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Hyperspectral Remote Sensing and Groundwater Simulation for Detecting Riparian Wetness Gradients

Yirdaw-Zeleke, S
umyirdaw@cc.umanitoba.ca
University of Manitoba Department of Civil Engineering, 15 Gillson Street, Winnipeg, MB R3T 5V6 Canada
Batelaan, O
batelaan@vub.ac.be
Free University of Brussels Department of Hydrology and Hydaulic Engineering, 1050 Brussels, Brussels, 1050 Belgium
Snelgrove, K R
snelgrov@cc.umanitoba.ca
University of Manitoba Department of Civil Engineering, 15 Gillson Street, Winnipeg, MB R3T 5V6 Canada

Groundwater is a precious resource of limited extent. The importance of determining and describing hydrological groundwater flow systems is one of the most important aspects for the management and development of ecological values, especially in valleys of river basin. Knowledge about discharge and recharge zones forms the basis for sound, quantitatively and qualitatively, water management of groundwater flow systems. Determination of discharge-recharge zones using hydrological models needs a large volume of data from various sources. Integrated Hyperspectral remote sensed data and GIS can provide an effective tool in characterizing groundwater flow systems and discharge-recharge relationships. In the present study, an integrated hyperspectral remote sensing and GIS based methodology is developed and tested for the evaluation of groundwater flow system of Doode Bemde wetland in the valley of the Dijle River, Belgium. There are three components of the study; (a) Development of groundwater model using the three dimensional groundwater model, MODFLOW, (b) Extraction of information about the groundwater flow system from CASI-SWIR hyperspectral data using ENVI 3.5 software and, (c) Comparison of each individual CASI-SWIR band with the simulated groundwater depth and discharge-recharge zones. The simulated discharge areas are verified by hyperspectral remote sensed data. The first principle component is found to be the best for identification of recharge zones in study area. An area cross-tabulation two-dimensional table that summarizes the areal overlap of all the possible combination of the two input maps (from the hydrological model and the image) or an error matrix is applied for expressing classification accuracy. The correlation values between 0.6 and 0.65 are observed on the wavelength domain from 0.90 to 1.30æm and on the first principle component with the groundwater depth. These bands are among the best for use as a source of information for shallow groundwater depth (up to 1.5m) for natural grasslands.