

Plate motion and glacial isostatic adjustment from DORIS

Don Argus⁽¹⁾, Pascal Willis^(1,2)

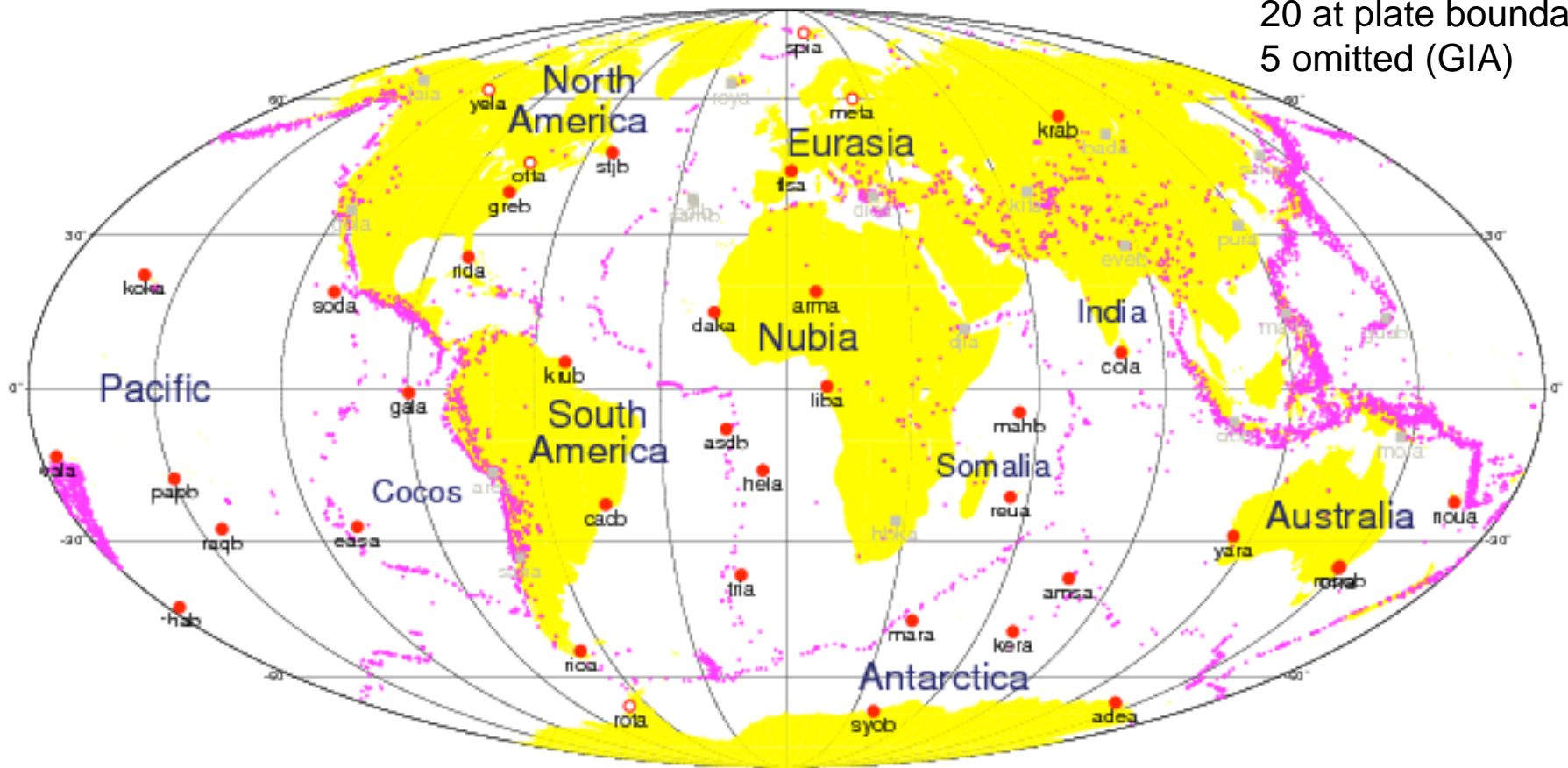
- (1) Jet Propulsion Laboratory, California Institute of Technology, USA
- (2) Institut Geographique National, France

