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| **ALOS-2 Robust Operational Deforestation Detection and Early Warning in Amazonia with JJ-FAST Ver. 4.2** |
| Monitoring of forest cover loss and tracking of related deforestation activities is one hot topic in Earth Observation today. Especially in the tropical rainforest belt, low-frequency L-band radar sensors have a unique potential to provide authorities with reliable information about ongoing deforestation all year round. This is mainly owed to their capability to “see” through clouds as well as through the entire forest canopy down to the very ground surface. JICA and JAXA have been operating the JJ-FAST (JICA-JAXA forest early warning in the tropics) since mid-2016. The system exclusively uses ALOS-2/PALSAR-2 wide-swath ScanSAR images with 50-m resolution and a nominal revisit of 42-days. After relatively low reliability in the first years of operation, the performance has been drastically improving recently. In an unprecedented massive validation exercise over 3 1°x1°-sites in Brazil, the outstanding performance of the current JJ-FAST algorithm version 4.1, launched in November 2024, has been confirmed. The comprehensive validation dataset based on visual interpretation of Planet daily images allowed for the first time to assess both user's (UA) and producer's (PA) accuracies with high reliability. Since it is still not a trivial task to identify all deforestation cases in Planet data due to the often-limited image quality, such a validation data set is always associated with a certain degree of uncertainty. It is worth mentioning, however, that these uncertainties usually result in an underestimation of the JJ-FAST accuracy values. Thus, we assume that the validation results are indeed quite robust and meaningful. Using different parameter settings for optimized UA and optimized PA, UA for all detections larger 1.5 ha ranged between 70.2% and 40.7% and PA ranged from 28.2% to 38.7%, respectively. The reduced image quality of the ScanSAR mode makes it generally more difficult to achieve higher PA. The ratio between UA and PA is in the order of 3, i.e. for every point increase in PA we lose about 3 points in UA and vice versa. Based on this satisfying performance, the responsible authority in Brazil, IBAMA, has recently started to include JJ-FAST detections as core information for their operational procedures to combat illegal deforestation. One main disadvantage of optical data-based validation and calibration approaches is the fact that useful optical image timeseries are only available during the dry season. That means the calibrated parameters may work well under similar environmental and meteorological conditions, but their suitability during the rainy season is largely unknown. To overcome this problem and to evaluate the Ver. 4.1 performance outside the dry season, we made great effort to validate every JJ-FAST detection in the Legal Amazon during the rainy season 2023/2024. Using this information on the true operational user's accuracy together with the seasonal statistics of the corresponding PALSAR-2 images, the seasonal parameters were adjusted to suit the more challenging wet conditions. At the time of writing the confirmed rainy season UA with the updated Ver. 4.2 parameter settings was 48.7% for all polygons sizes larger 1.5 ha and 78.9% for all polygons larger 10 ha, respectively. |