Regional Mapping of Forest Canopy Water Content and Biomass Using AIRSAR Images Over BOREAS Study Area

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In recent years, monitoring vegetation biomass over various climate zones has become the primary focus of several studies interested in assessing the role of the ecosystem responses to climate change and human activities. Airborne and spaceborne synthetic-aperture radar (SAR) systems provide a useful tool to directly estimate biomass due to its sensitivity structural and moisture characteristics of vegetation canopies. Even though, the sensitivity of SAR data to total aboveground biomass has been successfully demonstrated in many controlled experiments over boreal forests and forest plantations, so far, no biomass estimation algorithm has been developed. This is mainly due to the fact that the SAR data, even at the lowest frequency (P-band) saturates at biomass levels of about 200 tons/ha, and the structure and moisture information in the SAR signal forces the estimation algorithm to be forest type dependent.

In this paper, we discuss the development of a hybrid forest biomass algorithm which uses a SAR derived land cover map in conjunction with forest backscatter modeling and inversion algorithm to estimate forest canopy water content. It is shown that unlike the direct biomass estimation from SAR data, the estimation of water content does not depend on the seasonal and/or environmental conditions. The total aboveground biomass can then be derived from canopy water content for each type of forest by incorporating other ecological information. Preliminary results from this technique over several boreal forest stands indicated that,: 1) the forest biomass can be estimated with reasonable accuracy, and 2) the saturation level of the SAR signal can be enhanced by separating the crown and trunk biomass in the inversion algorithm.

We have used to NASA/JPL AIRSAR data over BOREAS southern study area to test the algorithm and to generate regional scale waler content and biomass maps. The results are compared with ground data and the sources of error are discussed. Several SAR images in synoptic modes are used to generate the parameter maps. The maps are then combined to generate mosaic maps over the BOREAS modeling grid.

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