Implementation of high resolution POLSAR & POLINSAR imagery for geo/bio-environmental monitoring of natural hazard-prone and man-induced disaster

Boerner, Wolfgang-Martin - UIC-ECE Communications, Sensing & Navigation Laboratory
Sumantyo, Josaphat Tetuko Sri - Chiba University, The Center for Environmental Remote Sensing (CEReS)
Nugroho, Arifin - Institute of Technology Bandung, GS-EES
Hattori, Katsumi - Chiba University, Earthquake Res. Centre

The Indonesian Islands stretch over almost four time zones along the equatorial belt in between +/- 10* latitude, and its lush vegetation along with its mineral resources are exposed to increasing natural hazards like volcano eruptions, earthquakes and seaquakes with ensuing tsunami, cyclones with devastating floods plus ruthless mineral mining; thus, disaster assessment and prevention has become an ever more pressing topic of top priority. Current ground-based disaster damage assessment methods are cumbersome and costly due to sudden sporadic hazard occurrences; and local point measurements are not representative of larger affected regions. Due to the strong spatial and temporal dynamics of geo/bio-environmental constituents frequent continual observations are necessary for which satellite remote sensing and stress change monitoring provide the sought for repetitive monitoring capability and synoptic coverage. On average, about 70% to 80% of the Indonesian surface is covered by clouds, haze and/or precipitation, for which optical remote sensing techniques from space fail. Microwave radar sensors are ideally suited for space imaging within the equatorial belt because those are almost weather independent, and humidity, haze and cloudiness are increasing at a rather rapid pace for irreversible reasons due to expansive aerosol build-up in these tropical regions; enforcing the rapid advancement of polarimetric radar and especially POL-SAR and polarimetric SAR interferometry. Such fully polarimetric interferometric SAR sensing methods allow distinct penetration into vegetative layered structures not possible with optical methods. Although the ALOS-PALSAR (L-band) and the RADAR-SAT-II (C-Band) satellite POLSAR sensors provided spectacular imagery, in this proposed study on identifying minute surface changes due to natural hazards and anthropogenic destruction of the precious tropical vegetative ground covers inflicted mainly by rigorous surface mining (coal, ore, gold, precious and rare minerals) invites the implementation of the DLR TerraSAR-X/TanDEM-X satellite sensors for testing its applicability for a selected set of distinct test-regions spread along the entire equatorial extent from North-west Sumatra via Java, Tenggara, Kalimantan, Sulawesi to the Maluku/Timor islands and Papua. During the recent years, excellent satellite X-Band remote sensing results had already been obtained for some randomly selected regions over Kalimantan on Borneo, which need to be supplemented by a more rigorous selection of pertinent test sites across all of Indonesia with the upgraded DLR TerraSAR-X/TanDEM-X satellite sensors. In addition, for assessing next to the DLR satellite X-Band SAR sensors, the suitability of other microwave band sensors, the implementation of the DLR FSAR airborne platform is urgently in need and must be made available for testing over a well defined set of sites coordinated with those of the TerraSAR-X/TanDEM-X satellite over flights. Based on these measurement campaigns, the development of pertinent equatorially orbiting satellites including tandem satellite configurations covering all of the identified preferential microwave bands must be designed and advanced rapidly; and be considered of top priority for the entire international global satellite SAR remote sensing community.