

Overview of national realizations of the integrated geodetic reference in Europe

Version 1.0a (2024-11-15)

Citation

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Attribution

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Description

The information below has been compiled in the course of the [EUREF Working Group "European Unified Height Reference"](#). It is based on the contributions submitted by the bodies responsible for the national geodetic reference (e.g. national mapping agencies) since 2022. It contains specifics on the national ETRS89 realizations and their relations to the European realizations (ETRF). This information is relevant at the centimeter level and frequently not included in CRS inventories such as the EPSG. Furthermore, it provides a list of current national height reference surfaces (geoid models) and the corresponding height reference frames in order to provide easier access and use for GNSS-based height determination. For details, please refer to the corresponding [EVRS website](#).

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Contact

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Note

Convention for 7-parameter Helmert transformation (according to [EUREF Technical Note Nr. 1](#)):
$$\mathbf{X}_{\text{Target}} = \mathbf{X}_{\text{nat}} + T + D \cdot \mathbf{X}_{\text{nat}} + \begin{bmatrix} 0 & -R_z & R_y \\ R_z & 0 & -R_x \\ -R_y & R_x & 0 \end{bmatrix} \cdot \mathbf{X}_{\text{nat}}$$

List of changes

- Version 1.0 (2024-11-04): Initial version
- Version 1.0a (2024-11-15):
 - Correction for Croatia (HR): HTRS96 refers to ETRF89 in Tables 1 and 2

CC	Country	Date of info	Valid from	Valid until	Name of realization	Target frame	Epoch [yr]	Tx [mm]	Ty [mm]	Tz [mm]	D [ppb]	Rx [mas]	Ry [mas]	Rz [mas]	Re-remarks	EPSG
GR	Greece	2022-03-23	unknown	unknown	HTRS07 (Hellenic Terrestrial Reference System 2007)	ETRF2000	2007.83									
HR	Croatia	2024-11-01	2004-08-04	present	HTRS96 (Croatian Terrestrial Reference System 1996)	ETRF89	1995.55									4889
		2024-11-01	2023-12-09	present	CROPOS (CORS network)	ETRF2000 (R05)	2008.83									
IE	Ireland	2023-08-03	unknown	unknown	EUREF IE/UK 2009	ETRF2000	2009.756									
IS	Iceland	2024-08-19	1997-01-01	2007-12-31	ISN93	ITRF93	1993.6									4945
		2024-08-19	2008-01-01	2017-08-31	ISN2004	ITRF2000	2004.6									5323
		2024-08-19	2017-09-01	unknown	ISN2016	ITRF2014	2016.5								[6]	8085
IT	Italy	2024-11-01	1996-01-01	2011-11-10	IGM95	ETRF89	1996.0									4983
		2024-11-01	2011-11-10	present	RDN2008	ETRF2000	2008.0									6705
LI	Liechtenstein	See CH Switzerland														
LT	Lithuania	2023-03-03	unknown	unknown	LKS94	ETRF2000	2003.75								[7]	4951
LU	Luxembourg	2024-07-01	unknown	unknown		ETRF2000	2020.82	see [6]							[8]	
LV	Latvia	2024-07-01	unknown	2024-12-31	LKS-92 (EUREF-BAL92)	N/A	1992.75								[11]	4949
MC	Monaco	See FR France														
MD	Moldova	2024-08-21	unknown	unknown	MOLDREF99	ETRF97	1999.4									4017
MK	North Macedonia	2022-06-15	unknown	unknown	EUREF-MAK2010	ETRF2000	2010.631									
NI	Northern Ireland	2023-08-03	unknown	present	EUREF IE/UK 2009	ETRF2000	2009.756									
NL	The Netherlands	2022-05-03	unknown	unknown	AGRS2010	ETRF2000	2010.5									
NO	Norway	2024-07-01	unknown	unknown	EUREF89	ETRF93	1995.0								[11]	
PL	Poland	2024-07-01	unknown	unknown	PL-ETRF2000-GRS80h	ETRF2000	2011.0									9701
PT	Portugal (Mainland)	2024-07-01	2007-01-01	2026-01-01	ETRS89 (ETRF97)	ETRF97	1995.4									
	Portugal (Azores, Madeira)	2024-07-01	2007-01-01	2026-01-01	PTRA08 (ITRF93)	ITRF93	1994.0								[9]	5012
RO	Romania	2022-05-03	unknown	unknown		ETRF2000	2000.0									
RS	Serbia	2024-07-01	2012-03-16	unknown	EUREF Serbia 2010 (SRB_ETRS89)	ETRF2000	2010.63									8683
SE	Sweden	2024-10-09	unknown	unknown	SWEREF 99	ETRF97	1999.5									
SI	Slovenia	2024-07-01	unknown	2019-12-31	ETRS89/D96	ETRF96	1995.5									4883
		2024-07-01	2020-01-01	unknown	ETRS89/D96-17	ETRF2000	2016.75	-236.6	98.5	201.3	0.0	-17.79	3.673	-24.370		
SK	Slovak Republic	2024-08-23	2011-04-01	2024-03-31	SKTRF09	ETRF2000	2008.5									
		2024-08-23	2024-04-01	present	SKTRF2022	ETRF2000	2008.5									
TR	Turkey	2022-05-11	unknown	unknown	TUREF (Turkish National Reference Frame)	ITRF96	2005.0									5251

Remarks

[1] Used for the coordinates of the 27 reference stations of the active ALBCOR network in Albania. Differences with the official KRGJSH realization are negligible (5-7 mm for all components).

[2] The original definition of CHTRF95 was to be identical to ETRF93(1993.0). Today, this is no longer strictly realized due to equipment changes and modified values in the local ties. The transformation of CHTRF95 to any ETRF frame for a certain epoch is done empirically by a 3D translation. The coordinates of the GNSS station in Zimmerwald (Station name: ZIMM00CHE, domes number: 14001M004) in CHTRF95

(Epoch 1993.0, velocity=0) are $X=4331297.348$, $Y=567555.639$, $Z=4633133.728$. The transformation parameters to ETRF2000 given here were calculated in 2019 and were used in the projects DACH-Geoid, EAlpG and EUHR.

