ANALYSIS OF ALOS-PRISM AND KOMPSAT2 IMAGE GEOMETRY FOR ADVANCED PHOTOGRAMMETRIC APPLICATIONS

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Potential of ALOS-PRISM stereo triplet and KOMPSAT2 images for photogrammetric applications like DEM and orthoimages creation is promising. But, before using these images in any photogrammetric processing, you have to understand and correctly model their geometry. This paper will describe the methodology we have set up and tested in order to enhance our understanding of ALOS-PRISM and KOMPSAT2 image geometry thanks to Reference3D data.

PRISM sensor, aboard Japanese satellite ALOS, contains three cameras pointing backward, nadir and forward. In stereoscopic configuration, 12 images (4 backward, 4 nadir and 4 forward), each corresponding to 1 CCD line, are produced with a total width of 35 km and GSD equal to 2.5 m. Ancillary data provided with imagery is used to build rigorous location model. Moreover, rational polynomial coefficients (RPC) are provided on request and may be useful to validate rigorous model implementation. MSC instrument aboard Korean satellite KOMPSAT2 has 1 panchromatic and 4 multi-spectral channels. Image swath width is 15 km with panchromatic GSD equal to 1 m and multispectral GSD equal to 4 m. Contrary to ALOS, there is no stereoscopic mode but stereo pairs can be made thanks to KOMPSAT2 agility: roll tilt goes up to 56° and pitch tilt up to 30°. Pan, red (MS4), blue (MS2) and NIR (MS3) images are registered on green (MS1) image and ancillary data concerns only MS1 location model. RPC are always provided with KOMPSAT2 images.

On the other hand, French Mapping Agency (IGN) and Spot Image are producing a global geographic database called Reference3D that contains 1" DEM and 5m orthoimages made exclusively from SPOT5 HRS stereo pairs. In January 2009, more than 6 million km2 are already produced with planimetric accuracy equal to 15 m (at 90%) and altimetric accuracy equal to 10 m (at 90% for slopes lower than 20%) for DEMs and planimetric accuracy equal to 15 m for orthoimages.

Traditionally, image geometry of a new satellite is evaluated thanks to several very accurate GCP, most of the time GPS points. In this paper, we describe how we use Reference3D data to evaluate image geometry of ALOS-PRISM and KOMPSAT2-MS1 images, thanks to image matching methods and statistical tools, even if Reference3D accuracy is smaller than GPS points accuracy. Reference3D orthoimages and DEM enable us to refine our knowledge of ALOS-PRISM and KOMPSAT2 image geometry. It enables us to overcome the lack of documentation, especially concerning ALOS-PRISM focal frame geometry.

At first, reference data is used, in a traditional way, as a source of GCP to adjust rigorous models. At this stage, we can evaluate absolute location accuracy and validate our global understanding of image geometry. But thanks to reference data, we can go much further to improve geometric accuracy. With DEM and adjusted model, ALOS-PRISM and KOMPSAT2 orthoimages are calculated and compared with reference orthoimages by image matching techniques. Computed disparity maps are then turned in a correction model for each CCD line thanks to statistical tools. These correction models are then re-injected in rigorous model and adjustment is calculated again. Orthoimages are re-computed and comparison with reference data shows registration performance achieved with enhanced model.

In the same way, DEMs are calculated by correlation of ALOS triplet images with initial model and with enhanced model. Then, they are compared with Reference3D DEM by image matching techniques. Statistical processing gives planimetric shift between DEMs and quantify gain between initial and enhanced models. We also compute altimetric differences between calculated DEMs and reference DEM.

This paper reports several tests of this methodology applied on ALOS PRISM triplet and KOMPSAT2 images including images over Southern France and Japan. Considering results of these tests, this iterative strategy has proved to be efficient to create DEM and orthoimages compliant with Reference3D data.