BIOMASS RETRIEVAL BASED ON UAVSAR POLARIMETRIC DATA

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1. INTRODUCTION

Vegetation spatial structure parameters are important factors having effect on the carbon cycle between the landscape and atmosphere, and the biodiversity of ecosystems. Retrieval of above-ground biomass remains a challenging task, especially in those areas with complex forest stand structure and environmental conditions [1]. Therefore, how to estimate biomass more accurately is still a problem need to be worked out urgently. Many studies have validated that because of the penetration capability and sensitive to the water content in vegetation, radar is naturally a facility that can be used to detect spatial structure and aboveground biomass ([2]-[10]).

UAVSAR provides high resolution polarimetric SAR data for use on multiple studies, such as retrieval of forest structure parameters. As other airborne SARs, one disadvantage of UAVSAR image data is the large range of local incidence angles (θ_0) across the image (about 40 degrees in our data) [11]. Along the range line, radiometric distortion due to the illumination area is increasing as a function of θ_0. In order to correct this distortion, several studies had been taken. Sader chose some homogeneous areas of the same types along the range line, and made these areas as the equal backscattering signatures, then calibrated the total image. The disadvantage of this method is that it doesn't work well with image that have multiple land cover types [12]. Another method taken by Yuel et al. is normalizing the SAR data by the total power. This method removed most of distortion by local incidence angle, but at the same time it changed some information of SAR data, and can't discriminate all of classes in the image [13]. When Ranson and Sun used AIRSAR data, they picked some pixels of each image line within sapwood areas, calculated the mean values and standard deviations. The study picked out all pixels inside of ± 2 standard deviations to estimate the mean values at each image row, and used a linear regression to retrieve calibration ratio for each row, and finally the total image was calibrated by these ratios [14]. In [15], Kellndorfer et al. used the local incidence angle with an equation to correct this radiometric distortion, and he found it would be enough for use on land cover classification. Ranson and Sun validated this method's usability [16] [17].

As mentioned above, most studies focused on classification of land cover types, and didn't give enough attention on local incidence angle correction. This paper will discuss and build the relationship between backscattering coefficient and local incidence angle, estimate aboveground biomass by using the corrected backscattering coefficient.

2. DATA AND TEST SITES

Our test sites are in Maine, one site is the Northern Experimental Forest (NEF), Howland (45o15'N, 68o45'W). The other site is Penobscot Experimental Forest (44.8 o N, 68.6 o W). About 20 persons spent two weeks measuring 24 plots (50m by 200 m per plot, divided into 16 25m by 25m subplots) in these two sites according to UAVSAR flight line. The DBH (Diameter at breast height) of all live/dead trees with a DBH $\geq$10 cm and three highest trees' height in each subplot were recorded. Trees with a DBH < 10 cm were counted within a 2m wide transect in the center of the plot, and tallying stems by subplot and size class.

UAVSAR, a reconfigurable, polarimetric L-band synthetic aperture radar (SAR), is specifically designed to acquire airborne repeat track SAR data for differential interferometric measurements (http://uavsar.jpl.nasa.gov). It provides high resolution polarimetric SAR data for use on multiple studies, such as retrieval of forest structure parameters.

3. METHODS

The processing of field sampling data, UAVSAR data will be described in detail in this paper. Local incidence angle image will be generated from DEM and UAVSAR metadata. Incidence angle at the center of radar image will be calculated from incidence angle image in ground range but without geocoding. In this paper all land cover types covered in the image will be selected to analysis the relation between uncorrected backscattering coefficient in different polarizations and local incidence angle, and try to develop a model to correct the radiometric distortion caused by local incidence angle. This method will be compared with other existing models, and validate the method's feasibility. Using corrected backscattering coefficient by the method we get, this paper also try to develop a model to estimate above-ground biomass.

4. RESULTS

The results will show a nice relationship between backscattering coefficient and local incidence angle, Using several UAVSAR images acquired at the same time but slightly different flight line, the method will be validated that correction equation would be well used for eliminating the radiometric distortion. At the same time, biomass retrieval by corrected backscattering coefficient will be more accurate.

5. REFERENCES

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Biography:

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