

# **EPN TIME SERIES ANALYSIS: BEFORE AND AFTER GPSWK1400**

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**EPN TIME SERIES ANALYSIS SPECIAL PROJECT**

**EUREF2007 SYMPOSIUM, 6-9 JUNE 2007 LONDON**

# OUTLINE

- **TIME SERIES WEB PAGES REVITALIZED ( AS ANNOUNCED IN EUREFMAIL\_3328 )**

## **STATE-OF-THE-ART RESULTS AND PRODUCTS**

- **NOISE AND HARMONIC ANALYSIS**
- **COORDINATE AND VELOCITY ESTIMATES**

- **THE (SHAKED WORLD AFTER GPSWK1400**

- **ITRF2000 → ITRF2005**
- **REL → ABS PCV TRANSITION (IGS05)**

## **PROBLEMS (?) AT COMBINATION AND IN THE CUMULATIVE SOLUTION**

- **RE-ANALYSIS EXAMPLES**

# NEW TIME SERIES WEB PAGES

**LONG AWAITED MODERNISATION**

**NEW CONTENT, NEW DESIGN**

- **EPN\_TSA CUMULATIVE SOLUTION ( CATREF )**

**DESCRIPTION, RELATED QUALITY MEASURES**

- **NOISE ANALYSIS ( CATS\_MLE )**

**COLOR NOISE → HIGHER VELOCITY UNCERTAINTIES**

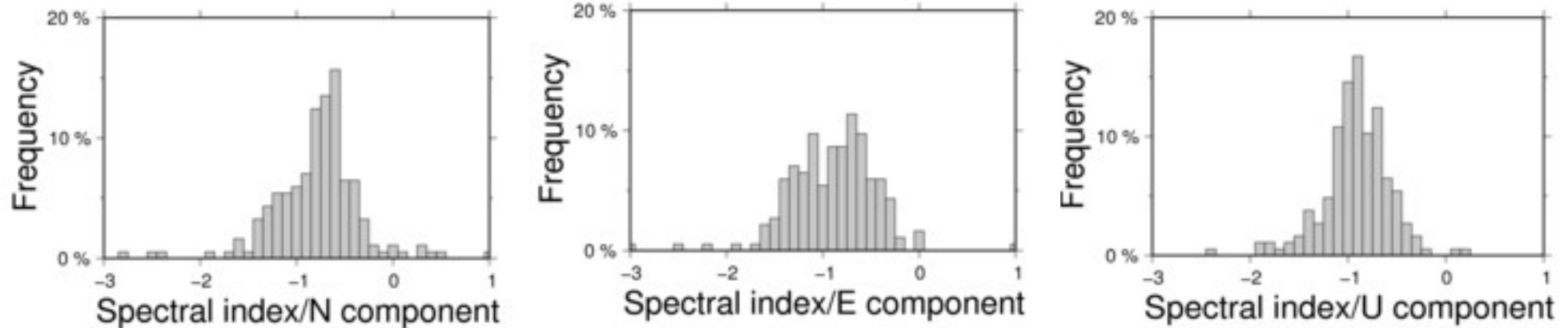
- **HARMONIC ANALYSIS**

**ESTIMATION OF THE SEASONAL VARIATION**

**ONGOING COMPARISON WITH ENVIRONMENTAL MODELS**

**( RE-ANALYSIS! )**

# NOISE ANALYSIS - CATS\_MLE



***HISTOGRAMS OF THE SPECTRAL INDEX DISTRIBUTION***

**PRESENCE OF COLORED NOISE (  $K=-1$  === FLICKER NOISE )**

**IMPACT ON VELOCITY UNCERTAINTY ESTIMATION:**

**LARGER (MORE REALISTIC) UNCERTAINTIES  
COMPARED TO THE WHITE-ONLY NOISE MODEL**

<b>EXAMPLE:</b>	<b>HERS</b>	<b>N</b>	<b>E</b>	<b>U</b>
	<b>V [MM/Y]</b>	<b>16.4</b>	<b>16.6</b>	<b>0.24</b>
	<b><math>\sigma_V</math> (WHITE)</b>	<b>0.00</b>	<b>0.04</b>	<b>0.19</b>
	<b><math>\sigma_V</math> (COLORED)</b>	<b>0.09</b>	<b>0.12</b>	<b>0.28</b>

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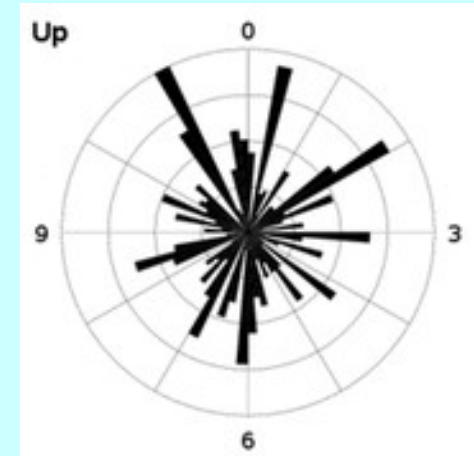
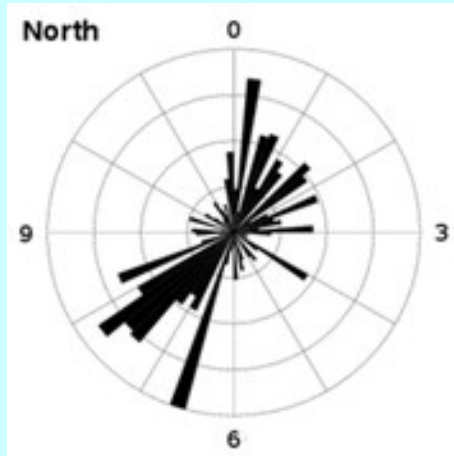
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( RE-ANALYSIS! )**