SUMMARY

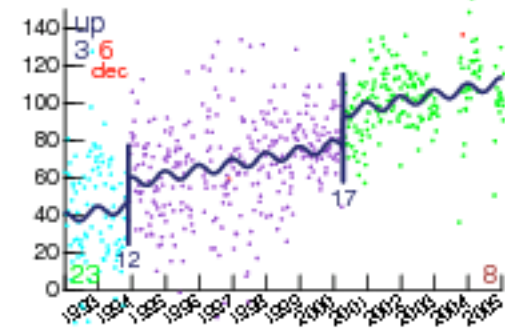
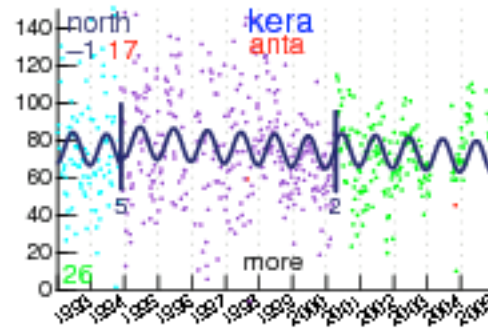
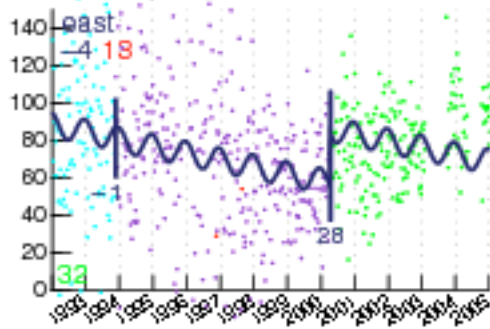
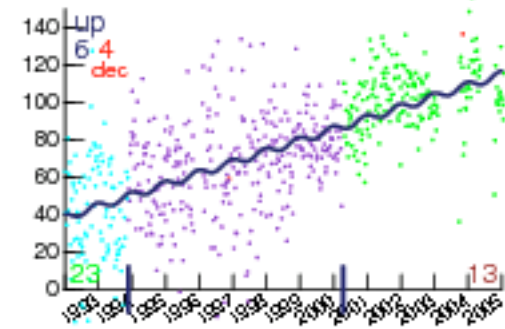
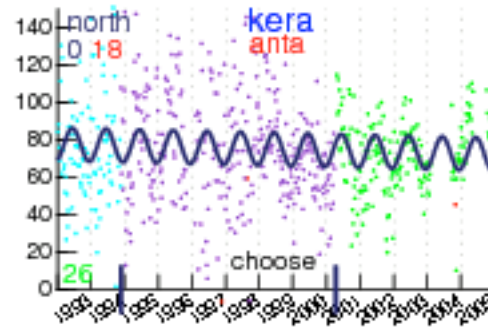
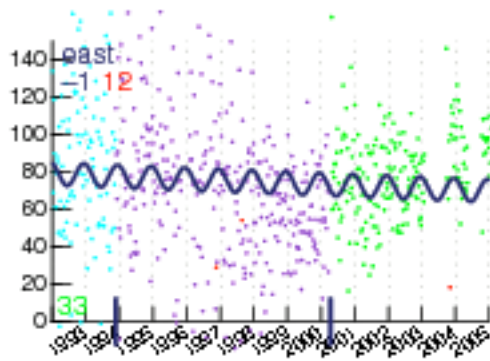
- Scientific goals
 - Validate DORIS precision (station velocity)
 - Is DORIS useful in a GPS-VLBI-SLR solutions?
- Method (using STCD files)
- Results

