ORDNANCE SURVEY GB

OS TERRAIN 50™ – OVERVIEW

OFFICIAL
Ver 1.5
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Version history

Version	Date	Description
1.3	03/2017	Minor updates.
1.4	07/2021	Introduction of GeoPackage and vector tiles formats.
1.5	02/2022	Minor updates. Document title changed to Overview from User Guide.

Purpose of this document

This document provides information about and insight into the OS Terrain 50 product and its potential applications. For information on the contents and structure of OS Terrain 50, please refer to the Technical Specification.

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Contact details

OS website 'Contact us' page (https://www.ordnancesurvey.co.uk/contact-us).

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1. Introduction to the product

OS Terrain is the name given to Ordnance Survey's two height products. The two products provide detailed three-dimensional digital terrain models (DTMs) of Great Britain. A DTM primarily defines the ground surface, having removed all protruding features (such as buildings and trees) elevated above the bare earth. The main difference between the two products is their level of resolution:

- **OS Terrain 5** is a mid-resolution DTM, designed to be interoperable with our large-scale data.
- **OS Terrain 50** is a lower-resolution DTM product, designed for landscape visualisation and analysis over large areas. It is an Open Data product and, as such, it is free to view, download and use for commercial, educational and personal purposes

OS Terrain 50 is published as both grid data and contour data in a variety of formats. Both data types are created from the same source data and are supplied as 10km-by-10km tiles. These tiles are identified by quoting the National Grid reference of the south-west corner of the area they cover.

- **OS Terrain 50 grid**: A grid of heighted points with regular 50m post spacing.
- **OS Terrain 50 contours**: A contour dataset of 10m interval standard contour polylines. This includes mean high water and mean low water boundaries and spot heights.

1.1 Key features of the product

- The product is maintained by our integrated 3 to 5 year flying programme and is synchronised with our other product updates.
- There is specific modelling of significant features, particularly networks.
- DTM grid data is available in ASCII (American Standard Code for Information Interchange) grid and Geography Markup Language (GML) 3.2.1, using Open Geospatial Consortium (OGC) Simple Features Profile (level 0).
- DTM contour data is available in GML 3.2.1, Esri shapefile, GeoPackage and vector tiles (MBTiles).
- There is full coverage of Great Britain.
- It is provided free at the point of use as a download through the Ordnance Survey Data Hub (https://osdatahub.os.uk/downloads/open/Terrain50).
- It is designed to work with Ordnance Survey's small-scale data.
- The product is updated annually in July.
- It is based on the INSPIRE elevation specification.

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1.2 Product applications

OS Terrain 50 provides an ideal base to enable the third dimension for other data within an appropriate geographical information system (GIS). The height data has been created from a source that is also used to update our large-scale data products.

OS Terrain 50 can be used in conjunction with various Ordnance Survey digital products for analytical, modelling, planning and visual purposes. These uses enable customers to undertake the following:

- Asset/site management
- Signal propagation
- Environmental analysis
- High-level development
- Geological analysis
- Line of sight planning
- View shed modelling
- Using the product as a visual aid

1.3 Accuracy

OS Terrain 50 has been compared with GPS points in a range of sample areas to provide a route mean square error (RMSE) value for the height points in each geographic area: urban and major communication routes, rural, and mountain and moorland. OS Terrain 50 grid data has been verified to be 4m RMSE.

1.4 INSPIRE compliance

OS Terrain 50 is designed to be INSPIRE (Infrastructure for Spatial Data in Europe) ready. Ordnance Survey is a leading member of the UK Location Programme, which is charged with delivering INSPIRE, a directive that applies to all member states and aims to enable more joined-up data across public bodies for environmental applications.

At the time of OS Terrain's product development, the INSPIRE elevation specification had not been finalised. The data structures of OS Terrain products and the details of the GML encoding have been based on the draft INSPIRE specification.

For more information about INSPIRE and UK Location, please view the INSPIRE webpages (https://inspire.ec.europa.eu/data-specifications/2892).

