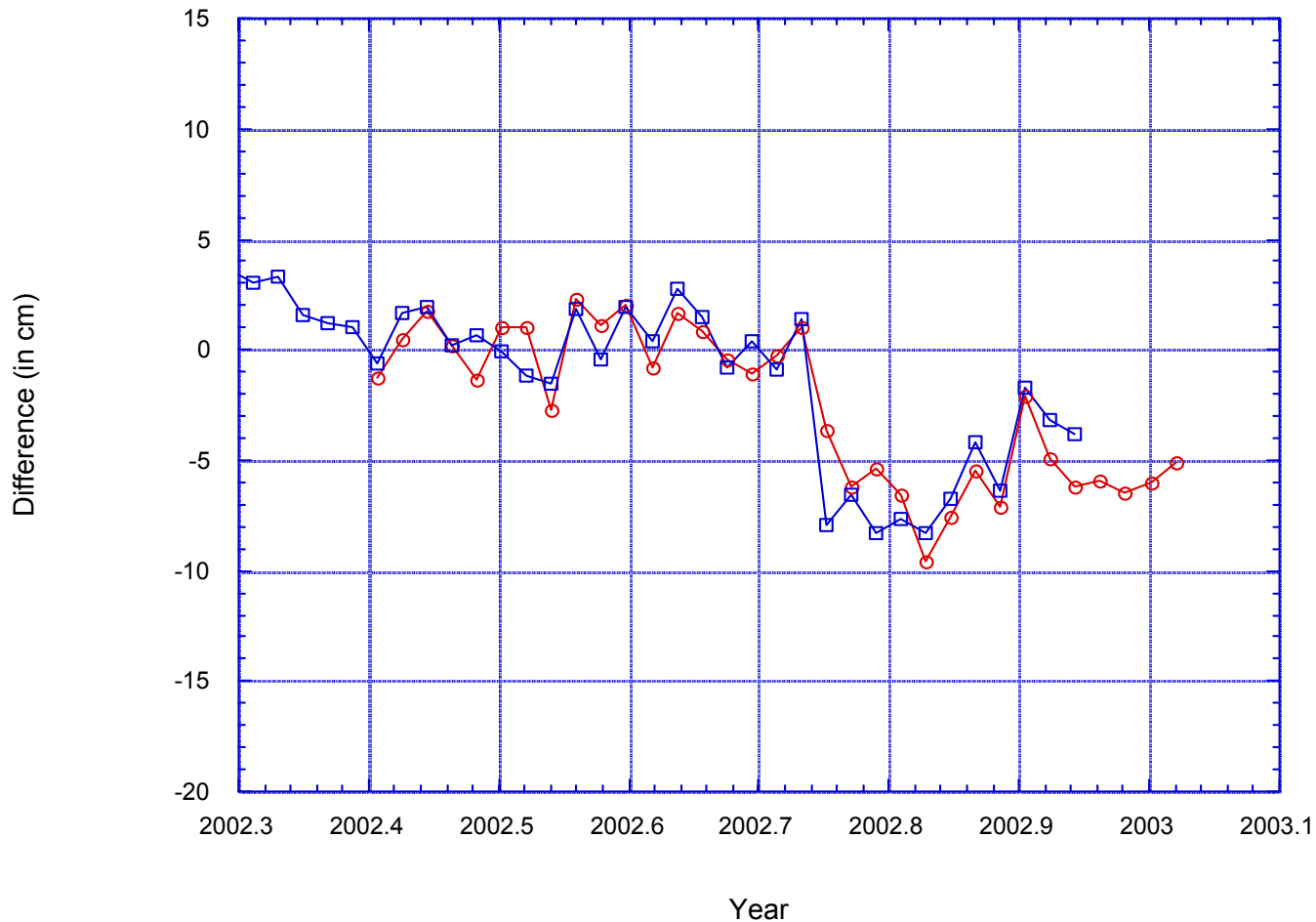
—○— SSA altitude + 3 cm
—□— IGN altitude

DORIS Weekly positioning Station Socorro (SODB) (Velocity removed)



