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Some Results from the 2000 P and X band Airborne Polarimetric INPE-DSG SAR Mission for Biomass Estimation, Land Cover Classification and Digital Elevation and Surface Model Estimation.

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ABSTRACT

A joint INPE-DSG (Diretoria do Serviço Geográfico do Exército) airborne mission in September of 2000 over the Tapajós National Forest, has acquired P and X band interferometric data over a region which comprises primary forest, secondary succession in several stages of regrowth, pasture, crop plantations, bare soil, water and other land use classes. The AeS-1 polarimetric system, from AeroSensing Radarsysteme GmbH, Germany, provided P band polarimetric data for two pass interferometry and X band single polarization, single pass interferometric data. During the radar mission, ground survey was carried out for target identification, collection of tri-dimensional differential GPS data for P and X band corner reflectors and collection of vegetation parameters, like species, DBH, count and height for several primary and regenerations transects. Biomass data was calculated for the mentioned transects using allometric equations based in the dendrometric parameters. Full polarimetric calibrated P band SAR imagery was generated and a model of the transects biomass data as a function of the backscatter established. Georeferenced Digital Elevation Models (DEMs), with spatial resolution of 2.5 meters, were generated considering X and P bands interferograms. X band DEM generally shows higher altitude than the P band DEM, especially over forested areas, because the considerably higher penetration of P band towards the forest floor, while X Band DEM reflects the canopy altitude. X band DEM is called here a Digital Surface Model (DSM), because it is related mainly with the top of the land cover. The difference between the DSM and the DEM (P band) potentially gives the forest height. Actual internal average height of forest and regeneration transects was compared with the DSM-DEM difference. The results showed that the DSM-DEM difference tends to underestimate the forest height under secondary sucessions stages, probably due higher volume scattering (derived from interactions with trunk, branches, twigs) of P band emission. The DSM-DEM difference over primary forest is closely related to the average height, in the transects, standing between the global average tree height and the average height of the upper store trees of the forests transects. The full polarimetric P band data was used for land cover classification. From a initial set of 10 classes, a derived set comprising only three classes was found to have an adequate mapping precision, but enough to detect deforestation areas. For the future we will be experimenting new models for biomass estimation for overcoming the 200 ton/ ha saturation point, using simultaneously the backscatter and the interferometric data and seeking integration with other Remote Sensing instrumentation, particularly the LVIS instrument.