DORIS network and major plate tectonics

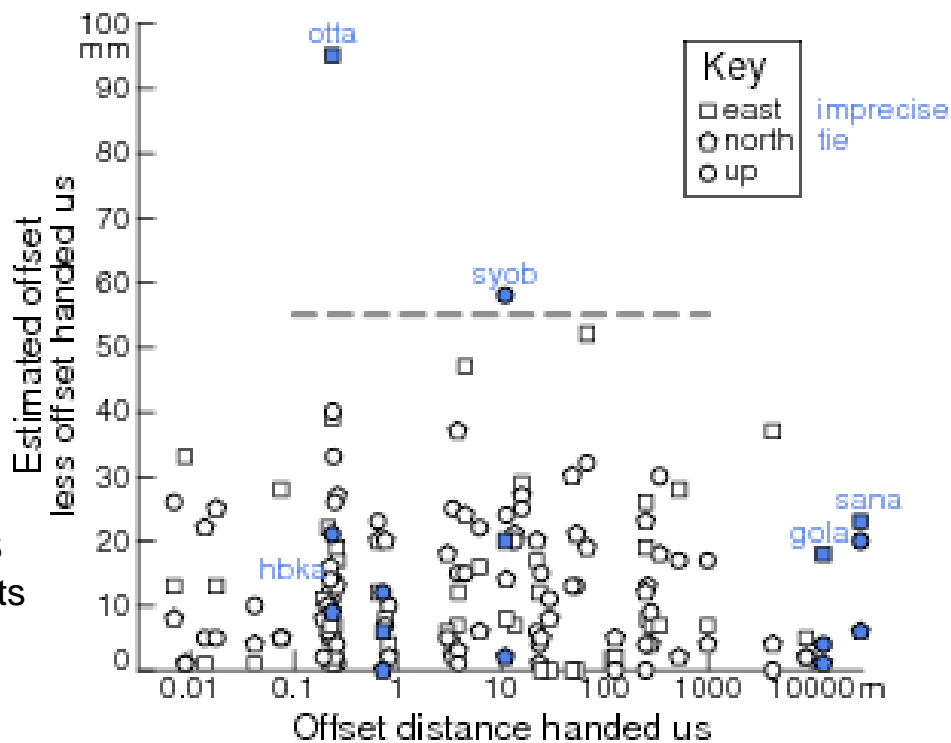
34 used on plates
 20 at plate boundary
 5 omitted (GIA)



Analyzing STCD files: Estimating velocity + annual signal with/without breaks



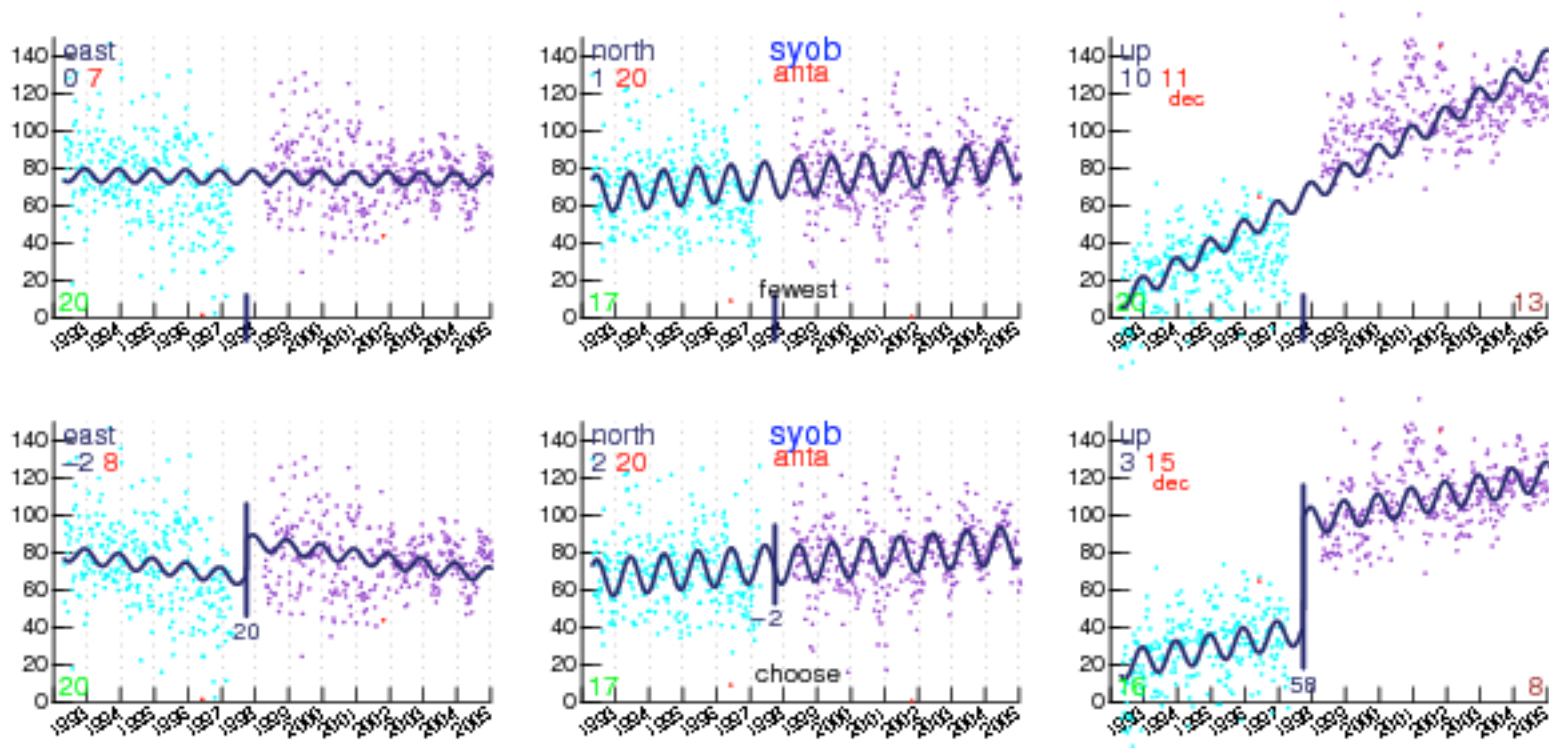
Concatenating/correcting STCD files Verifying DORIS-DORIS local ties (SIMB)



