ETRS89 Realizations

- What is the problem ?
- Proposal for Remedy
- Procedures
- Recommendations

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Problem

Coordinates jumps between successive ETRS89 realizations at epochs posterior to 1989.0, due to transformation parameter rates between successive ITRS realizations.

Proposal

- **Minimize the transformation between ETRF2000 and future ETRFyy solutions, starting with the ETRF2005.**

- **This means adopting ETRF2000 as a conventional frame of the ETRS89 system.**

Procedures

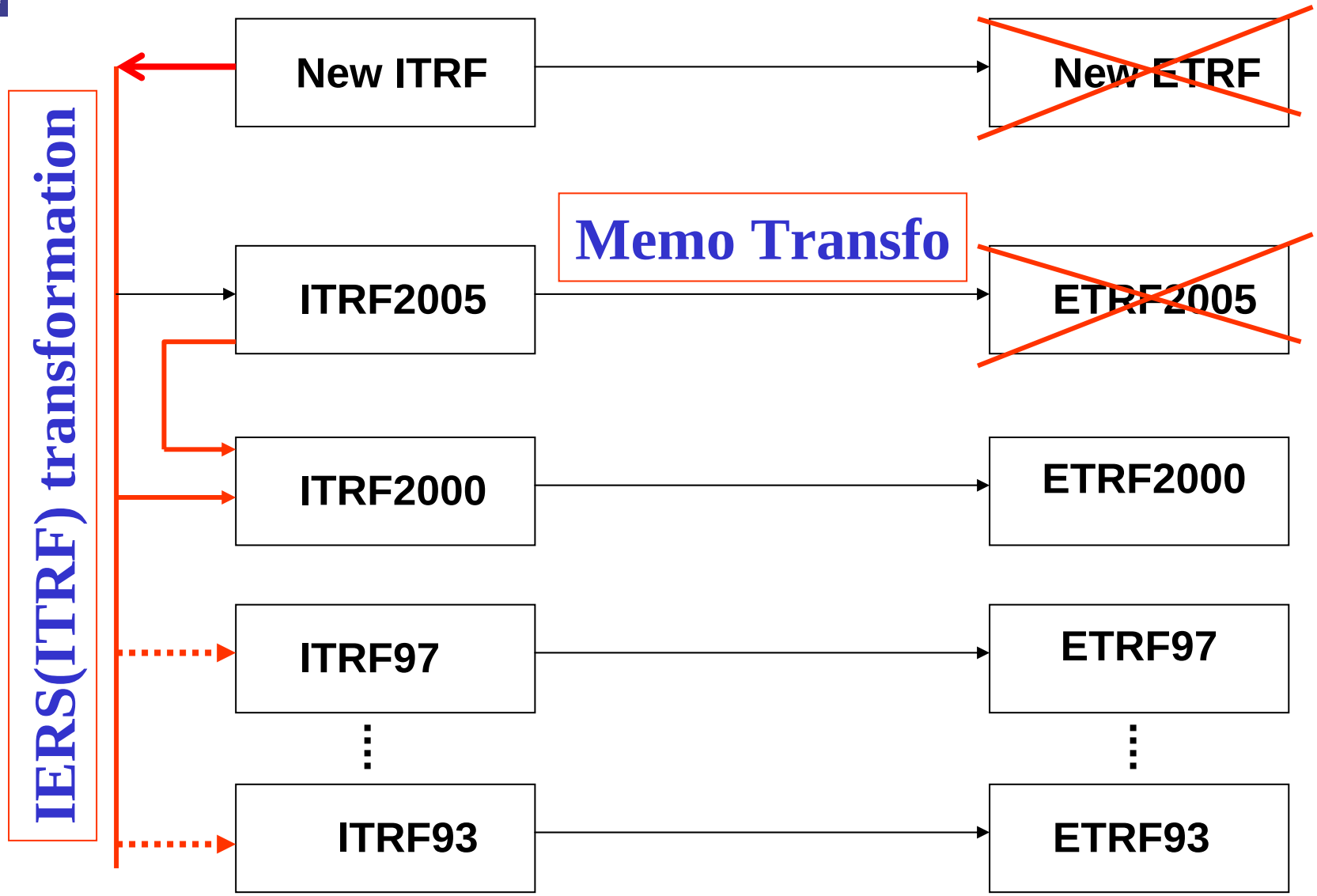
- **There are two proposed procedures**
- **Approach A:**
  - **Transform from ITRF2005(8, 10) to ITRF2000 (97, ...,93)**
  - **Use the ITRS-to-ETRS89 Transformation Formulae**

