

COORDINATES WEB PAGES



EUREF TWG
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EUREF DENSIFICATION OF THE ITRF

TWO STEPS

- ✕ Two-step approach
 - + Densify ITRF2005
 - + Keep densification up-to-date

STEP 1: Densify ITRF2005:

- + EPN data until Dec. 2005 (like ITRF2005, fall 2006)
- + EUREF mail 4142 (Dec. 12, 2008) – *long overdue*
- + ftp://epncb.oma.be/pub/station/coord/EPN/EUREF_DensificationITRF2005.pdf
- + Still need for a more up-to-date EPN coordinate solution



EUREF DENSIFICATION OF THE ITRF2005



The EUREF ITRF2005 densification solution includes the list of ITRF2005 and ETRF2000 coordinates and velocities for the full EPN network (status Dec. 2005, up to GPS week 1355) and the associated SINEX file.

For the future updates of this densification solution, including ITRF2005 and ETRF2000 coordinates of recent EPN stations and taking into account station coordinate discontinuities occurring after Jan 1st, 2006, we refer to the “Remarks” section. These future updates will replace the present release.

Future updates of the EUREF densification of the ITRF2005:

The present release of the ITRF2005 densification does not take into account any of the EPN data gathered after Jan 1st, 2006 and consequently does not reflect the most recent status of the EPN. As explained above, its usage is therefore limited. To remedy to this problem, the EUREF TWG decided at its meeting of Nov 3-4, 2008 in Munich, to release in the future regular official updates of the ITRS/ETRS89 coordinates/velocities of the EPN stations. Once published, the updated values will replace those from the presently published SSC and SINEX files. More information, including the exact location of the updated solutions and the frequency of the updates, will follow later.



TODAY ON EPN CB WEB

STATION COORDINATES

EPN station positions and velocities:

(select a station) ▼

EPN Positions/Velocities:

Positions/velocities published by EUREF

These positions/velocities result from the [EUREF densification of the ITRF2005](#) based on the data from the EPN. The solution was validated by the EUREF Technical Working Group at its meeting of Nov 3-4, 2008 in Munich. The EUREF ITRF2005 densification solution includes the positions and velocities of the full EPN network (status Dec. 2005, up to GPS week 1355). Consequently this release does not include positions/velocities of recent EPN stations and does not take into account station coordinate discontinuities occurring after Jan 1st, 2006. In addition, it is solely based on relative antenna models. A new release, including the most recent EPN data and analysis results, is foreseen for early 2009. The EUREF densification of the ITRF2005 is available from the EPN CB web site: ITRF2005 ([position/velocity table](#), [SINEX file](#)).

In addition, EUREF transformed this ITRF2005 densification to the ETRS89 (conventional reference frame ETRF2000) using the procedure described in the [Memo](#) by Boucher and Altamimi, 2008. This ETRF2000 [position/velocity table](#) is available from the EPN CB.

Positions/velocities published by the ITRS Product Centre

These positions/velocities are computed by the ITRS Product Centre of the [IERS](#) (International Earth Rotation and Reference Systems Service) as a result of a combination of the multi-year coordinate solutions obtained by several space geodetic techniques (GPS, SLR, VLBI, and DORIS) based on the input of the different technique centers (IGS, ILRS, IVS, and IDS). The latest realization is based on observation data up to Dec. 2005 and includes only the EPN stations part of the IGS at that date. The ITRS positions/velocities published by the IERS are available through the [ITRF web site](#).

In addition, EUREF transformed each ITRS realization to the ETRS89 using the procedure described in the [Memo](#) by Boucher and Altamimi, 2008. For example, the ITRF2005 was transformed to the ETRF2000 and the associated position/velocity table, known as the ETRF2000(R05), is available from the [ETRS89 web site](#).

Preliminary EPN Positions/Velocities:

Positions/velocities computed from the EPN time series analysis

These regularly updated positions/velocities are the result of a multi-year adjustment of all the weekly combined EPN solutions in which outliers have been eliminated and station discontinuities were applied, resulting, for each station in a set of solution numbers identifying the validity of a specific position and/or velocity set.

