MAINTENANCE OF THE ETRS89 COORDINATES AND VELOCITIES AT EPN SITES

AMBRUS KENYERES

EUREF SYMPOSIUM, FLORENCE 27-29 MAY 2009
OUTLINE

● CUMULATIVE SOLUTIONS
  ITRFyy; ITRFyy DENSIFICATION; EPN

● STATION CLASSES
  WHY AND HOW?

● NEW EPN PRODUCT:
  'CLASSED' EPN COORDINATE AND VELOCITY SOLUTIONS
CUMULATIVE SOLUTIONS

- STACKING OF LONG TERM SINEX SETS (GLOBAL, REGIONAL, … )

- PRODUCT: CUMULATIVE SNX AND SSC SOLUTIONS
  - ITRF2005 (ITRF2005_TRF.SNX)
  - ITRF2005 DENSIFICATION (EPN_C1355.SNX)
  - ITRF2008 😊
ITRF2005 DENSIFICATION

- CREATED BY CATREF (A.K. - TIME SERIES PROJECT
  - MINIMUM CONSTRAINT APPROACH
  - DATUM: 22 ITRF2005 SITES 43 SOLUTIONS
  - ITRF/IGS DISCONTINUITY HARMONIZATION
  - INCLUDED EPN SINEXES: GPSweek 860 - 1355
- RELEASED 12.2008(WK 1508) EUREFmail 4142
- AVAILABLE AT EPNCB WEBSITE
ITRF2005 REFERENCE NETWORK

22 SITES, 43 SOLUTION NUMBERS
CUMULATIVE SOLUTIONS

- STACKING OF LONG TERM SINEX SETS (GLOBAL, REGIONAL, ...)

- PRODUCT: CUMULATIVE SNX AND SSC SOLUTIONS
  - ITRF2005 (ITRF2005_TRF.SNX)
  - ITRF2005 DENSIFICATION (EPN_C1355.SNX)

- 'CLASSIC' TYPE: ALL COORDINATES REFER TO THE SAME EPOCH
  COORDINATES MAPPED USING THE ESTIMATED VELOCITY
COORDINATE MAPPING FOR 'YOUNG' SITES

USING DIFFERENT LENGTH OF DATA THE MAPPING COULD RESULT VERY DIFFERENT COORDINATES!

ITRF2005 REFERENCE EPOCH
TARGET: UP-TO-DATE CRD&VEL PRODUCT

HOW?

- **WEEKLY COMBINED (AC)**
  - COORDINATE VARIABILITY
- **ITRF DENSIFICATION**
  - RARE UPDATES
- **'CLASSIC' CUMULATIVE SOLUTION**
  - CRD VARIABILITY FOR 'YOUNG' STATIONS
- **'CLASSED' CUMULATIVE SOLUTION**
  + STABLE COORDINATES
  + SAME QUALITY AS THE ITRF DENSIFICATION
  + FREQUENT UPDATE
EPN SITE CATEGORIZATION

STATIONS WITH **SUFFICIENT LENGTH OF OBSERVATIONS** AND HAVING HIGH QUALITY VELOCITIES SHOULD BE DISTINGUISHED FROM 'YOUNGER' SITES.

**EUREF ANALOGY:**

**CLASS_A:** \(<1 \text{ CM PRECISION ETRS89 CRD AND } \!<1 \text{ MM/YEAR VEL AT ANY EPOCH}\)

**CLASS_B:** \(<1 \text{ CM PRECISION ETRS89 CRD (\text{-VEL-}) AT EPOCH OF MINIMUM VARIANCE (NORMALLY } == \text{ MEAN EPOCH) }\)
SITE CATEGORIZATION

TESTING A SERIES OF CUMULATIVE SOLUTIONS COMPUTED IN EACH 5 WEEKS

CLASS_A STATION CRITERIA:

- MINIMUM OBSERVATION LENGTH: 1 YEAR
- VELOCITY 'REPEATABILITY' < 0.5 MM/YEAR OVER THE LAST 10 SOLUTIONS (45 WEEKS)
- THE UNCERTAINTY OF THE LAST VELOCITY SOLUTION IS < 0.5 MM/YEAR
- LAST SOLUTION NOT OLDER THAN 2 YEARS
CATEGORIZATION IN THE PRODUCTS