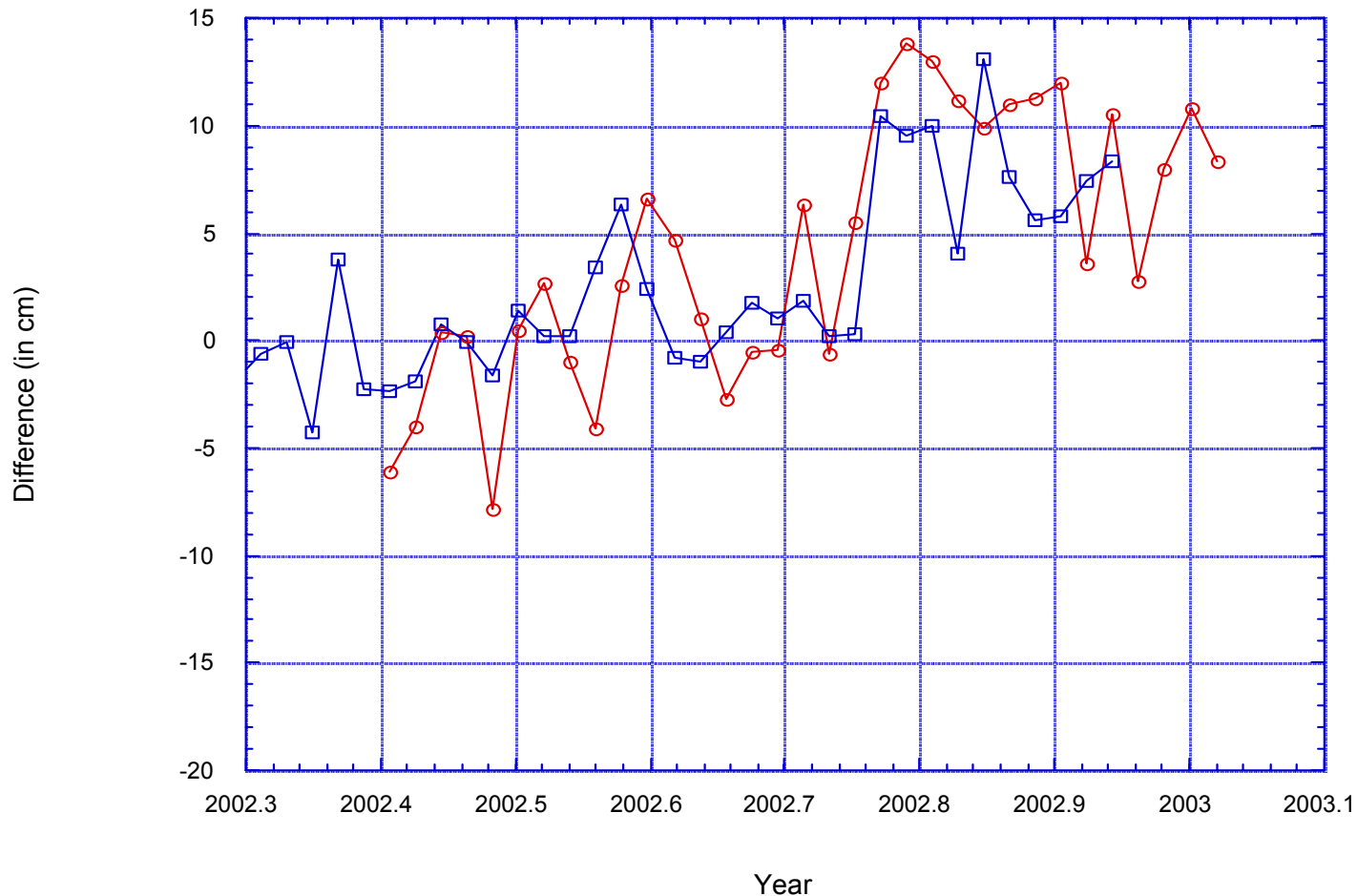
—○— SSA Latitude - 2 cm
—□— IGN Latitude

DORIS Weekly positioning Station Socorro (SODB) (Velocity removed)



—○— SSA Longitude + 7 cm
—□— IGN Longitude

DORIS Weekly positioning Station Socorro (SODB) (Velocity removed)

