Author(s): Natascha Oppelt, Wolfram Mauser
Speaker:

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Derivation of the Nitrogen Status of Different Crop Types with the Airborne Imaging Spectrometer AVIS - First Results

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Abstract (365 words):
Nitrogen is known as one of the limiting factors for the production of biomass in natural ecosystems. In the last few years, several investigations with regard to the derivation of the nitrogen status of vegetation were carried out at both leaf and canopy scale. Field spectrometers as well as imaging spectrometers were used to determine empirical relationships between the nitrogen status and the spectral reflection patterns of controlled test sites with different nitrogen applications. In addition, several studies were published concerning the influence of the canopy consistency, the plant morphology, and the plant architecture upon the nitrogen status. However, many difficulties in the two-dimensional derivation of the nitrogen status of vegetatin from reflection patterns still exist.
In this paper, a new approach to the two-dimensional derivation of the nitrogen status of different crop types as maize, oat, and wheat is presented. The database is a multitemporal set from twelve AVIS (Airborne Visible near Infrared Imaging Spectrometer) campaigns flown in 1999. Three water protection areas, located in the Bavarian alpine forelands between Starnberger See and the Ammersee and predominately agiculturally used, were chosen as test sites.
The sensor was flown on board of an Do-27 aircraft. Between April and September 1999 twelve data sets were flown. First the data was system-corrected and calibrated. Then the data was atmospherically corrected and reflection calibrated. An external calibration with field spectrometer data during the AVIS overpasses was carried out during two of the data sets.
The calculations were carried out with a spectral model developed at the Institute of Geography in Munich. It includes the standard absorption spectra of the involved substances like chlorophyll, other pigments, and water as well as scattering and absorption processes.
Good preliminary results for the quantitative determination of nitrogen content were achieved using a combination of the form and positioning of the red edge together with the depth of water absorption at 960 nm. The multitemporal data set also provides an insight into the changes of the reflection throuout a vegetation period.
For the validation of the approach, ground truth measurements of both plant nitrogen and plant phenology (biomass) were carried out. Results of the comparison beween modelled and measured nitrogen will be presented.