

EUREF2003 Symposium, June 4, Toledo, Spain

EPN Special Project on “Coordinate time series analysis” Status and results

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PRIMARY OBJECTIVE:

**TRACKING THE PERFORMANCE OF EACH
EPN SITE USING THE WEEKLY
COMBINED EPN SINEX SOLUTION**

TASKS:

- **OFFSET & OUTLIER DETECTION**
- **CREATION OF 'IMPROVED' TIME SERIES**
- **ESTIMATION OF EPN SITE VELOCITIES**
- **HARMONIC ANALYSIS**

THE CONCEPT OF 'COORDINATE' TIME SERIES:

**RESIDUALS OF A SERIES OF 7 PARAMETER
HELMERT TRANSFORMATION BETWEEN A
COMBINED MULTI-YEAR AND THE CONSECUTIVE
EUREF WEEKLY SOLUTIONS**

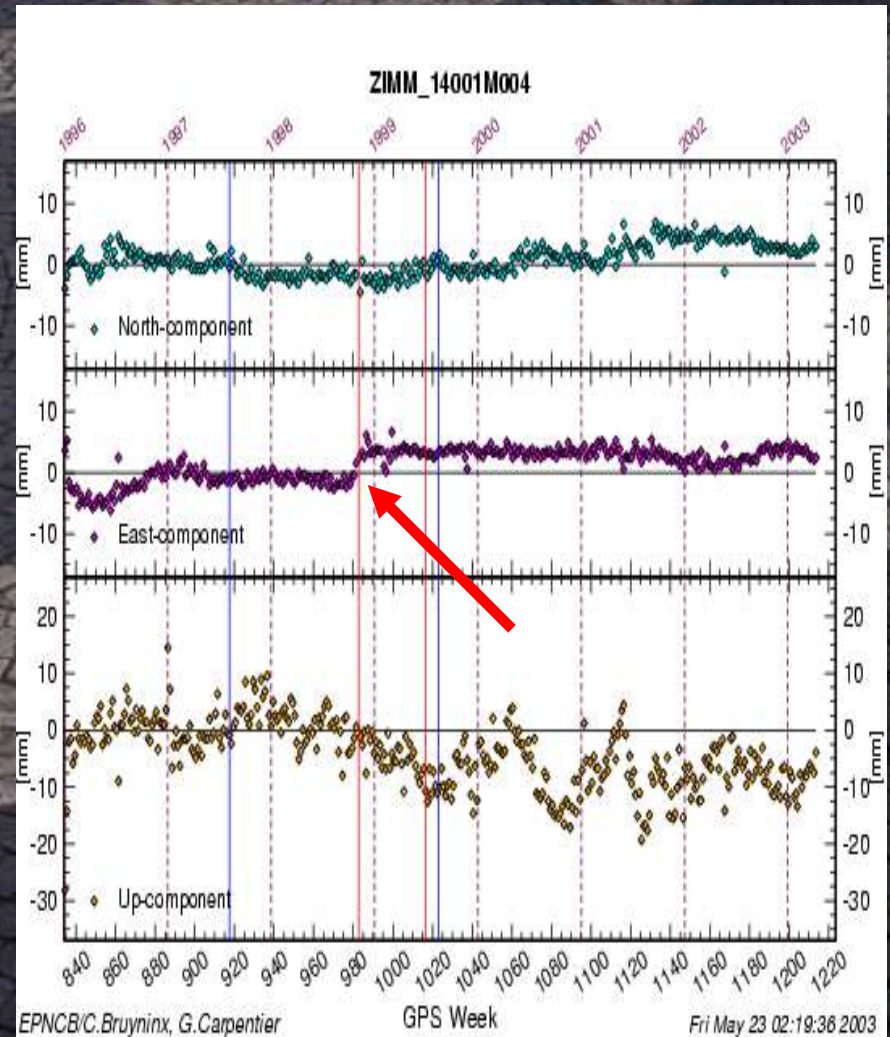
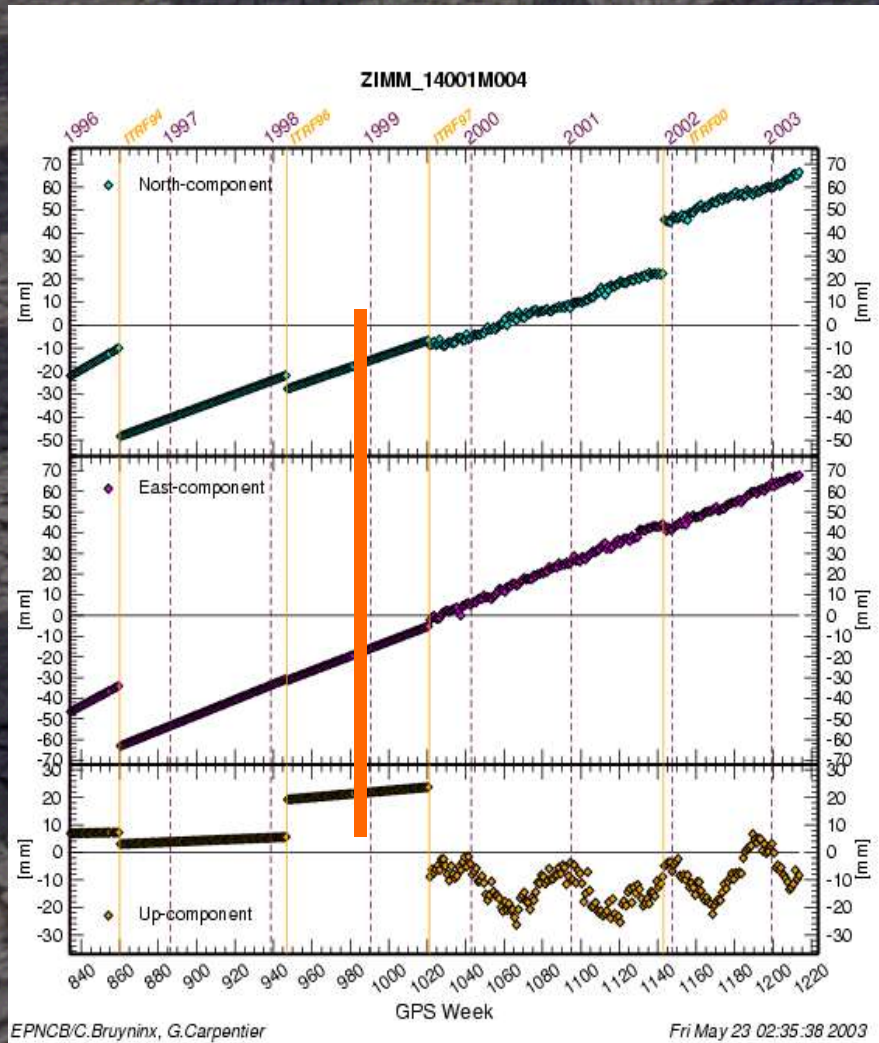
WHY?

**GLOBAL EFFECTS (ORBIT, REFERENCE FRAME CHANGES,
ANNUAL PERIODICITY)**

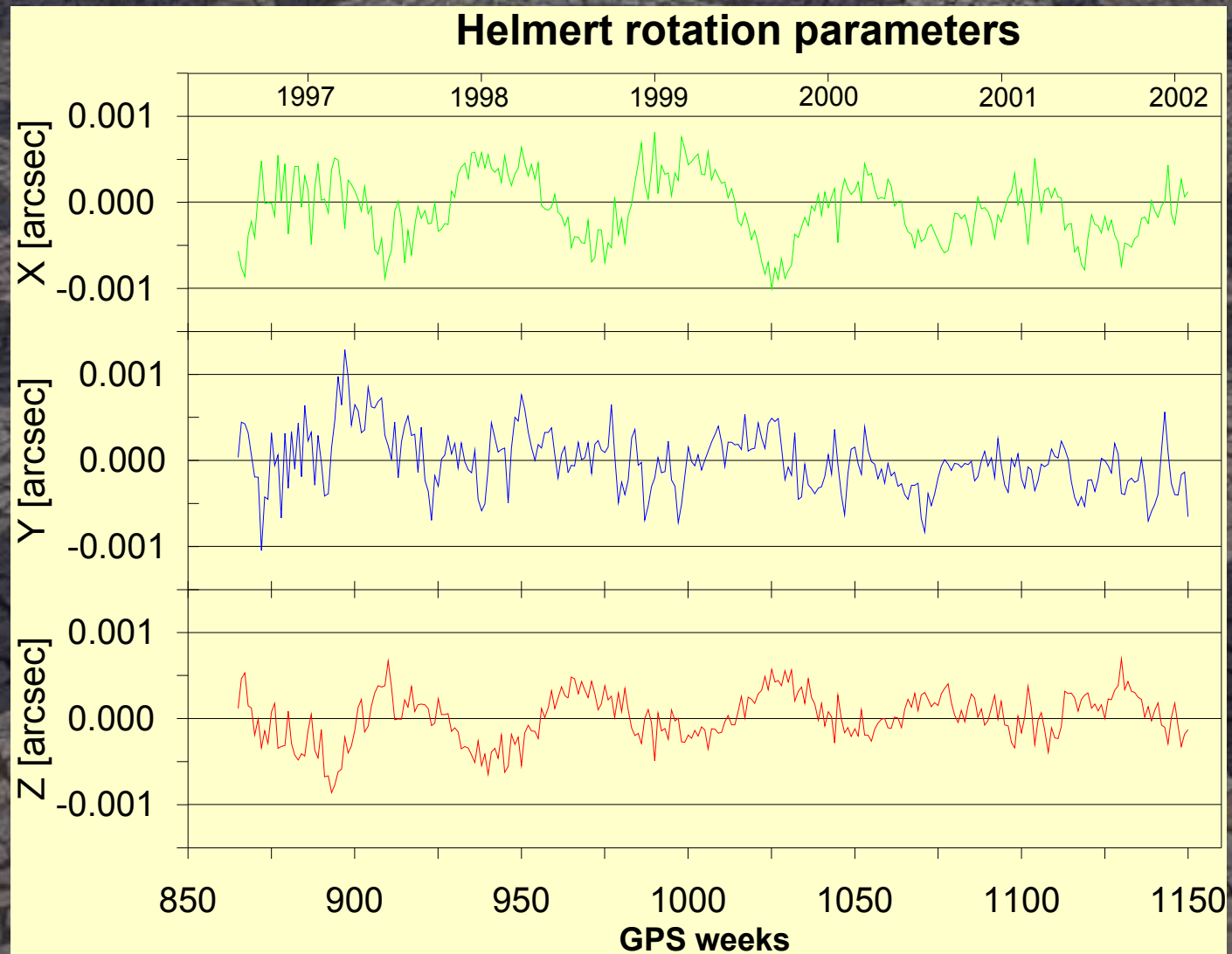
AND

A PRIORI CONSTRAINTS ARE ELIMINATED.