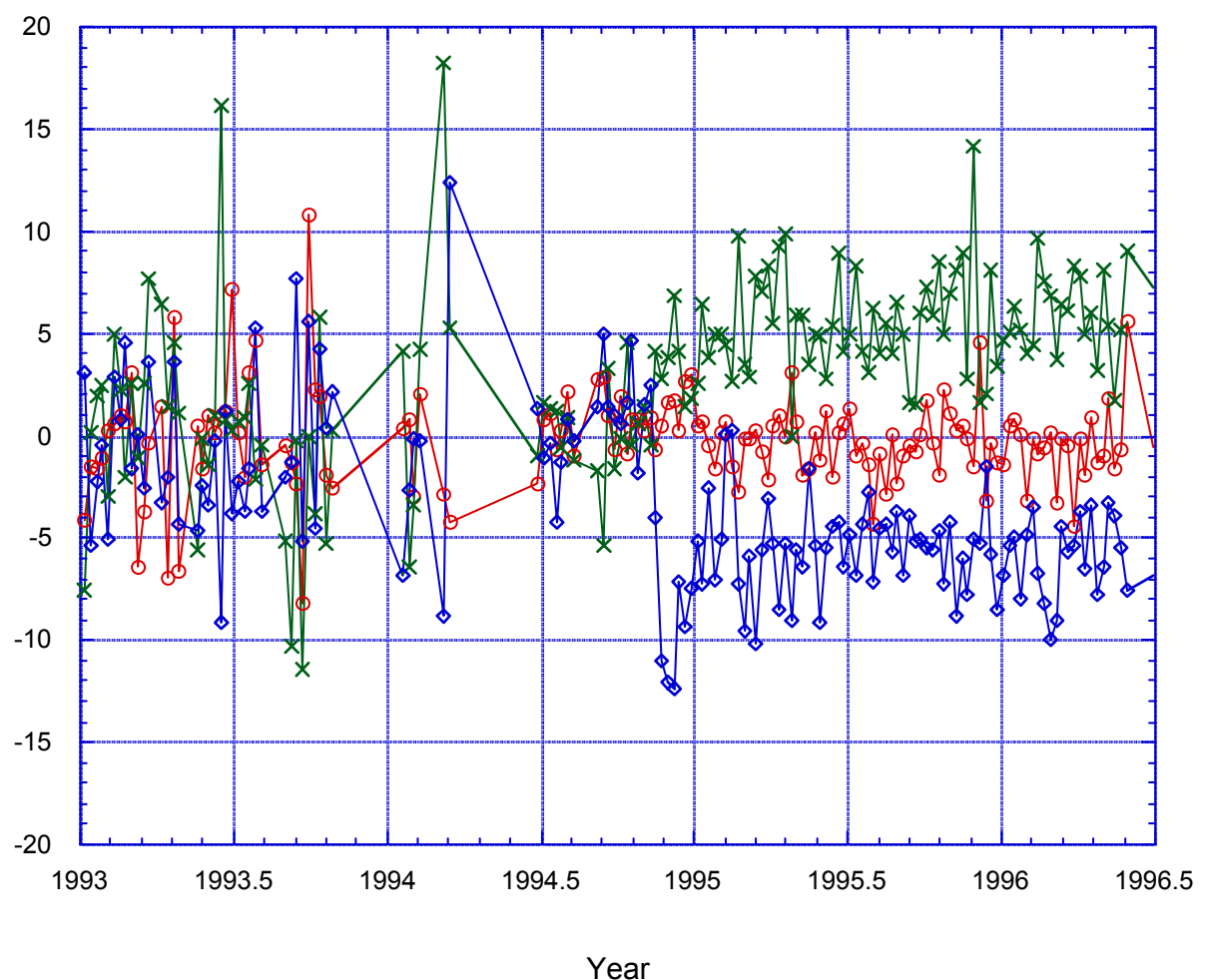


Acronym	Station	DOMES	Problem	Comment
COLA	Colombo	23501S001 Pt #2	Break on Nov 16, 1994 (lat - 6 cm,lon +5 cm,vert 0 cm)	Earthquake Philippines Nov 14, 1994
SAKA	Sakhalins	12329S001 Pt #2	Break between Sep 28 - Nov 9, 1994 (lat 0 cm, lon +3cm, vert +3cm)	Data gap?
SAKA	Sakhalins	12329S001 Pt #3	Break between Dec 16, 1998 - Feb 3, 2002 (lat +4cm, lon -5cm, +1cm rad)	Data gap?
DIOA	Dyonisos	12602S011 Pt #2	Break on Apr 1, 1995 (lat -1cm, lon +4cm, -5cm)	?
KRAB	Krasnoyarsk	12349S001 Pt #2	Break between August 5, 1998 - May 19, 1999 (lat 0cm,lon -3cm,rad +3cm)	Data gap?

○ COLA vertical
× COLA longitude
◇ COLA latitude

DORIS-5 satellites weekly point positioning station Colombo (COLA)

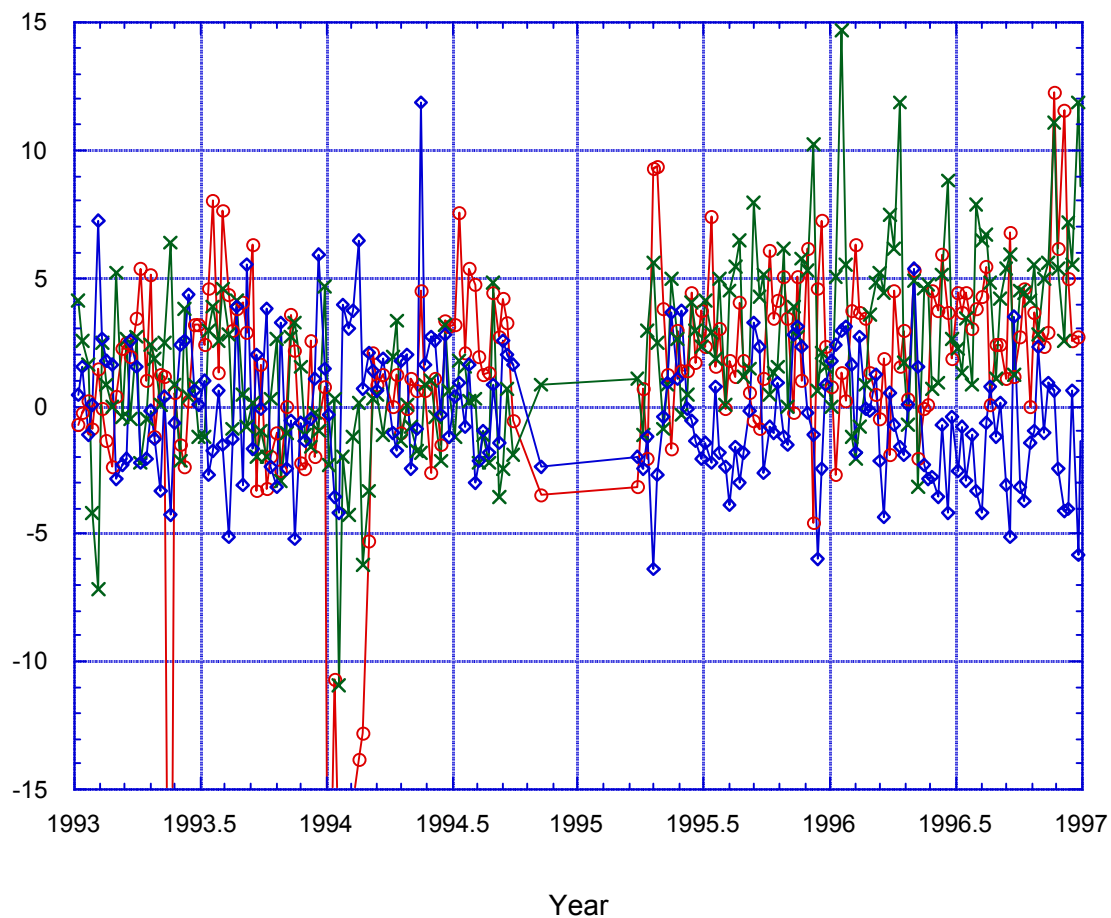
Latitude: -6 cm
 Longitude: +5 cm
 Altitude: 0 cm