They are available through the [web page of the EPN time series analysis](#).

Positions (no velocities) computed by the EPN Combination Centre

These coordinates are extracted from the most recent weekly [combined EPN solution](#) which is based on the weekly subnetwork solutions submitted by the [EPN Local Analysis Centres](#).

To obtain the site positions at an epoch t different from t_0 , apply the site velocities: $X(t) = X(t_0) + (t-t_0)*V_X$; $Y(t) = Y(t_0) + (t-t_0)*V_Y$; $Z(t) = Z(t_0) + (t-t_0)*V_Z$
 Periods indicated in red are of reduced quality (e.g. caused by short observation history) and should be used with care.

1. EPN POSITIONS/VELOCITIES

1. A) Positions/velocities published by EUREF (release Dec. 2008)

15% of the EPN stations missing

BADH_14288M001 (Bad Homburg, Germany) is not included in the most recent ITRF2005 densification published by EUREF.

1. B) Positions/velocities published by the IERS

Last ETRS89/ITRS realization (release July 2006):

BADH_14288M001 (Bad Homburg, Germany) is not included in the ETRF2000(R05) list (=ITRF2005 converted to the ETRF2000).

BADH_14288M001 (Bad Homburg, Germany) is not included in the ITRF2005 list published by the IERS.

Previous ETRS89/ITRS realizations:

BADH_14288M001 (Bad Homburg, Germany) is not included in any of the previous ETRS89 realizations.

BADH_14288M001 (Bad Homburg, Germany) is not included in any of the previous ITRS realizations.

2. PRELIMINARY EPN POSITIONS/VELOCITIES

2. A) Positions/velocities computed from the EPN time series analysis (release 12/05/2009)

Updated each 5 weeks

ETRF2000	epoch t_0	Position (m)			Velocity (m/y)		
		X_{EPN}	Y_{EPN}	Z_{EPN}	VX_{EPN}	VY_{EPN}	VZ_{EPN}
127/06 - 115/09	2000.0	4042498.108 ± 0.001	612081.190 ± 0.000	4879250.853 ± 0.002	-0.0029 ± 0.0002	-0.0007 ± 0.0001	-0.0023 ± 0.0002

ITRF2005	epoch t_0	Position (m)			Velocity (m/y)		
		X_{EPN}	Y_{EPN}	Z_{EPN}	VX_{EPN}	VY_{EPN}	VZ_{EPN}
127/06 - 115/09	2000.0	4042497.899 ± 0.001	612081.331 ± 0.000	4879251.008 ± 0.002	-0.0163 ± 0.0002	0.0167 ± 0.0001	0.0092 ± 0.0002

2. B) Positions computed by the EPN Combination Centre

	Position (m)			
	epoch t_0	X_{weekly}	Y_{weekly}	Z_{weekly}
IGS05	2009.26 (Wk No 1526)	4042497.7491 ± 0.0006	612081.4862 ± 0.0002	4879251.0941 ± 0.0007

BRST_10004M004

To obtain the site positions at an epoch t different from t_0 , apply the site velocities: $X(t) = X(t_0) + (t-t_0)*VX$; $Y(t) = Y(t_0) + (t-t_0)*VY$; $Z(t) = Z(t_0) + (t-t_0)*VZ$
Periods indicated in red are of reduced quality (e.g. caused by short observation history) and should be used with care.

1. EPN POSITIONS/VELOCITIES

1. A) Positions/velocities published by EUREF (release Dec. 2008)

ETRF2000*	epoch t_0	Position (m)			Velocity (m/y)		
		X_{EPN}	Y_{EPN}	Z_{EPN}	VX_{EPN}	VY_{EPN}	VZ_{EPN}
361/98 - 109/07	2000.0	4231162.800 ± 0.001	-332746.917 ± 0.000	4745130.700 ± 0.001	-0.0010 ± 0.0001	-0.0009 ± 0.0000	-0.0002 ± 0.0001

