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Drought Risk Assessment based on Natural and Social Factors

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In many parts of the world, drought hazard is becoming more frequent and severe due to climate change and human activities. It is crucial to monitor and assess drought conditions, especially for decision making support in agriculture sector. The vegetation index (VI) decreases, and the land surface temperature (LST) increases when the vegetation is under drought stress. Therefore both of these remotely sensed indices are widely used in drought monitoring and assessment. Temperature-Vegetation Dryness Index (TVDI) is obtained by establishing the feature space of the normalized difference vegetation index (NDVI) and LST, which reflects agriculture dry situation by inverting soil moisture. However, these indices only concern the natural hazard-causing factors. Our society is a complex large-scale system with various natural and social elements. The drought risk is the joint consequence of hazard-causing factors and hazard-affected bodies. For example, as the population increases, the exposure of the hazard-affected bodies also tends to increase. The high GDP enhances the response ability of government, and the irrigation and water conservancy reduces the vulnerability. Such characteristics of hazard-affected bodies should be coupled with natural factors. In this study, the 16-day moderate-resolution imaging spectroradiometer (MODIS) NDVI and LST data are combined to establish NDVI-Ts space according to different land use types in Yunnan Province, China. And then, TVDIs are calculated through dry and wet edges modeled as a linear fit to data for each land cover type. Next, the efforts are turned to establish an integrated drought assessment index of social factors and TVDI through ascertaining attribute weight based on rough sets theory. Thus, the new CDI (comprehensive drought index) recorded during spring of 2010 and the spatial variations in drought are analyzed and compared with TVDI dataset. Moreover, actual drought risk situation in the study area is given to verify the effectiveness of the CDI. In addition, GIS is applied to provide geographically referenced information, i.e. information involving location, elevation, land use, water resources distance and so on, which are essential inputs for spatial analysis in drought risk assessment. On the whole, this study has proposed a new idea on drought risk assessment integrating natural factors with social factors, as well as providing a real-time drought monitoring method in a social context.