Hydroinformatics and ecohydrology tools for ecologically sustainable development in northern China

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Abstract Due to natural and human disturbances (e.g., urban expansion), ecosystems have been changed dramatically on time scales ranging from years to decades. Especially in recent years, the ecohydrological system in northern China (including Inner Mongolia and around the Beijing area) has faced several environmental issues such as the shrinking of wetlands, water table decline, water quality deterioration, grassland degradation, dune expansion, and the urban heat island effect. These merging issues make it necessary to consider the social context of interactive processes linking hydrology and ecology; hence the need for the Ecohydrology Approach. This transdisciplinary challenge requires an integration of various types of information, knowledge, and techniques referred to as hydroinformatics for ecologically-sustainable development. In this study, the current conditions and problems of ecohydrology in northern China are reviewed. A transdisciplinary ecohydrological framework is proposed for future research, which incorporates remote sensing, geographic information systems, and geographic positioning systems to extract hydro-ecological information for coupling ecohydrological models of different scale and resolution to simulate regional environmental change over time under various climate, land-use, and environment management scenarios. The remote sensing (RS) monitoring of resources and the eco-environment around the Beijing area are also introduced. The large-scale remote sensing data processing system CASMImage can be used to fast process hydro-ecological elements monitored by RS for the system. The proposed research plan is to study long-term regional hydrological change in the metropolitan and surrounding areas, and to determine the functionality and water cycle changes under controlled environment conditions in response to vegetation growth. The framework provides an opportunity for linking hydrology and ecology, as well as integration with modern information technology, leading to ecologically sustainable development of the region.

Key words remote sensing; geographic information system; hydro-ecological model; monitoring; human disturbance