*ETRF2000 is the conventional reference frame used to realise the ETRS89

ITRF2005	epoch t_0	Position (m)			Velocity (m/y)		
		X_{EPN}	Y_{EPN}	Z_{EPN}	VX_{EPN}	VY_{EPN}	VZ_{EPN}
361/98 - 365/05	2000.0	4231162.634 ± 0.001	-332746.768 ± 0.000	4745130.864 ± 0.001	-0.0104 ± 0.0001	0.0171 ± 0.0000	0.0121 ± 0.0001

1. B) Positions/velocities published by the IERS

Last ETRS89/ITRS realization (release July 2006):

ETRF2000(R05)	epoch t_0	Position (m)			Velocity (m/y)		
		X_{IERS}	Y_{IERS}	Z_{IERS}	VX_{IERS}	VY_{IERS}	VZ_{IERS}
start - end	2000.0	4231162.804 ± 0.004	-332746.913 ± 0.001	4745130.695 ± 0.004	-0.0017 ± 0.0009	-0.0018 ± 0.0003	0.0010 ± 0.0009

ITRF2005	epoch t_0	Position (m)			Velocity (m/y)		
		X_{IERS}	Y_{IERS}	Z_{IERS}	VX_{IERS}	VY_{IERS}	VZ_{IERS}
start - 365/05	2000.0	4231162.638 ± 0.004	-332746.764 ± 0.001	4745130.859 ± 0.004	-0.0111 ± 0.0009	0.0162 ± 0.0003	0.0134 ± 0.0009

Previous ETRS89/ITRS realizations:

ETRS89	epoch t_0	Position (m)			Velocity (m/y)		
		X_{IERS}	Y_{IERS}	Z_{IERS}	VX_{IERS}	VY_{IERS}	VZ_{IERS}
ETRF2000 start - 365/00	1989.0	4231162.837 ± 0.022	-332746.921 ± 0.005	4745130.721 ± 0.022	-0.0033 ± 0.0021	0.0003 ± 0.0004	-0.0017 ± 0.0022



PROPOSAL FOR EPN CB WEB



STATION COORDINATES

[EPN station positions and velocities:](#)

(select a station) ▼

As decided at the EUREF TWG meeting of Feb. 26-27 2009 in Budapest and announced on ?? by EUREF mail no ???, the original [EUREF densification of the ITRF2005](#) (released on Dec 12, 2008 by [EUREF mail 4142](#)) is now updated each 5 weeks taking the most recent EPN results as much as possible into account. These regularly updated positions/velocities are the result of a multi-year adjustment of all the weekly combined EPN solutions in which outliers have been eliminated and station discontinuities were applied. Details are available through the [Time Series Analysis](#) web page at the EPN Central Bureau.

In order to provide the most reliable products, the EPN stations are categorized taking the station quality and the length of available observation span into account (Kenyeres, 2009):

- **Class A:** station positions have a 1 cm accuracy at all epochs of the time span of the used observations
- **Class B:** station positions have a 1 cm accuracy at the epoch of minimal variance of each station



Only Class A stations are suitable as fiducial stations for the densification of the ETRS89. The associated files can be downloaded from the EPN Central Bureau; the most recent realization is available through the links:

In the ITRS:

- [EPN A ITRF2005.SSC](#), table with site positions (at epoch 2005.0) and velocities
- [EPN A ITRF2005.SNX.Z](#), solution in SINEX format

In the ETRS89:

- [EPN A ETRF2000.SSC](#), table with site positions (at epoch 2005.0) and velocities
- [EPN A ETRF2000.SNX.Z](#), solution in SINEX format

More details about the usage of the Class A stations for EUREF densifications is available from ["Guidelines for EUREF Densifications"](#) by Bruyninx et al.

For **Class B** stations, EUREF provides only position estimates at the epoch of minimal variance while the velocity estimates are not released because of their limited accuracy (caused by e.g. the short observation period of the station).



