APPLICATION OF ASPECT ANGLE NORMALIZED POLSAR IMAGES FOR URBAN BUILDING DETECTION

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1. INTRODUCTION

The aspect angles of buildings, defined as the angles between the flight direction of the satellite (azimuth direction) and the vertical walls of buildings, usually are not uniform. Buildings with different aspect angles will reduce the accuracy of building detection and terrain classification from POLSAR data. The primary reason is that buildings with different aspect angles can lead to different backscattering returns due to the structure-sensitive characteristic of POLSAR image. The existing building detection methods based on POLSAR data usually are effective for buildings in a limited aspect angle range. As a result, the removal of the disadvantageous influences caused by variation in the aspect angle of buildings and detection of buildings at any aspect angle in urban areas still needs to be researched. In this paper, double-bounce scattering component derived from the aspect angle normalized POLSAR data is used to extract the buildings, while removing the influence of aspect angle.

2. METHOD

From POLSAR images, the orientation angle shift defined as the angle between the major axis of the polarization ellipse and the horizontal axis can be derived. The orientation angle shift has been found to be induced not only by terrain slope [1] but also by building structure[2]. The aspect angle of building in even urban region is the primary reason to induce the orientation angle shift. Therefore, the aspect angle can be changed by adjusting the orientation angle shift. If the orientation angle shift is compensated to zero, the aspect angle is also equal to zero. As a result, buildings with any aspect angle can be considered to be parallel to the flight direction and also form good dihedral structures, and the disadvantageous influences caused by the aspect angle can be removed. The POLSAR data process of change varied aspect angles to zero degree can be regarded as aspect angle normalization. Theoretically, the same building detecting results will be obtained from the buildings with different aspect angles by using aspect angle normalized POLSAR data. The double-bounce scattering component can be derived by using Yamaguchi four-component decomposition method [3]. To sum up, the detail steps are list in the following.

Step1. Get the orientation angle shift image from filtered POLSAR data by using the circular polarization method.

Step2. Rotate the orientation angles based on the orientation angle shift image and get the aspect angle normalized POLSAR data.

Step3. Get the double-bounce scattering component from the aspect angle normalized POLSAR data by using Yamaguchi four-component decomposition method.

Step4. Detect the urban buildings by using some classification method, such as Maximum Likelihood supervised method.

3. RESULTS AND DISCUSSIONS

Tiantongyuan, located in Beijing, China, is chosen as the study area shown in Fig.1 (a). The building detection results derived from the RadarSat-2 original and the aspect angle normalized POLSAR images by using Yamaguchi four-component decomposition and Maximum Likelihood method are shown in Fig.1(b) and (c), respectively. From Fig.1, those buildings with large aspect angles which could not be detected from the original image can be detected effectively from the aspect angle normalized image, while the buildings with small aspect angles which can be detected by the original image also can be detected by the normalized image. The results show the enhanced effects of the aspect angle normalized POLSAR images on the urban building detection.

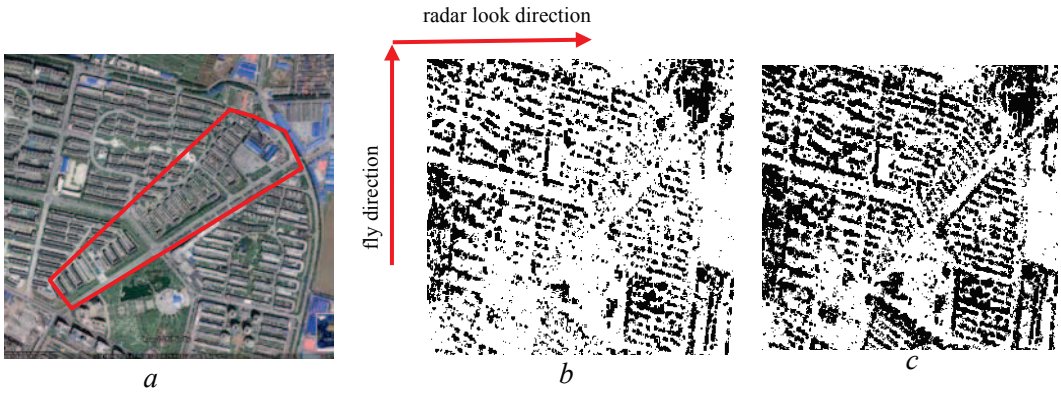

Fig.1 Building detection comparison between the original (b) and aspect angle normalized (c) PolSAR images in Tiantongyuan, Beijing, China (a). The red line in (a) show the buildings with large aspect anlges.

11. REFERENCES

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