# EPN HARMONIC ANALYSIS: TS SEASONAL VARIATION



**WINDROSE DIAGRAMS OF THE ESTIMATED PHASE LAG AND AMPLITUDE**

**N,E - WELL DEFINED PHASE LAG**

**U - MORE HOMOGENOUS LAG DISTRIBUTION**

**LIMITED LIFETIME – THE REPROCESSING WILL OVERWRITE  
ALL PRIOR DEDUCTIONS!**

# NEW TIME SERIES WEB PAGES

## EPN\_TSA PRODUCTS

- **DATABASE OF**
  - **OFFSETS AND OUTLIERS**
  - ***NOISE SPECTRAL INDICES***
  - **SEASONAL COORDINATE VARIATION (AMPLITUDE AND PHASE LAG)**
  - **VELOCITIES AND UNCERTAINTIES**
- **'OFFICIAL' EPN COORDINATE AND VELOCITY SOLUTION BETWEEN THE RELEASES OF THE ITRF SOLUTIONS**

# **“GPSWK 1400” SYNDROME**

**COMPLICATIONS CAUSED BY THE REL/ABS PCV  
TRANSITION ( ITRF2005/IGS05 )**

- COMBINATION INCONSISTENCIES**

**DESPITE OF THE CAREFUL PREPARATIONS  
COORDINATE JUMPS COULD NOT BE AVOIDED!**

- THE STACKING ELIMINATES THE REFERENCE  
FRAME RELATED OFFSETS**
  - HELMERT TRANSFORMATION PARAMETERS**
- THE REST IS DUE TO REL/ABS PCV  
INCONSISTENCIES**



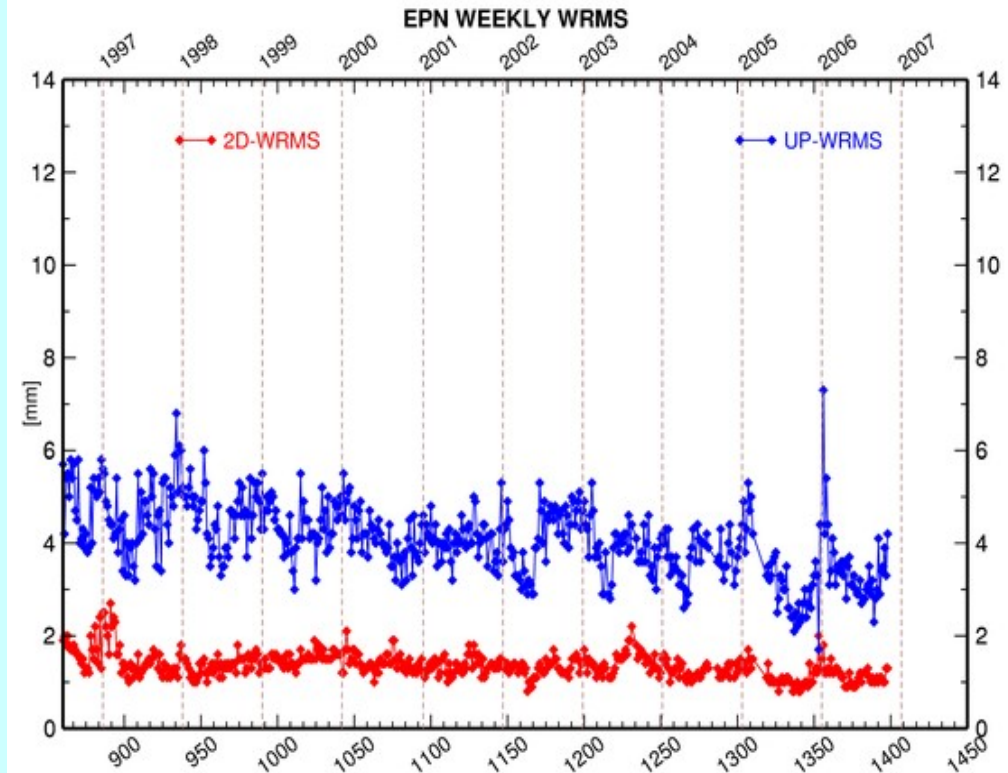
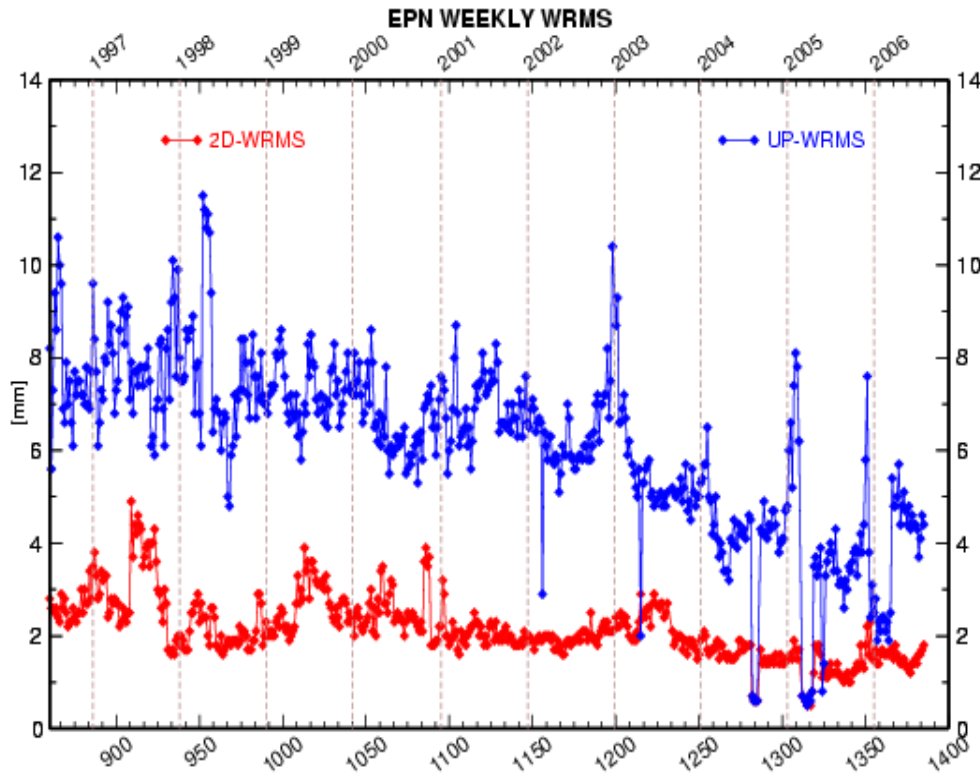
# EPN WEIGHTED RMS SERIES