○ SAKA vertical
× SAKA longitude
◇ SAKA latitude

DORIS-5 satellites weekly point positioning station Sakhalins (SAKA)

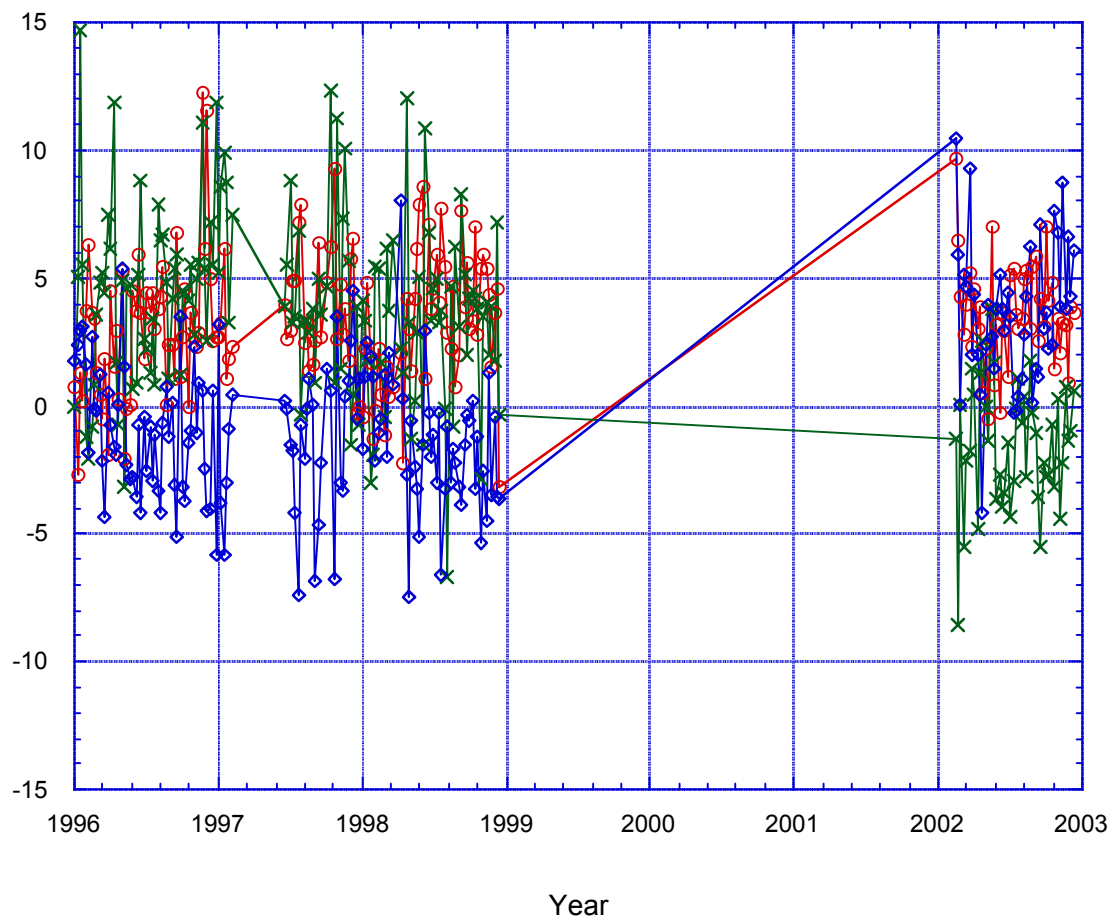
Latitude: 0 cm
Longitude: +3 cm
Altitude: +3 cm