- **Approach B: Use 14 Transformation Parameters between ITRF2005(8, 10,..) and ETRF2000 :**
  - **B-1 Computed Parameters**

  or

  - **B-2 Estimated Parameters**

Approach A


New ITRF
New ETRF
Memo Transfo
ITRF2005
ETRF2005
ITRF2000
ETRF2000
ITRF97
ETRF97
ITRF93
ETRF93
IERS(ITRF) transformation

Approach A: Advantages

- Straightforward and clear approach
- Minimum update of the Memo
- Valid for the past and the future
- Satisfies all users
- Already used by a certain number of NMAs
- Guarantees zero jumps

B-1 Computed Parameters

Summation of the transformation

- **ITRF2005-To-ITRF2000 (IERS)**

and

- **ITRF2000-To-ETRF2000 (EUREF Memo)**

	T1 mm	T2 mm	T3 mm	D 10-9	R1 mas	R2 mas	R3 mas	Epoch y
	54.1	50.2	-53.8	0.40	0.891	5.390	-8.712	00:001
Rates	-0.2	0.1	-1.8	0.08	0.081	0.490	-0.792	

B-2 Estimated Parameters

Using ITRF2005 & ETRF2000 published solutions: 35 stations

(1)

	T1 mm	T2 mm	T3 mm	D 10-9	R1 mas	R2 mas	R3 mas	Epoch y
	49.3	54.0	-49.1	0.58	0.983	5.616	-8.838	00:001
+/-	1.9	3.0	1.6	0.23	0.089	0.065	0.063	
Rates	-1.6	3.4	-0.6	-0.14	0.161	0.553	-0.848	
+/-	1.9	3.0	1.6	0.23	0.089	0.065	0.063	

Using EPN-ITRF2005 Dens-solution & ETRF2000: 48 stations

(2)

	T1 mm	T2 mm	T3 mm	D 10-9	R1 mas	R2 mas	R3 mas	Epoch y
	57.1	40.3	-56.1	0.86	0.710	5.293	-8.468	00:001
+/-	1.8	3.4	1.8	0.27	0.100	0.062	0.077	
Rates	-0.3	0.4	-1.8	-0.09	0.064	0.491	-0.808	
+/-	1.8	3.4	1.8	0.27	0.100	0.062	0.077	

Correlation between parameters and their rates

	Tx	Ty	Tz	D	Rx	Ry	Rz
Tx						-0.88	
Ty					0.94		-0.79
Tz				-0.72		0.65	
D							
Rx							
Ry							
Rz							