## QUALITY INDICATOR OF THE WEEKLY COMBINED SOLUTIONS

BEFORE WK 1400

RAW

CLEAN

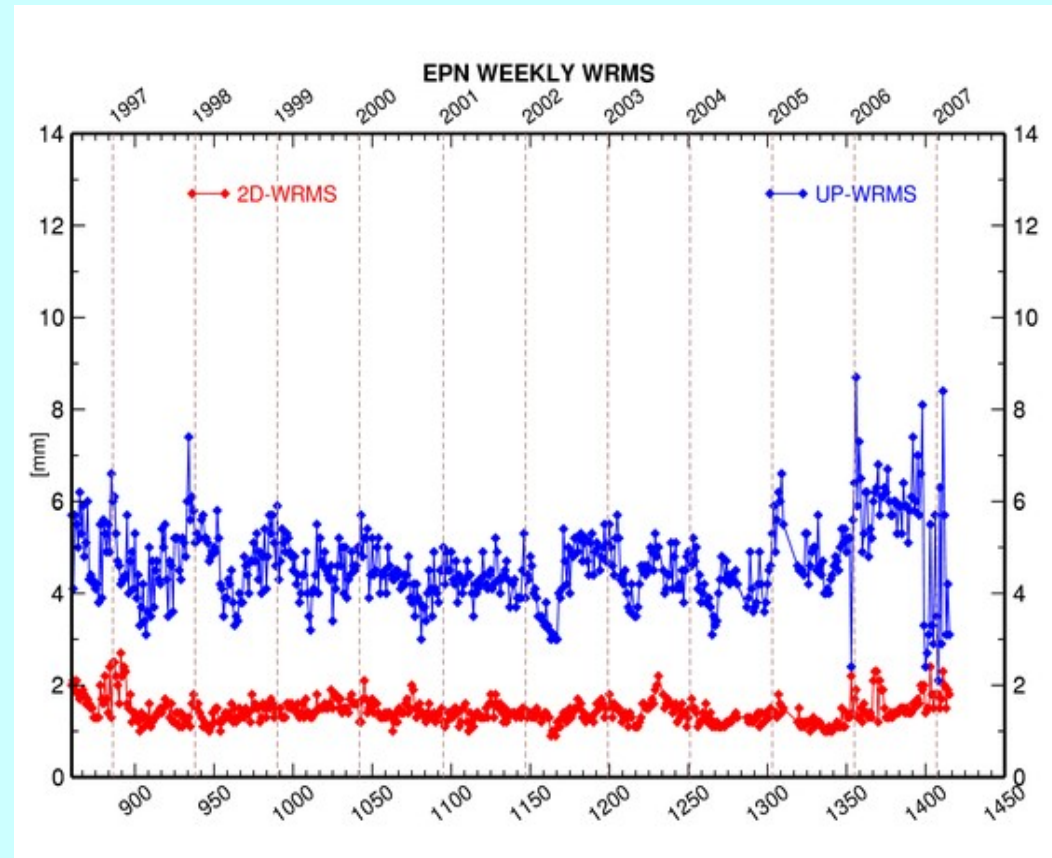
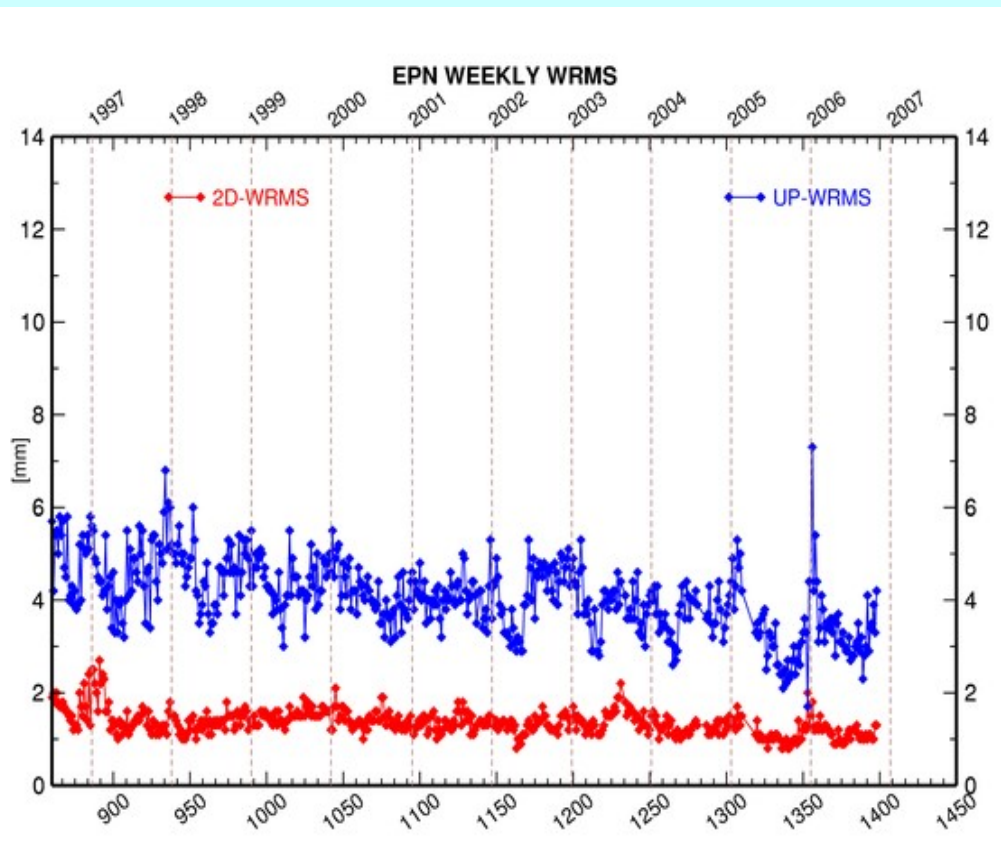