SINEX and STANDARD COORDINATE TIME SERIES



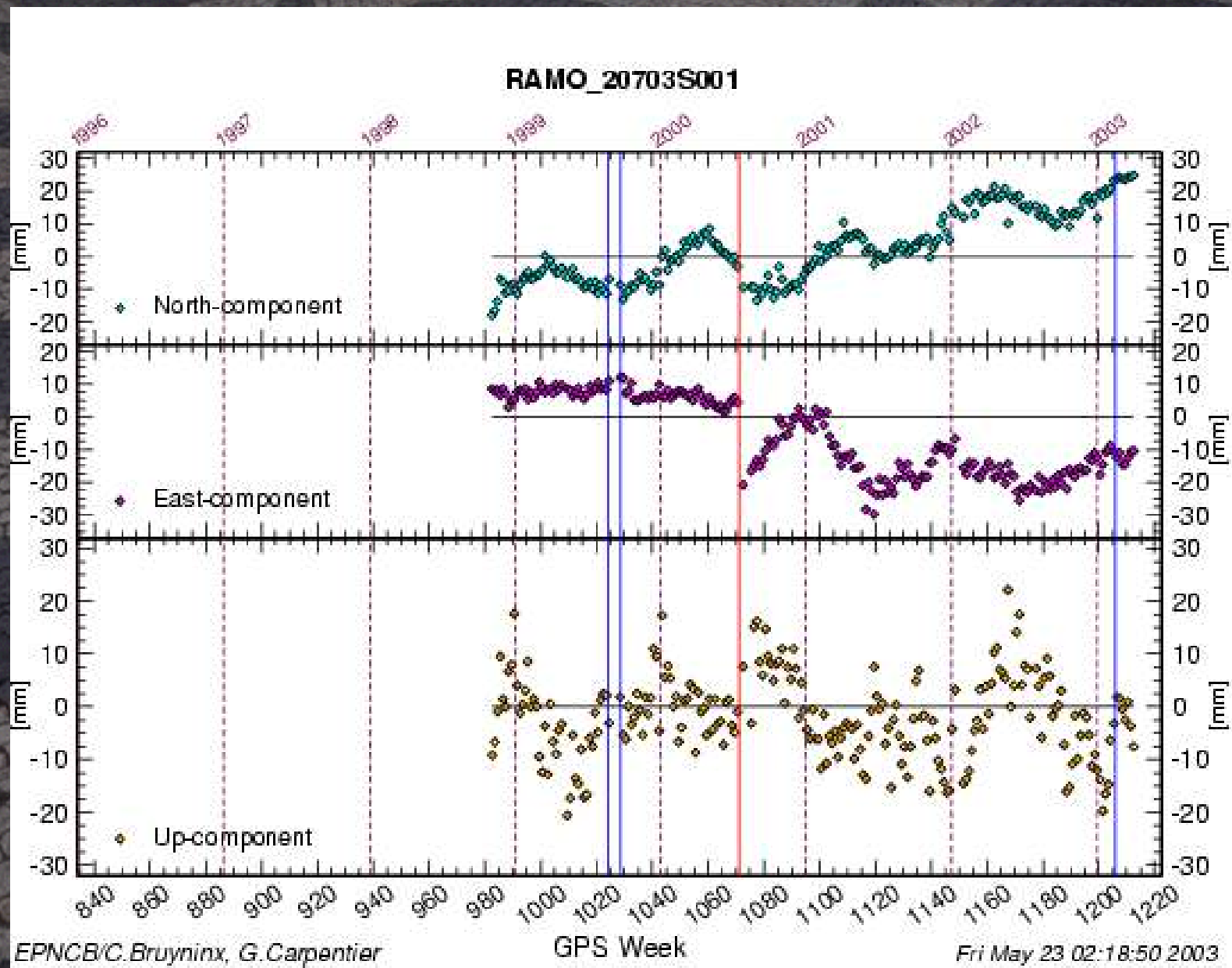
SERIES OF THE HELMERT ROTATION PARAMETERS



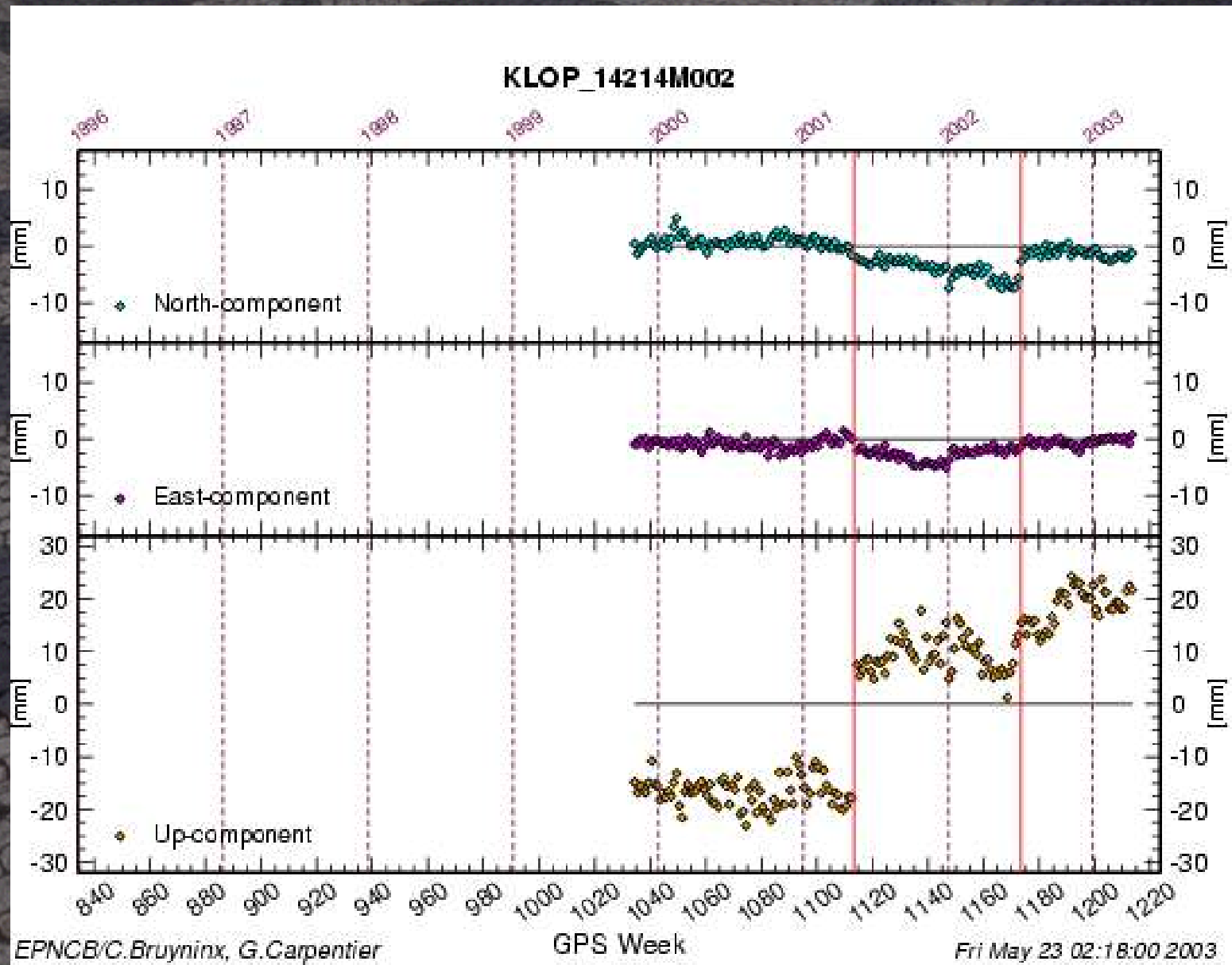
SOURCES OF COORDINATE AND VELOCITY INCONSISTENCIES

- **SHORT OBSERVATION HISTORY**
- **ANTENNA CHANGE** [RAMO, KLOP]
- **ANTENNA PROBLEMS** [HERS, BZRG]
- **(ANNUAL) PERIODICITY** [HFLK, RAMO]
- **TECTONIC ACTIVITY** [ANKR, TUBI]
- **CHANGES IN PROCESSING STRATEGY**
- **MONUMENTATION WEAKNESS**

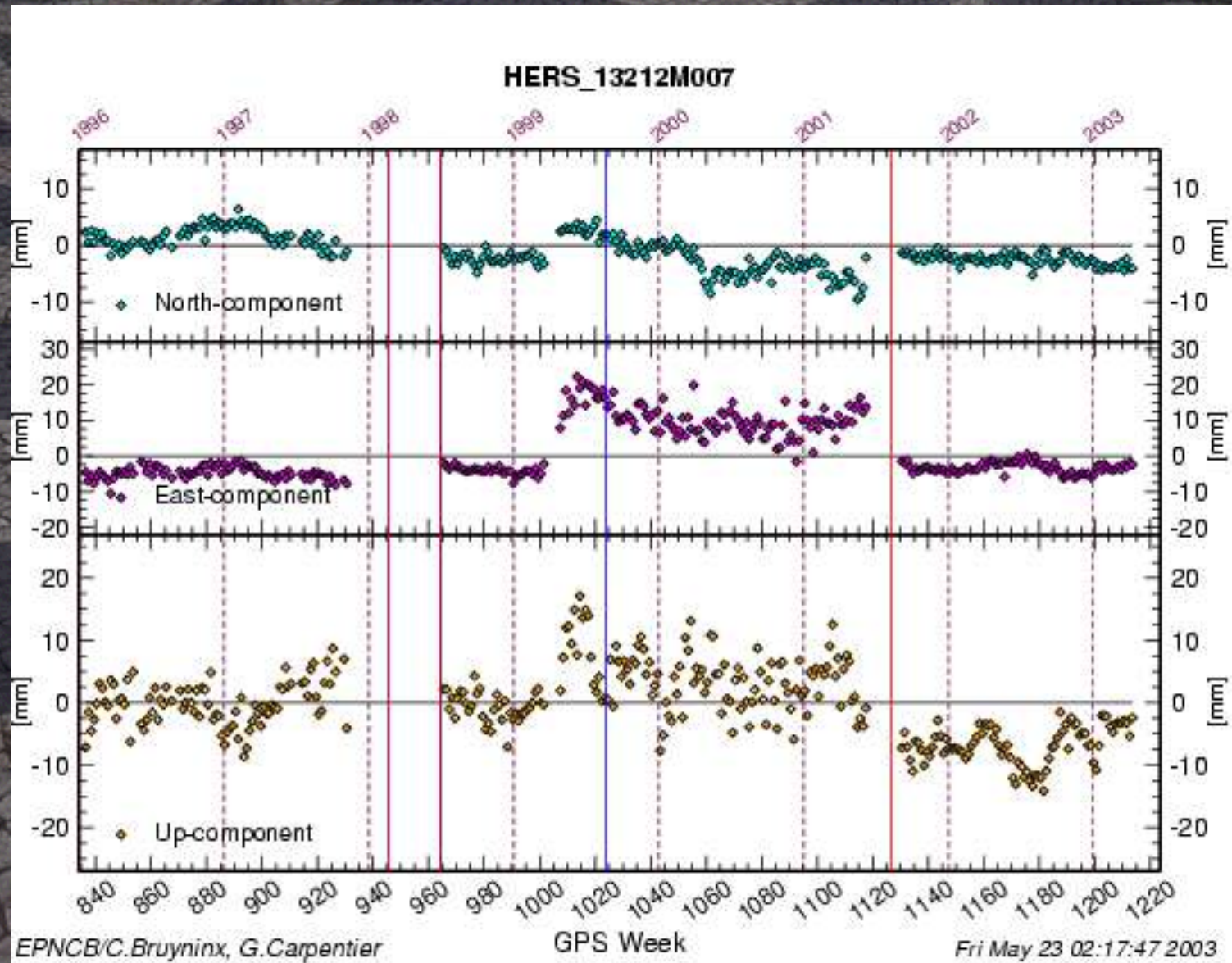
ANTENNA CHANGE I.