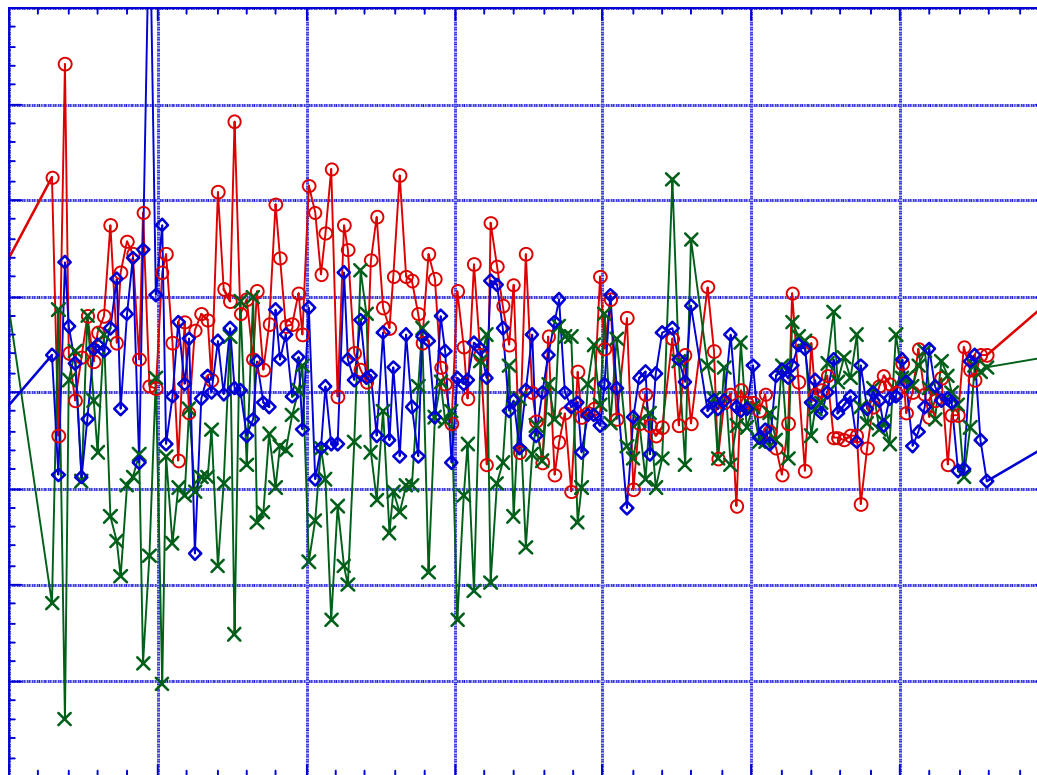
- SAKA vertical
- ×— SAKA longitude
- ◇— SAKA latitude

DORIS-5 satellites weekly point positioning station Sakhalins (SAKA)

Latitude: +4 cm
Longitude: -5 cm
Altitude: +1 cm



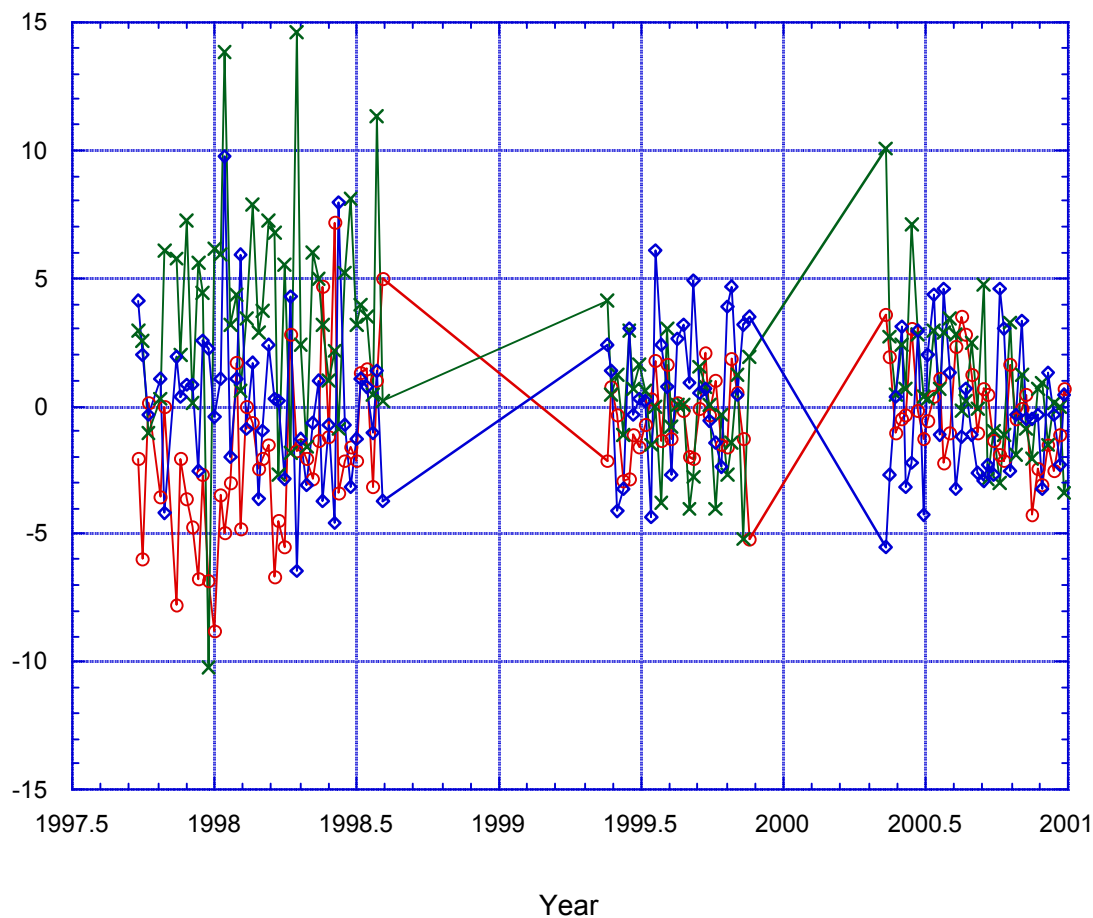
Latitude: -1 cm
Longitude: +4 cm
Altitude: -5 cm