# EPN WEIGHTED RMS SERIES

QUALITY INDICATOR OF THE WEEKLY COMBINED SOLUTIONS

CLEANED COMBINATION UP TO  
WK1400

WK1415



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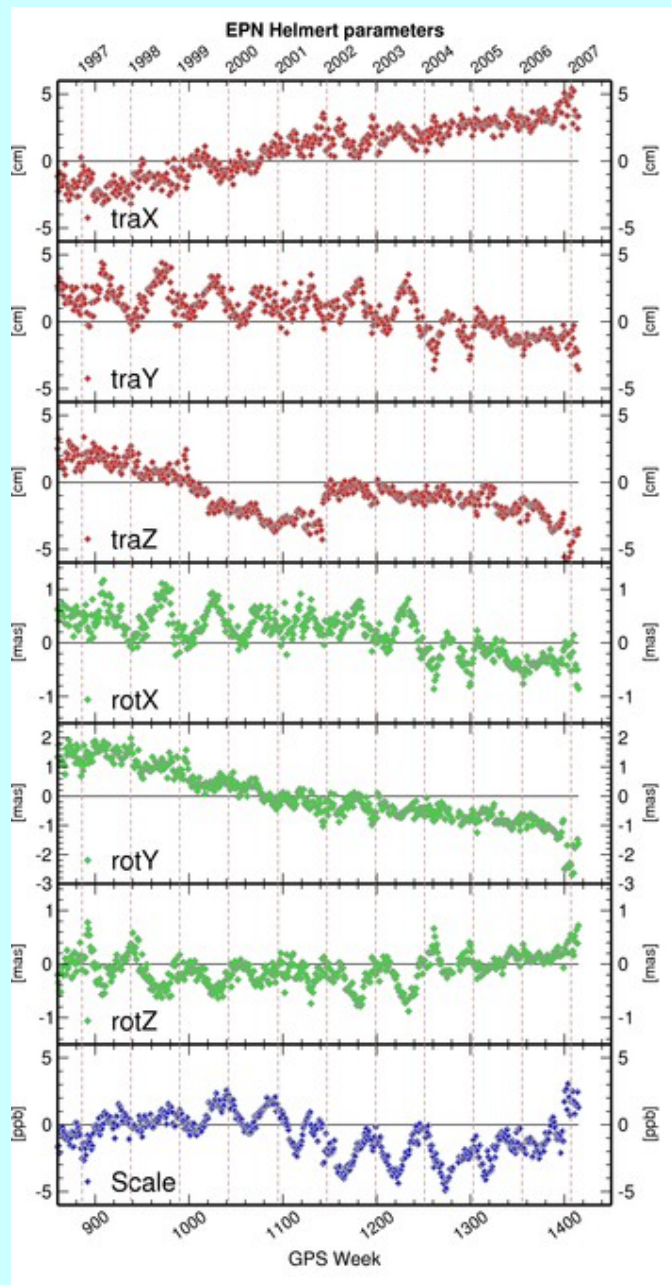
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# HELMERT TRANSFORMATION PARAMETERS



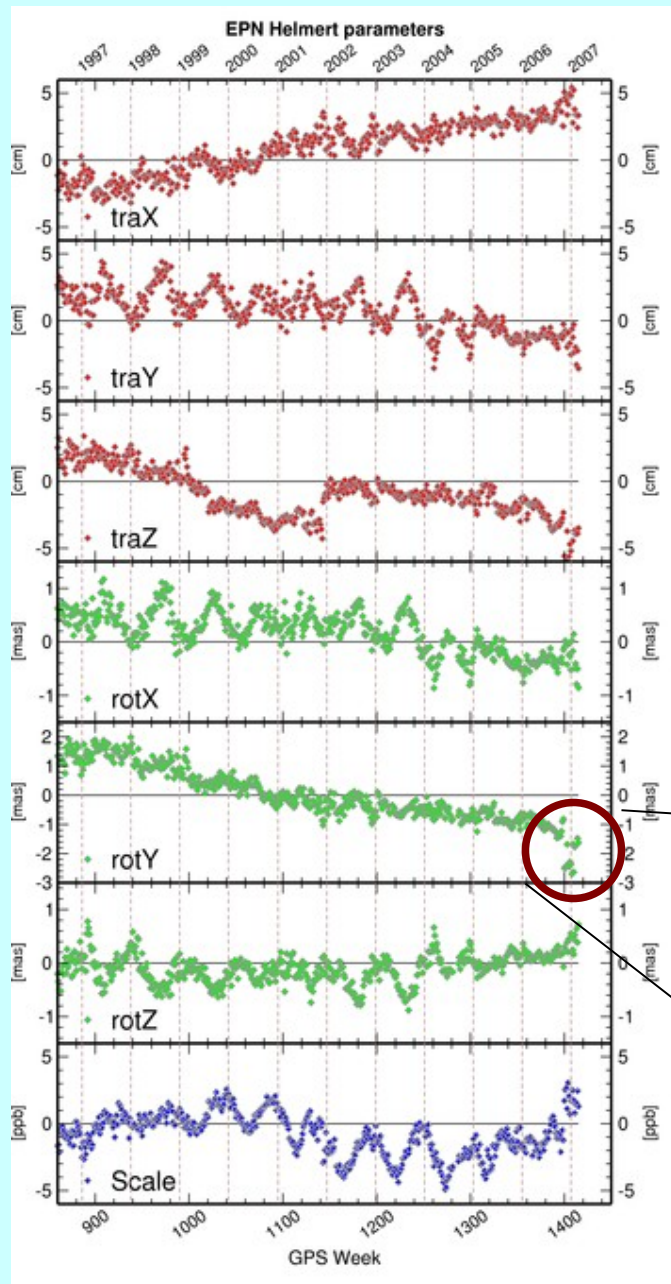
**BYPRODUCT OF THE CUMULATIVE SOLUTION**

