



Comprehensive assessment of regional droughts considering the underlying surface conditions: a case study of Hunan, China

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Drought is normally caused by below-normal precipitation over a period of months to years. However, even if the climate and meteorological conditions are identical in each area of the region, the local drought phenomena might be vastly different. This is because the varied underlying surface conditions (USCs), such as land use and land cover (LULC), soil type, crop type, irrigation and phenology, mutually play different roles for the drought process. It is extremely difficult to use any specific meteorological-based drought index to get the real drought severities in the region. Due to the heterogeneous USCs, the other site observed data, such as soil moisture, river-flow, could not be extrapolated reasonably to monitor droughts of all the area of the region. Although the remotely sensed data provide full views of drought situation for a large scale area, yet, essentially, it does not make diverse for different USCs. Therefore, in this research, a comprehensive drought assessment method considering the local USCs was proposed to get the real drought severities of the region.

This method has the following two characteristics: 1) a series of multiple drought indices based on meteorological, hydrological, remotely sensed data are employed, and the comprehensive judgement of the drought severities is determined by the majority of the severities of multiple drought indices, named mode method; 2) the USCs characterized by LULC, soil, crop, irrigation and phenology are considered, which according to, the drought indices were filtered, the drought severity classifications were revised and the drought assessment model was established.

It is a complex and systematic work to implement the comprehensive assessment of regional drought. In our study, a number of drought indices based on the multi-sources data were screened to form an alternative indices pool, and the application scope of each index is assessed. Then for a specific USC, the candidate indices have been selected from the pool in advance, so that each USC corresponds to a set of indices. Afterwards, the thresholds of each index for the specific USC is recalibrated basically by the percentile method as well as exploring the relationship between drought indices and impacts. Finally, the drought assessment in each area was synthesized by the mode method based on the corresponding set of candidate indices with the recalibrated classifications. For simplicity of realization, all the data are technically meshed, and the drought assessment was conducted on each grid.

This methodology has been carried out for a pilot study in Hunan province, China in July and August 2017. At that time, the major crop in the area is the second season of the double cropping paddy rice. There are a number of irrigation area which crop drought can be avoided or reduced. The drought assessment results were compared with the reporting data from each county, which shows that the proposed method are convinced and can reflect the real drought situations.