—○— KRAB vertical
—×— KRAB longitude
—◇— KRAB latitude

DORIS-5 satellites weekly point positioning station Krasnoyarsk (KRAB)

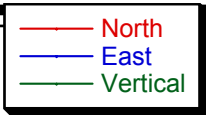
Latitude: 0 cm
Longitude: -3 cm
Altitude: +3 cm



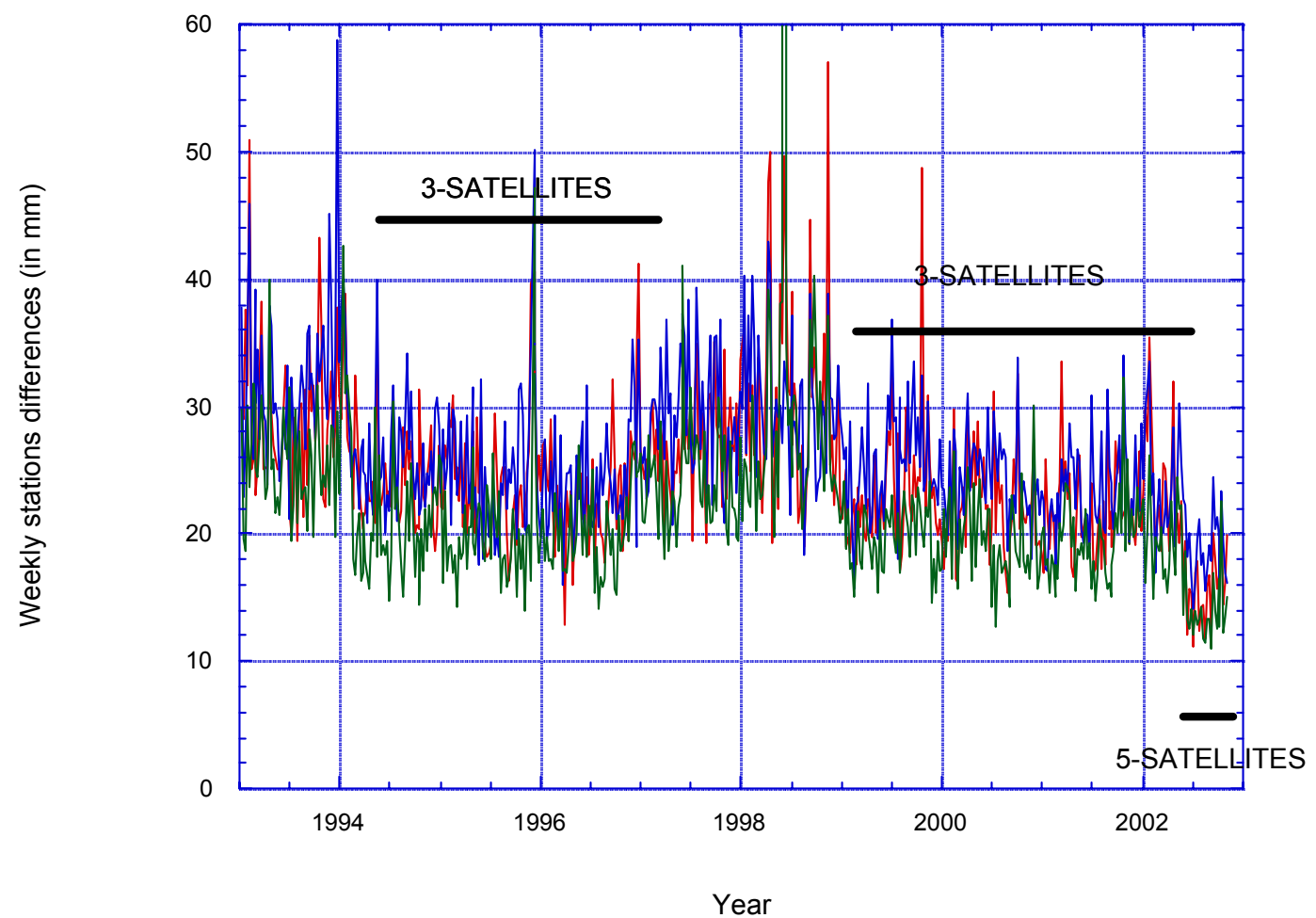
IERS Meeting Munich, 2002

Recommendation 6

(IVS, ILRS, IGS, IDS) are urged to ask their respective Analysis Centers to adopt a unique list of time breaks, as a consequence of geophysical phenomena. The ITRS PC and Technique Centers are also asked to ensure consistency of time breaks in the collocation sites.

