

Euro-Maps 3D – DSM generation and procedures for validation and product finalization

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Abstract

GAF AG, the exclusive provider of optical IRS data in Europe, has been providing optical satellite data to ESA's CSC-DA Data Warehouse for many years. GAF's Euro-Maps 3D digital surface model (DSM), which is a high-resolution, transnational elevation model, is available through ESA.

This presentation reports on the DSM processing steps and on the subsequent steps that handle data validation, product editing, quality control (QC), and product finalisation.

Euro-Maps 3D is a 5 m DSM, based on 2.5 m optical in-flight stereo data from the IRS-P5 Cartosat-1 satellite. It is part of the GAF Elevation Suite, which consists of multi-stereo satellite based digital elevation models (DEMs) with resolutions of 0.3 m – 10 m. A dedicated Cartosat-1 processing chain has been developed and continuously refined in a long-standing and close cooperation between GAF and the Remote Sensing Technology Institute (IMF) of the German Aerospace Center (DLR).

In addition to the validation steps performed in the processing chain, several tests using available external reference datasets are carried out on the processing chain's output. External reference datasets that are used include, for example, ICESat data with appropriate filtering applied, high-accuracy imagery available from national agencies, available high-resolution elevation datasets, and kinematic GPS transects. Suitable tools for DSM validation have been developed in-house and these allow the Euro-Maps 3D ortho layer to be checked against optical reference data and the height layer to be checked against raster and vector reference data.

After validation of the processing chain's output, the first data preparation steps, e.g. tiling and format conversion, are carried out. These are followed by several error detection algorithms that are run on the tiled datasets.

In the subsequent product editing phase, a standardised DSM editing workflow is applied which involves fully-manual editing as well as script based checks of the created geometries and the resulting rasters. Special emphasis is put on assuring seamless product accuracy across tiles. A dedicated river editing workflow is applied, to ensure the generation of hydrologically correct DSMs. All editing is done with tools developed in-house as part of the GAFmap GIS.

After the manual QC of the editing output has been conducted, the data is ready for archiving and the preparation of customer-specific products.

The 5 m DSM data, with automatically detected errors removed, also forms the base data for the product Euro-Maps 3D for Ortho. The DEM with 10 m post spacing is a good approximation to a digital terrain model (DTM) in urban areas and a DSM elsewhere, and comes with the seamless 2.5 m resolution panchromatic ortho layer. It is highly suitable for the orthorectification of VHR satellite images.

The stereo-matched Cartosat-1 base data is also used for additional products. For the Urban Atlas Building Height 2012 product, created as part of the Copernicus Land Monitoring Services (CLMS) hotspot monitoring products, 3 m DSMs and DTMs for the EU-28 and EFTA capital cities were generated to derive building block heights with a height accuracy better than 3 m and a final resolution of 10 m.

Keywords - Digital Elevation Model (DEM)