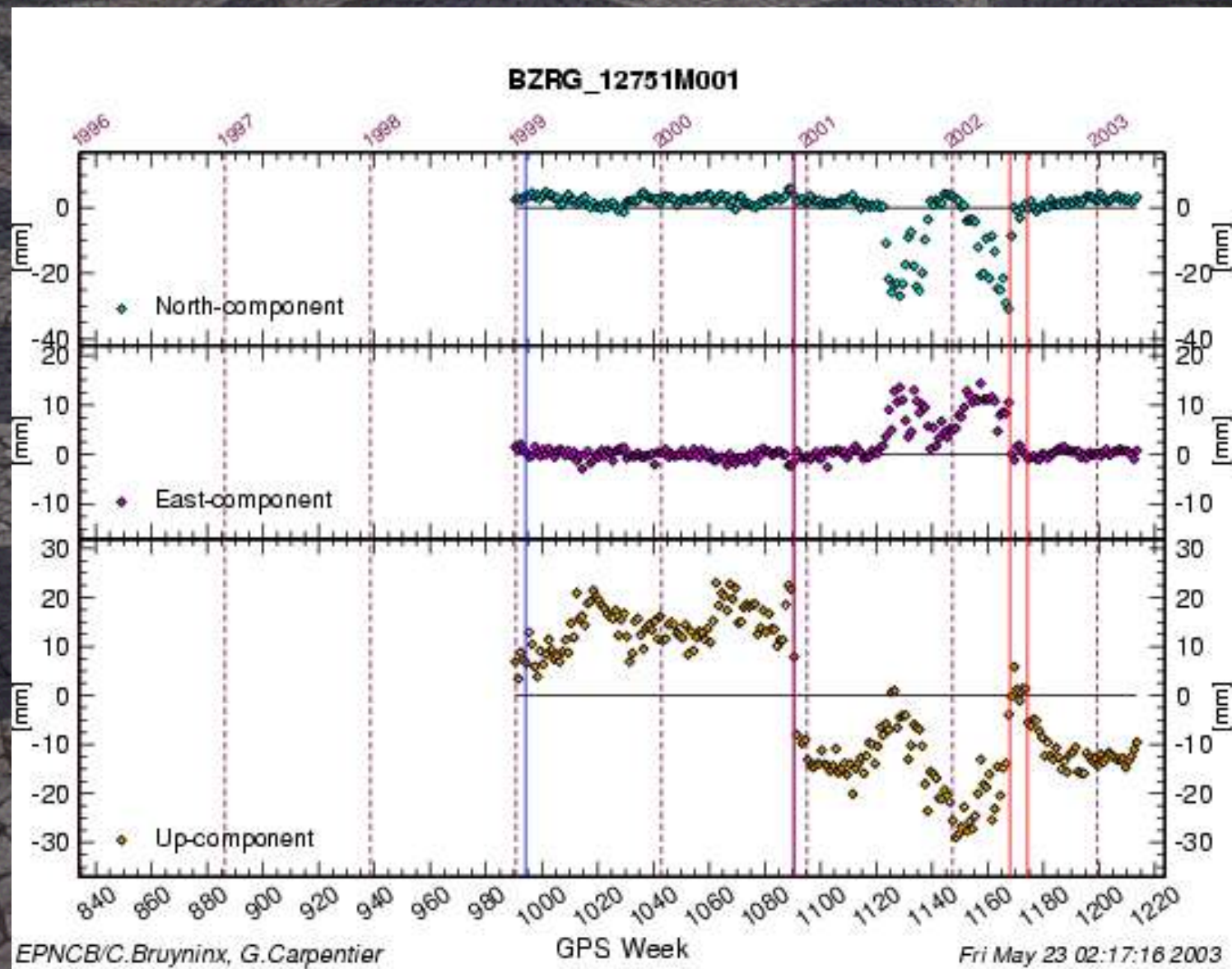
ANTENNA (RADOME) CHANGE II.



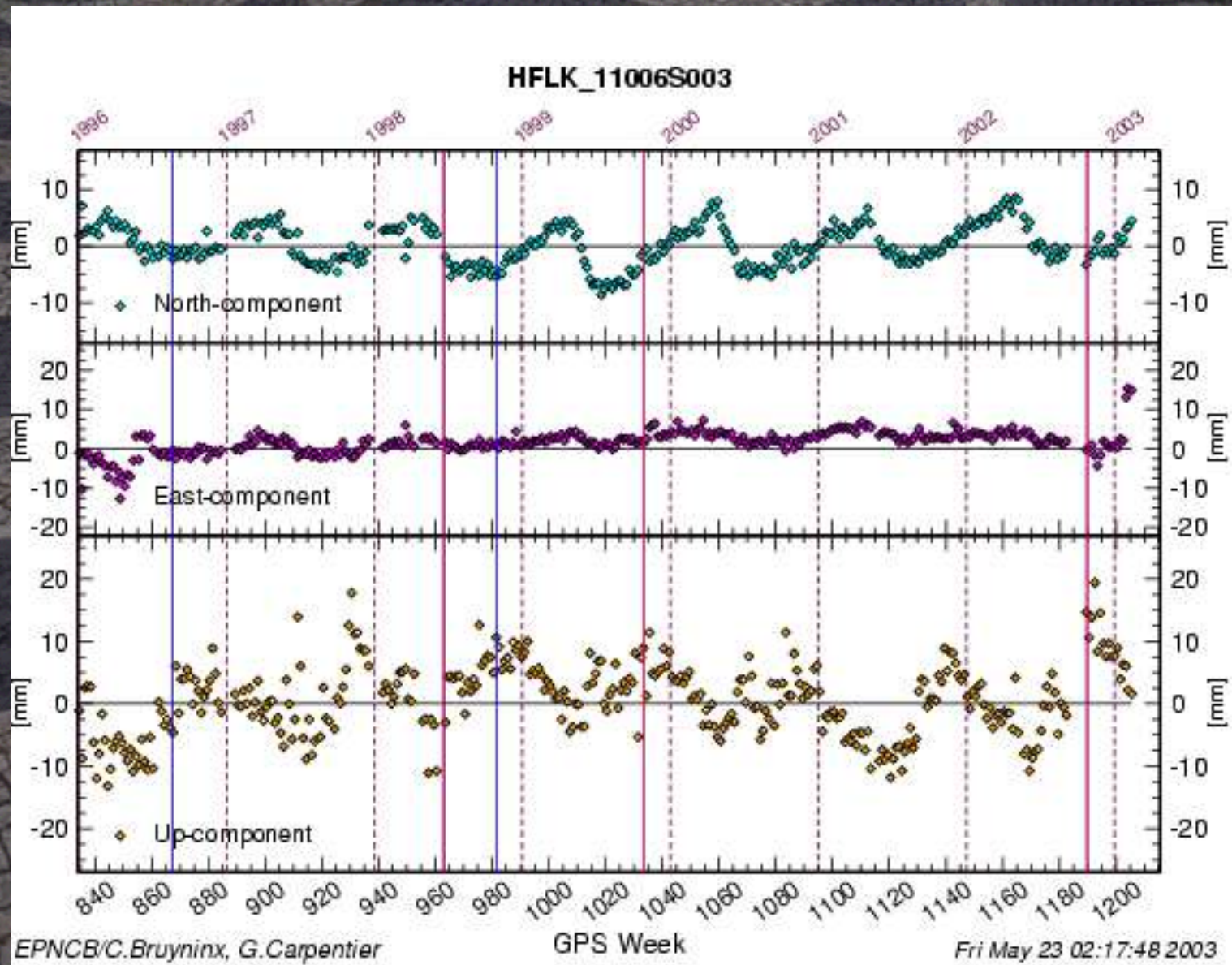
ANTENNA PROBLEMS I.