Noise is in the DORIS
IGN/JPL weekly results

Not in local ties

We enforced all geodetic local ties provided by IGN/SIMB
(45 with formal error ≤ 5 mm, only 5 not used)



(NB: SYOB tie is provided with 50 mm formal error by SIMB)

Discontinuities detected for DORIS stations on plates

Station	Epoch	E (mm)	N (mm)	V (mm)	Comment
syob	01-OCT-1998	20	-2	58	Imprecise tie
adea	25-MAR-1998	17	15	-8	Belleny Earthquake M 8.1
cola	16-NOV-1994	53	-54	6	Unknown cause
otta	01-JAN-1998	95	-9	-21	Imprecise tie
tria	29-JUL-2004	-18	-65	-40	Volcanic activity Mb 4.2
soda	06-OCT-2002	60	-40	1	Unknown cause

Discontinuities detected for DORIS stations at plate boundary

Station	Epoch	E (mm)	N (mm)	V (mm)	Comment
sana	01-JAN-1997	23	6	20	Imprecise tie
saka	25-SEP-2003	-7	-13	-11	Hokkaido Earthquake M 8.3
hbla	01-JUN-1997	-6	0	-12	Imprecise tie
gola	11-AUG-1994	-18	-1	4	Imprecise tie
gola	16-OCT-1999	-16	-4	-1	Hector Mine Earthquake M 7.1

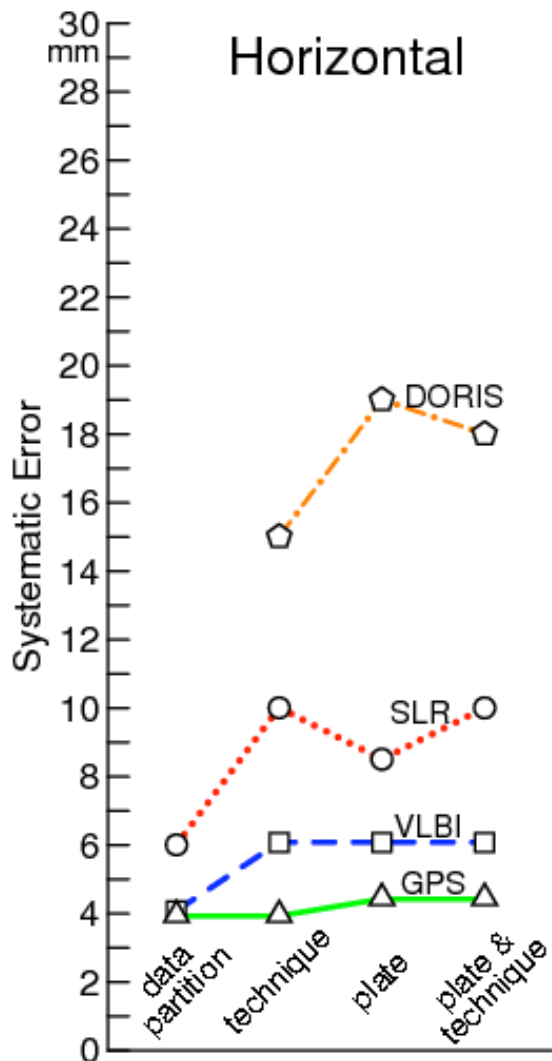
ERROR BUDGET

$$\left(\text{true error}\right)^2 = \left(\text{random error}\right)^2 + \left(\text{system error}\right)^2$$