[3] The original observation epoch of the underlying GNSS campaign and thus the epoch of the dynamic (nation-wide residual) uplift signal is 2015.829. However, the systematic part (nation-wide trend) of the land uplift in the national ETRS89 realization refers to approximately 1994.705 since the coordinates were referenced to the previous realization by Helmert transformation.

[4] Network of passive GNSS benchmarks

[5] Network of active GNSS reference stations (used for RTK etc.)

[6] Semi-dynamic datum (land uplift model ISN_vel_beta)

[7] Land uplift model NKG2016LU at epoch 2008.0

[8] Epoch 2020-10-25. LUREF2020 is a GNSS-based realization of the national LURES datum (based on Hayford ellipsoid). Transformation from LUREF2020 to ETRF2000 according to convention of EUREF Technical Note Nr. 1: $T_x = -189.2280$ m, $T_y = 12.0035$ m, $T_z = -42.6303$ m, $D = 463.46$ ppb, $R_x = -481.71$ mas, $R_y = -3099.48$ mas, $R_z = 2686.39$ mas (source <https://act.public.lu/dam-assets/fr/publications/documents-techniques/20210129-DTECH-ETRF2000toLUREF-datum-transition.pdf>, note the inverse sign convention for the rotation parameters with w.r.t. EUREF Technical Note Nr. 1).

[9] TANGO 1994 campaign and subsequent measurements between 1995 and 2005

[10] SWEREF 99 was updated in early 2021 (2021-02-07), and the NKG2008 transformation should be used for coordinates that relate prior to that date. After that update, NKG2020 transformation should be applied instead.

[11] Information about NKG20xx transformations from national ETRS89 realizations to NKG_ETRF2000 resp. NKG_ETRF2014 can be found in:

- NKG2008 transformation to NKG_ETRF2000 at epoch 2000.0: Häkli et al. (2016), <https://doi.org/10.1515/jogs-2016-0001>

- NKG2020 transformation to NKG_ETRF2014 at epoch 2000.0: Häkli et al. (2023), <https://doi.org/10.1515/jogs-2022-0155>

Recommended transformation to ETRF2014 at epoch 2000.0 by means of EUREF Transformations 2020 (however, see [10] for exceptions in Sweden).

Table 2 Overview of national height reference surfaces (geoid models) for transformation between ellipsoidal heights and leveling heights. For more details on the GNSS realizations, please refer to Table 1.

Height types: **NH** Normal heights, **NOH** Normal-orthometric heights, **OH** Orthometric heights (Helmert heights not precluded), **OH(H)** Helmert orthometric heights (confirmed), **U** Uncorrected for gravity

Background colors: **Yellow** CRS of grid is not ETRS89 or WGS84 geographic (longitude, latitude) → projected coordinates and/or other datum, **Grey** No longer in use

Standard CRS of interpolation grids: “ETRS89 geographic” (i.e., any ETRFxxxx) assumed as EPSG:4258, “WGS84 geographic” (i.e., any ITRFxxxx) assumed as EPSG:4326

CC	Country	Subregion	HRS grid	Valid from	Valid until	CRS of grid	GNSS realization of ellipsoidal height	ETRS89 datum?	Ell. height linked to	Height realization	Height datum	Height type	Re-remarks	Link
AL	Albania		ALBAGEO03 (software only)	2008		ETRS89 geographic	KRGJSH	yes	ETRF2000 (2008.00)	ALB86	Durrës	OH(H)		
AT	Austria		Austrian Geoid 2008 (GRS80) (EPSG:9276)	2008-01-01		ETRS89 geographic	ETRS89 with GRS80 ellipsoid (EPSG:4937)	yes	ETRF2000 (2002.56)	EVRF2000 Austria (EPSG:9274)	Amsterdam/NAP	OH	[1] [2]	Info Info ZIP
AT	Austria		Austrian Geoid 2008 (Bessel) (EPSG:9277)	2008-01-01		MGI geogr. with Bessel (EPSG:4312)	MGI with Bessel ellipsoid (EPSG:9267)	no	ETRF2000 (2002.56) by transf.	EVRF2000 Austria (EPSG:9274)	Amsterdam/NAP	OH	[1] [2]	Info Info ZIP
AT	Austria		Höhen-Grid plus Geoid (EPSG:9499)	2013-11-08		MGI geogr. with Bessel (EPSG:4312)	ETRS89 with GRS80 ellipsoid (EPSG:4937)	(yes)	ETRF2000 (2002.56)	GHA height (EPSG:5778)	Trieste (MGI/Adria)	NOH	[2]	Info Info ZIP
BA	Bosnia and Herzegovina	Federation of Bosnia and Herzegovina	Not yet available				BH_ETRS89 (EPSG:10327)	yes	ETRF2000 (2011.31)	BH_VRS1875 (EPSG:5195)	Trieste 1875	NOH		
BE	Belgium		hbG18	2018-08-01		ETRS89 geographic	BEREF (EPSG:4937)	yes	ETRF2000 (2002.73)	TAW/DNG height (EPSG:5710)	Ostende	U		ISG
BG	Bulgaria		BG_VRS_2021	2021-01-01		ETRS89 UTM35 (EPSG:7800)	BGS2005 (EPSG:7797)	yes	ETRF2000 (2005.00)	BGS2005 height (EPSG:9669)	Amsterdam/NAP	NH	[3]	Info Mail
BG	Bulgaria		GEOID.BG	2018-01-01		ETRS89 geographic	BGS2005 (EPSG:7797)	yes	ETRF2000 (2005.00)	Baltic Height System 1982 (EPSG:5786)	Kronstadt	NH		Info
CH	Switzerland		CHGeo2004_ETRS89	2005-01-01		ETRS89 geographic	CHTRF95 (EPSG:4933)	yes	ETRF93 (1993.00)	LHN95 (EPSG:5729)	Marseille (RPN)	OH	[4] [5]	Info ZIP
CH	Switzerland		CHGeo2004_HTRANS_ETRS89	2005-01-01		ETRS89 geographic	CHTRF95 (EPSG:4933)	yes	ETRF93 (1993.00)	LN02 (EPSG:5728)	Marseille (RPN)	U	[4] [6]	Info ZIP
CH	Switzerland		CHGeo2004_LV95	2005-01-01		CH1903+/LV95 with Bessel (EPSG:2056)	CHTRF95 (EPSG:4933)	(yes)	ETRF93 (1993.00)	LHN95 (EPSG:5729)	Marseille (RPN)	OH	[4] [5]	Info ZIP
CH	Switzerland		CHGeo2004_HTRANS_LV95	2005-01-01		CH1903+/LV95 with Bessel (EPSG:2056)	CHTRF95 (EPSG:4933)	(yes)	ETRF93 (1993.00)	LN02 (EPSG:5728)	Marseille (RPN)	U	[4] [6]	Info ZIP