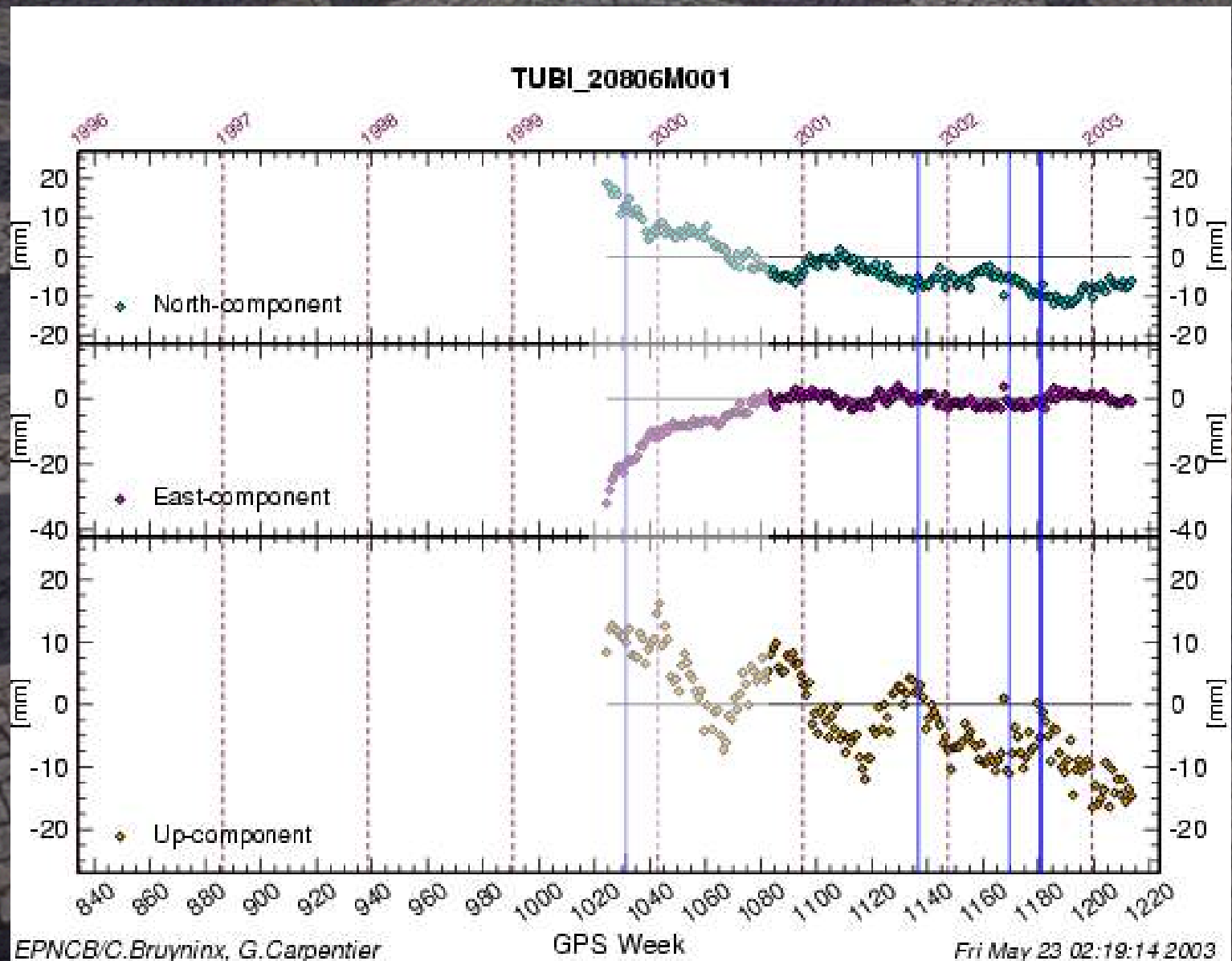
ANTENNA PROBLEMS II.



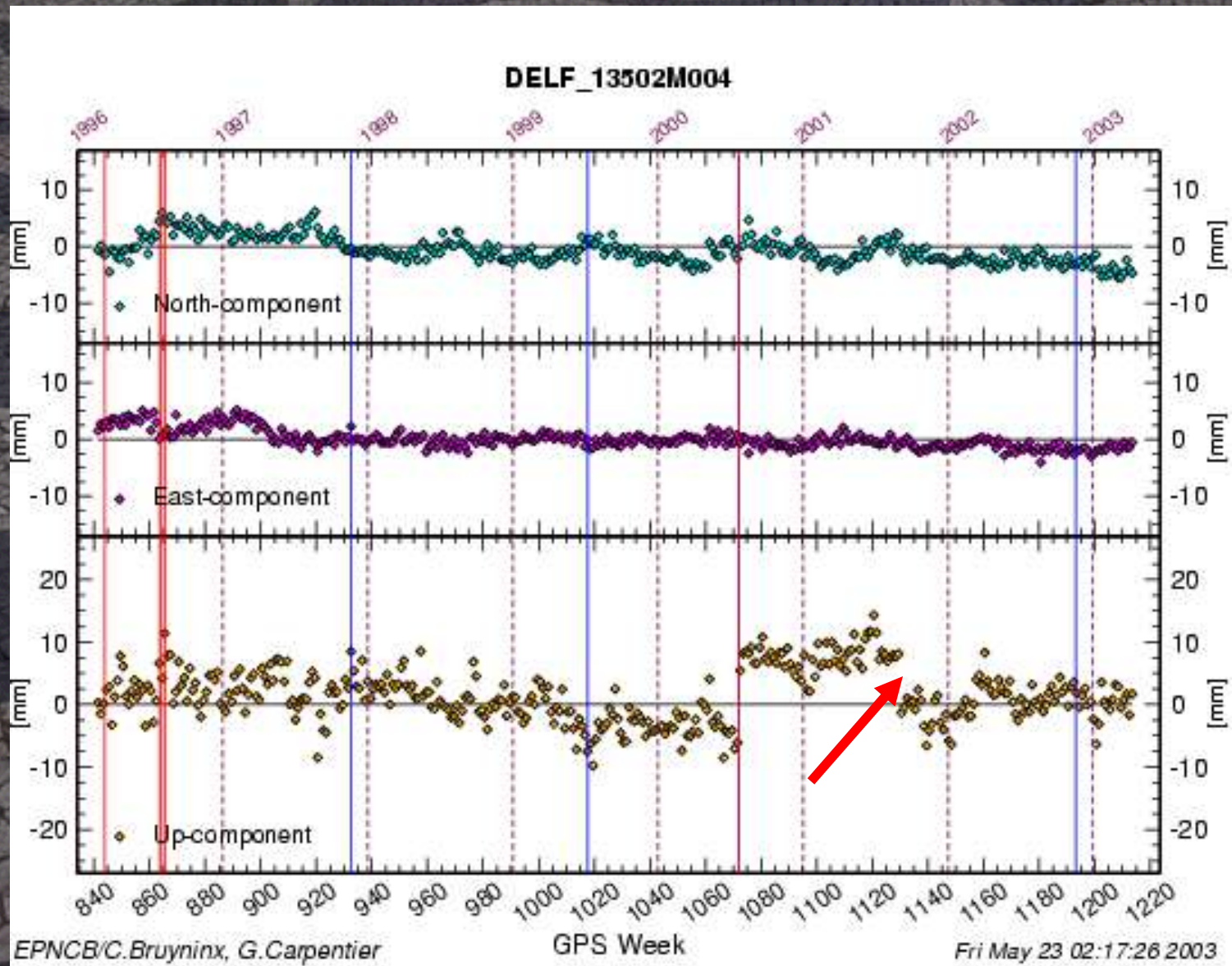
ANNUAL PERIODICITY



TECTONIC ACTIVITY – NON LINEAR VELOCITY DEVELOPMENT



CHANGES IN PROCESSING STRATEGY



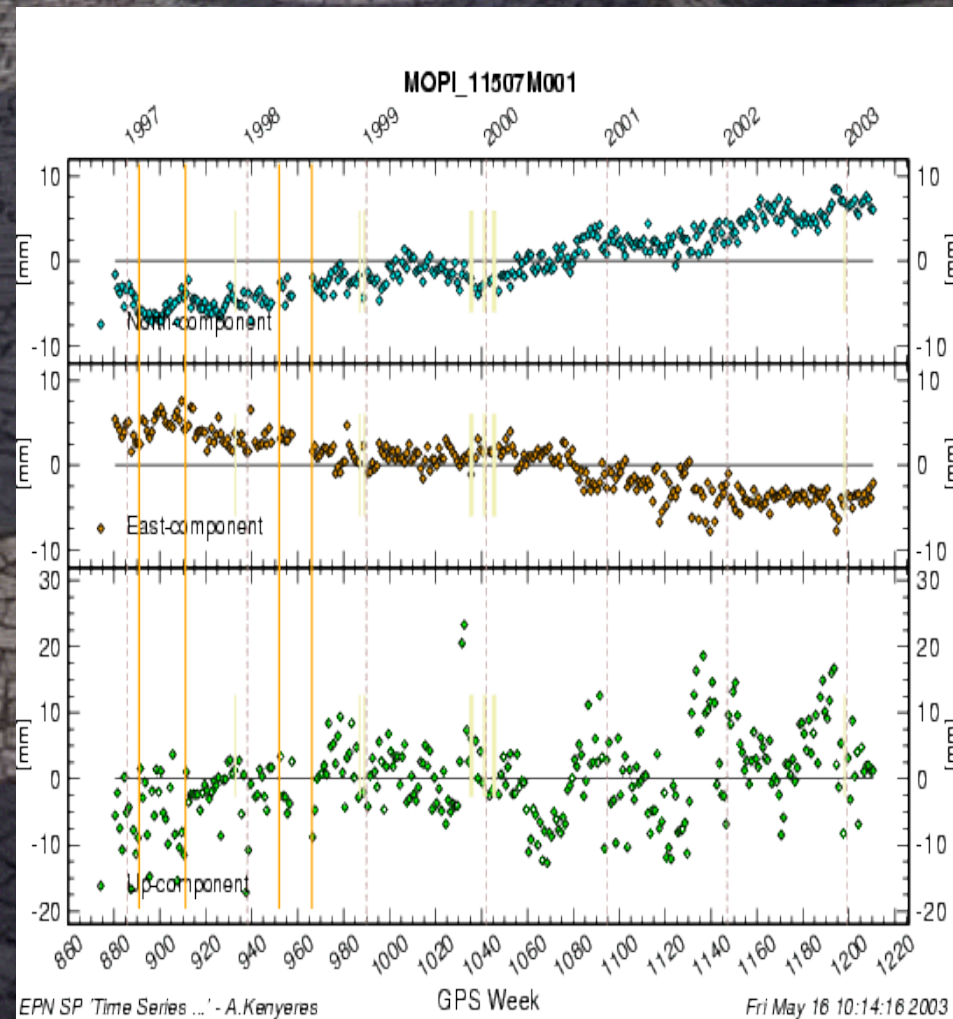
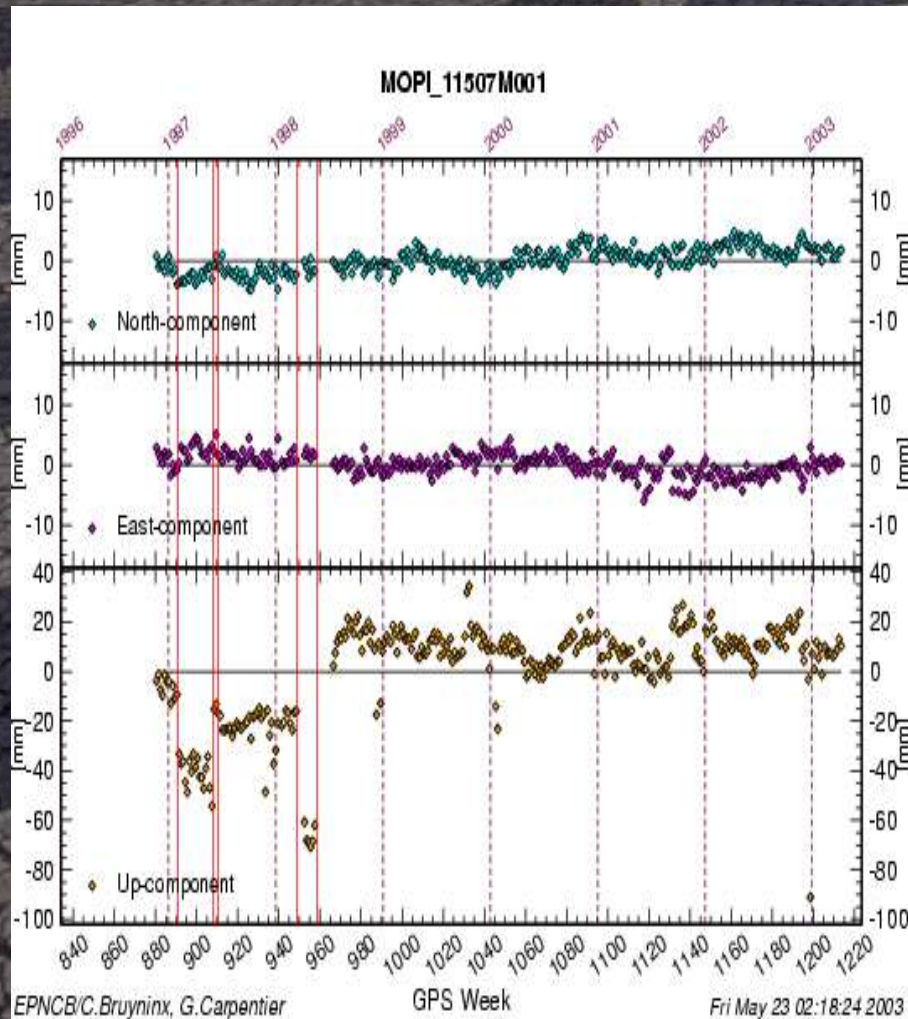
THE TOOL:

