Abstract submitted for oral presentation and paper for the 23rd EARSeL Annual Symposium 2003, 2-5 June 2003, Gent, Belgium.

Hyperspectral sensing of moisture gradients: set-up and first results of a combined field and airborne campaign

B. VERBEIREN[1], O. BATELAAN[1], L.Q. HUNG[1] and F. DE SMEDT[1]

[1]Department of Hydrology and Hydraulic Engineering
Vrije Universiteit Brussel
Pleinlaan 2, 1050 Brussels
Belgium
Tel. 00-32-2-6293021
Fax: 00-32-2-6293022
Email: bverbeir@vub.ac.be

Abstract

Determination and description of hydrological groundwater systems is essential for the management and development of ecological values, especially in valleys of the river basin. At the ground surface, groundwater systems appear as infiltration and discharge zones; the latter are relatively wet because of the upward groundwater seepage, while the former are relatively dry. Groundwater discharge zones offer potential high nature values because of their constant moisture availability and their specific water quality. Valleys usually have a complex pattern of moisture gradients, caused by a complex interaction of regional groundwater flow with local influences of differences in soil and topography. Knowledge about infiltration- and discharge zones also forms the basis for sound, quantitatively and qualitatively, water management of groundwater systems. Current methods for the determination of discharge and infiltration zones use very data intensive numerical simulation models. Consequently there is a direct need for repeatable, area covering, mapping possibilities for the determination of moisture gradients and more specifically discharge and infiltration zones.

Within the framework of the CASI-SWIR measuring campaign 2002, the Department of Hydrology and Hydraulic Engineering of the Vrije Universiteit Brussel (VUB) executed a hyperspectral remote sensing and field campaign in the Doode Bemde to analyse moisture gradients in a valley area.

The main objective of the study is to test the best hyperspectral analysis method, using the CASI-SWIR data, for the known (based upon field and simulation data) moisture gradients in the Doode Bemde area in the valley of the Dijle River. The study area has been object of study of extensive hydro-ecological research during the last five years, due to which a lot of field measurements as well as simulations have been carried out. The area is hydrochemically uniform, and has clear, relatively constant moisture gradients with associated differences in vegetation on a small scale caused by groundwater flow differences.

Simultaneously with the remote sensing, field measurements of soil moisture, groundwater levels, vegetation temperature and spectral vegetation characteristics of some key species (phreatophytes) were performed.

The paper describes the set-up of the field and airborne measurement campaign, the methodology of analysis as well as first analysis results. Moisture gradients, from measurements and simulations and derived from maps of groundwater depth and of infiltration and discharge areas, are statistically compared with individual bands, a combination of bands and multivariate derivatives. Using the available hydrological and vegetation knowledge, a physical explanation for the statistical best proxies is given.