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1.5 Product supply details

1.5.1 Supply format

OS Terrain 50 is available as:

- A 50m grid in ASCII grid and GML 3.2.1 (Simple Features Profile – level 0)
- 10m contours in Esri shapefile, GML 3.2.1 (Simple Features Profile – level 0), GeoPackage and vector tiles (MBTiles)

1.5.2 Supply mechanism

OS Terrain 50 is supplied as an online download, which is available with no registration required. Data can be downloaded in various formats from the Ordnance Survey Data Hub (https://osdatahub.os.uk/downloads/open/Terrain50).

For the ASCII, GML and Esri shapefile formats, the data is provided as a full set of Great Britain in tiles. The national dataset is supplied as 10km-by-10km tiles of data. There are 2,858 tiles in the product which are arranged into 55 folders, with each folder representing a 100km tile grid square.

The GeoPackage and vector tile data formats are provided as a single national set within one flat file.

The product will be supplied separately for grid or contour as compressed folders for each geographic tile of data. Each compressed folder will contain data plus several additional files.

It is recommended that a download manager is used to extract the tiled data as this additional functionality will automate the process and organise the data folders as desired. There are many commercial and open-source download clients available to help manage the data.

This data is designed to be kept up to date by annual full tile resupply.

1.5.3 Coverage and file sizes

OS Terrain 50 gives full national coverage of Great Britain. The data is derived from the same source data as our large-scale revision programme that updates OS MasterMap Topography Layer.

Data will be compressed using the zip compression method and is not encrypted. Compression rates vary for contour tiles and depend upon the number of features in the geographic location.

A full national supply of OS Terrain 50 grid tiles is 157 Mb compressed.

1.5.4 Product update schedule

OS Terrain 50 is supplied to customers annually each July, incorporating any updates made by the revision programme.

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1.6 Pre-requisites for using OS Terrain 50

1.6.1 Computer hardware

This product may be used on a wide range of hardware platforms (provided sufficient memory and storage facilities are available), varying from tablets or computers using GIS or CAD to mainframe computers with specialised translators and applications. Please see Coverage for more information. Your system supplier will be able to advise on your requirements.

1.6.2 Computer software

OS Terrain 50 is supplied as inert data in a variety of formats and does not include software for data manipulation.

GML is an open standard format, and the data may need to be translated into the appropriate format for use within a GIS application. A wide range of GIS software can read the GML contour data without translation.

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2. Data structure

This section describes the structure of the data in grid and contour forms.

2.1 Grid

2.1.1 Introduction

The height data is presented as a raster dataset of height values which are calculated at the centre of the pixel. This method of creating the data means that there are no overlaps between tiles nor common values along the edge. Coordinate reference systems for DTMs may be used to calculate the DTM origin and coordinates of individual posts.

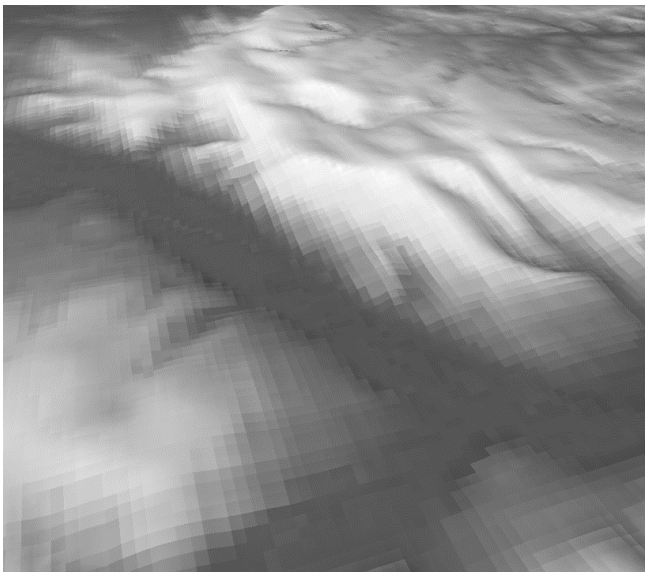

Figure 1: OS Terrain 50 posts displayed as a heighted, shaded raster in a GIS.

2.1.2 Mean high and low water representation in grid

Due to local tidal conditions, the height of the mean high and low water mark varies continuously around the coast of Britain. The mean high and low water lines have been derived from our large-scale mapping and assigned constant height values, based on the average for each tile. This average value has been determined from local tide tables. The mean high and low water lines were used as heighted breaklines when creating the grid to ensure that the grid product is consistent with the contour product. This means that there may be a small discrete step in the height of tidal water between adjacent tiles. For areas of permanent tidal water, in the grid, the height of the mean low water has been extended out to the tile edge to ensure that the tile is complete. Heights in the foreshore area are interpolated between the mean high and low water heights.

