Spatial Variation of Agricultural Drought within a Catchment

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Existing drought indices are not suitable for monitoring drought status of small farms and orchards in complex terrain. This study suggests a practical method for site-specific monitoring of agricultural drought by using an integrated information on the crop species, development stage, and soil moisture at a plot scale. This method consists of an estimation of long term water balance and the subsequent comparison with the probability distribution of the climatological normals, resulting in a relative severity of drought at any week in a given year. Water supply is the difference between precipitation and surface runoff, and the demand is determined by evapotranspiration (ET) in this method. The precipitation is substituted by an effective precipitation weighted daily for the recent 60 days, and the surface runoff can be estimated by the USDA SCS curve number model. Actual ET can be obtained by applying relevant crop and phenology specific coefficients to the FAO reference ET. The probability distribution is prepared by transforming the natural logarithm of the effective precipitation, which is the supply-demand difference at 61 synoptic stations across South Korea for 1971-2000. Once the effective precipitation is calculated for a given plot for the week in any year, the relative position on the probability distribution can be determined to get one of 4 severity classes. We applied this method to thousands of plots on a catchment of 53km^2 (a slow city 'Akyang') in 2009 by preparing the necessary information for water balance estimation based on the high-resolution geospatial information like topography, land use, climate and soils. Results showed that this method could simulate a medium to severe drought stage at week 20 and a rapid mitigation at week 21, which is in a good agreement with the observed drought status at many plots in this region.

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