CC	Country	Subregion	HRS grid	Valid from	Valid until	CRS of grid	GNSS realization of ellipsoidal height	ETRS89 datum?	Ell. height linked to	Height realization	Height datum	Height type	Re-remarks	Link
CZ	Czech Republic		CR2005_v1005	2011-01-02	unknown	ETRS89 geographic	ETRF2000 (EPSG:4937)	yes	ETRF2000 (2007.00)	Baltic System (Bpv) (EPSG:8357)	Kronstadt	NH		Info ZIP
CZ	Czech Republic		QGZÚ-2013	2013-01-02	unknown	ETRS89 geographic	ETRF2000 (EPSG:4937)	yes	ETRF2000 (2007.00)	Baltic System (Bpv) (EPSG:8357)	Kronstadt	NH	[7]	Info ZIP
DE	Germany		GCG2011	2011	2016-11-30	ETRS89 geographic	ETRS89/DREF91/Realization 2002	yes	ETRF2000 (2002.79) by transf.	DHHN92 (EPSG:5783)	Amsterdam/NAP	NH		ZIP
DE	Germany		GCG2016 (EPSG:10294)	2016-12-01	2023-12-03	ETRS89 geographic	ETRS89/DREF91/Realization 2016 (EPSG:10283)	yes	ETRF2000 (2008.46)	DHHN2016 (EPSG:7837)	Amsterdam/NAP	NH		
DE	Germany		GCG2016/2023 (EPSG:10294)	2023-12-04	present	ETRS89 geographic	ETRS89/DREF91/Realization 2016 (EPSG:10283)	yes	ETRF2000 (2008.46)	DHHN2016 (EPSG:7837)	Amsterdam/NAP	NH		Info ZIP
DK	Denmark		DKgeoid2013B (EPSG:10491)	2013-03-01	2023-11-30	ETRS89 geographic	ETRS89/EUREF-DK94	yes	ETRF92 (1994.71)	DVR90(2013) (EPSG:10484)	10 tide gauges	OH(H)	[8] [24]	FTP
DK	Denmark		DVR90(2023) (EPSG:10493)	2023-12-01	present	ETRS89 geographic	ETRS89/EUREF-DK94(2015)	yes	ETRF92 (1994.71)	DVR90(2023) (EPSG:10485)	10 tide gauges	OH(H)	[9] [24]	FTP
EE	Estonia		EST-GEOID2017	2018-01-01	unknown	ETRS89 geographic	EUREF-EST97 (EPSG:4935)	yes	ETRF96 (1997.56)	EH2000 (EPSG:9662)	Amsterdam/NAP	NH	[10] [24]	Mail
ES	Spain	Iberian Peninsula	EGM08_RED NAP (EPSG:9410)	2007-07-28	unknown	ETRS89 geographic	REGENTE	yes	ETRF96 (1995.40)	Alicante height (EPSG:5782)	Alicante	OH(H)		Info
ES	Spain	Ceuta	EGM08_RED NAP (EPSG:9414)	2007-07-28	unknown	ETRS89 geographic	REGENTE	yes	ETRF96 (1995.40)	Ceuta height (EPSG:9402)	Ceuta 2	OH(H)		Info
ES	Spain	Melilla	EGM08_RED NAP (EPSG:10362)	2007-07-28	unknown	ETRS89 geographic	REGENTE	yes	ETRF96 (1995.40)	Melilla height (EPSG:10354)	Melilla	OH(H)		Info
ES	Spain	Alboran	EGM08_RED NAP (EPSG:10360)	2007-07-28	unknown	ETRS89 geographic	REGENTE	yes	ETRF96 (1995.40)	Alboran height (EPSG:10353)	Alboran	OH(H)		Info
ES	Spain	Formentera	EGM08_RED NAP (EPSG:10358)	2007-07-28	unknown	ETRS89 geographic	REGENTE	yes	ETRF96 (1998.30)	Formentera height (EPSG:10352)	Formentera	OH(H)		Info
ES	Spain	Ibiza	EGM08_RED NAP (EPSG:9413)	2007-07-28	unknown	ETRS89 geographic	REGENTE	yes	ETRF96 (1998.30)	Ibiza height (EPSG:9394)	Ibiza	OH(H)		Info
ES	Spain	Mallorca	EGM08_RED NAP (EPSG:9411)	2007-07-28	unknown	ETRS89 geographic	REGENTE	yes	ETRF96 (1998.30)	Mallorca height (EPSG:9392)	Mallorca	OH(H)		Info
ES	Spain	Menorca	EGM08_RED NAP (EPSG:9412)	2007-07-28	unknown	ETRS89 geographic	REGENTE	yes	ETRF96 (1998.30)	Menorca height (EPSG:9393)	Menorca	OH(H)		Info
ES	Spain	El Hierro	EGM08_RED NAP Canarias (EPSG:9421)	2007-07-28	unknown	WGS84 geographic	REGCAN95 (EPSG:4080)	no	ITRF93 (1994.80)	El Hierro height (EPSG:9401)	El Hierro	OH(H)		Info
ES	Spain	La Palma	EGM08_RED NAP Canarias (EPSG:9420)	2007-07-28	unknown	WGS84 geographic	REGCAN95 (EPSG:4080)	no	ITRF93 (1994.80)	La Palma height (EPSG:9400)	La Palma	OH(H)		Info

