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High Resolution 3D Earth Observation Data Analysis for Safeguards Activities

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This paper provides an overview of the investigations performed in the last three years at DLR and highlights the application of SAR and optical data for 3D analysis in the context of Safeguards. The Research Center Jülich and the adjacent open cut mines were used as main test site, and a comprehensive stack of ascending and descending TerraSAR data was acquired over two years. TerraSAR data acquisition was performed, and various ways to visualize stacks of radar images were evaluated. Building height estimation was performed using a combination of ascending-descending radar images, as well as height-from-shadow, height-from-layover. A tutorial on building signatures from SAR images highlighted the sensor specific imaging characteristics. These topics were particularly relevant in safeguards activity with a “small-budget” as only a single image – or a couple - were employed. Interferometric coherence map interpretation allows the detection of used dirt roads.

Digital surface models (DSM) were generated from TanDEM-X interferometric data and from optical VHR data. Sub-meter Worldview-2 and GeoEye-1 data was processed into highly detailed DSM with a grid spacing of 1 m, showing building structures. 3D change and volume detection was performed with both optical and radar DSMs. The TanDEM-X DSMs proved useful for volume change detection and computation in mining areas, and down to building level with optical data. Virtual fly-through were found to be a good tool to provide an intuitive understanding of site structure and might be useful for inspector briefing. Tools for most of the above mentioned tasks have been developed for the ENVI environment and can be used by IAEA internally. The work presented has been funded under GER SP Task JNT D1657.

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