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Coping with vegetation dynamics in low-land wetlands – Integration of RS derived interception into the rainfall-runoff model WetSpa

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The effective protection of wetlands demands knowledge of hydrological processes, which can be appropriately analysed using distributed models. It is eminent that the calibration and verification of distributed models of catchments with significant wetland coverage have to focus on wetland-specific issues such as the hydrological response of natural vegetation, i.e. parameterisation and dynamics of vegetation. An important and useful parameter describing vegetation canopy structure in terrestrial ecosystems is the Leaf Area Index (LAI), which is closely related to photosynthesis, net primary productivity, evapotranspiration and interception storage capacity. LAI can be estimated with remote sensing data, its suitability to derive the actual state of vegetation is high. This study focuses on improving the interception capacity calculation in the distributed hydrological model WetSpa. The main objective is to integrate seasonal LAI data. Not only field measurements, but also remote sensing derived LAI data is integrated into a WetSpa model for the Upper Biebrza catchment (northeast Poland). Biebrza National Park is characterized by a significant coverage of wetland and large variation in vegetation types. The use of remote sensing derived LAI values considerably improves the assessment of the actual status of vegetation and its seasonal dynamics. Landsat Thematic Mapper images are used to represent the different vegetation stages during the growing season (near LAI minimum and LAI maximum). They are analysed and processed to estimate the interception storage capacity of plant communities typical for Biebrza River valley. LAI of different plant communities has been measured using LAI-2000, and empirical relationships between these measurements and several spectral vegetation indices were established using linear and non-linear regression analysis. The vegetation indices with the highest correlation and the strongest linear relationship regarding LAI are NDVI ($R^2 = 0.72$), SAVI ($R^2 = 0.72$), MSI ($R^2 = 0.70$) and MSR ($R^2 = 0.70$). The minimum/maximum LAI maps are combined with the established equations to calculate spatially distributed hydrological parameter maps, i.e. minimum and maximum interception storage capacity. The model application yields considerable spatio-temporal differences in interception estimates for scenarios using interception maps calculated based on (1) LAI measurements and remote sensing data, compared to (2) the standard Corine Land Cover 2006 based data.