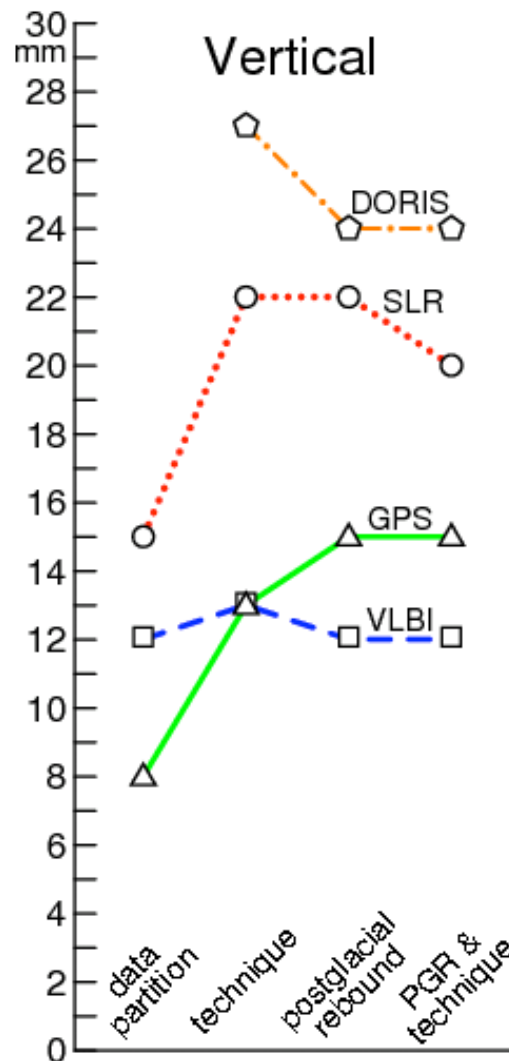
random error = dispersion of position estimates
about constant velocity

