Early stage deforestation detection for JJ-FAST system by using PALSAR-2 polarimetry data.

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Global forest monitoring, including deforestation detection, is important to understand global climate change. Several global/country level deforestation monitoring systems based on the optical satellite data are working. Only one SAR-based deforestation detection system was developed by JICA and JAXA, called “JICA-JAXA Forest Early Warning System in the Tropics (JJ-FAST)”. The JJ-FAST system started from November 2016 [1], and has a merit to work not only in dry season, but also in a rainy season. The current system uses decrease of g^0_{HV} for deforestation detection. Watanabe et al. [2] used time series of PALSAR-2/ScanSAR data, and examined difference of deforestation detection timing in the most active deforestation sites in Peru and Brazil. He clarified that increase of gamma_0_HH was able to detect the early-stage deforestation stage, in which felled trees were left on the ground. On the other hand, gamma_0_HV started to decrease 1-1.5 months after the deforestation detected by gamma_0_HH. The HH polarization data plan to use the deforestation detection in the JJ-FAST system from April, 2018.

In this paper, several representative polarimetric parameters are examined to identify preferable parameters for detecting the early-stage deforestation. PALSAR-2/full polarimetric data observed on May 31, 2016 were analyzed to obtain sigma_0, 4-component decomposition, and entropy/alpha/anisotropy decomposition parameters. 15 early-stage deforestation sites, in which the deforestation happened within 1.5 month and the size ranges from 9.9 to 69.6 ha, were identified by using Sentinel-2 image observed on April 15 and June 20, 2016. Forest stand neighboring the early-stage deforestation stand was picked up for the representative of forest parameters. Larger parameter difference between the forest and the early-stage deforestation stand were observed for sigma_0_HH, sigma_0_surface, and alpha angle, and the difference were 0.7 dB, 1.6 dB, and 2.6 degree respectively. 0.1 times standard deviation were also estimated for each parameters, and show ~0.4 dB, ~0.5 dB, and ~0.7 degree, respectively. This indicates that alpha angle and sigma_0_surface have better performance than sigma_0_HH to detect the early-stage deforestation stands. The entropy/alpha/anisotropy parameters estimated from dual polarization data will be examined for the availability for the JJ-FAST system.

[1] JJ-FAST, http://www.eorc.jaxa.jp/jjfast/jj_index.html, February 16, 2017

[2] Manabu Watanabe, et al., Early-stage deforestation detection in the tropics with L-band SAR, IEEE JSTARS, accepted.

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