Geophysical Research Abstracts,
Vol. 11, EGU2009-13468, 2009
EGU General Assembly 2009

Automated inundation monitoring using TerraSAR-X multitemporal imagery

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The Mekong Delta in Vietnam offers natural resources for several million inhabitants. However, a strong population increase, changing climatic conditions and regulatory measures at the upper reaches of the Mekong lead to severe changes in the Delta. Extreme flood events occur more frequently, drinking water availability is increasingly limited, soils show signs of salinization or acidification, species and complete habitats diminish. During the Monsoon season the river regularly overflows its banks in the lower Mekong area, usually with beneficial effects. However, extreme flood events occur more frequently causing extensive damage, on the average once every 6 to 10 years river flood levels exceed the critical beneficial level

X-band SAR data are well suited for deriving inundated surface areas. The TerraSAR-X sensor with its different scanning modi allows for the derivation of spatial and temporal high resolved inundation masks. The paper presents an automated procedure for deriving inundated areas from TerraSAR-X Scansar and Stripmap image data. Within the framework of the German-Vietnamese WISDOM project, focussing the Mekong Delta region in Vietnam, images have been acquired covering the flood season from June 2008 to November 2008. Based on these images a time series of the so called watermask showing inundated areas have been derived. The product is required as intermediate to (i) calibrate 2d inundation model scenarios, (ii) estimate the extent of affected areas, and (iii) analyze the scope of prior crisis.

The image processing approach is based on the assumption that water surfaces are forward scattering the radar signal resulting in low backscatter signals to the sensor. It uses multiple grey level thresholds and image morphological operations. The approach is robust in terms of automation, accuracy, robustness, and processing time. The resulting watermasks show the seasonal flooding pattern with inundations starting in July, having their peak at the end of September, and lower down until December in 2008.

The results are a valuable input for monitoring and understanding the seasonal regional flood patterns for calibrating 2d inundation models, as also for generating value added products in combination with agricultural land use and socio-economic data for further separation of inundated and irrigated areas.