AIRBORNE AND SPACEBORNE RADAR IMAGES FOR GEOLOGIC AND ENVIRONMENTAL MAPPING IN THE AMAZON RAINFOREST, BRASIL

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Spaceborne and airborne radar images of portions of the Middle and Upper Amazon Basin in the State of Amazonas and the Territory of Roraima are compared for purposes of geological and environmental mapping. The image data were obtained by Shuttle Imaging Radar B (SIR-B) in 1984, by SIR-A in 1981, and by Radambrasil in the early to middle 70's. Each of the data sets was acquired through a different range of incidence angles. Wavelengths are 23.5 cm for the spaceborne data and 2.8 cm for the airborne data. The contrasted illumination geometries and imaging parameters are related to terrain slope and surface roughness characteristics for corresponding areas that were covered by each of the radar imaging systems. Landforms range from deeply dissected mountains and plateau with relief up to 500 m in Roraima, revealing ancient layered rocks through folded residual mountains to deeply beveled pediplain in Amazonas.

Geomorphic features provide distinct textural signatures that are characteristic of different rock associations. The principal drainages in the areas covered are the Rio Negro, Rio Branco, and Rio Japura. Shadowing effects and low radar sensitivity to subtle linear features that are aligned parallel or nearly parallel to the direction of radar illumination illustrate the need to obtain multiple coverage with viewing directions about 90° apart. The sensitivity of the radar systems to changes of incidence angle are illustrated by strong contrast in shadowing effect across 15° at the high incidence angles used on the airborne radar, and by the contrast in perception of low-relief drainage in the lower range of incidence angles used on the spaceborne radars. Perception of standing water and alluvial forest in floodplains varies with incidence angle and with season. Multitemporal data sets acquired over periods of years provide an ideal method of monitoring environmental changes, notably clearcutting, reforestation and changes in stream channels caused by flooding. New findings are discussed on the adaption of the drainage network to the structural lineaments.