CC	Country	Subregion	HRS grid	Valid from	Valid until	CRS of grid	GNSS realization of ellipsoidal height	ETRS89 datum?	Ell. height linked to	Height realization	Height datum	Height type	Re-remarks	Link
ES	Spain	La Gomera	EGM08_RED NAP Canarias (EPSG:9419)	2007-07-28	unknown	WGS84 geographic	REGCAN95 (EPSG:4080)	no	ITRF93 (1994.80)	La Gomera height (EPSG:9399)	La Gomera	OH(H)		Info
ES	Spain	Tenerife	EGM08_RED NAP Canarias (EPSG:9418)	2007-07-28	unknown	WGS84 geographic	REGCAN95 (EPSG:4080)	no	ITRF93 (1994.80)	Tenerife height (EPSG:9398)	Tenerife	OH(H)		Info
ES	Spain	Gran Canaria	EGM08_RED NAP Canarias (EPSG:9417)	2007-07-28	unknown	WGS84 geographic	REGCAN95 (EPSG:4080)	no	ITRF93 (1994.80)	Gran Canaria height (EPSG:9397)	Gran Canaria	OH(H)		Info
ES	Spain	Fuerte-ventura	EGM08_RED NAP Canarias (EPSG:9416)	2007-07-28	unknown	WGS84 geographic	REGCAN95 (EPSG:4080)	no	ITRF93 (1994.80)	Fuerteventura height (EPSG:9396)	Fuerteventura	OH(H)		Info
ES	Spain	Lanzarote	EGM08_RED NAP Canarias (EPSG:9415)	2007-07-28	unknown	WGS84 geographic	REGCAN95 (EPSG:4080)	no	ITRF93 (1994.80)	Lanzarote height (EPSG:9395)	Lanzarote	OH(H)		Info
FI	Finland		FIN2005N00	2009	present	ETRS89 geographic	EUREF-FIN	yes	ETRF96 (1997.00)	N2000 (EPSG:3900)	Amsterdam/NAP	NH	[24]	Info ZIP
FI	Finland		FIN2023N00	2024-01-15	present (recomm.)	ETRS89 geographic	EUREF-FIN	yes	ETRF96 (1997.00)	N2000 (EPSG:3900)	Amsterdam/NAP	NH	[24]	Info ZIP
FO	Faroe Islands		Fogeoid12.02	2012-01-01	unknown	ETRS89 geographic	ETRS89 (EPSG:4937)	yes	ETRF2000 (2008.75)	FVR09 (EPSG:5317)	4 tide gauges	OH		Info TIFF
FR	France	Mainland	RAF09 (EPSG:8371)	2010-05-31	2018-07-11	ETRS89 geographic	RGF93 v2 (EPSG:9776)	yes	ETRF2000 (2009.00)	NGF-IGN69 (EPSG:5720)	Marseille	NH		Info TXT
FR	France	Mainland	RAF18 (EPSG:8885)	2018-07-12	2020-01-27	ETRS89 geographic	RGF93 v2 (EPSG:9776)	yes	ETRF2000 (2009.00)	NGF-IGN69 (EPSG:5720)	Marseille	NH		Info TXT
FR	France	Mainland	RAF18b (EPSG:9786)	2020-01-28	2021-07-01	ETRS89 geographic	RGF93 v2b (EPSG:9781)	yes	ETRF2000 (2019.00)	NGF-IGN69 (EPSG:5720)	Marseille	NH		Info TXT
FR	France	Mainland	RAF20 (EPSG:9876)	2021-07-02	unknown	ETRS89 geographic	RGF93 v2b (EPSG:9781)	yes	ETRF2000 (2019.00)	NGF-IGN69 (EPSG:5720)	Marseille	NH		Info TXT
FR	France	Corsica	RAC09 (EPSG:8372)	2010-06-15	2023-10-27	ETRS89 geographic	RGF93 v2 (EPSG:9776)	yes	ETRF2000 (2009.00)	NGF-IGN78 (EPSG:5721)	Ajaccio	NH		Info TXT
FR	France	Corsica	RAC23 (EPSG:10506)	2023-10-23	unknown	ETRS89 geographic	RGF93 v2b (EPSG:9781)	yes	ETRF2000 (2019.00)	NGF-IGN78 (EPSG:5721)	Ajaccio	NH		Info TXT
GB	Great Britain	Mainland + 2km	OSGM15_GB (EPSG:7711)	2016-08-01	unknown	ETRS89 TM (EPSG:19916)	EUREF IE/UK 2009 / OS Net	yes	ETRF97 (2009.76)	ODN height (EPSG:5701)	Newlyn	NOH		Info ZIP
GB	Great Britain	Offshore	OSGM15_GB (EPSG:7713)	2016-08-01	unknown	ETRS89 TM (EPSG:19916)	EUREF IE/UK 2009 / OS Net	yes	ETRF97 (2009.76)	ODN (Off-shore) height (EPSG:7707)	Newlyn	NOH		Info ZIP
GB	Great Britain	Orkney Islands	OSGM15_GB (EPSG:7712)	2016-08-01	unknown	ETRS89 TM (EPSG:19916)	EUREF IE/UK 2009 / OS Net	yes	ETRF97 (2009.76)	ODN Orkney height (EPSG:5740)	Newlyn (Orkney Islands)	NOH		Info ZIP
GB	Great Britain	Shetland Islands	OSGM15_GB (EPSG:7714)	2016-08-01	unknown	ETRS89	EUREF IE/UK 2009 / OS Net	yes	ETRF97 (2009.76)	Lerwick height (EPSG:5742)	Lerwick	NOH		Info ZIP

