UPDATED RESULTS OF CALIBRATION AND VALIDATION OF PRISM ONBOARD ALOS

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1. INTRODUCTION

The Advanced Land Observing Satellite (ALOS) is continuously operating more than four years since January 24, 2006, and it is works very well. ALOS has three mission instruments i.e. an L-band Synthetic Aperture Radar (PALSAR) and two optical sensors, the Panchromatic Remote-sensing Instrument for Stereo Mapping (PRISM) and the Advanced Visible and Near Infrared Radiometer type-2 (AVNIR-2). The global images are acquiring and the numbers of archived images are more than 1,410,060 scenes by PALSAR, 1,886,642 scenes by PRISM and 842,622 scenes by AVNIR-2 as of November 2009, and they are using for cartography, forests and environmental monitoring as well as disaster monitoring. Especially, PRISM performs the along-track triplet stereo observations by forward (FWD), nadir (NDR) and backward (BWD) independent panchromatic optical line sensors with 2.5 meters ground resolution at nadir in 35 km wide swath width. FWD and BWD instruments are arranged at an inclination of +/-23.8 degrees from NDR to realize a base to height ratio (B/H) equal to 1.0. It is used to derive a precise digital surface model (DSM) or digital elevation model (DEM) with high spatial resolution.

This paper describes updated results of operational calibration of PRISM in particular geometric accuracy evaluation. We are now updating the pointing alignment parameters for existing acquired data, which are used the system correction processing for generating the standards products. We are expecting that geometric error will reduce a few meters after updating the parameters. We also describe updated validation results of generated DSM by PRISM. This evaluation is carrying out for harsher natural conditions.

2. PRISM GEOMETRIC CALIBRATION UPDATES

The sensor calibration is most important to use ALOS data in any application fields because they directly effect to the accuracy of the results in applications. Especially, the geometric calibration of PRISM is important in generating a precise DSM by stereo pair images. The calibration is carrying out since launch the satellite [1]-[4]. The absolute geometric calibration is done by evaluating the pointing alignment parameters, which are calculated by the Precision Pointing and Geolocation Determination System (PPDS) that is a ground processing system to achieve determinations of precise attitude and pointing vectors for each PRISM radiometer [5]. The absolute geometric accuracy of PRISM is about 7.8 meters for NDR and FWD, and 8.7 meters for BWD (RMSE) as of July 2009 [6]. This result was obtained from more than 12,000 ground control points (GCPs) used as check points in 1,336 scenes in worldwide. To improve geometric absolute accuracy of PRISM, the pointing alignment parameters have to estimate precisely including variations of recurrent as well as time dependency. We will update them about each two months to keep the accuracy if accuracy degradation is confirmed.

In the past, the pointing alignment parameters have not been updated if once released them. However, we could found the seasonal variation trends of them based on the evaluation results of PRISM geometric accuracies more than three years. We are currently updating and evaluating them, and expecting that the absolute geometric accuracy of PRISM will be a few meters smaller than current parameters after releasing them.

3. PRISM DSM VALIDATION UPDATES

The DSM and ortho-rectified image (ORI) Generation Software for ALOS-PRISM (DOGS-AP) is developing at Earth Observation Research Center (EORC), JAXA as a part of validation of PRISM. It is introducing the cross-correlation based exclusive triplet images matching algorithm, and updating with the calibration results [7]-[11]. Various test sites including various terrain characteristics were prepared and used for the DSM validations with the reference DSM data sets derived from Lidar instruments or aerial photo matching [11]. The height accuracy of generated DSM by PRISM with DOGS-AP is about 4.4 meters at flat terrain, 6.9 meters in urban areas, and 7.9 meters in mountainous areas (RMSE) without GCP at the test sites. We can basically possible to generate DSMs by PRISM in any areas, if the images are available with acquisition good conditions.

In this study, we are trying to validate the DSMs under harsher natural conditions such as more steep mountainous and glaciers because these textures are basically weak to take an image matching between stereo pair images of PRISM. The validation test sites are located in Mt. Tateyama, Toyama Pref., Japan, and Bhutan - Nepal - Himalayan regions. The altitude of summit of Mt. Tateyama is 3,015 meters and around top of mountain is covered by snow. Himalayan regions are located in the altitude more than 3,000 meters with many glaciers. We were corrected GCPs in all of these regions as reference.

Furthermore, we are investigating spatial interpolation method for 1 arc-sec ASTER Global DEM (GDEM) Product using 0.3 arc-sec of PRISM DSM. This is result of "ASTER GDEM Validation Project" and contributes

to a task of GEO "Global DEM". These are depends on the availability and quality of ASTER GDEM as well as PRISM imageries.

4. REFERENCES

List and number all bibliographical references at the end of the paper. The references can be numbered in alphabetic order or in order of appearance in the document. When referring to them in the text, type the corresponding reference number in square brackets as shown at the end of this sentence [1].

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