**EPN_CWWWW.SNX** - EPN cumulative SINEX

- includes all weekly solutions up to GPS week WWWW

INTERNALLY

**EPN_A_ITRF20yy_CWWWW.SSC** / **SNX**  
CRD & VEL

**EPN_B_ITRF20yy_CWWWW.SSC**  
no SNX !  
CRD **no VEL** !

**EPN_A_ETRF2000_CWWWW.SSC** / **SNX**  
CRD & VEL

**EPN_B_ETRF2000_CWWWW.SSC**  
no SNX !  
CRD **no VEL** !

**A** - pre-defined single epoch (2005.0)

**B** - the actual epoch of minimal variance for each station
'OLD' STATION: BRUS
OFFSET: ANKR

EPN cumulative solutions by AK

Coordinate repeatabilities
'VERY YOUNG' STATION: BYDG

BYDG_12224M001 (cat_C)

GPS WEEK

X-component

Y-component

Z-component

EPN cumulative solutions by AK

Coordinate repeatabilities
'VERY YOUNG' STATION: BYDG

Coordinate repeatabilities
'YOUNG' STATION: SALA

Coordinate repeatabilities
• **ITRF2005 DENSIFICATION**: THE 1ST EPN MAINTENANCE STEP

• 'INTERNAL' CUMULATIVE SOLUTIONS ARE COMPUTED EACH 5 WEEKS USED FOR SITE CATEGORIZATION

• THE MAINTENANCE CUMULATIVE SOLUTION IS UPDATED IN EACH 15 WEEKS (C1525)

• **CLASS_A & B SNX AND SSC SOLUTIONS** ARE PUBLISHED IN ITRF2005 AND ETRF2000
### Sample class_B SSC file

**CLASS_B EPN STATION POSITIONS**  
**REFERENCE FRAME: ETRF2000 AT EPOCH OF MINIMAL VARIANCE**  
**CUMULATIVE SOLUTION OF GPSWEEKS [ 860 - 1525 ]**  
**RELEASE NAME: EPN_B_ETRF2000_C1525**  
**RELEASED ON 12/05/2009 BY EUREF (A.KENYERES, FOMI)**

<table>
<thead>
<tr>
<th>DOMES NB.</th>
<th>SITE NAME</th>
<th>TECH. ID.</th>
<th>X</th>
<th>Y</th>
<th>Z</th>
<th>Sigmas</th>
<th>SOLN</th>
<th>DATA_START</th>
<th>DATA_END</th>
<th>REF. EPOCH</th>
</tr>
</thead>
<tbody>
<tr>
<td>13452M001</td>
<td>ALBA</td>
<td>GPS ALBA</td>
<td>4962848.194</td>
<td>-160854.377</td>
<td>3990884.188</td>
<td>0.001</td>
<td>0.000</td>
<td>0.001</td>
<td>07:25</td>
<td>09:09</td>
</tr>
<tr>
<td>13480M001</td>
<td>BORR</td>
<td>GPS BORR</td>
<td>4899519.296</td>
<td>-7115.824</td>
<td>4069961.400</td>
<td>0.001</td>
<td>0.000</td>
<td>0.001</td>
<td>07:29</td>
<td>09:09</td>
</tr>
<tr>
<td>12223M001</td>
<td>BPDL</td>
<td>GPS BPDL</td>
<td>3615990.152</td>
<td>1544390.853</td>
<td>5005373.512</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>08:16</td>
<td>09:09</td>
</tr>
<tr>
<td>12224M001</td>
<td>BYDG</td>
<td>GPS BYDG</td>
<td>3647217.200</td>
<td>1184604.089</td>
<td>5079624.980</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>08:16</td>
<td>09:09</td>
</tr>
<tr>
<td>13449M002</td>
<td>CEU1</td>
<td>GPS CEU1</td>
<td>5150907.999</td>
<td>-478415.039</td>
<td>3718518.221</td>
<td>0.001</td>
<td>0.000</td>
<td>0.000</td>
<td>08:06</td>
<td>09:09</td>
</tr>
<tr>
<td>13449M001</td>
<td>CEUT</td>
<td>GPS CEUT</td>
<td>5150601.969</td>
<td>-478834.678</td>
<td>3718884.594</td>
<td>0.001</td>
<td>0.000</td>
<td>0.000</td>
<td>05:06</td>
<td>06:21</td>
</tr>
</tbody>
</table>
**NAMING CONVENTION:**
- **INTERNAL**  EPN_A/B_ETRF2000_CWWWW
- **PUBLICATION**  EPN_A/B_ETRF2000

**THE COORDINATES BOTH IN CLASS_A & B ARE STABLE ON THE MM-LEVEL**

**CLASS_A STATIONS ARE PROMOTED TO USE FOR EUREF DENSIFICATION**

**THE 'HISTORICAL' SOLUTIONS ARE ARCHIVED**