CC	Country	Subregion	HRS grid	Valid from	Valid until	CRS of grid	GNSS realization of ellipsoidal height	ETRS89 datum?	Ell. height linked to	Height realization	Height datum	Height type	Re-remarks	Link
						TM (EPSG:19916)								
GB	Great Britain	Outer Hebrides	OSGM15_GB (EPSG:7715)	2016-08-01	unknown	ETRS89 TM (EPSG:19916)	EUREF IE/UK 2009 / OS Net	yes	ETRF97 (2009.76)	Stornoway height (EPSG:5746)	Storno-way15	NOH		Info ZIP
GB	Great Britain	Scilly Islands	OSGM15_GB (EPSG:7716)	2016-08-01	unknown	ETRS89 TM (EPSG:19916)	EUREF IE/UK 2009 / OS Net	yes	ETRF97 (2009.76)	St. Marys height (EPSG:5749)	St. Mary	NOH		Info ZIP
GB	Great Britain	Isle of Man	OSGM15_GB (EPSG:7717)	2016-08-01	unknown	ETRS89 TM (EPSG:19916)	EUREF IE/UK 2009 / OS Net	yes	ETRF97 (2009.76)	Douglas height (EPSG:5750)	Douglas02	NOH		Info ZIP
GL	Greenland		gvr2016_2016.tif	2016-01-01	unknown	GR96 geographic	GR96 (EPSG:4909)	no	ITRF94 (1996.62)	GVR2016 (geoid-only) (EPSG:8267)	Nuuk 1960	OH		ZIP FTP
GR	Greece		GR_HEPOS2011	2011-01-01	unknown	ETRS89 TM07	HTRS07 (EUREF GR 2007)	yes	ETRF2000 (2007.83)	Hellenic Vertical Datum	Piraeus	OH		Info ZIP
HR	Croatia		HRG2009 (web application T7D)	2010-01-01	present	ETRS89 geographic	HTRS96 (EPSG:4889)	yes	ETRF89 (1995.55)	Croatian Vertical Ref. System 1971 (EPSG:5610)	5 tide gauges	NOH		Mail
IE	Ireland		OSGM15_Malin (EPSG:7959)	2023-08-03	unknown	ETRS89 geographic	EUREF IE/UK 2009	yes	ETRF2000 (2009.76)	Malin Head height (EPSG:5731)	Malin Head MSL 1960-69	NOH		Info ZIP
IS	Iceland		IceGeoid2011 (IceGeoid_ISN93)	2011-01-01	unknown	WGS84 geographic	ISN93 (EPSG:4945)	no	ITRF93 (1993.6)	ISH2004 (EPSG:8089)	Reykjavik 2004.6	NH	[11]	GTx
IS	Iceland		IceGeoid2011 (IceGeoid_ISN2004)	2011-01-01	unknown	WGS84 geographic	ISN2004 (EPSG:5323)	no	ITRF2000 (2004.6)	ISH2004 (EPSG:8089)	Reykjavik 2004.6	NH	[11]	Info ZIP
IS	Iceland		IceGeoid2011 (IceGeoid_ISN2016)	2017-09-01	unknown	WGS84 geographic	ISN2016 (EPSG:8085)	no	ITRF2014 (2016.5)	ISH2004 (EPSG:8089)	Reykjavik 2004.6	NH	[11]	GTx
IT	Italy	Mainland	ITALGEO2005 (EPSG:9727)	2005-01-01	unknown	ETRS89 geographic	RDN2008 (EPSG:6705)	yes	ETRF2000 (2008.0)	GE42 height (EPSG:5214)	Genova 1942	U	[12]	Info
IT	Italy	Sicily	ITALGEO2005 (EPSG:9727)	2005-01-01	unknown	ETRS89 geographic	RDN2008 (EPSG:6705)	yes	ETRF2000 (2008.0)	Catania 1965 height (EPSG:9721)	Catania 1965	U	[12]	Info
IT	Italy	Sardinia	ITALGEO2005 (EPSG:9728)	2005-01-01	unknown	ETRS89 geographic	RDN2008 (EPSG:6705)	yes	ETRF2000 (2008.0)	Cagliari 1956 height (EPSG:9722)	Cagliari 1956	U	[12]	Info
LI	Liechtenstein		See CH Switzerland											
LT	Lithuania		LIT20G	2021-01-01	2025-12-31	ETRS89 geographic	LKS94 (EPSG:4951)	yes	ETRF89 (2003.75)	LAS07 (EPSG:9666)	Amsterdam/NAP	NH	[13] [24]	Info

CC	Country	Subregion	HRS grid	Valid from	Valid until	CRS of grid	GNSS realization of ellipsoidal height	ETRS89 datum?	Ell. height linked to	Height realization	Height datum	Height type	Re-remarks	Link
LU	Luxembourg		N/A (NULL transformation)	unknown	unknown	N/A	LUREF2020 with Hayford 1924 ellipsoid (EPSG:9893)	no	ETRF2000 (2020.82) by transf.	NG95 (EPSG:5774)	Amsterdam/NAP	NOH	[14]	Info
LV	Latvia		LV'14	2014-12-01	2024-12-31	ETRS89 geographic	LKS-92 (EUREF BAL-92) (EPSG:4949)	yes	ETRF2014 (2000.0) by transf.	LAS2000,5 (Latvian Height System 2000) (EPSG:1162)	Amsterdam/NAP	NH	[15] [24]	Info ZIP
LV	Latvia		N.N. (not yet published)	2025-01-01	unknown	ETRS89 geographic	LKS-2020 (EPSG:10304)	yes	ETRF2020 (2020.29)	LAS2000,5 (Latvian Height System 2000) (EPSG:1162)	Amsterdam/NAP	NH	[15]	
MC	Monaco	See FR France												
MD	Moldova		EGM2008 geoid	2015-07-04	unknown	WGS84 geographic	MOLDREF99 (EPSG:4017)	no	ETRF97 (1999.4)	Baltic 1977 height (EPSG:5705)	Kronstadt 1974-1978	NH	[16]	
MK	North Macedonia		N.N. (not yet published)	unknown	unknown		EUREF-MAK2010		ETRF2000 (2010.631)	NVT1	Trieste 1875	NOH		
NI	Northern Ireland		OSGM15 Belfast (EPSG:7958)	2023-08-03	unknown	ETRS89 geographic	EUREF IE/UK 2009	yes	ETRF2000 (2009.76)	Belfast height (EPSG:5732)	Belfast Lough	NOH		
NL	The Netherlands		NLGeo2018 (EPSG:9283)	2019-08-01	unknown	ETRS89 geographic	AGRS2010 (EPSG:7931)	yes	ETRF2000 (2010.50)	NAP (EPSG:5709)	Amsterdam/NAP	U		TXT
NO	Norway		Href2018B (EPSG:9485)	2018	unknown	ETRS89 geographic	EUREF89	yes	ETRF93 (1995.00)	NN2000 (EPSG:5941)	Amsterdam/NAP	NH	[17] [24]	Info ZIP
PL	Poland		PL-geoid2021	2022-04-05	unknown	ETRS89 geographic	PL-ETRF2000 (EPSG:9701)	yes	ETRF2000 (2011.00)	PL-EVRF2007-NH	Amsterdam/NAP	NH	[18]	Info TXT
PT	Portugal	Mainland	GeodPT08 (EPSG:10544)	2009-01-01	2026-01-01	ETRS89 geographic	ETRS89/Portugal (ETRF97)	yes	ETRF97 (1995.4)	Cascais Helmert 1938 (EPSG:5780)	Cascais	OH(H)		Info TXT
PT	Portugal/Azores	São Jorge	GeodAz2014	2014-01-01	2026-01-01	WGS84 geographic	PTRA08 (ITRF93) (EPSG:5012)	no	ITRF93 (94-05)	Cais das Velas height (EPSG:6180)	Cais das Velas	OH		Info TXT
PT	Portugal/Azores	Faial	GeodAz2014	2014-01-01	2026-01-01	WGS84 geographic	PTRA08 (ITRF93) (EPSG:5012)	no	ITRF93 (94-05)	Horta height (EPSG:6181)	Horta	OH		Info TXT
PT	Portugal/Azores	Pico	GeodAz2014	2014-01-01	2026-01-01	WGS84 geographic	PTRA08 (ITRF93) (EPSG:5012)	no	ITRF93 (94-05)	Cais da Madalena height (EPSG:6182)	Cais da Madalena	OH		Info TXT
PT	Portugal/Azores	Graciosa	GeodAz2014	2014-01-01	2026-01-01	WGS84 geographic	PTRA08 (ITRF93) (EPSG:5012)	no	ITRF93 (94-05)	Santa Cruz da Graciosa hgt. (EPSG:6183)	Santa Cruz da Graciosa	OH		Info TXT
PT	Portugal/Azores	Terceira	GeodAz2014	2014-01-01	2026-01-01	WGS84 geographic	PTRA08 (ITRF93) (EPSG:5012)	no	ITRF93 (94-05)	Cais da Figuerinha hgt. (EPSG:6184)	Cais da Figuerinha	OH		Info TXT