**NO STRICT PHYSICAL MEANING,  
BUT GOOD INDICATION OF INCONSISTENCIES:**

- REFERENCE FRAME CHANGES**
- ANALYSIS MODEL ERRORS (TIDAL BUG)**
- INCONSISTENCIES, NOT YET HANDLED  
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# REL ABS PCV TRANSITION: OFFSETS IN THE TIME SERIES

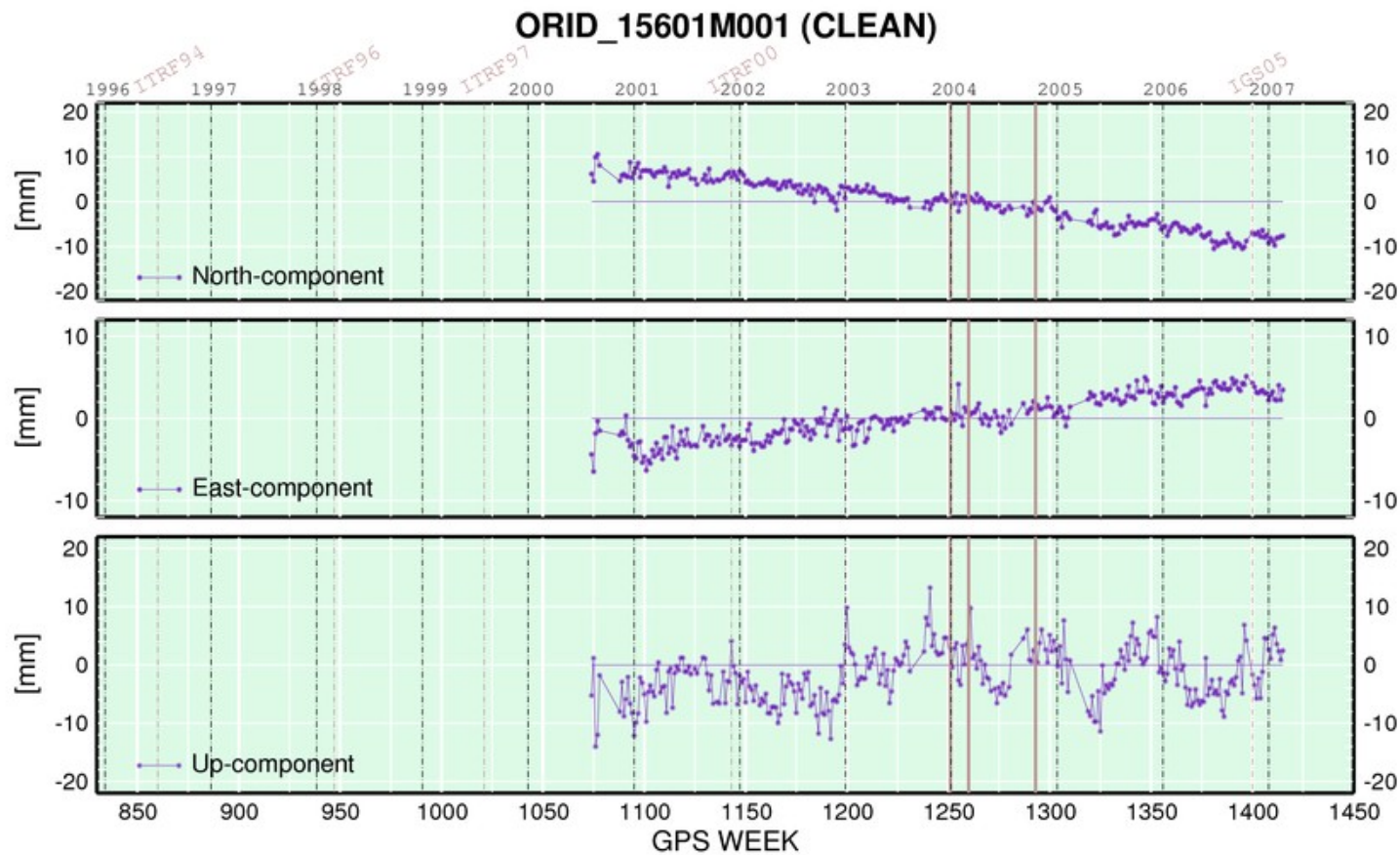
**ONLY ROUGH ANALYSIS POSSIBLE DUE TO THE SHORT SERIES AVAILABLE**

**OFFSET STATISTICS SORTED BY ANTENNA/RADOME TYPES:**

ANTENNA TYPE	RADOME TYPE	ALL/FITTING SITES	N	E	U
			mean offset at GPSwk 1400		
AOAD/M_T	ANY	25/22	✓	✓	✓
ASH700936A_M	ANY	5/4	✓	✓	✓
ASH700936D_M	ANY	7/6	~	-	>+10 mm
ASH700936[BC]_M	NONE	11/10	✓	✓	✓
ASH700936C_M	SNOW	5/5	~	~ 3 mm	>+10 mm
ASH700936E_M	SCIS	5/5	~	~ 3 mm	>+10 mm
JPSREGANT_DD_E	NONE	2/2	3	-3	> +10 mm
ASH701946.2	SNOW	3/3	✓	✓	✓
LEIAT504	LEIS	12/?	~	-	12/4 – 5 mm
TPSCR3_GGD	CONE	5/4	✓	✓	✓
TRM29659.00	NONE	41/29	✓	✓	✓
TRM29659.00	UNAV	5/5	-5 mm	> -5 mm	10 mm
TRM29659.00	TCWD	6/4	~	-5 mm	10 mm
TRM41249.00	NONE	5/5	5 mm	-	✓

