Extraction of Buildings from TanDEM-X Data

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Since 2011, the new satellite configuration of TerraSAR-X and TanDEM-X delivers high resolution single-pass InSAR data. These new data prepare the ground for new applications; in particular, methods to automatically derive cartographic information are in great demand. One major challenge is the monitoring of urban areas especially in case of disasters, where SAR systems are capable of providing information independent of daytime and weather. In recent work on building extraction from spaceborne SAR and InSAR data, two main trends can be distinguished. First, analysis of single SAR images with fast applicability, but showing drawbacks in dense urban areas. Second, analysis of InSAR time series which provides results of high precision, but takes a long time to acquire the data. The first group utilizes the intensity signatures of buildings. In the community, top down approach are presented, in which simulated building signatures are compared with real SAR images to enable the detection of collapsed buildings after earthquakes. In parallel, other groups published bottom up strategies where, based on detected intensity features (e.g., layover, corner, shadow), building hypotheses are generated and rated. The second group investigates the interferometric phase signature of buildings, and particularly point scatterers at façades, which allows the detection of movements. In our work, this new single-pass interferograms of the TanDEM-X mission are utilized to automatically reconstruct buildings. To this purpose, first an interferogram is calculated from a TanDEM pair. Then, a new detector is applied that analyses phase ramps in the interferogram. Phase ramps being a pattern typically observable in layover areas of buildings, the detector is able to indicate building locations. Moreover, the phase ramp detector is applied to the whole scene, followed by a segmentation step in order to obtain building patches. Afterwards, the detected building areas are analyzed in more detail to extract width, length, and height of the buildings. Then, an edge and a line detector are applied to deduce the building shapes. Finally, the 3D building hypotheses are geocoded and compared with reference data.