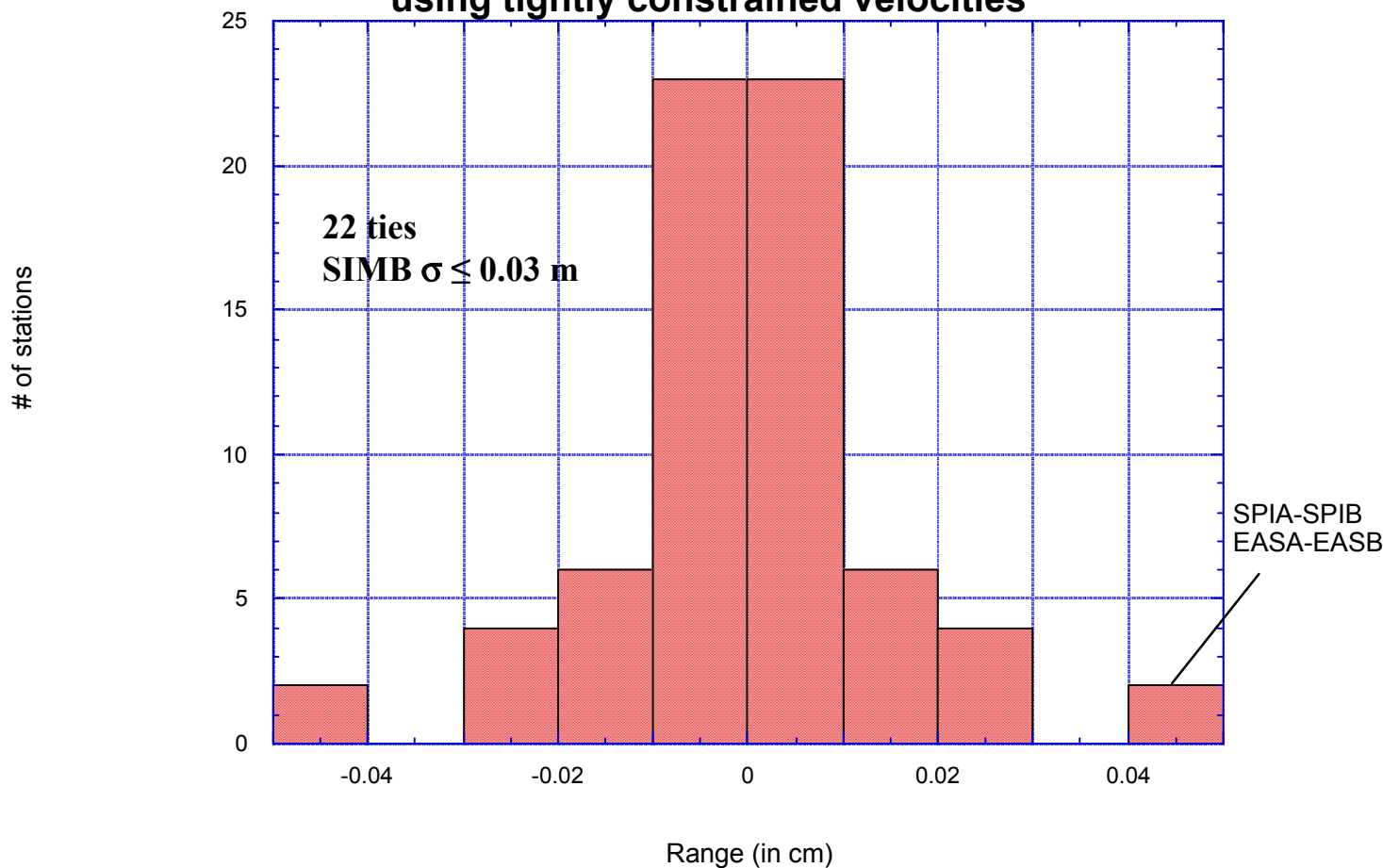


DORIS Weekly positioning Comparison with IGN02D02



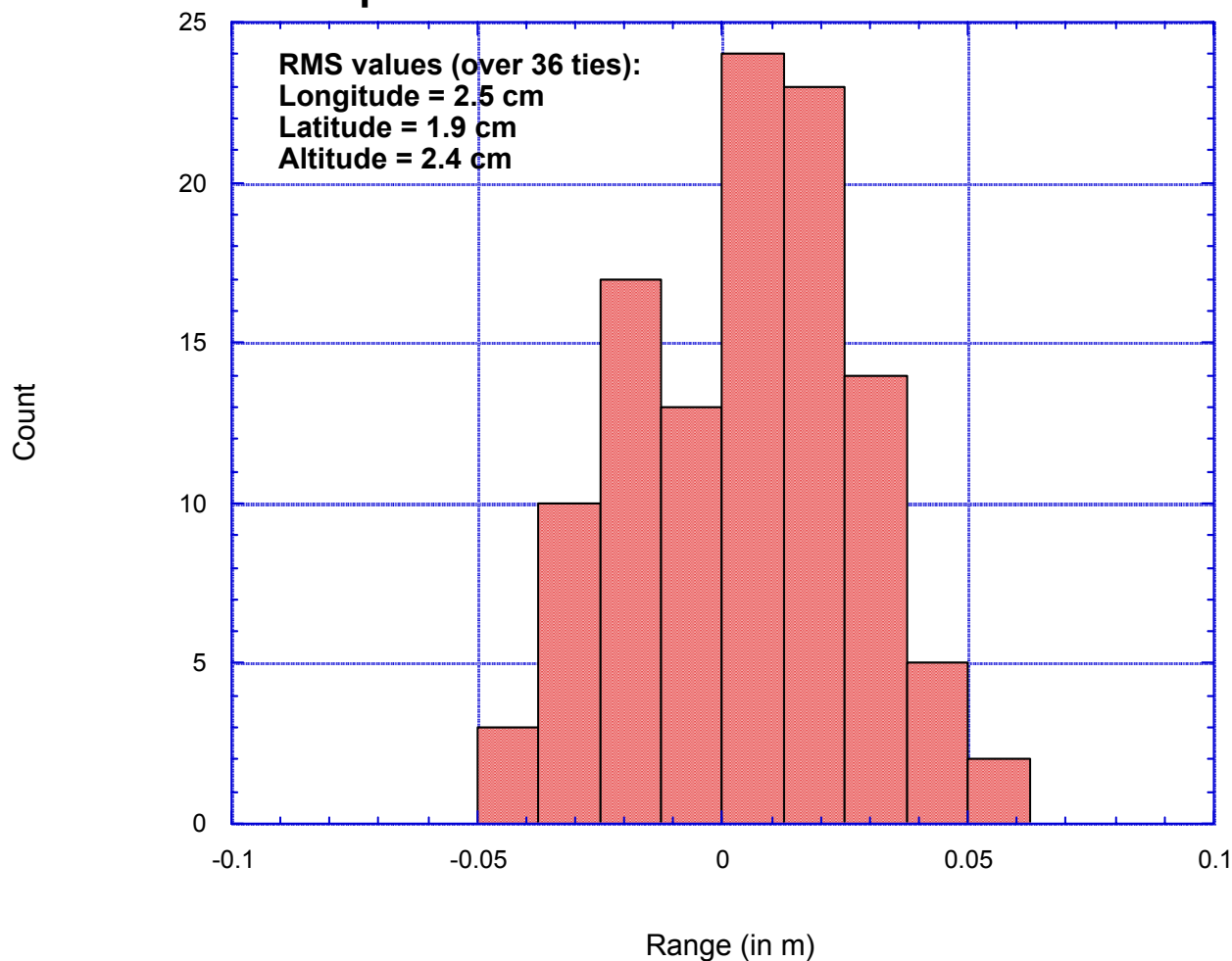
Local tie/SIMB - DORIS estimation

**DORIS-DORIS local tie
Difference in X,Y,Z between
SIMB values and DORIS coordinates at 1997.0
using tightly constrained velocities**



Local tie/SIMB - DORIS/GPS estimation

DORIS/GPS local tie Differences in lat/lon/rad Epoch: mean observation time for DORIS



Preliminary results
(Zuheir Altamimi)
Longitude : 1.30 cm
Latitude : 0.73 cm
Altitude: 1.15 cm

(to be confirmed)

GPS-DORIS tie study

Low accuracy local ties

(New surveys are planned by SIMB when)

DOMES	Station	Problem
41705S007	Santiago	SANA-SANT precision 10 cm
91201S002	Kerguelen	KERA-KERG precision 10 cm
97301S004	Kourou	KRUB-KOUR precision 5 cm
66006S001	Syowa	SYOB-SYOG precision 5 cm
39801S005	Mahe	MAHB-SEY1 precision 2 cm
42202S005	Arequipa	AREA-AREQ precision 1 cm
40424S008	Kokee Park	KOKA-KOKB precision 1 cm



DOMES	Station	Problem found	
30302S202 30302S005 30302S006	Hartebeesthoek	HBKA-HARB -5.7/+1.0/+2.3 HBLA-HARB -7.1/+1.3/+1.3 HBKB-HARB -7.4/+1.5/+2.1	Local tie GPS/DORIS ? Gravity field?
40408S004 40408S005	Fairbanks	FAIA-FAIR +7.9/-11.9/+0.3 FAIB-FAIR +1.3/+3.5/+2.0	Break in GPS time series in early 1996 (but not in DORIS/IGN solution) for FAIA
