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| **Next-generation Radar Forest Monitoring with ALOS-4** |
| Forest monitoring is one prime objective for radar Earth Observation satellite missions. Especially in the tropical rainforest belt, low-frequency L-band radar sensors have a unique potential to provide reliable information in various applications including biomass estimation, deforestation detection, and forest classification. 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.Approaching the eagerly awaited launch in 2024, the ALOS-4 will be the 4th generation high-performance fully-polarimetric L-band SAR in orbit. Following its predecessor JERS-1, ALOS, and ALOS-2, ALOS-4 will be able to acquire dual and quad-pol wide-swath observations in high resolution Stripmap mode using cutting-edge digital beam forming technology. This will allow to overcome the limitations in operational forest monitoring with the current generation which can only provide frequent pantropical coverage in the coarse ScanSAR mode used, e.g., in the JJ-FAST system (JICA-JAXA forest early warning in the tropics). Together with the partial polarimetric NISAR mission which aims to achieve global coverage every 12-days and is also set for launch this year, the next-generation L-band Earth Observation era will provide new opportunities for systematic, seamless global forest observation from space.Using a case-study over one of the ALOS-2 supersites in the Brazilian Amazon, we highlight the tremendous potential of frequent high resolution polarimetric L-band SAR observations to finally provide the means to stop illegal deforestation. Launched in May 2014 and nearing 10 years in orbit, ALOS-2 can arguably still be considered as the state-of-the-art SAR forest monitoring mission in operation. Over the Novo Progresso region, one of the severe deforestation hotspots in the state of Para, Brazil, ALOS-2 has acquired a unique dual-polarization timeseries in 10-m Stripmap mode. Between July 2019 and March 2024, 69 scenes were observed. Using JAXA’s next-generation deforestation detection algorithm, we demonstrate the tremendous potential of the upcoming 4th generation L-band satellite missions ALOS-4 to detect virtually all ongoing deforestation activities in the humid tropical forest. Thorough and comprehensive validation of the early warning polygons confirmed the highly reliable detection accuracy of well above 80% for both user’s and producer’s accuracies when considering all freshly deforested areas larger 0.5 ha. In addition, we will also address the potential of ALOS-4 quad-pol observations for various forest applications using different ALOS-2 examples. |