BADH_14288M001

To obtain the site positions at an epoch t different from t_0 , apply the site velocities: $X(t) = X(t_0) + (t-t_0)*V_X$; $Y(t) = Y(t_0) + (t-t_0)*V_Y$; $Z(t) = Z(t_0) + (t-t_0)*V_Z$

1. POSITIONS/VELOCITIES PUBLISHED BY EUREF

Release date: 12/05/2009, Next release expected for: 16/06/2009

EUREF has classified BADH_14288M001 (Bad Homburg, Germany) as a **class A station** which means that it can be used as fiducial station for EUREF densifications.

ETRF2000*	epoch t_0	Position (m)			Velocity (m/y)		
		X	Y	Z	V_X	V_Y	V_Z
127/06 - 094/09	001/05	4042498.096 ± 0.001	612081.187 ± 0.000	4879250.845 ± 0.001	-0.0029 ± 0.0002	-0.0007 ± 0.0001	-0.0023 ± 0.0002

*ETRF2000 is the conventional reference frame used to realise the ETRS89

ITRF2005	epoch t_0	Position (m)			Velocity (m/y)		
		X	Y	Z	V_X	V_Y	V_Z
127/06 - 094/09	001/05	4042497.817 ± 0.001	612081.414 ± 0.000	4879251.054 ± 0.001	-0.0163 ± 0.0002	0.0167 ± 0.0001	0.0092 ± 0.0002

Click [HERE](#) to see a plot of how the station positions between successive cumulative solutions agree with each other.

2. POSITIONS/VELOCITIES PUBLISHED BY THE IERS

Last ETRS89/ITRS realization (release July 2006):

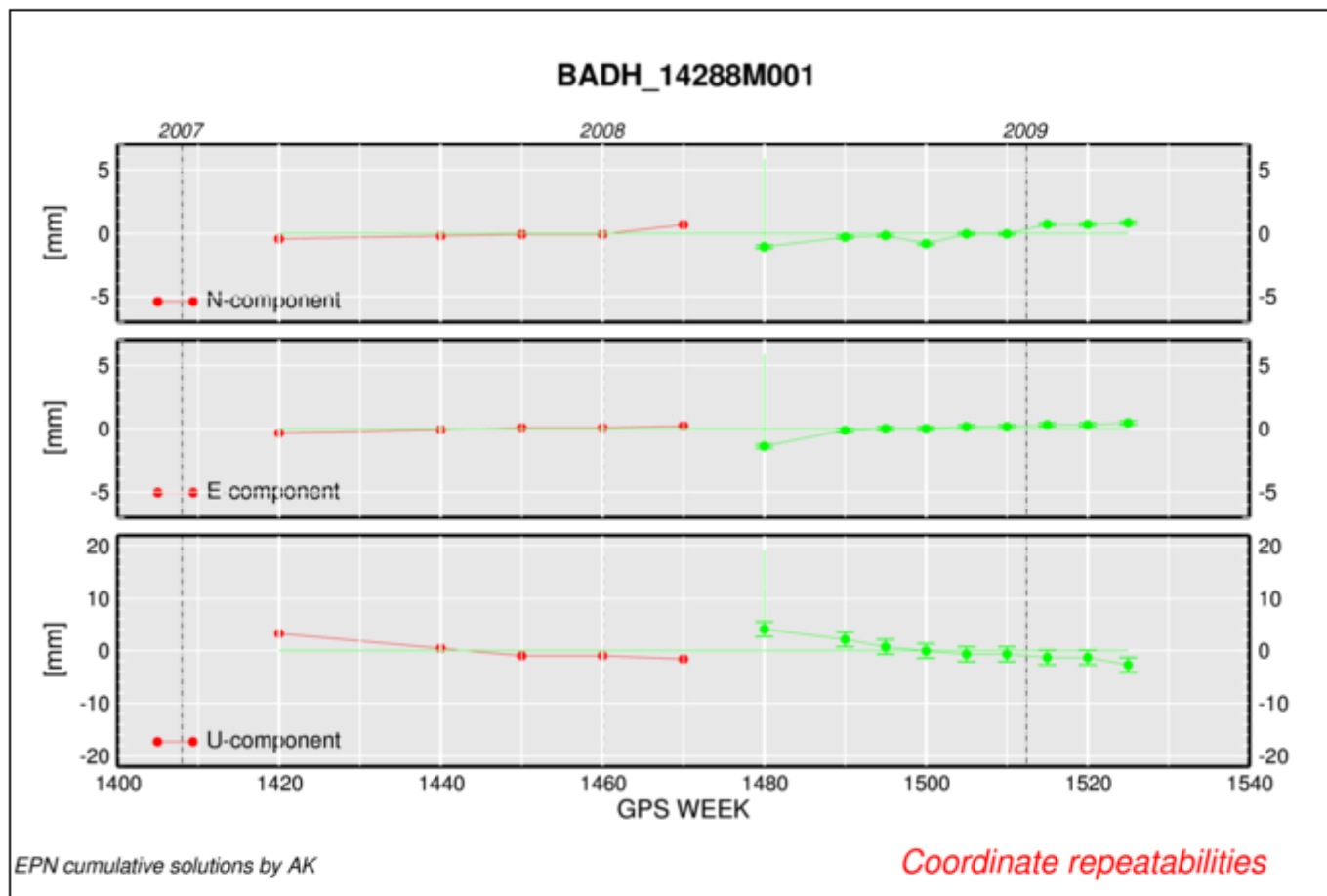
BADH_14288M001 (Bad Homburg, Germany) is not included in the ETRF2000(R05) list (=ITRF2005 converted to the ETRF2000).