system error = $\frac{\text{distance}}{\text{time}}$

18mm/12yr
= 1.5 mm/yr

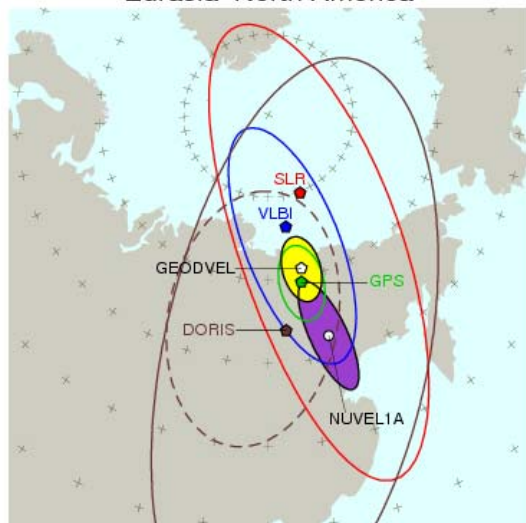


24mm/12yr
= 2.0 mm/yr

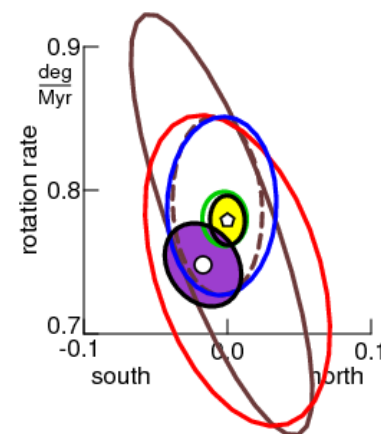
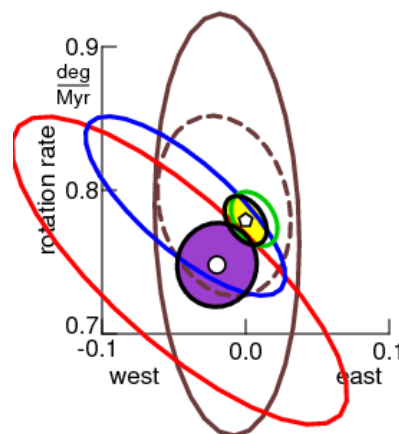
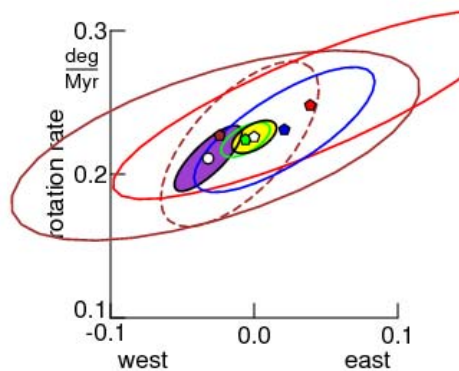
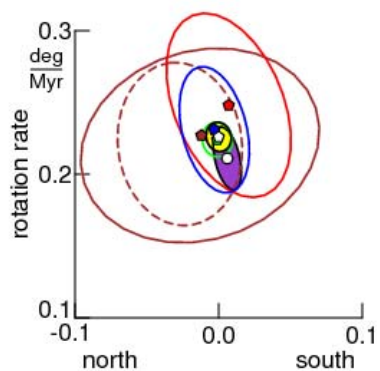
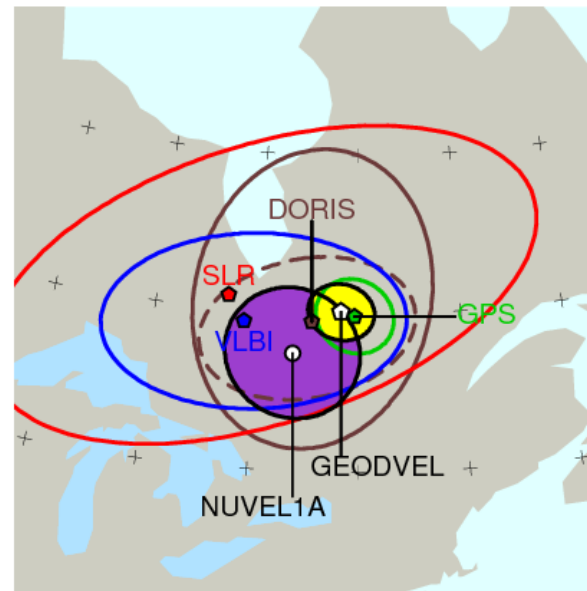


When other techniques are present

Eurasia–North America



North America–Pacific

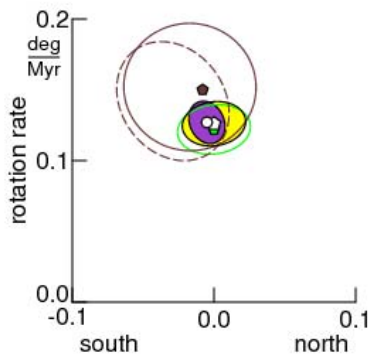
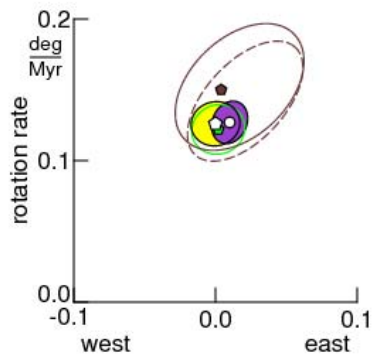
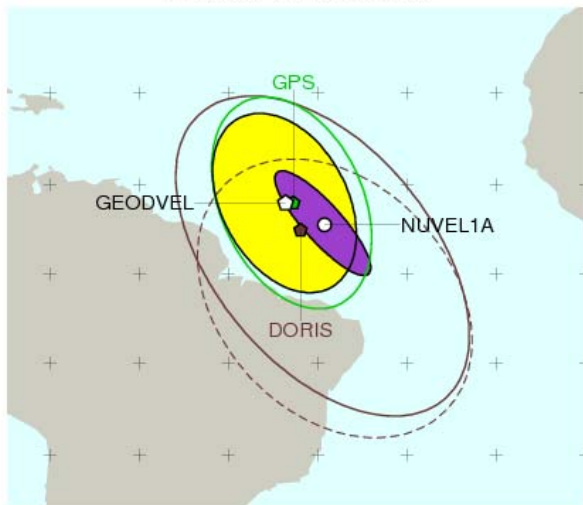