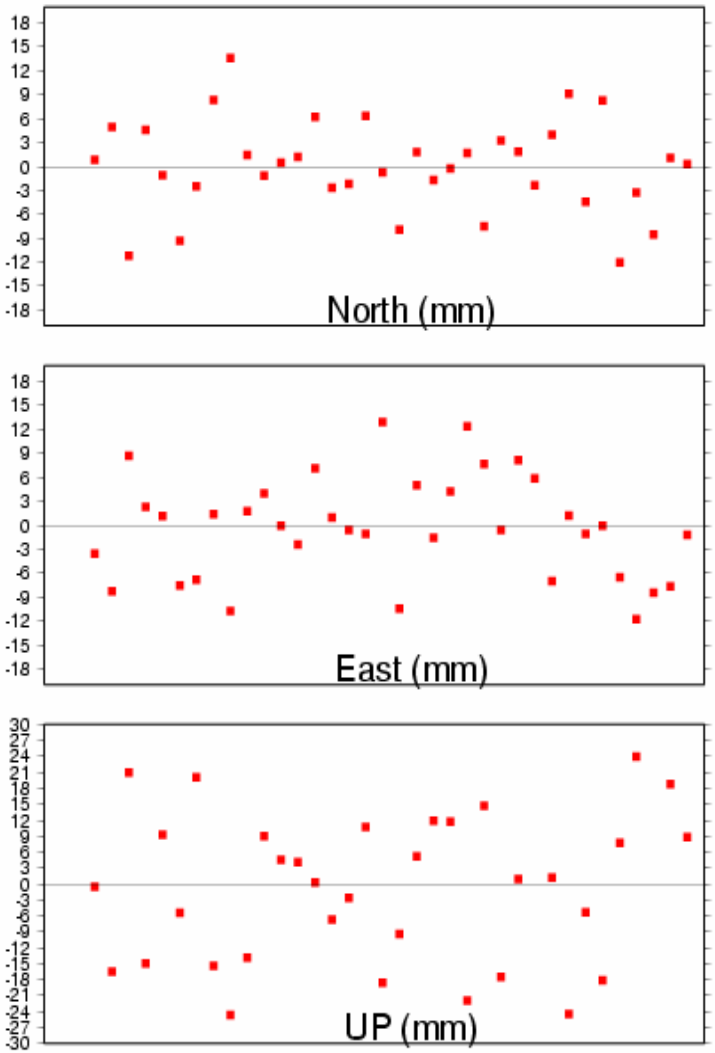
B-2 Estimated Parameters

(1)

	T1 mm	T2 mm	T3 mm	D 10-9	R1 mas	R2 mas	R3 mas	Epoch y
	49.3	54.0	-49.1	0.58	0.983	5.616	-8.838	00:001
+/-	1.9	3.0	1.6	0.23	0.089	0.065	0.063	
	33.6	87.9	-55.1	-0.81	2.595	11.141	-17.314	10:001
+/-	7.1	11.2	5.9	0.86	0.338	0.247	0.239	
Rates	-1.6	3.4	-0.6	-0.14	0.161	0.553	-0.848	
+/-	1.9	3.0	1.6	0.23	0.089	0.065	0.063	

N	WRMS-Pos. E mm	WRMS-Pos. N mm	WRMS-Pos. U mm	Epoch y	WRMS-Vel. E mm/y	WRMS-Vel. N mm/y	WRMS-Vel. U mm/y
35	2.1	1.8	3.1	00: 1	0.5	0.5	1.4
35	6.2	5.6	14.5	10: 1	0.5	0.5	1.4

Residuals at 2010



Conclusions

- **Approach A is th most straightforward**
- **A & B are equivalent only if the computed parameters are adopted**
- **The estimated 14 parameters are subject to imprecision and introduce more jumps at current epochs.**

Recommendations

- Adopte Approach A: the simpliste for the users
- Explain all possible approaches to EUREF community: advantages and disadvantages
- Leave the freedom to users to adopt their preferred Frame and their preferred procedure, do we have any choice to influence NMAs ?
- Possibly think about modifying the ETRS89 definition

ETRS89: Basic Priciples

- Avoid complication to the users
- The ETRS89 as a system should remain unchanged
- Keep the existing geodetic/mathematical transformation formulae between ITRS and ETRS89. An essential link between the two systems
- Admit/accept the existence of different realizations of both systems
- Keep one way to realize the ETRS89, using the pre-existing transformation formulae
- Different users adopted different frames (ETRFyy)

Users of ETRS89 Realizations

- **Type_1 : all national datum users:**
  - **Different ETRFyy frames were already adopted by different countries, with legal status!**
- **Type_2: EPN users: weekly time solutions**
  - **(1): users who wants to have access ETRS89 via the whole EPN network**
  - **(2): users of country-EPN stations, but need weekly solutions expressed in their national ETRFyy**

Concluding Remarks

- **Differnt users with different frames (ETRFyy)**
- **Impossible to eliminate now shifts between already existing and USED frames**
- **Shifts/changes are not limited to ETRF2000 and ETRF2005, but concern almost all ETRFyy**
- **Impossible to impose/recommend the usage of one frame (not a system) for the entire Europe**
- **We have to leave the freedom to users to select their « preferred » frame**

Recommendations

- **Transformation formulae should remain flexible (not to be changed)**
- **Recommendation: (Approach A)**
  - **Use the most recent ITRF (IGS) frame for GPS data reduction**
  - **Transform to ITRFyy corresponding to the user ETRFyy**
  - **Do the transformation ITRF-to-ETRF**
- **Advantages:**
  - **No extra formula is added to the « famous » memo**
  - **Satisfy « all » type of users**