BADH_14288M001 (Bad Homburg, Germany) is not included in the ITRF2005 list published by the IERS.

Previous ETRS89/ITRS realizations:

BADH_14288M001 (Bad Homburg, Germany) is not included in any of the previous ETRS89 realizations.

BADH_14288M001 (Bad Homburg, Germany) is not included in any of the previous ITRS realizations.



Legend:

The plot shows the differences in North, East and Up between the station positions obtained from each cumulative solution (available each 5 weeks).

Each point in the plot shows the station position obtained from a cumulative solution. The time stamp of the point is the epoch of the last GPS Week for which data for this station were included in the cumulative solution. With time, and with the inclusion of more observations in the cumulative solution, the estimated station positions should normally converge. The red dots indicate the estimated cumulative positions during the period that the station was a Class B station (always the first step in a station history). These positions are given at the epoch of minimal variance.

The green dots indicate the estimated cumulative positions during the period that the station is a Class A station. These positions are given at the epoch 2005.0.



To obtain the site positions at an epoch t different from t_0 , apply the site velocities: $X(t) = X(t_0) + (t-t_0)*V_X$; $Y(t) = Y(t_0) + (t-t_0)*V_Y$; $Z(t) = Z(t_0) + (t-t_0)*V_Z$

1. POSITIONS/VELOCITIES PUBLISHED BY EUREF

Release date: 12/05/2009, Next release expected for: 16/06/2009

EUREF has classified BRST_10004M004 (Brest, France) as a **class A station** which means that it can be used as fiducial station for EUREF densifications.

ETRF2000*	epoch t_0	Position (m)			Velocity (m/y)		
		X	Y	Z	V_X	V_Y	V_Z
361/98 - 012/06	001/05	4231162.797 ± 0.000	-332746.922 ± 0.000	4745130.702 ± 0.000	-0.0020 ± 0.0001	-0.0009 ± 0.0000	-0.0012 ± 0.0001
147/07 - 166/08	001/05	4231162.802 ± 0.000	-332746.916 ± 0.000	4745130.699 ± 0.000	-0.0020 ± 0.0001	-0.0009 ± 0.0000	-0.0012 ± 0.0001
167/08 - 094/09	001/05	4231162.800 ± 0.001	-332746.920 ± 0.000	4745130.706 ± 0.001	-0.0020 ± 0.0001	-0.0009 ± 0.0000	-0.0012 ± 0.0001

