Geophysical Research Abstracts
Vol. 14, EGU2012-9577, 2012
EGU General Assembly 2012

Monitoring urban development using satellite time series data and GIS technologies: a case study of Vienna 1986-2011

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The spatial and temporal distribution of urban areas is a fundamental information for a series of applications such as land management, future urban planning, ecology and others. This project deals with a classification approach for the area of Vienna during the time from 1986 to 2011 using Landsat 5 TM datasets. Time series of Landsat 5 TM data were downloaded and pre-processed. To minimize the effect of vegetation phenology and sun illumination geometry, Landsat 5 TM acquisitions were limited to a specific time window (June-July). Due to the high amount of data collected an automated approach was necessary. Conventional supervised classification algorithms based only on spectral features were not successful in differentiating urban areas from bare soils due to similarities in the spectral reflectance. To further distinguish these two land cover types their attributes in texture were used. Urban areas showed a high variance in texture data within a uniform reference unit whereas agricultural or bare soil fields demonstrated a very uniform distribution of texture value. For the textural analysis a new pixel value was assigned dependent on the spectral differences of each pixel concerning its neighbouring pixels. The textural analysis was included as an additional feature within the Landsat 5 TM dataset. Furthermore it was evaluated which combination of bands (spectral and textural) was best to discriminate above mentioned areas. These bands were then used for a supervised classification. The distribution of vegetation land cover was calculated and an accuracy assessment was performed based on an independent data set derived from the visual interpretation of high resolution images and ancillary information. Furthermore, a GIS analysis was carried out to evaluate the expansions (in space and time) of the Vienna urban area for each municipality. Preliminary results are presented and discussed.