MODIFIED VERSION OF BERNESE V4.2

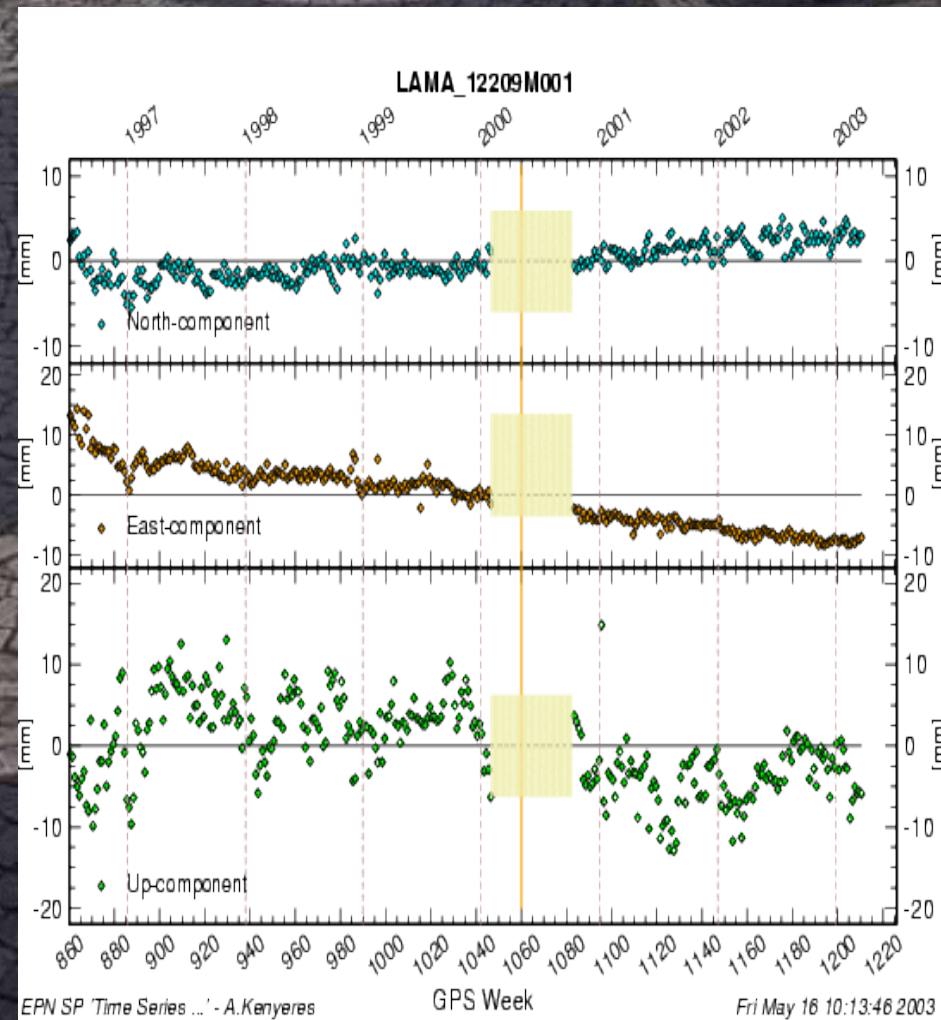
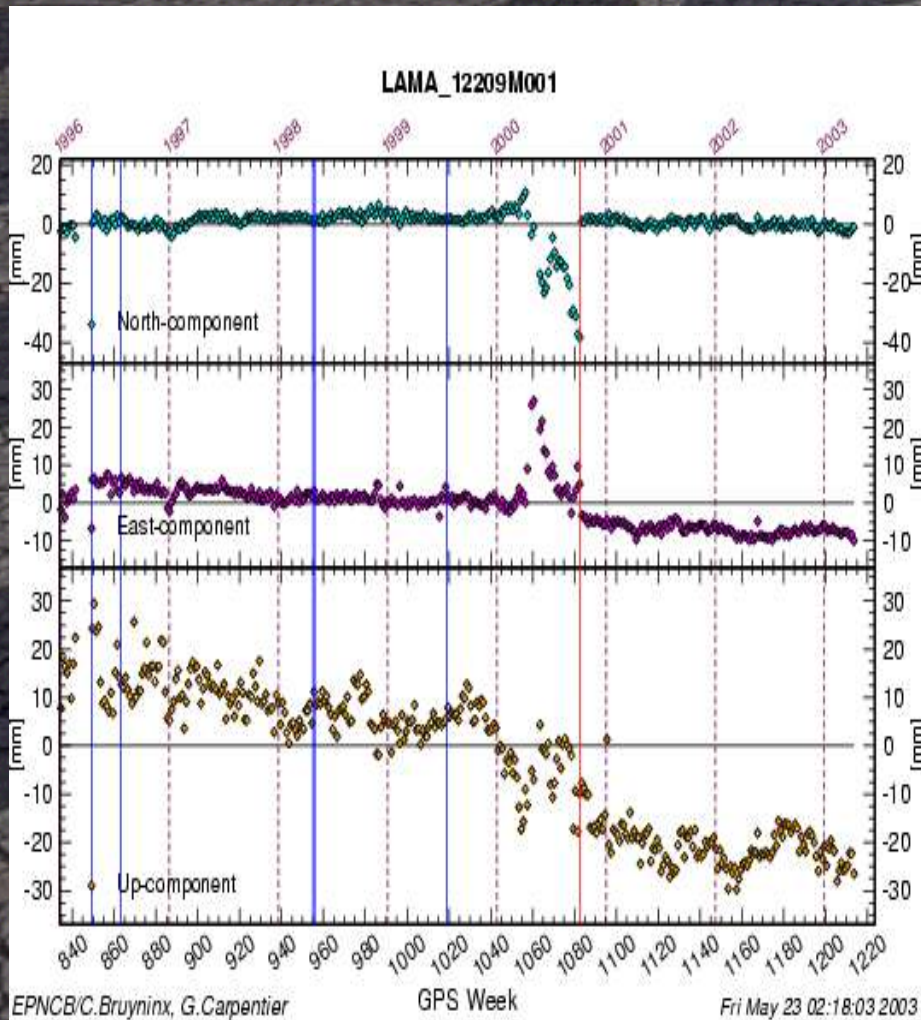
ADDNEQ PROGRAM

- **VERTICAL AND HORIZONTAL ANTENNA EXCENTRICITIES ARE HANDLED TOGETHER**
- **JUMPS AND VELOCITIES ARE ESTIMATED ON A UNIFORM MANNER**
- **THE OUTLIER PERIODS AND JUMPS ARE STORED IN THE BERNESE **STACRUX.EPN** FILE**

OFFSET CORRECTION



OUTLIER ELIMINATION



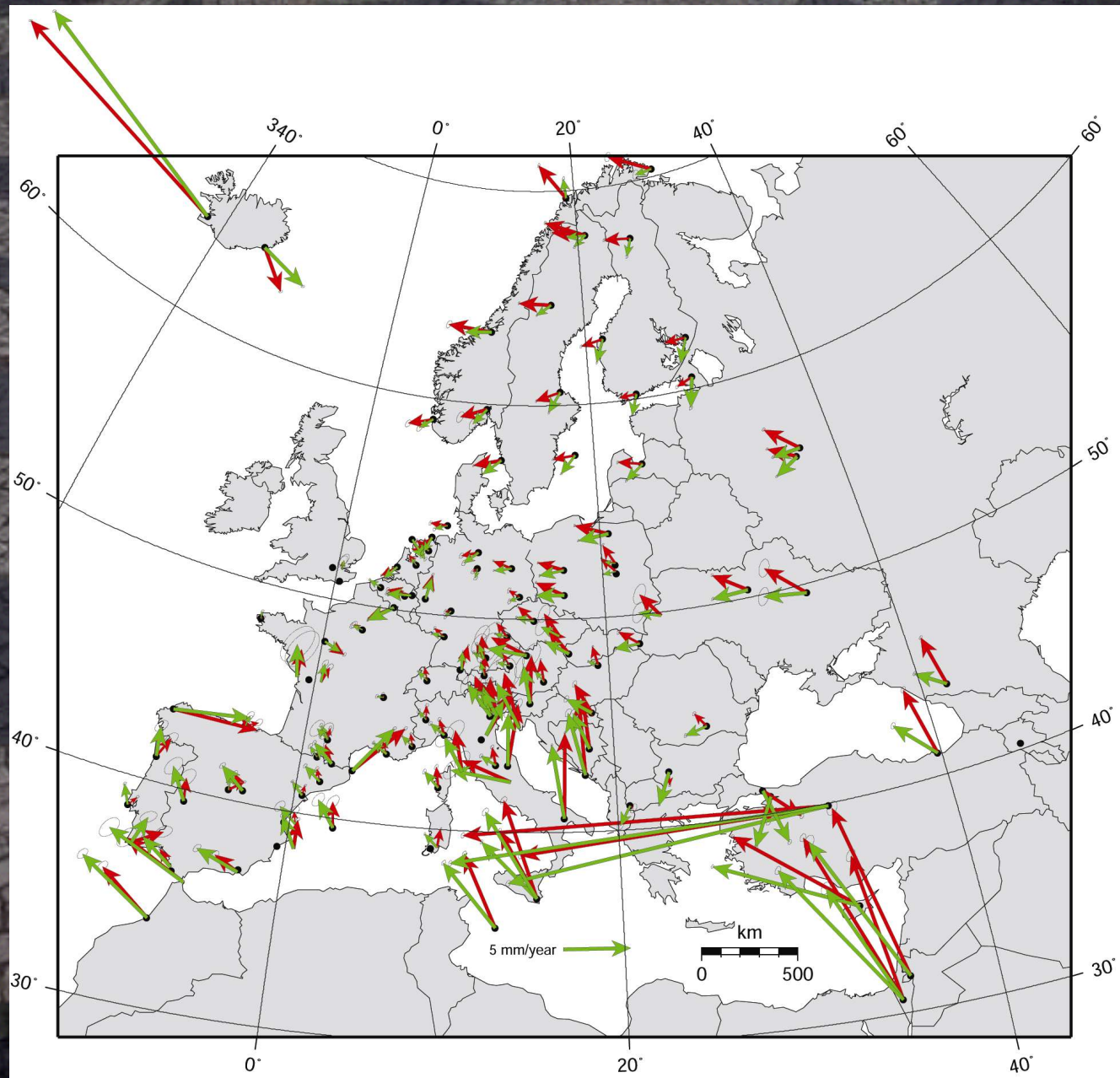
THE PRODUCT:

TABLE OF CORRECTIONS

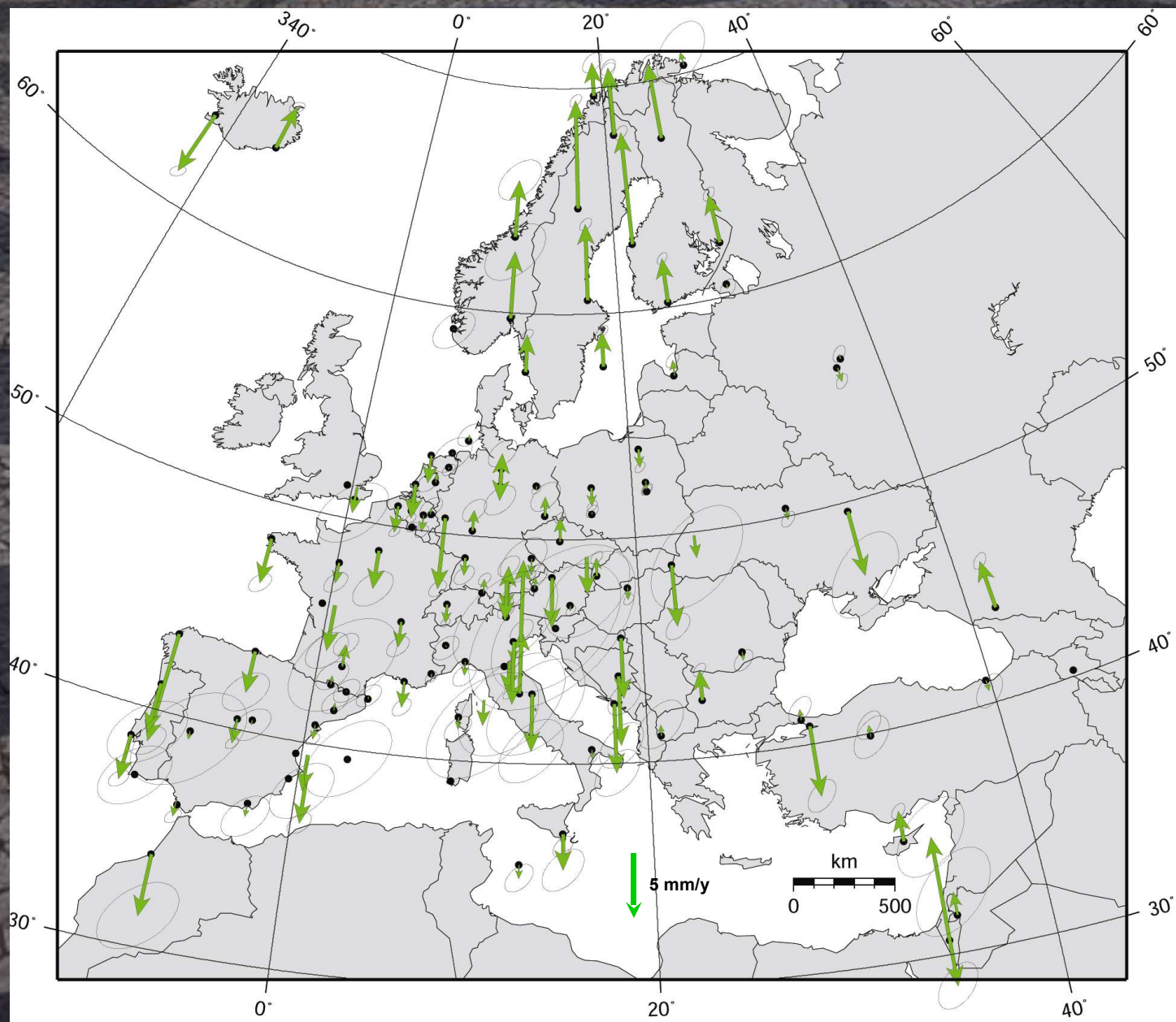
I. JUMPS

STATION	GPSWK	[N/E/UP]	CAUSE	ESTIM. SIZE [mm]	UNCERT. [mm]
KARL	1113	N	EQUIP. CHANGE	2	0.5
		E	=	2	0.5
		UP	=	38	1.5
MATE	1015	N	EQUIP. CHANGE	-4	0.3
		E	=	5	0.3
		UP	=	3	1.8
..

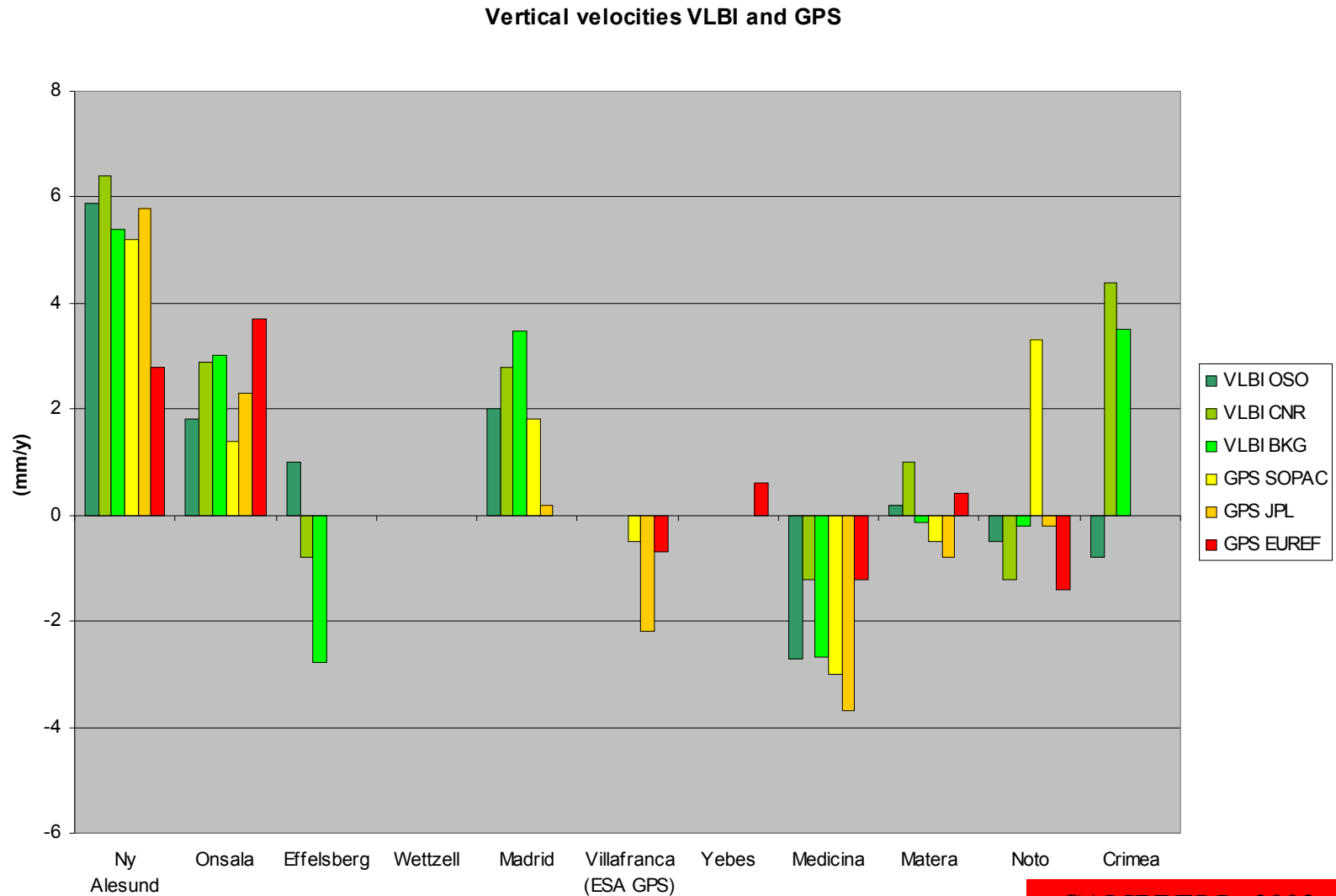
ESTIMATED HORIZONTAL VELOCITIES wrt ITRF2000 and NNR-NUVEL1A