41703S008 41703S009	Eastern Island	EASA-EISL +7.5/-1.3/+1.4 EASB-EISL +0.2/+0.7/-1.7	Antenna fall not properly taken into account for EASA
31906S001 31906S002	Ponda Delgada	PDLB-PDEL +6.4/-1.7/+9.4 PDMB-PDEL +6.6/-1.8/+8.9	GPS antenna reference point ? (10 cm in altitude)
42202S005 42202S006	Arequipa	AREA-AREQ +5.1/-2.2/+11.6 AREB-AREQ +3.1/+4.7/+2.5	Earthquake in Arequipa for AREA (not properly taken into account in DORIS/IGN solution)
41507S003 41507S004 41507S005	Rio Grande	RIOA-RIOG +5.9/+4.0/+9.0 RIOB-RIOG +3.8/+5.5/+6.9 RIPB-RIOG +1.7/+0.7/+2.4	Local ties for RIOA and RIOB are 3 mm (slightly too optimistic?) Local tie for RIPB is 1 mm and gives better results
12334S004 12334S005 12334S006	Kitab	KITA-KIT3 +3.2/+1.7/+3.1 KITB-KIT3 +4.1/-0.4/+4.8 KIUB-KIT3 +4.3/-0.3/+4.5	Local tie GPS/DORIS? Gravity field?

CONCLUSIONS

- **Free-network approach advantages** :
 - mathematically correct
 - Possible post-processing
(a posteriori station elimination or renaming)
 - makes it easy to recreate new series
- **Stations related problems**
 - DORIS AC need to agree on stations breaks (with other techniques)
 - Further geophysical interpretation needed for some stations
 - Need for a good, permanent DORIS network
- **Local tie studies**
 - Revealed some problems in the present DORIS IGN/JPL solution
 - DORIS-DORIS and DORIS-GPS local ties are good