March 13-15, 2006

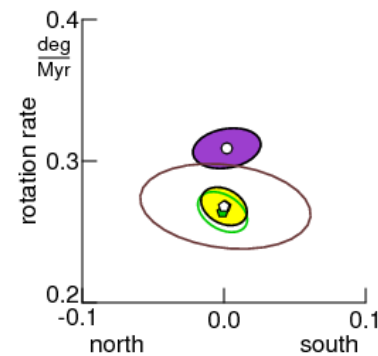
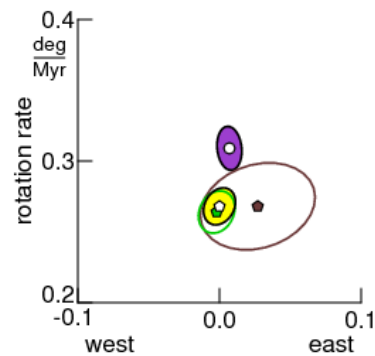
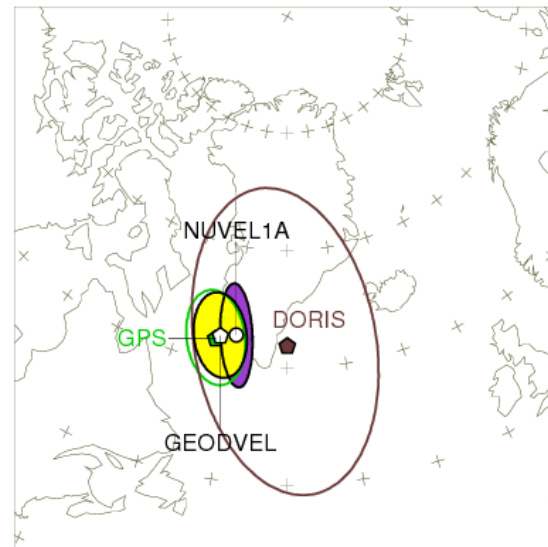
IDS Workshop, Venice, Italy

When other techniques are scarce

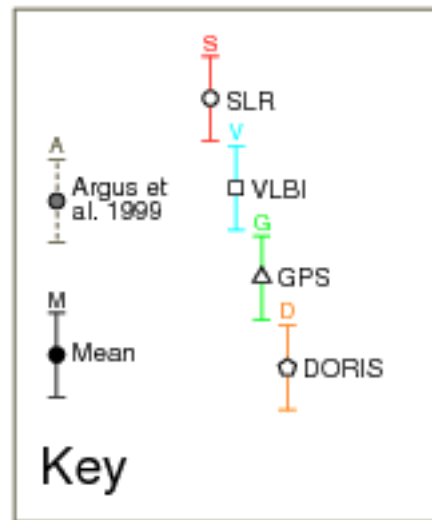
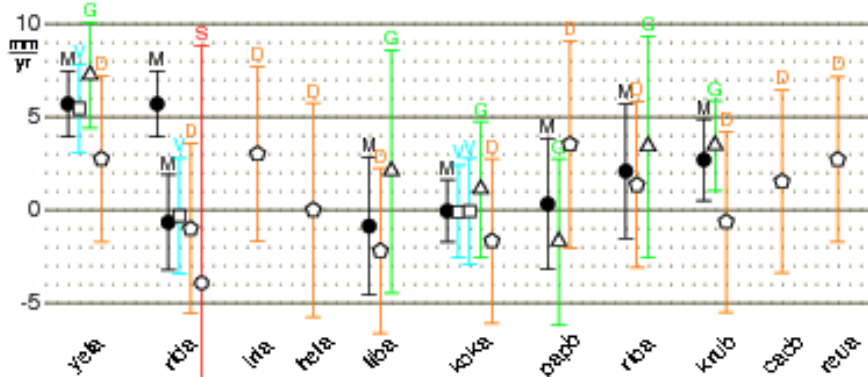
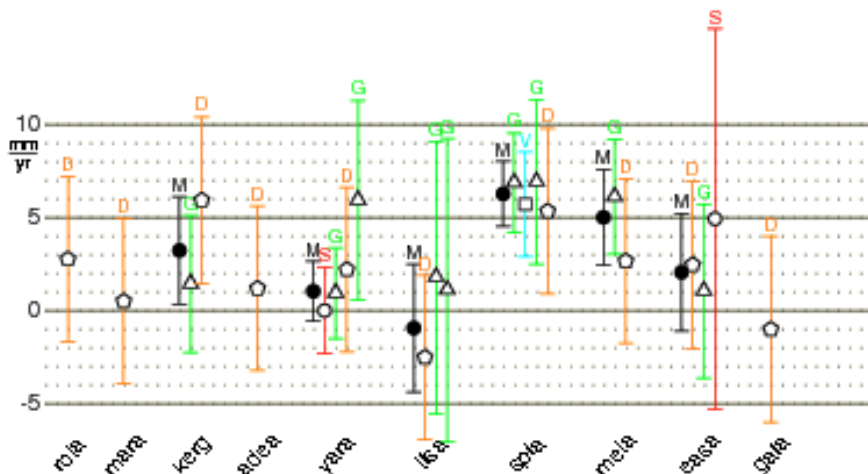
Nubia–Antarctica