# A0AD/M\_T

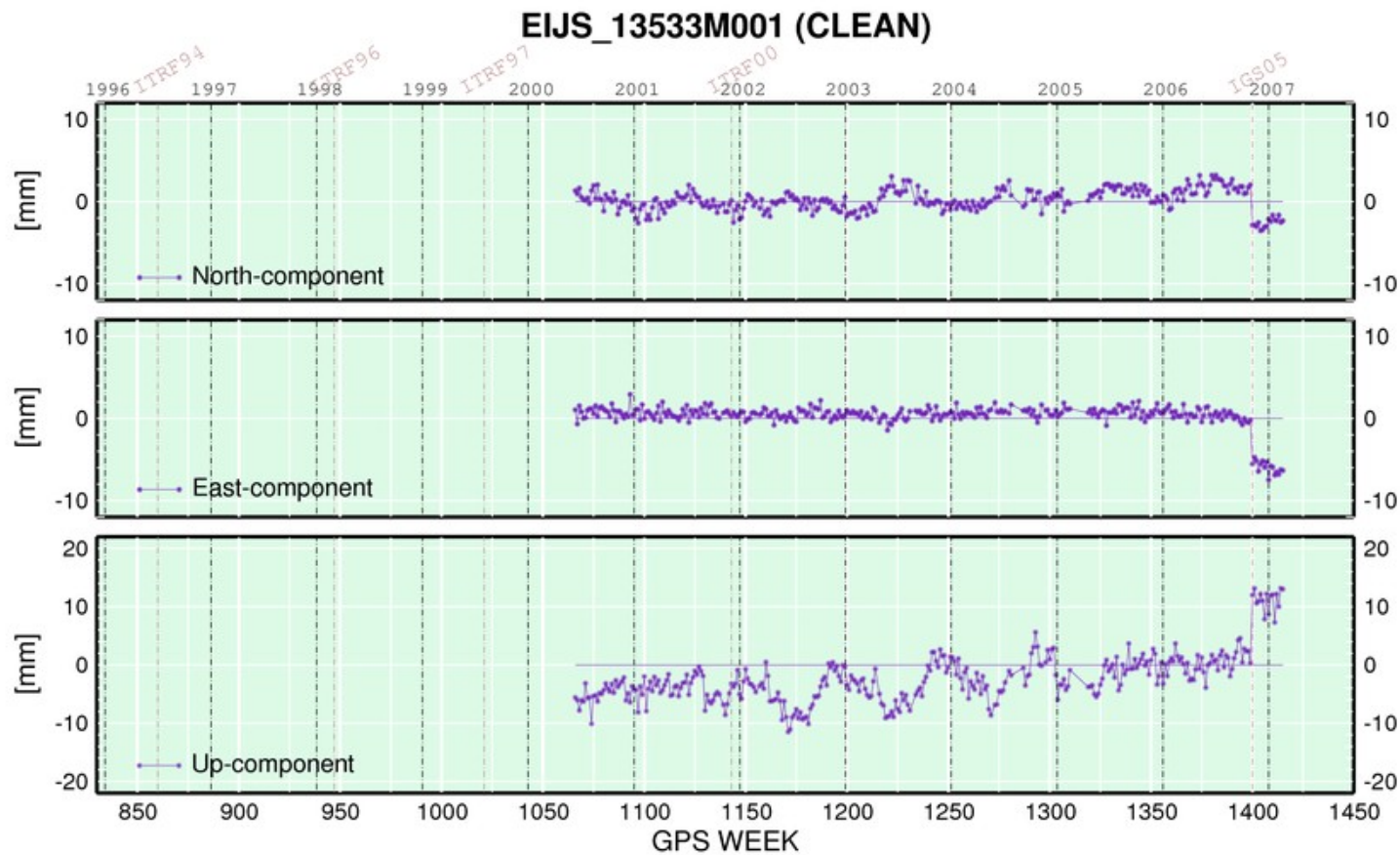
**25/22 ARE OK – EXCEPTIONS DUE TO LOCAL PROBLEMS?**





# TRM29659.00\_UNAV

5/5 ( DELF, TERS, EIJS, LINZ, TUBI )