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2.2 Contours

2.2.1 Introduction

The contours are presented as polyline and spot height features. The contour lines have been divided into tiles for product supply. The contour values can be viewed and analysed in a GIS.

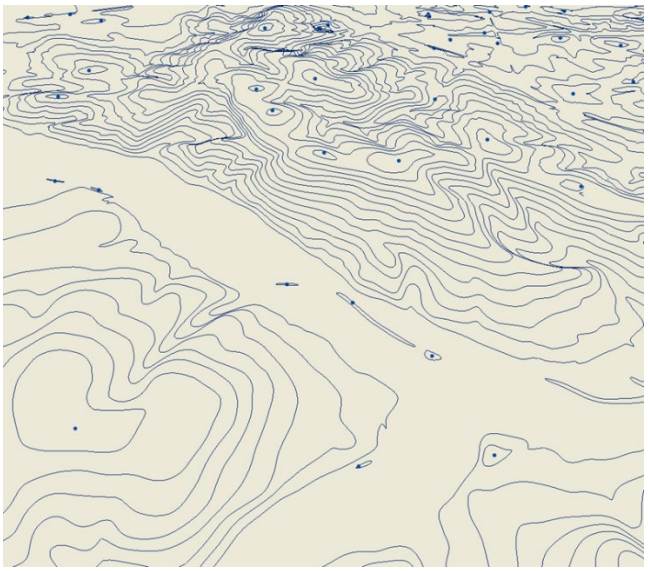

Figure 2: OS Terrain 50 contours and spot heights displayed as a heighted raster in a GIS.

2.2.2 Feature types

The terms used for the feature types are drawn from the INSPIRE elevation specification. The draft INSPIRE elevation specification requires height values to be held in an attribute called propertyValue, which has been implemented in the new OS Terrain contour GML. In the shapefile format, the GML feature types and attributes have been followed but with a 10-character limit imposed on shapefile field names, for example, propertyValue is abbreviated to PROP_VALUE.

The contours are named master and ordinary, which are equivalent to index and standard contours in Ordnance Survey's now withdrawn product, Land-Form PROFILE.

2.2.3 Mean high and low water representation in contours

In the contour products, the mean high and mean low water lines have been derived from our large-scale mapping and assigned constant height values, based on the average for each tile. This average value has been determined from local tide tables. Inevitably, this means that there is a small discrete step between adjacent tiles. There are no contours supplied between the mean high and low water lines.

The LandWaterBoundary feature type has an attribute of waterLevelCategory, which has four possible sub-values: meanHighWater and meanLowWater, or meanHighWaterSprings and meanLowWaterSprings for Scotland. This attribution allows their display parameters to be changed to show individual features, as desired.

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2.2.4 Spot heights

Spot heights have been created using an algorithm that selects the highest source data point within every enclosed contour. As they are from an interpolated surface of the real world, they cannot be guaranteed as summits or highest points of the feature, but it is intended that, in time, the height source data will be enriched by additional spot height data. The GML data model (available in the OS Terrain 50 Technical Specification) lists the spot height sub-value of spotHeightType, which allows the potential for formSpot, generic, mountainPass or summit to be used in future releases of the product. Currently, all spot height features are attributed as generic.

It is possible that there will be some instances of spot heights recording lower height values than the enclosing contour, but it is likely that these are the result of genuine depressions.

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3. Source data for OS Terrain 50

3.1 Introduction

The source DTM for the two OS Terrain products is captured as a triangulated irregular network (TIN) by editing with mass points and breaklines and/or automated techniques within a photogrammetric environment. The TIN is a superior model for three-dimensional data as it uses triangles which can retain the edges of features more accurately than a grid.

The source data capture is subject to demanding rules defined by the height capture specification. Particular attention is paid to communication routes and features significant to height applications. This section describes some of the key capture requirements from the detailed capture specification which we endeavour to achieve in the source data.