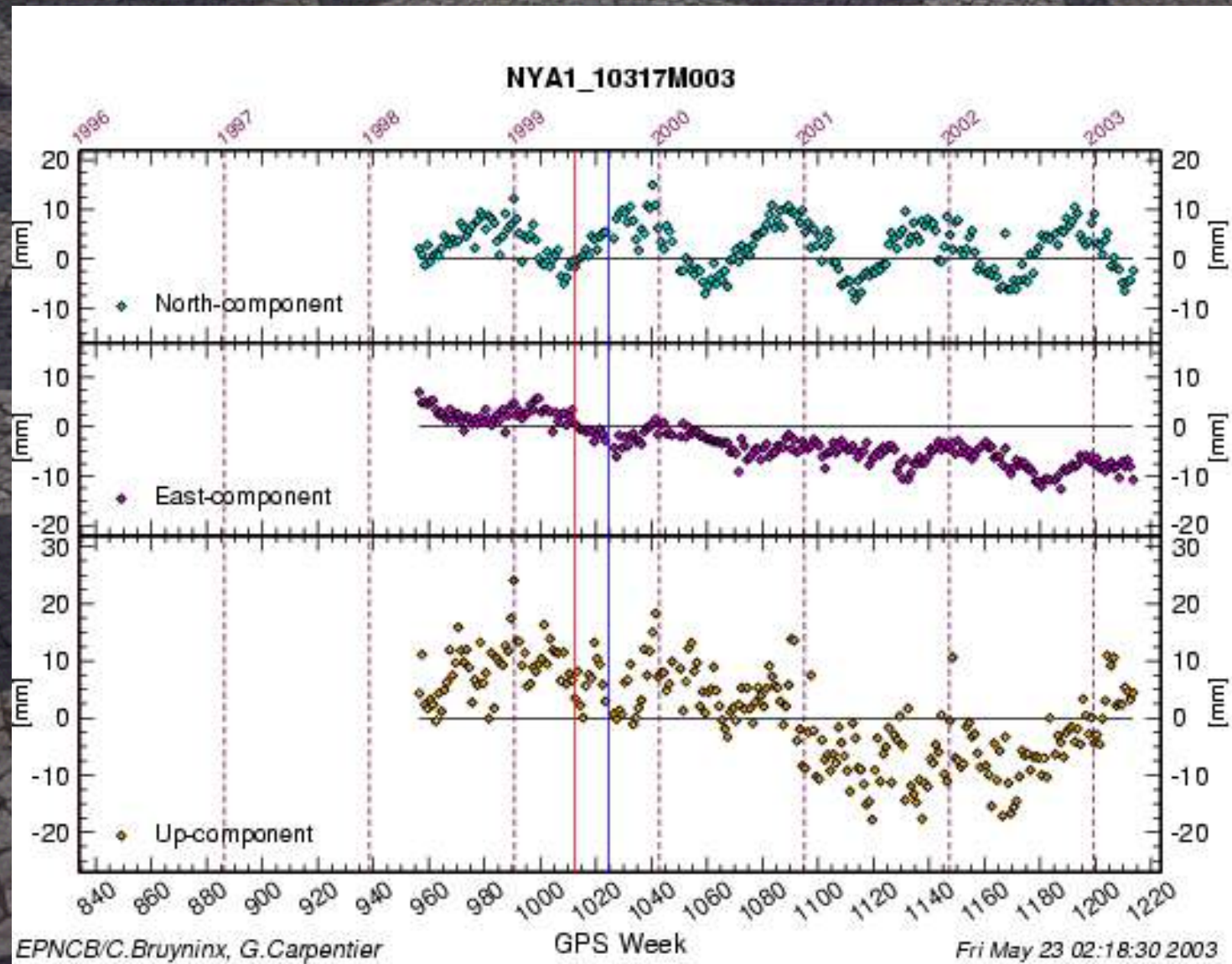
ESTIMATED HEIGHT VELOCITIES



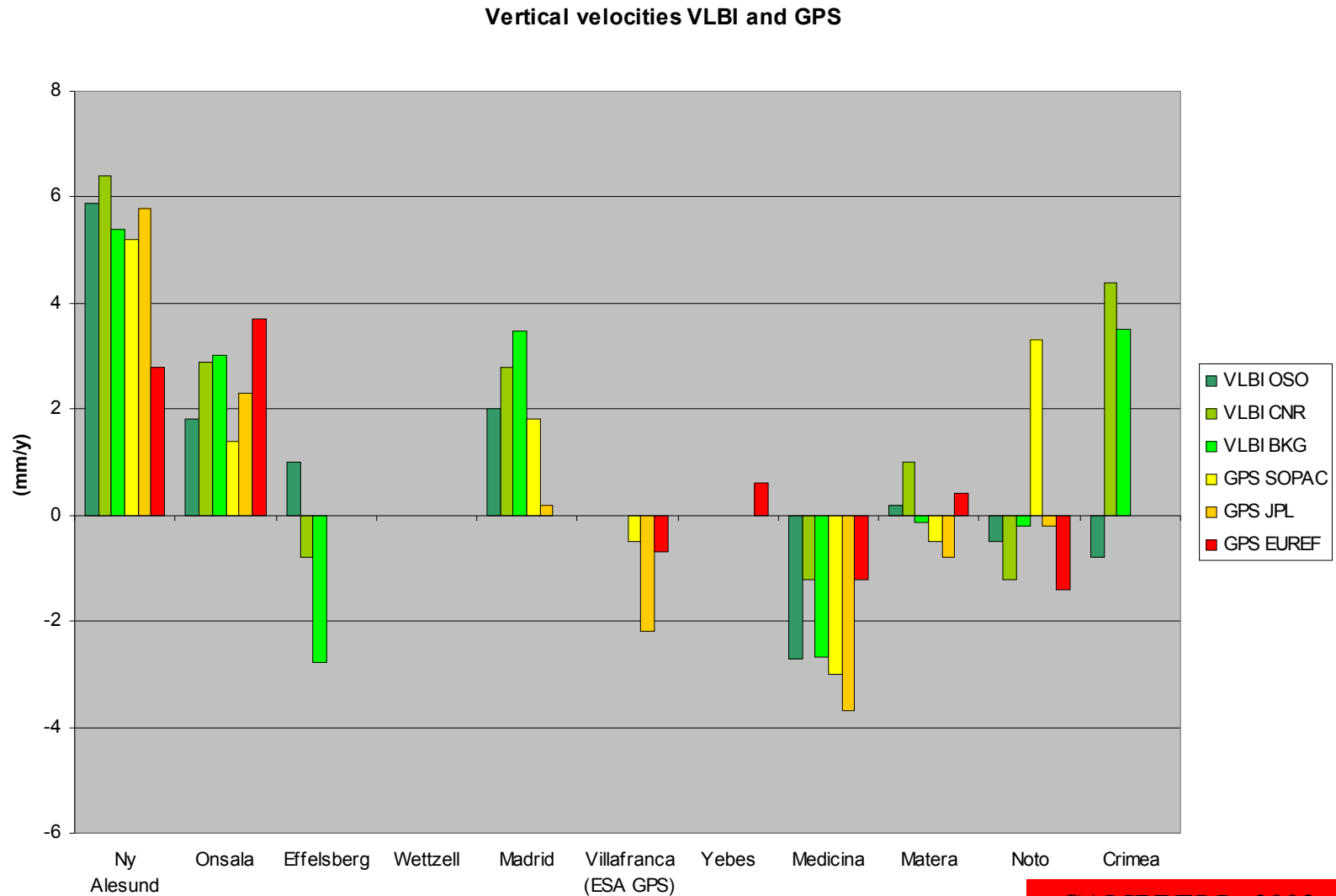
HEIGHT COMPONENT VELOCITY COMPARED TO VLBI



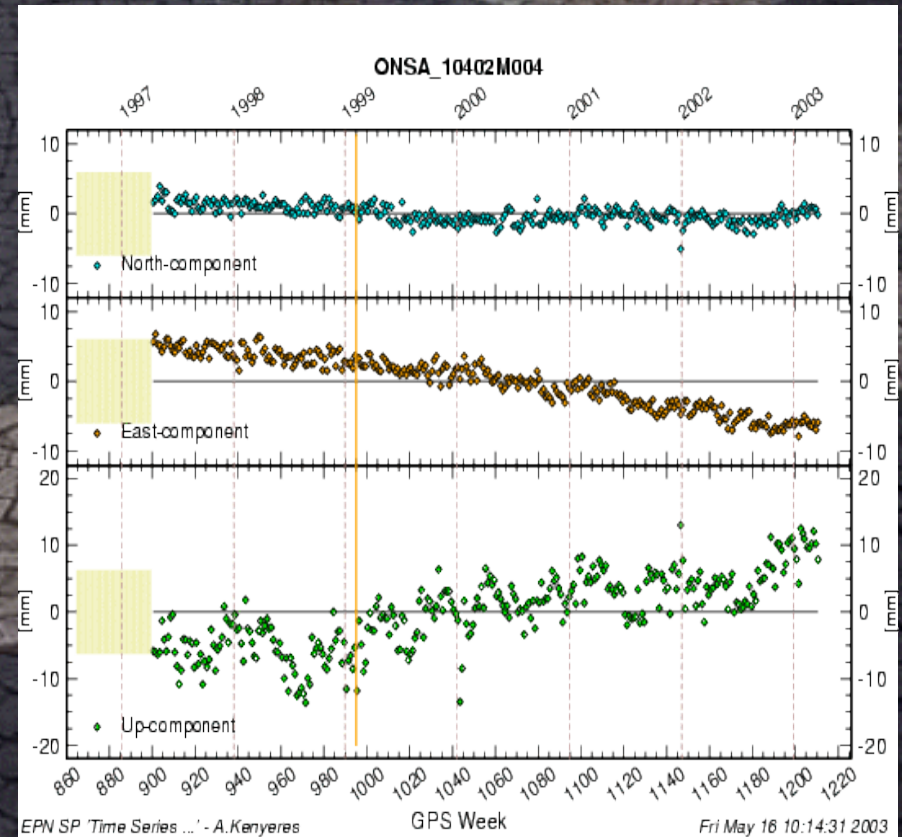
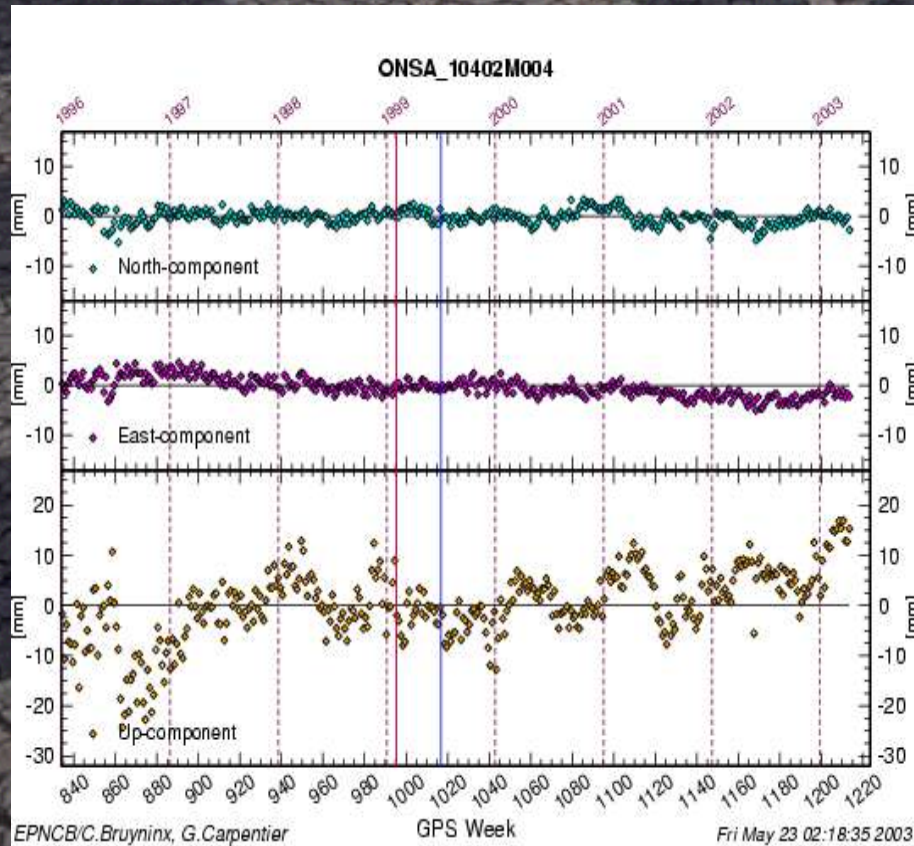
STANDARD TIME SERIES OF NYA1



