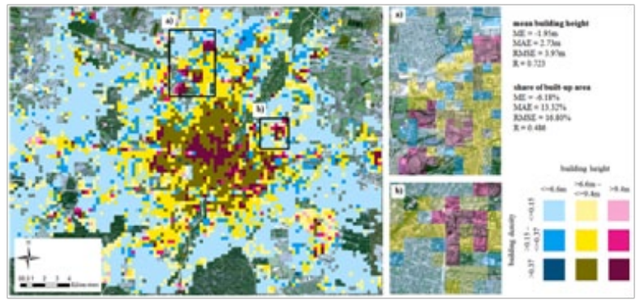
Global Partnership using Space-based technology applications for disaster risk reduction – GP-STAR

Large-Area Morphological Characterization of Urban Environments for Exposure Modelling

Global targets, Priority for Action 1, 4.



An example showing the mapping of built-up height, and share of built-up areas in the city of Munich.

Application field: To support exposure modelling by providing large-area information on the physical morphology of urban environments, a fully automated processing chain based on imagery of the Sentinel-2 satellite mission, operated by the European Space Agency (ESA) in the frame of the European Union Copernicus Programme, and of the German satellite mission TanDEM-X, is currently being developed for application in disaster risk reduction efforts world-wide.

Methodology and workflow: Recent Earth observation missions feature a notable trade-off between a fairly high spatial resolution and large-area coverage. TanDEM-X, in particular, is a spaceborne radar interferometer that delivers a global digital surface model with an unprec-edented pixel spacing of 0.4 arc seconds (~12m). In addition, ESA's recently launched Sentinel-2 satellites provide multispectral imagery with a spatial resolution of 10m for the bands covering visible light and near infrared, and a repetition rate of about 5 days. The developed workflow comprises of three main modules. The first module relies on the so-called Global Urban Foot-print, which provides binary information on "built-up" and "non built-up" areas. The second module includes the derivation of height information of objects in urban environments from the digital surface model generated by the TanDEM-X mission. The third module contains com-putation of the features used for characterization of urban morphology. The final output com-prises built-up heights and share of built-up areas.

Key results: Derivation of built-up heights and built-up densities, which can serve as key proxies for exposure patterns.

Innovative impact: This initiative aims at quantitatively characterizing urban environments without the incorporation of prior knowledge, and a priori determination of thematic classes according to specific semantics. This is done to allow for consistent and automated large-area analysis. Moreover, local peculiarities are bypassed, and a more objective statistical description of settlements is provided. Such a quantitative characterization can be transferred into themat-ic classes a posteriori, and also allows for a targeted collection of in situ knowledge for specific applications in exposure mapping.

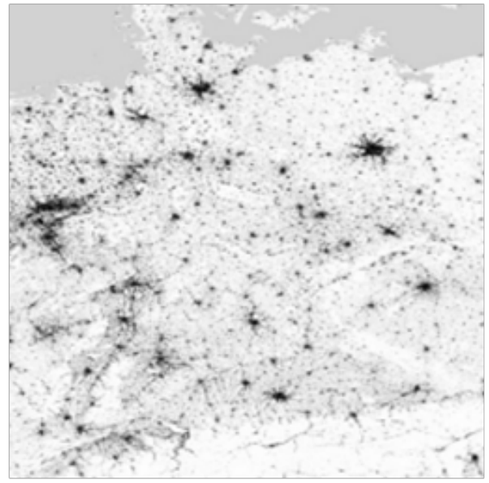
GP-STAR Factsheet

Global Partnership using Space-based technology applications for disaster risk reduction – GP-STAR

Large-Area Morphological Characterization of Urban Environments for Exposure Modelling

Application status: Pilot/pre-operational.

Area of application: National Level



Background: Derivation of built-up heights and built-up densities using data from the TanDEM-X mission and Sentinel-2. Data from TanDEM-X can be accessed free of cost for specified areas via a scientific proposal, whereas data from Sentinel-2 is accessible free of cost via an ESA data hub.

Key publications:

Geiß, C., Wurm, M., Taubenböck, H. (2017) Towards large-area morphologic characterization of urban environments using the TanDEM-X mission and Sentinel-2, JURSE 2017 - Joint Urban Remote Sensing Event, pp. pending. Joint Urban Remote Sensing Event, 6.-8. March 2017, Dubai, United Arab Emirates.

Geiß, C., Wurm, M., Breunig, M., Felbier, A., and Taubenböck, H. (2015): Normalization of TanDEM-X DSM Data in Urban Environments with Morphological Filters. IEEE Transactions on Geoscience and Remote Sensing, 53(8), 4348-4362.

http://www.dlr.de/eoc/en/desktopdefault.aspx/tabid-5290/9370_read-18028/

Prof. Dr. Günter Strunz, Guenter.Strunz@dlr.de; Dr. Christian Geiß, Christian.Geiss@dlr.de

German Aerospace Center (DLR), German Remote Sensing Data Center (DFD), Georisks & Civil Security; Münchener Straße 20, 82234 Wessling, Germany.