# RE-PROCESSING EXAMPLES

## EXPECTATIONS

**MORE CONSISTENT TIME SERIES**  
**CONSISTENT ORBIT, PCV**

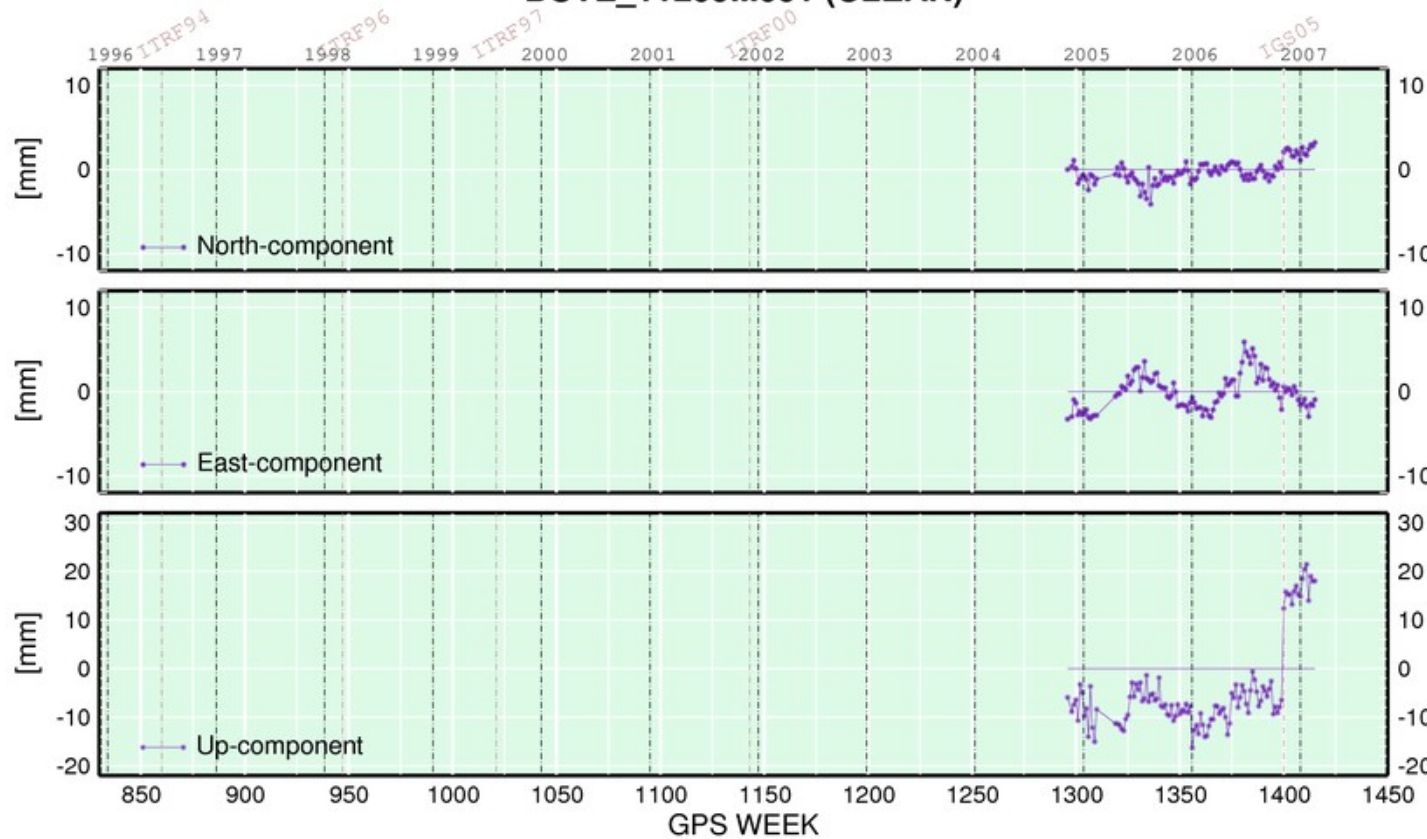


- **LESS AND SMALLER OFFSETS**
- **SMALLER RMS SCATTER**
- **DECREASED SEASONAL VARIATION**

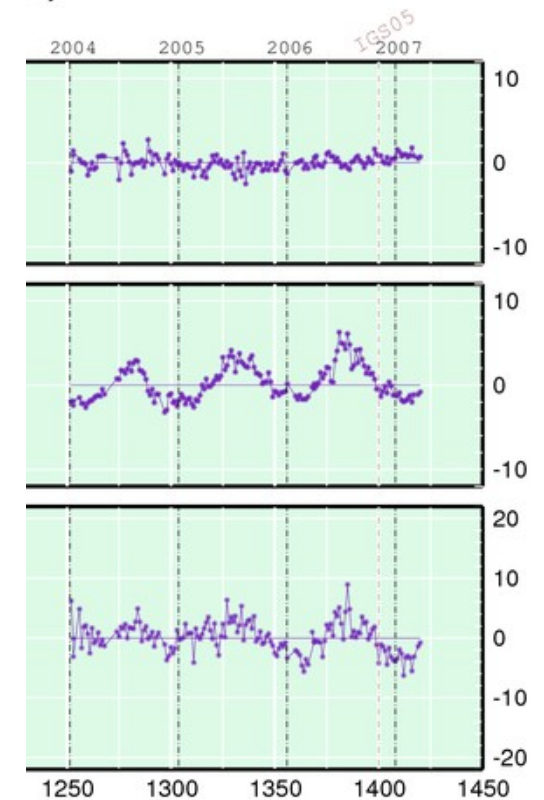
# RE-PROCESSING EXAMPLES

**BUTE ( TRM33429.20 TCWD )**

**BUTE\_11209M001 (CLEAN)**

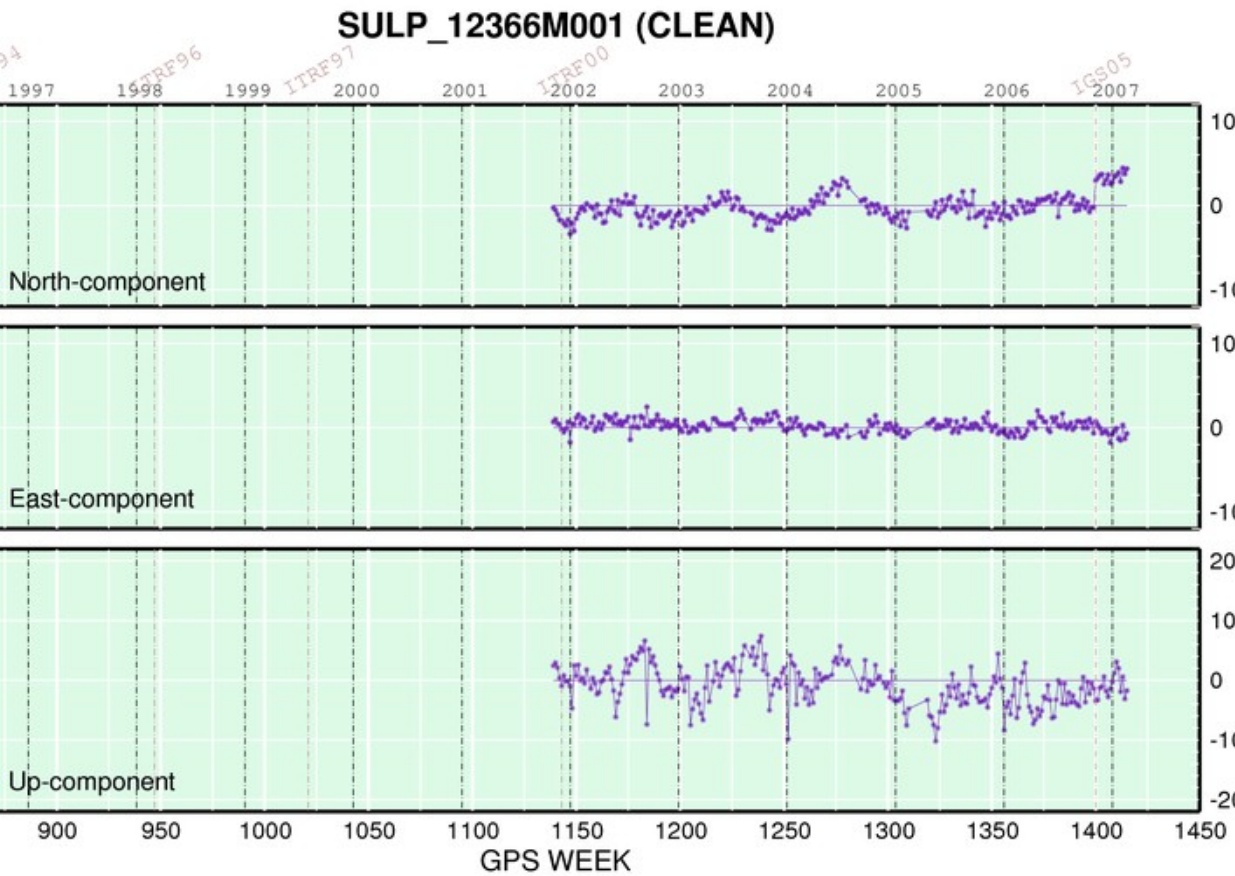


**N)**

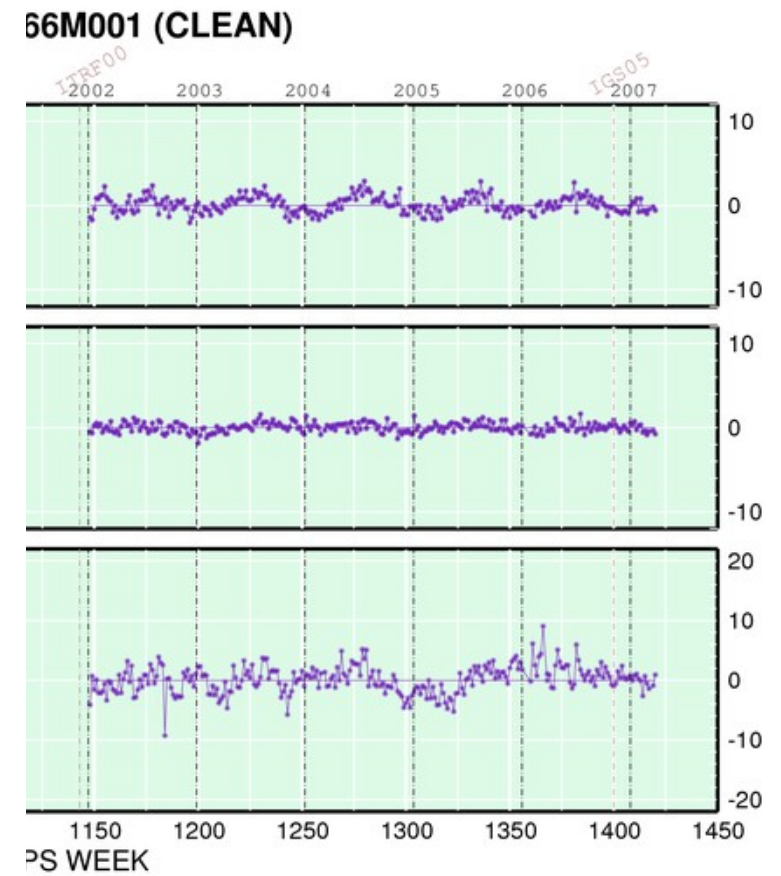


# RE-PROCESSING EXAMPLES

**SULP ( TRM33429.20      NONE**



Sat May 19 23:46:48 2007



Thu Apr 26 14:45:25 2007

# SUMMARY

- **NEW EPN\_TSA WEB PAGES**  
**UP-TO-DATE RESULTS, NOISE AND HARMONIC ANALYSIS**  
**OFFICIAL COORDINATE AND VELOCITY SOLUTION**
- **CUMULATIVE SOLUTION QUALITY MEASURES**
- **ANALYSIS OF THE REL-ABS PCV CHANGE**  
**ANTENNA/RADOME DEPENDENT OFFSETS**
- **RE-ANALYSIS: LIMITED VALIDITY RESULTS**
  - **SMOOTHER TIME SERIES ( ESP. UP COMPONENT )**
  - **SEASONAL TERM REMAINS IN N,E COMP.**