Nubia–South America



Vertical motion

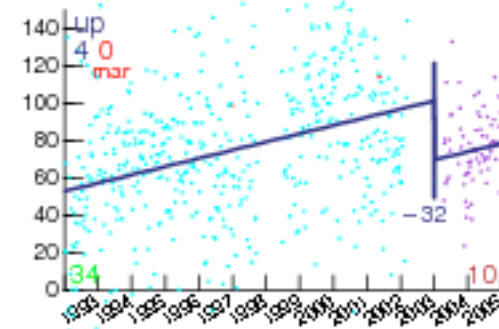
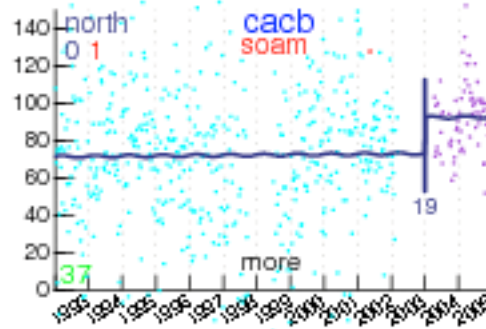
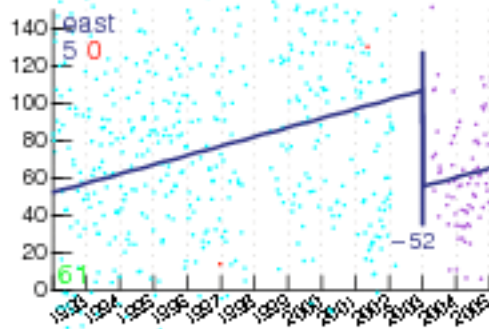
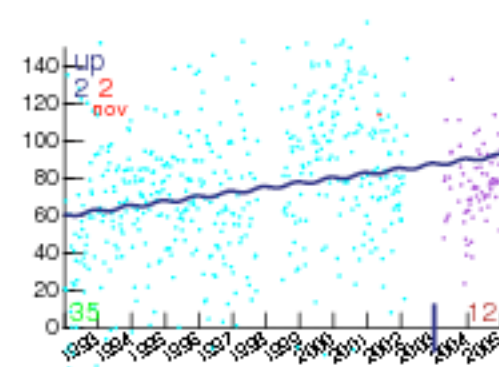
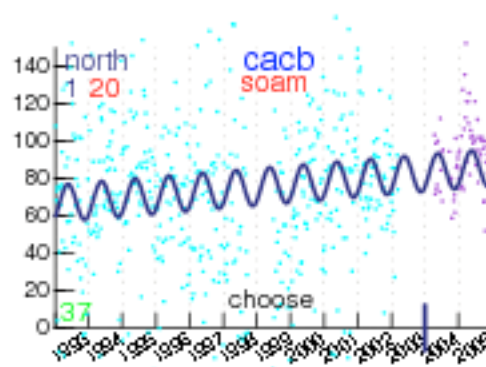
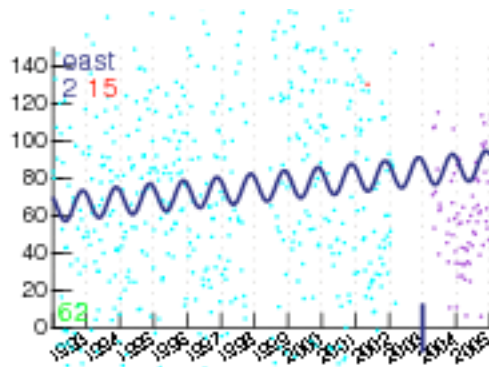


CONCLUSIONS

- Local ties (SIMB) were checked and are good (when formal errors ≤ 5 mm)
- DORIS accuracy in velocity
 - Horizontal: 1.5 mm/yr
 - Vertical: 2.0 mm/yr
- DORIS is becoming useful for geodynamics
 - specifically in vertical
 - When no other technique or just GPS is present

BACK-UP SLIDES

Analyzing STCD files: offset + rate + annual signal + discontinuities



Analyzing STCD files: offset + rate + annual signal + discontinuities