The grid and contour forms of the products are both interpolated from this source TIN model. This is because the TIN model is not widely supported by GIS software. As OS Terrain 50 is designed to work with small-scale products, the feature modelling will have a more generalised representation in the product.

3.2 Coverage

The minimum coverage of the data extends out to the low water mark, defined by Hydrographic Office tables with a height value for each tile. For England and Wales, the low water mark is Mean Low Water (MLW); for Scotland, it is Mean Low Water (Springs) (MLW(S)).

All land wholly within inland water bodies that is represented by topographic area features is captured according to the positional accuracy requirements of the area. The minimum requirement is to capture the outer edge of the feature. The surrounding water will remain flat.

Any other land within inland water bodies captured by automated processes will be removed from the data.

3.3 Positional accuracy requirements

The z values of the source TIN data must meet positional accuracy requirements according to their geographic location. The terrain has been divided into the following three classifications to ensure that modelling reflects customer requirements:

- Urban and major communication routes
- Rural
- Mountain and moorland

The accuracy of the height value above Newlyn Datum must achieve the root mean square error (RMSE) set for each area.

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3.4 Modelling of features in source data

3.4.1 Representation of the surface

The height of the bare earth surface is recorded as a series of points with three-dimensional coordinates. The X and Y coordinates are Eastings and Northings in OSGB36; the Z coordinate is height in metres relative to the datum for the area. Most areas will record a height relative to Ordnance Survey Newlyn Datum. For a small number of offshore islands, a local datum has been used.

The bare earth surface excludes buildings, supported structures and vegetation. Structures that form an obstruction at ground level – such as dams, breakwaters and groynes (wide enough to affect the positional accuracy requirements), bridge revetments and earthworks – are considered to be part of the bare earth surface. Only permanent terrain features (those expected to remain until the next revision period or longer) are modelled.

3.4.2 Underground and overhead features

Underground and overhead features are, by definition, not the ground surface and are thus not included in a DTM. Underground features are those that are obscured and require excavation to construct. Underground features are not recorded, and overhead features are removed from the data.

3.4.3 Terrain smoothness

The DTM will be free of spikes and wells that do not reflect the real-world terrain. A surface that is smooth is one that consists of a regular plane (which may be angled). For example, a road carriageway or railway track bed will appear smooth in the data.

3.4.4 Edgematching

Most data will present without visible tile edges or discernible height differences between tiles. In places, there may be small edges present or a difference in feature modelling between new and older content. There will also be small tile edges in tidal areas due to local tidal differences.

3.4.5 Supported structures

Supported structures include bridges, viaducts, cranes, elevated buildings, and jetties or piers on legs. All supported structures will be removed from the data where the structure departs from the bare earth surface and an air gap exists.

3.4.6 Vegetation

Areas of vegetation, such as hedgerows and trees, are removed to ensure that the bare earth surface is correctly recorded.

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3.4.7 Vertical features

Locations with a vertical change in height or an overhang have the height of the top of the feature recorded at the correct planimetric location according to the positional accuracy requirements.

The height at the lowest point of the vertical feature is recorded according to the positional accuracy requirements of the feature but is offset from its real-world planimetric position to ensure that there is only one z value present in the same location.

3.4.8 Major communication routes

Major communication routes are major road and rail networks identified in our core database.

The limits of a road carriageway or railway track bed are modelled to ensure that the route reflects its real-world shape. Modelling is required for changes in height to meet the positional accuracy requirements, to smooth the surface and to remove extraneous features, such as road furniture and bridges. Any associated slopes and embankments along the length of the route are also modelled.

In all other cases, the surface will be smooth, flat (not necessarily horizontal) and free from undulations.

3.4.9 Manmade landforms associated with mineral workings and landfill

The outer limits, shape and depth of mineral extraction and landfill sites are captured to meet positional accuracy requirements. Temporary features that do not represent the terrain at the time of capture (for example, spoil heaps) are removed from the data.

3.4.10 Contained water bodies greater than 0.7ha

In order to respond to the Flood and Water Management Act 2010, the extent of all flat-water bodies that are greater than 0.7ha in area (that is, greater than 7000 cubic metres capacity) must have their limits captured to ensure that the presence of the water body can be inferred from the data. The height of the water recorded is that at the lowest height of the surrounding data. The surface of the water will be flat.

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