

Potential of forest degradation monitoring using high resolution L-band Synthetic Aperture Radar data

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Abstract: Forest degradation, which is changes of canopy and structure affecting ecological function or services negatively, is important information for assessment of environmental changes such as carbon dynamics and biodiversity and for mitigating the impacts from these changes. L-band microwave synthetic aperture radar (SAR) is useful especially for monitoring of tropical forest changes because of cloud-free observation capacity and highly sensitivity to forest biomass. Many studies have demonstrated the usefulness of spaceborne L-band SAR data for forest/non-forest mapping, deforestation detection, and biomass estimation, but for forest degradation, highly spatial resolution is required to detect because the scale of forest degradation is generally small. The Japanese next SAR satellite, namely ALOS-2 PALSAR-2, is planned to be launched in JFY 2013 and it can provide higher resolution images (i.e., 3 m) compared to the previous spaceborne L-band SAR (e.g., ALOS PALSAR and JERS-1 SAR). This study aims to investigate the potential of such high resolution L-band SAR data for monitoring forest degradation. Two case studies are presented: canopy cover changes by fallen trees in peat swamp forests in Riau, Indonesia and selective logging in evergreen coniferous forests in Hokkaido, Japan. High resolution L-band SAR images were acquired by using the Japanese airborne SAR, Pi-SAR-L2. The specification of Pi-SAR-L2 is similar to that of PALSAR-2, bandwidth is 85 MHz, slant range resolution is about 1.76 m, and four look azimuth resolution is about 3.2 m. Therefore, we can simulate the PALSAR-2 observations and its performance by using the Pi-SAR-L2 data. The sensitivity to forest degradation events were investigated for multiple SAR parameters such as backscattering coefficient, correlation between polarization, full polarimetric decomposition parameters, and texture information. The classification using these SAR parameters was also attempted to create a forest degradation probability map.

Keywords: Pi-SAR-L2, synthetic aperture radar, forest degradation, Indonesia, Japan