

**Advance notice of:
OSGM02 geoid model update to OSGM15
OSTN02 transformation update to OSTN15**

Introduction.

The Ordnance Surveys of Great Britain (OS), Ireland (OSi) and Land & Property Services (LPS, formally Ordnance Survey Northern Ireland) have collaborated once more to improve the OSGM02 geoid model covering the United Kingdom and Ireland. The new model is OSGM15.

OS have also updated the horizontal transformation grid for GB, OSTN02, to OSTN15.
The horizontal transformation polynomial for Ireland and Northern Ireland is unchanged.

The geoid and transformation models enable heights and positions collected using satellite positioning (e.g. GPS) to be transformed from the ETRS89 system to “traditional” height and coordinate systems used in mapping, and vice versa.

The changes will go live on websites and within RINEX data files on August 26th 2016.

Reasons for the updates.

Improvements in the coordinates and especially ellipsoidal heights of permanent GPS stations for the realisation of the ETRS89 system in both Ireland / Northern Ireland and GB require a revision of the OSGM model. Also, improved gravity data (since OSGM02) has enabled a more accurate model to be computed.

In GB the fitting of OSGM02 to local datums in the Scottish islands (e.g. Outer Hebrides) was not optimal – this has been improved in OSGM15.

The OSTN15 transformation grid has been updated to take into account a slight change in the realisation of ETRS89 in GB.

What is unchanged?

The horizontal transformation polynomial for Ireland and Northern Ireland is unchanged.

For OSTN15/OSGM15 in GB the grid file format is the same as for OSTN02/OSGM02. The grid dimensions and transformation algorithm and formulae are also unchanged.

What has changed?

The transformation software utility Grid InQuest has been replaced with a new software utility, Grid InQuest II, which is in the developers pack along with raw transformation data and user guides.

The grid file format and grid dimensions for the OSGM15 model in Ireland and Northern Ireland (Malin Head and Belfast datums respectively) has changed significantly from the OSGM02 versions. Full details are in the developers guide.

OSTN02/OSGM02 in GB was “cookie cut” to 10km offshore with transformation parameters and datum flag outside this limit being set to zero. The OSTN15/OSGM15 grid for GB is now fully populated with parameters. I.e. there is no longer a “cookie cut”.

Some of the OSGM15 datum flags in the OSTN15/OSGM15 file are changed. Where a datum flag was also used in OSGM02 the flag value is the same. Flags in OSGM15 are:

- 1 = Ordnance Datum Newlyn, UK mainland.
- 2 = St Marys datum, Scilly Isles.
- 3 = Douglas02 datum, Isle of Man.
- 4 = Stornoway15 datum, Outer Hebrides.

6 = Lerwick datum, Shetland Isles.
7 = Newlyn (Orkney), Orkney Isles.
15 = Ordnance Datum Newlyn (Offshore) – new flag in OSGM15.
16 = Outside transformation area – new flag in OSGM15.

So, compared to OSGM02, the following flags are no longer used:

0, Outside model boundary.
5, St Kilda.
8, Fair Isle.
9, Flannan Isles.
10, North Rona.
11, Sule Skerry.
12, Foula.

The in-built transformation boundary, parameters beyond which are flagged as datum "16", is based on the UK EEZ line, see -

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/346014/UK_Exclusive_Economic_Zone.pdf

Accuracies

OSTN15. Same as OSTN02. Within Great Britain, OSTN15 is the definitive OSGB36/ETRS89 transformation. OSTN15 in combination with the ETRS89 coordinates of the OS Net stations, rather than the fixed triangulation network, define the National Grid. This means that, for example, the National Grid coordinates of an existing OSGB36 point, refixed using GNSS from OS Net and OSTN15, will be the correct ones. The original archived OSGB36 National Grid coordinates of the point (if different) will be wrong, by definition, but the two coordinates (new and archived) will agree on average to better than 0.1m (0.1m rmse, 68% probability). Out from the GB landmass (flags 15 and 16 in the file) the accuracy of OSTN15 degrades from 0.1m to the 3m level since the transformation is extrapolated from the land based core data set and is increasingly based instead on a simpler 7 parameter transformation.

Polynomial for Ireland and Northern Ireland. Unchanged - Within the Republic of Ireland and Northern Ireland, the OSi/OSNI polynomial transformation is recommended for coordinate transformations between ETRS89 and Irish Grid. Transformed ETRS89 coordinates will agree with Irish Grid coordinates derived from traditional survey control to within 0.4m (95% data).

OSGM15. An improvement on OSGM02 especially in the north west of Scotland and Scottish Islands. Standard errors for the different datums are as follows. The figures (in metres) are derived from post fit residual statistics (between levelling surface and gravimetric geoid surface) generated during the creation of the model.

Mainland GB (ODN, Newlyn) 0.008
Orkney 0.017
Shetland 0.018
Outer Hebrides 0.011
Isle of Man 0.03
Scilly Isles Single offset from ODN
Malin Head 0.023
Belfast 0.014

Differences from previous models

OSTN15 v OSTN02. The same ETRS89 coordinates passed through the OSTN15 and OSTN02 transformations results in RMS differences of 0.012m in East and 0.005m in North.

Polynomial for Ireland and Northern Ireland. Model unchanged so zero difference.

OSGM15 v OSGM02. The same ETRS89 coordinates passed through the OSGM15 and OSGM02 geoid models result in the following RMS differences (m) in height:

Datum:	Newlyn	St Marys	Douglas02	Stornoway15	Lerwick	Newlyn (Orkney)	Malin Head	Belfast
RMS:	0.026	0.365	0.000	0.175	0.013	0.021	0.093	0.018

Further information and request developers pack

If you require any further information or wish to request a developers pack containing raw data and user guides or wish to discuss the application or implications of the revised coordinates and model, please contact one of the following:

Ordnance Survey (GB): GeodeticEnquiries@os.uk

LPS (formerly OSNI): Peter.Downie@finance-ni.gov.uk

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