# Weekly comparative evaluations of some high resolution water stress variables at the Riggs Creek OzFlux tower site

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**Abstract:** From a hydroclimatic perspective, the standardized values of the main variables of the hydrological cycle (precipitation, streamflow (runoff and underground flow), soil moisture and evapotranspiration) can be used as proxies for drought, normal and wet conditions. Such variables may also be defined as water stress variables (WSVs). In past studies in Australia (Risbey 2011), WSVs that have been under consideration to evaluate the water stress status are generally based on rainfall indicators, such as the standardized precipitation index (McKee et al. 1995). However, recent research has identified drawbacks of this approach at the water management level, showing that for evaluating water stress, it is necessary to consider all main WSVs simultaneously.

One of the main impediments when assessing and monitoring WSVs is the availability of reliable data. Over the recent decades, advancement in monitoring and modelling technologies have opened possibilities to water resources experts to access a large number of high resolution data products. These products provide information on the surface processes, both in terms of the water and vegetation dynamics, as well as for the surface-to-atmosphere interactions. Amongst the available in-situ data sources throughout Australia, flux tower sites provide the most comprehensive and complete point data sets. In the present study, daily time series of precipitation, streamflow, soil moisture and evapotranspiration observed at the Riggs Creek OzFlux tower site are used in a proof-of-concept study. The reason for selecting this site lies in having full access to data, little to no data gaps, and a relatively homogeneous pattern of landuse (dryland agriculture) within the tower's footprint. The Riggs Creek site is located within the Goulburn-Broken catchment, south-east of Shepparton, in Victoria (36° 39'S, 145° 34'E). The data used here spans from November 2010, the beginning of its operational period, to December 2012.

The methodology presented in this paper is a step-wise process (Fig. 1): first, all variables are standardized using an equiprobability transformation, presented by Panofsky and Brier (1958). Then, statistical parameters such as, maximum, minimum, kurtosis and skewness of the data are calculated. Next, the best probability distribution functions (*pdf*) for the data sets are chosen via two statistical indicators, the Kolmogorov–Smirnov and Chi-squared, as the goodness of fit tests. After this step, the probabilistic amounts of normal and extreme events of WSVs based on their cumulative distribution functions (*cdf*) are extracted. Moreover, for each variable, the severities of extreme dry and wet events are calculated by considering magnitude and duration of events. Finally, to specify the correlation and relationships between WSVs, an analysis based on the agglomerative hierarchical clustering (AHC) is applied (Murtagh and Contreras 2012). In the present case, the linkage criterion of "*Ward*" and similarity function of "*Pearson Coefficient*" are used in the mentioned AHC. Further, to determine the accuracy and efficiency of the final clusters, a "*Cophenetic Coefficient*" ($0<CC<1$) is calculated. The higher the value of CC shows the better the accuracy of the final clustering. The results of this research can be used in helping managers to have further reliable information over weather and climate behaviours of different areas to apply in water resources management and planning. Here, initial results will be discussed and compared to the skills of traditional methods.

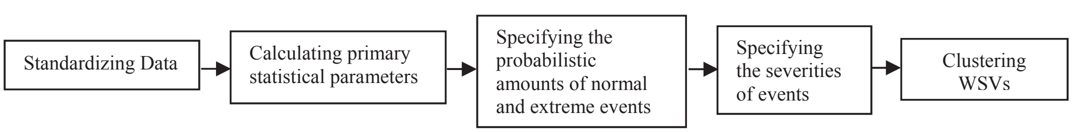


Figure 1. The step-wise process of used methodology in current study

***Keywords:*** *water stress variables, Riggs Creek OzFlux tower, statistical methods*