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Reconstructing 2-D/3-D Building Shapes from Spaceborne Tomographic Synthetic Aperture Radar Data

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Abstract. In this paper, we present an approach that allows automatic (parametric) reconstruction of building shapes in 2-D/3-D using TomoSAR point clouds. These point clouds are generated by processing radar image stacks via advanced interferometric technique, called SAR tomography. The proposed approach reconstructs the building outline by exploiting both the available roof and façade information. Roof points are extracted out by employing a surface normals based region growing procedure via selected seed points while the extraction of façade points is based on thresholding the point scatterer density *SD* estimated by robust M-estimator. Spatial clustering is then applied to the extracted roof points in a way such that each roof cluster represents an individual building. Extracted façade points are reconstructed and afterwards incorporated to the segmented roof cluster to reconstruct the complete building shape. Initial building footprints are derived by employing alpha shapes method that are later regularized. Finally, rectilinear constraints are added to yield better geometrically looking building shapes. The proposed approach is illustrated and validated by examples using TomoSAR point clouds generated from a stack of TerraSAR-X high-resolution spotlight images from ascending orbit only covering two different test areas with one containing relatively smaller buildings in densely populated regions and the other containing moderate sized buildings in the city of Las Vegas.