Title of the contribution:

DEM production utilizing stereo technology of the TerraSAR-X data

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Abstract (more than 500 words):

TerraSAR-X, launched in 2007, is one of the most sophisticated commercial SAR satellites capable of acquiring high-resolution images. Now the SAR data is widely in use for various applications, and high-resolution global DEM production is highly expected area for its potential exploitation.

Many researchers have studied the prospects of single-pass interferometry using both TanDEM-X, which will be launched this year and TerraSAR-X data. The methodology for the utilization of stereo technology, on the contrary, uses the parallax difference as perceived from two different points of observations, and makes it possible to acquire the height of objects with respect to a reference surface. The precondition of this methodology is the accuracy of the well controlled satellite's position. Comparing with the interferometry, the stereo methodology has a feature of homogeneous DEM for the wide area, despite of the values of baseline.

The purpose of this paper is to summarize the outline of DEM generation using stereo methodology and reveal the feature of DEM quantitatively and qualitatively as well.

The major procedures follow the image ingestion (image pair input, epi-polar resampling),

point acquisition (semi-automatic hierachical matching of mass points, break-line generation, stereo visualization), radargrammetry (coordinate computation, DEM generation, image ortho-rectification), initial editing (blunder removal, tile generation), final editing (cartographic editing of the derived contour, DEM in monoscopic environment; water bodies will be flattened and artificial objects, e.g., bridges and airports will be edited) , and final product generation. Point acquisition by semi-automated method makes it possible to produce high-quality DEM. Additionally, in the case of mountainous terrain, breaklines are optionally acquired. Theoretically, the slant range resolution and the geometry (mainly the intersection angle) are the determining factors related to the achievable vertical accuracy; in practical, however, the success of the auto-matching process, with respect to sub-pixel matching accuracy, is also a major determinant of the vertical accuracy that can be obtained. After this process, DEM and ortho-rectified image are produced at the stage of Radargrammetry. Then, DEM is cut to the square tile with the size of 7.5 degree. The pixel spacing of the final product is 10 m, and estimated horizontal accuracy is 5 m.

The evaluation of the feature of DEM generated by this method was done by some pair of TerraSAR-X data. They were compared with SRTM derived DEM and airborne DEM with high-resolution, and the accuracy was evaluated both by quantitatively and qualitatively. The results showed that the elevation was represented by TerraSAR-X quantitatively. Moreover, the absolute vertical accuracy was achieved better than 10 m, without critical affects on the land cover, ups and down, and satisfied the specification.

This study shows the potential of TerraSAR-X DEM generated by stereo technology method, and supplemental utilization of InSAR and stereo method would provide more practical products for many customers. We have plans to do further development in order to use this methodology under normal production purposes.