CC	Country	Subregion	HRS grid	Valid from	Valid until	CRS of grid	GNSS realization of ellipsoidal height	ETRS89 datum?	Ell. height linked to	Height realization	Height datum	Height type	Re-remarks	Link
PT	Portugal/ Azores	Corvo, Flores	N/A	unknown	unknown	WGS84 geographic	PTRA08 (ITRF93) (EPSG:5012)	no	ITRF93 (94-05)	Santa Cruz das Flores height (EPSG:6185)	Santa Cruz das Flores	OH	[19]	
PT	Portugal/ Azores	Santa Maria	GeodAz2014	2014-01-01	2026-01-01	WGS84 geographic	PTRA08 (ITRF93) (EPSG:5012)	no	ITRF93 (94-05)	Cais da Vila do Porto height (EPSG:6186)	Cais da Vila	OH		Info TXT
PT	Portugal/ Azores	São Miguel	GeodAz2014	2014-01-01	2026-01-01	WGS84 geographic	PTRA08 (ITRF93) (EPSG:5012)	no	ITRF93 (94-05)	Ponta Delgada height (EPSG:6187)	Ponta Delgada	OH		Info TXT
RO	Romania		EGG97_QGRJ	2017-01-01	unknown	ETRS89 geographic	ETRF2000 (EPSG:7931)	yes	ETRF2000 (2000.00)	Black Sea 1975 (EPSG:5179)	Constanta	NH		ZIP
RS	Serbia		SQM2011 (paid web application)	2012-01-01	unknown	SRB_ETRS89 geographic (EPSG:8685)	SRB_ETRS89 / EUREF Serbia 2010 (EPSG:8683)	yes	ETRF2000 (2010.63)	Serbian Vert. Ref. S. 2012 (EPSG:1216)	Adriatic Sea	NH	[20]	Info
RS	Serbia		SQM2011 (paid web application)	2012-01-01	unknown	SRB_ETRS89 UTM34 (EPSG:8682)	SRB_ETRS89 / EUREF Serbia 2010 (EPSG:8683)	yes	ETRF2000 (2010.63)	Serbian Vert. Ref. S. 2012 (EPSG:1216)	Adriatic Sea	NH	[20]	Info
SE	Sweden		SWEN17_RH2000	2017-10-25	unknown	ETRS89 geographic	SWEREF 99 (EPSG:4977)	yes	ETRF97 (1999.50)	RH2000 (EPSG:5613)	Amster- dam/NAP	NH	[21] [24]	Info ZIP
SI	Slovenia		SLO_AMG2000/ Trst	2000	2018-12-21	ETRS89 geographic	ETRS89/D96 (EPSG:4883)	yes	ETRF96 (1995.55)	SVS2000/Trst (EPSG:5779)	Trieste	NOH		ZIP
SI	Slovenia		SLO_VRP2016/ Koper (EPSG:10247)	2018-12-22	unknown	ETRS89 geographic	ETRS89/D96 (EPSG:4883)	yes	ETRF96 (1995.55)	SVS2010/Koper (EPSG:8690)	Koper	NH		ZIP
SK	Slovak Rep.		DVRM05 (EPSG:8361)	2005-01-01	unknown	ETRS89 geographic	ETRF2000	yes	ETRF2000 (2008.50)	Baltic 1957 (EPSG:8357)	Kronstadt	NH		ZIP
SK	Slovak Rep.		DMQSK2014-E	2014-07-01	unknown	ETRS89 geographic	ETRF2000	yes	ETRF2000 (2008.50)	EVRF2007 (EPSG:5621)	Amster- dam/NAP	NH		ZIP
SK	Slovak Rep.		DMQSK2022-A	2022-07-01	unknown	ETRS89 geographic	ETRF2000	yes	ETRF2000 (2008.50)	ČSJSN/J – ZNB Lišov	Trieste (Molo Sartorio)	NOH	[22]	ZIP
TR	Turkey		TG-20	2020-01-01	unknown	WGS84 geographic	TUREF (EPSG:5251)	no	ITRF96 (2005.00)	TUDKA-99 (EPSG:5775)	Antalya	OH(H)	[23]	Info ZIP

Remarks

[1] EVRF2000 Austria is the inofficial scientific height reference frame in Austria. To convert to “Höhe ü. Adria” (“Adria heights”) alias “MGI-Höhen” (“GHA heights”) with datum Trieste separately, see height transformation grid “Höhen-Grid” (“Height grid”) in Table 3.