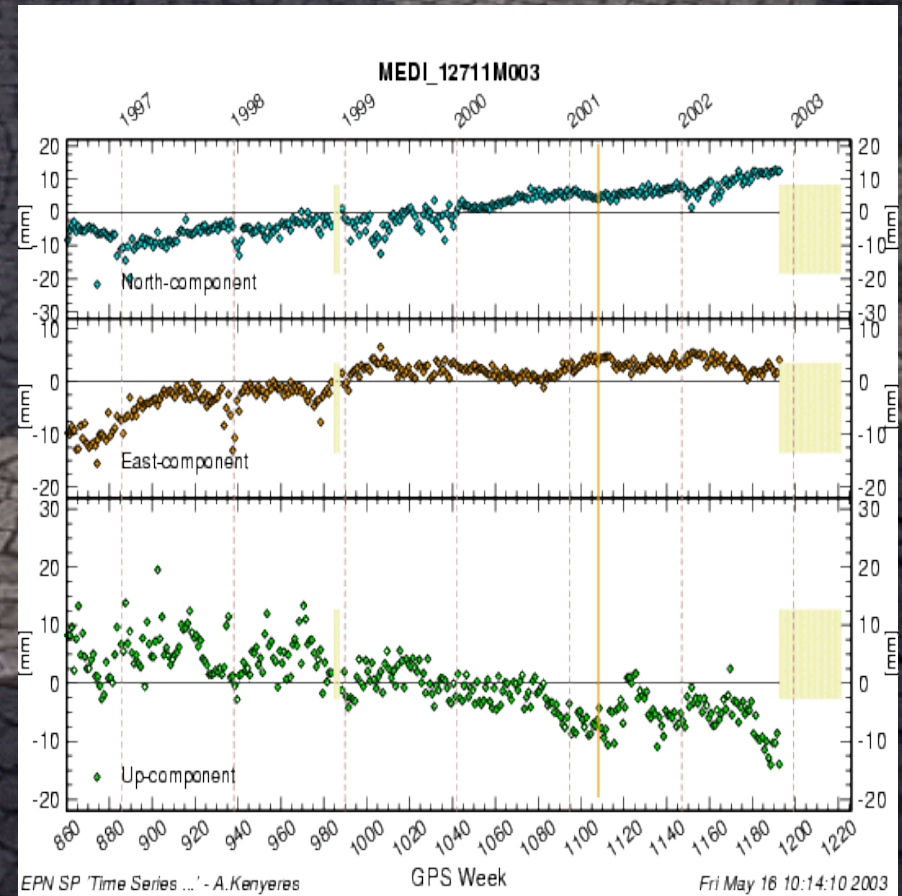
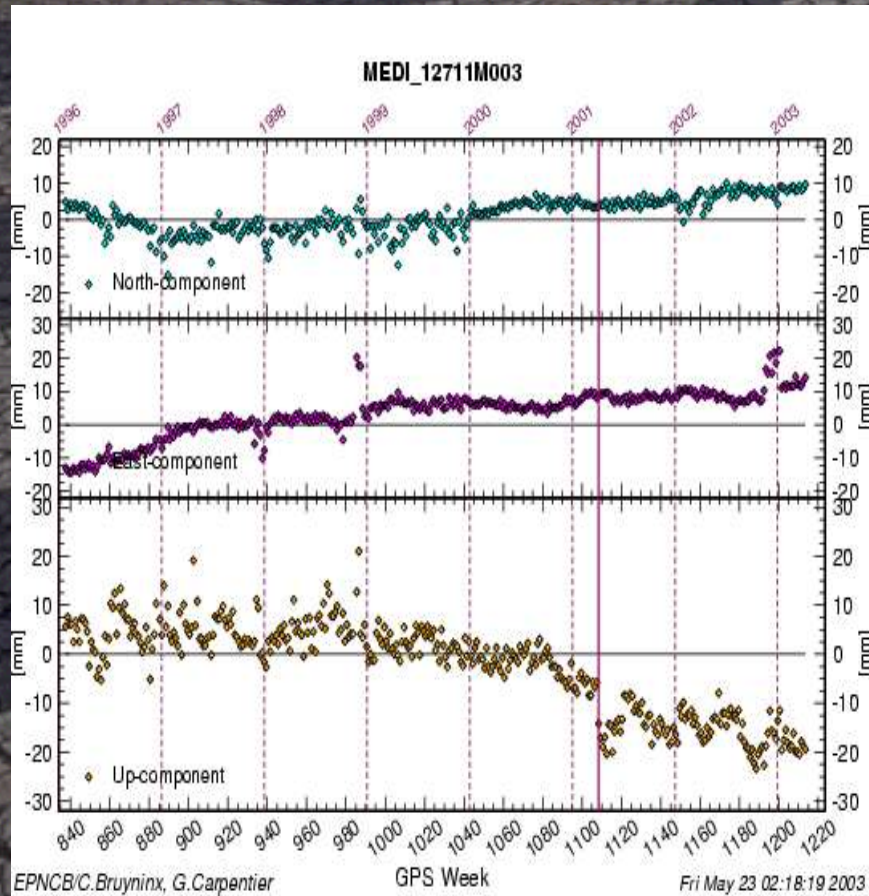
HEIGHT COMPONENT VELOCITY COMPARED TO VLBI



STANDARD AND IMPROVED TS OF ONSA

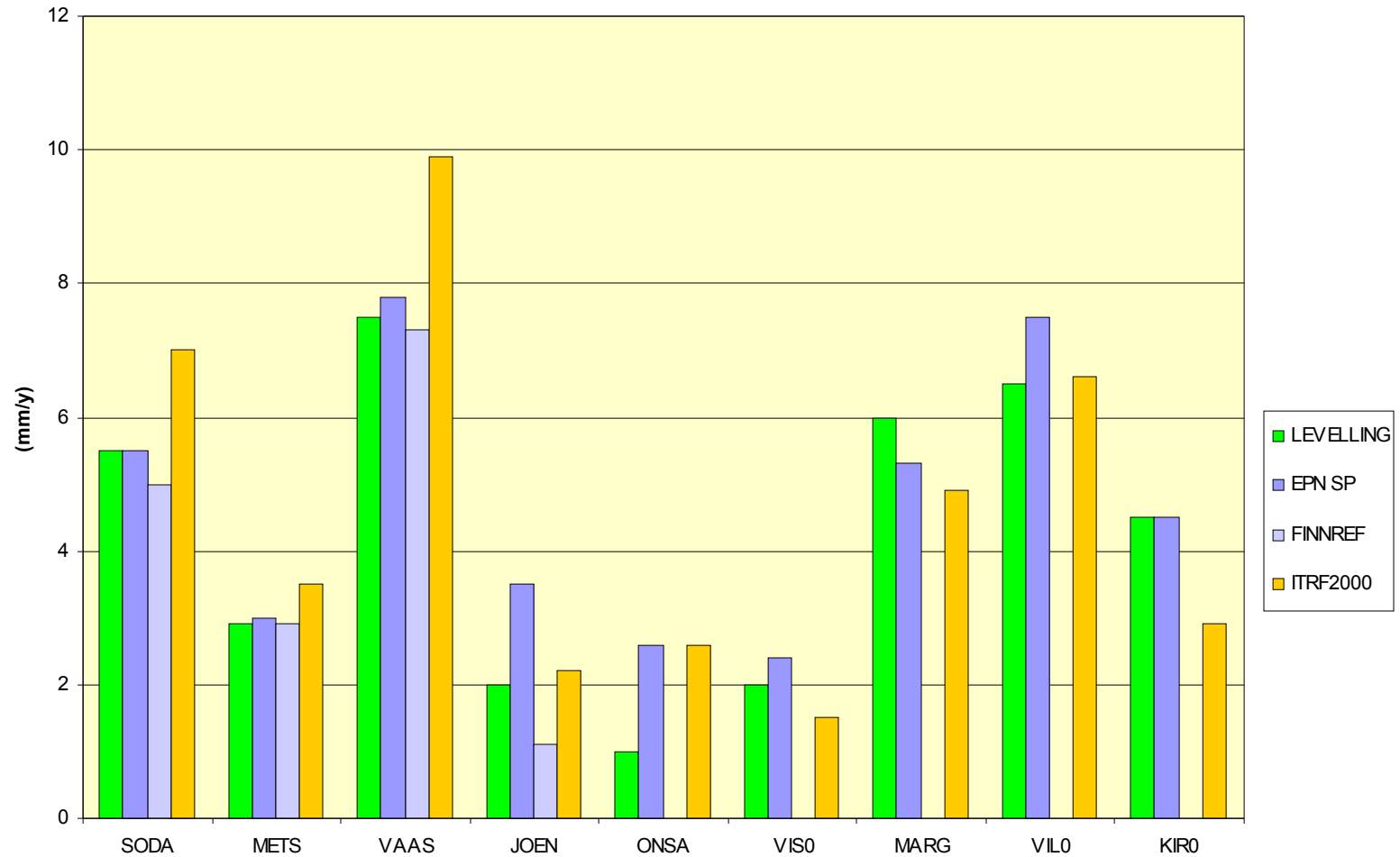


STANDARD AND IMPROVED TS OF MEDI



COMPARISON WITH FENNOSCANDIAN UPLIFT RATE

Vertical velocities from levelling and GPS



SUMMARY

THE HOMOGENEITY OF THE TIME SERIES IS DISTURBED AT LARGE PORTION OF THE SITES MAINLY DUE TO TECHNICAL DIFFICULTIES

THE ESTIMATED VELOCITY PARAMETERS ARE SENSITIVE TO OUTLIERS, JUMPS

CORRECTIONS ARE NECESSARY TO AVOID BIASED REFERENCE COORDINATE AND VELOCITY ESTIMATION

SUMMARY continued...

A RETROSPECTIVE ANALYSIS BACK TO 1996
HAS BEEN PERFORMED

A CORRECTION TABLE WITH JUMPS AND
OUTLIERS HAS BEEN PRODUCED

THE ESTIMATED VELOCITIES ARE SHOWING
SIGNIFICANT IMPROVEMENT, ESPECIALLY
FOR THE UP COMPONENT

THE WORK WILL BE CONTINUED WITH
SPECTRAL ANALYSIS

FUTURE PLANS

INDEPENDENT VELOCITY SOLUTIONS

CONTRIBUTION TO ITRF REALIZATIONS

CONTRIBUTION TO THE DENSIFIED ETRS89
VELOCITY SOLUTION

SPECTRAL ANALYSIS