*ETRF2000 is the conventional reference frame used to realize the ETRS89

ITRF2005	epoch t_0	Position (m)			Velocity (m/y)		
		X	Y	Z	V_X	V_Y	V_Z
361/98 - 012/06	001/05	4231162.581 ± 0.000	-332746.683 ± 0.000	4745130.924 ± 0.000	-0.0115 ± 0.0001	0.0171 ± 0.0000	0.0111 ± 0.0001
147/07 - 166/08	001/05	4231162.585 ± 0.000	-332746.676 ± 0.000	4745130.921 ± 0.000	-0.0115 ± 0.0001	0.0171 ± 0.0000	0.0111 ± 0.0001
167/08 - 094/09	001/05	4231162.584 ± 0.001	-332746.681 ± 0.000	4745130.928 ± 0.001	-0.0115 ± 0.0001	0.0171 ± 0.0000	0.0111 ± 0.0001

Click [HERE](#) to see a plot of how the station positions between successive cumulative solutions agree with each other.

2. POSITIONS/VELOCITIES PUBLISHED BY THE IERS

Last ETRS89/ITRS realization (release July 2006):

ETRF2000(R05)	epoch t_0	Position (m)			Velocity (m/y)		
		X	Y	Z	V_X	V_Y	V_Z
start - end	2000.0	4231162.804 ± 0.004	-332746.913 ± 0.001	4745130.695 ± 0.004	-0.0017 ± 0.0009	-0.0018 ± 0.0003	0.0010 ± 0.0009

ITRF2005	epoch t_0	Position (m)			Velocity (m/y)		
		X	Y	Z	V_X	V_Y	V_Z
start - 365/05	2000.0	4231162.638 ± 0.004	-332746.764 ± 0.001	4745130.859 ± 0.004	-0.0111 ± 0.0009	0.0162 ± 0.0003	0.0134 ± 0.0009

Previous ETRS89/ITRS realizations:

ETRS89	epoch t_0	Position (m)			Velocity (m/y)		
		X	Y	Z	V_X	V_Y	V_Z
ETRF2000 start - 365/00	1989.0	4231162.837 ± 0.022	-332746.921 ± 0.005	4745130.721 ± 0.022	-0.0033 ± 0.0021	0.0003 ± 0.0004	-0.0017 ± 0.0022

FLRS_31907M001

To obtain the site positions at an epoch t different from t_0 , apply the site velocities: $X(t) = X(t_0) + (t-t_0)*V_X$; $Y(t) = Y(t_0) + (t-t_0)*V_Y$; $Z(t) = Z(t_0) + (t-t_0)*V_Z$

1. POSITIONS/VELOCITIES PUBLISHED BY EUREF

Release date: 12/05/2009, Next release expected for: 16/06/2009

FLRS_31907M001 (Santa Cruz das Flores, Portugal) is a **class B station** and should NOT be used as fiducial station for EUREF densifications.

ETRF2000*	epoch t_0	Position (m)			Velocity (m/y)		
		X	Y	Z	V_X	V_Y	V_Z
244/08 - 094/09	345/08	4221530.151 ± 0.001	-2549242.620 ± 0.000	4031397.997 ± 0.001	NA	NA	NA

*ETRF2000 is the conventional reference frame used to realise the ETRS89

ITRF2005	epoch t_0	Position (m)			Velocity (m/y)		
		X	Y	Z	V_X	V_Y	V_Z
244/08 - 094/09	345/08	4221530.098 ± 0.001	-2549242.313 ± 0.000	4031398.282 ± 0.001	NA	NA	NA

Click [HERE](#) to see a plot of how the station positions between successive cumulative solutions agree with each other.

2. POSITIONS/VELOCITIES PUBLISHED BY THE IERS

Last ETRS89/ITRS realization (release July 2006):

FLRS_31907M001 (Santa Cruz das Flores, Portugal) is not included in the ETRF2000(R05) list (=ITRF2005 converted to the ETRF2000).
 FLRS_31907M001 (Santa Cruz das Flores, Portugal) is not included in the ITRF2005 list published by the IERS.

Previous ETRS89/ITRS realizations:

FLRS_31907M001 (Santa Cruz das Flores, Portugal) is not included in any of the previous ETRS89 realizations.
 FLRS_31907M001 (Santa Cruz das Flores, Portugal) is not included in any of the previous ITRS realizations.