[2] A detailed description of the datums and transformations used in Austria with EPSG codes can be found in https://www.bev.gv.at/dam/bevgvat/PDF-Dateien/Vermessungswesen/Formatbeschreibungen-und-sonstige-Info/EPDG_Austria_BEV.pdf. Transformation between ETRS89 (EPSG:4937) and MGI datum (EPSG:9267) is described in (ibid, Section 3.1). Helmert-based transformation parameters (EPSG:1619) are described in https://data.bev.gv.at/download/Transformationsparameter/Globale_Transformationsparameter.zip (Note the inverse sign convention for the rotation parameters with w.r.t. EUREF Technical Note Nr. 1). An online transformation service is available at <https://transformator.bev.gv.at/at.gv.bev.transformator/>.

- [3] BGS2005 height is based on EVRF2007 (zero-tide). The geoid grid is embedded in the BGSTrans software, it can be requested by formal letter or email from GCCA (Geodesy, Cartography and Cadastre Agency, acad@cadastre.bg).
- [4] Land uplift model for CHTRF95 is CH-VKM95 at epoch 1993.
- [5] LHN95 is the scientific height reference frame in Switzerland. Land uplift model for LHN95 is CH-VKM95 at epoch 1993.
- [6] LN02 is the height reference frame for practical use in surveying in Switzerland. There is no land uplift model for LN02. The HTRANS model is a simplified method for the conversion between uncorrected LN02 heights and orthometric LHN95 heights.
- [7] Inofficial model. Quasigeoid QGZU-2013 is especially aimed at the performing local transformations of heights in the given locality, for the expression of heights measured with GNSS technology or in other geometric methods in Baltic system (Bpv), for the mutual transformation of terrain heights between ETRS89 and Bpv in the given locality, etc. For cadastral purposes, only transformation service/software that includes quasigeoid CR2005 is allowed (resp. recommended for public service). Also within the official transformation published by Czech Office for Surveying, Mapping and Cadastre (CUZK), quasigeoid CR-2005 is included (see <http://geoportal.cuzk.cz/Default.aspx?lng=EN&mode=TextMeta&text=wcts&menu=19>).
- [8] Geoid model now referred to as DVR90(2013) geoid.
- [9] The original observation epoch of the underlying GNSS campaign is 2015.829. However, the land uplift epoch of the national ETRS89 realization after datum transformation is approximately 1994.705. See Table 1, remark [3].
- [10] Land uplift model for EH2000 is NKG2005LU at epoch 2000.
- [11] Land uplift model for ISH2004 is ISN_vel_beta at epoch 2004.6.
- [12] A detailed description of the datums and transformations used in Italy with EPSG codes can be found in https://www.igmi.org/++theme++igm/pdf/nuova_nota_EPSG.pdf. The ITALGEO2005 geoid model was originally computed for IGM95, but later updated for RDN2008. Within the overall accuracy it is valid for both RDN2008 and IGM95. For Sicily island, height offset between Genoa 1942 height and Catania 1965 height is 0.141 m (to be added to Genoa 1942 height, EPSG:9726).
- [13] LAS07 is based on EVRF2007 (zero-tide). Land uplift model for LAS07 and LKS94 is NKG2016LU at epoch 2008. Download requires registration at <https://www.geoportal.it>.
- [14] No geoid model available. NG95 heights are approximated by LUREF2020 coordinates (best-fitting Hayford 1924 ellipsoid) in the sense of a NULL transformation with accuracy of 5 – 15 cm countrywide. Transformation parameters from ETRF2000 at epoch 2020-10-25 (2020.82) to LUREF2020 are described in <https://act.public.lu/dam-assets/fr/publications/documents-techniques/20210129-DTECH-ETRF2000toLUREF-datum-transition.pdf> (see Table 1, remark [6]).
- [15] Latvijas normālo augstumu sistēma epohā 2000,5 (LAS2000,5) height is based on EVRF2007 (zero-tide) and uses an empirical land uplift model for Latvia at epoch 2000.5. Transformation of LKS-92 ellipsoidal coordinates to ETRF2014 recommended using NKG2020 transformation (see [20]).
- [16] The zero level of the global EGM2008 geoid grid approximately coincides with the zero level of the Baltic 1977 heights in Moldova (within the overall level of uncertainty of about 5 cm). In the municipality of Chişinău, a different realization of the Baltic height system is in use (MSL Kronstadt 1957-1977, not EPSG 8357) which deviates from the Baltic 1977 height system by 10 to 30 cm in the area.
- [17] NN2000 is based on EVRF2000. Land uplift model for NN2000 is NKG2005LU_lev at epoch 2000. Land uplift model for EUREF89 is NKG2005LU_abs at epoch 1995.
- [18] Land uplift model for PL-EVRF2007-NH is NKG2005LU at epoch 2000.
- [19] The islands of Flores and Corvo are not in the geoid model GeodAz2014 due to lack of data.
- [20] The geoid model is not available for purchase but as web application for height transformation, with input coordinates in SRB_ETRS89/UTM34N (EPSG:8662), to which only registered users who pay for its usage can have access.
- [21] RH2000 is based on EVRF2000. Land uplift model for RH2000 is NKG2005LU at epoch 2000.

[22] ČSJS/J – ZNB Lišov – Czechoslovak unified leveling network relating to the height of the basic leveling point of Lišov and the Adriatic height system, adjusted after 1945. The system has not been binding since 1957. Transformation is available through the transformation service <https://zbgis.skgeodesy.sk/rts/en/Transform>.

[23] Geoid model available free of charge at 5' resolution, 1' resolution for purchase at <https://www.harita.gov.tr/urun/jeoid-yuksekligi-kestirimi-1x-1-cozunurlugunde/490>.

[24] Information about NKG20xx transformations from national ETRS89 realizations to NKG_ETRF2000 resp. NKG_ETRF2014 can be found in:

- NKG2008 transformation to NKG_ETRF2000 at epoch 2000.0: Häkli et al. (2016), <https://doi.org/10.1515/jogs-2016-0001>

- NKG2020 transformation to NKG_ETRF2014 at epoch 2000.0: Häkli et al. (2023), <https://doi.org/10.1515/jogs-2022-0155>

Recommended transformation to ETRF2014 at epoch 2000.0 by means of EUREF Transformations 2020 (however, see remark [10] to Table 1 for exceptions in Sweden).

Table 3 Overview of national height transformation grids between different realizations of leveling heights.

Convention: $H_{VRF2} = H_{VRF1} + \Delta H_{Grid}$

Height types: **NH** Normal heights, **NOH** Normal-orthometric heights, **OH** Orthometric heights, **OH(H)** Helmert orthometric heights, **U** Uncorrected (closest to normal heights)

Background colors: **Yellow** CRS of grid is not ETRS89 or WGS84 geographic (longitude, latitude) → projected coordinates and/or other datum, **Grey** No longer in use

Standard CRS of interpolation grids: “ETRS89 geographic” (i.e., any ETRFxxxx) assumed as EPSG:4258, “WGS84 geographic” (i.e., any ITRFxxxx) assumed as EPSG:4326

CC	Country	Transformation grid	Valid from	Valid until	CRS of grid	VRF1 Name	VRF1 Height datum	VRF1 Type	VRF2 Name	VRF2 Height datum	VRF2 Type	Re-remarks	Link
AT	Austria	Höhen-Grid (EPSG:9275)	2013-11-08	unknown	MGI geogr. with Bessel (EPSG:4312)	GHA height (EPSG:5778)	Trieste (MGI/Adria)	NOH	EVRF2000 Austria (EPSG:9274)	Amsterdam/NAP	OH	[1]	Info Info ZIP
CH	Switzerland	HTRANS	2006	unknown	CH1903+/LV95 with Bessel (EPSG:2056)	LN02	Marseille (RPN)	U	LHN95	Marseille (RPN)	OH	[2]	Mail
CH	Switzerland	EVRF19MT-LN02	2019	unknown	CH1903+/LV95 with Bessel (EPSG:2056)	LN02	Marseille (RPN)	U	EVRF2019 mean-tide	Amsterdam/NAP	NH	[2]	Mail
CZ	Czech Republic	EvrF1301	2013-01-01	unknown	S-JTSK/Krovak with Bessel ell. (EPSG:2065)	Baltic System (Bpv) (EPSG:8357)	Kronstadt	NH	EVRF2007 zero-tide (EPSG:5621)	Amsterdam/NAP	NH	[3]	
BG	Bulgaria	BG07-19z	2022-01-01	unknown	ETRS89 geographic	BGS2005 height (EPSG:9669)	Amsterdam/NAP	NH	EVRF2019 zero-tide (EPSG:9389)	Amsterdam/NAP	NH	[4]	Mail
BG	Bulgaria	BG07-19m	2022-01-01	unknown	ETRS89 geographic	BGS2005 height (EPSG:9669)	Amsterdam/NAP	NH	EVRF2019 mean-tide (EPSG:9390)	Amsterdam/NAP	NH	[4]	Mail
BG	Bulgaria	BGBalt-19z	2022-01-01	unknown	ETRS89 geographic	Baltic height system 1982 (EPSG:5786)	Kronstadt	NH	EVRF2019 zero-tide (EPSG:9389)	Amsterdam/NAP	NH		Mail
BG	Bulgaria	BGBalt-19z	2022-01-01	unknown	ETRS89 geographic	Baltic height system 1982 (EPSG:5786)	Kronstadt	NH	EVRF2019 mean-tide (EPSG:9390)	Amsterdam/NAP	NH		Mail
DE	Germany	HOETRA2016	2016-12-01	unknown	ETRS89 geographic	DHHN92 (EPSG:5783)	Amsterdam/NAP	NH	DHHN2016 (EPSG:7837)	Amsterdam/NAP	NH		Info ZIP
HR	Croatia	HTMv08 (web application T7D)	2010-01-01	present	ETRS89 geographic	Croatian Vertical Ref. System 1875 (EPSG:5195)	Trieste	NOH	Croatian Vertical Ref. System 1971 (EPSG:5610)	5 tide gauges	NOH		Mail
SI	Slovenia	SLO-VTP2024	2018-12-22	unknown	ETRS89 geographic	SVS2000/Trst (EPSG:5779)	Trieste	NOH	SVS2010/Koper (EPSG:8690)	Koper	NH		ZIP

Remarks

[1] A detailed description of the datums and transformations used in Austria with EPSG codes can be found in https://www.bev.gv.at/dam/bevgvat/PDF-Dateien/Vermessungswesen/Formatbeschreibungen-und-sonstige-Info/EPSTG_Austria_BEV.pdf. Transformation between ETRS89 (EPSG:4937) and MGI datum (EPSG:9267) is described in (ibid, Section 3.1). Helmert-based transformation parameters (EPSG:1619) are described in https://data.bev.gv.at/download/Transformationsparameter/Globale_Transformationsparameter.zip (Note the inverse sign convention for the rotation parameters with w.r.t. EUREF Technical Note Nr. 1). An online transformation service is available at <https://transformator.bev.gv.at/at.gv.bev.transformator/>.

[2] There exist some other height transformation grids involving the following height systems: LN02, LHN95 (OH), LHN95 (NH), LHN95 (Potentials), EVRF2007(ZT), EVRF2019(ZT), EVRF2019(MT), EVRF2019 (Potentials). But these grids are not officially published. They are available on request from swisstopo. Grids in ETRS89 (geographic) are under preparation.

[3] This grid is included within the official transformation service published by Czech Office for Surveying, Mapping and Cadastre (see <http://geoportal.cuzk.cz/Default.aspx?lng=EN&mode=TextMeta&text=wcts&menu=19>)

[4] BGS2005 height is based on EVRF2007 (zero-tide).