Flow Duration Curves and Recession Curves Connection through a Mathematical Link

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Abstract : This study helps Public Water Bureaus in giving reliable answers to water concession requests. Rapidly increasing water requests can be supported provided that further uses of a river course are not totally compromised, and environmental features are protected as well. Strictly speaking, a water concession can be considered a continuous drawing from the source and causes a mean annual streamflow reduction. Therefore, deciding if a water concession is appropriate or inappropriate seems to be easily solved by comparing the generic demand to the mean annual streamflow value at disposal. Still, the immediate shortcoming for such a comparison is that streamflow data are information available only for few catchments and, most often, limited to specific sites. Subsequently, comparing the generic water demand to mean daily discharge is indeed far from being completely satisfactory since the mean daily streamflow is greater than the water withdrawal for a long period of a year. Consequently, such a comparison appears to be of little significance in order to preserve the quality and the quantity of the river. In order to overcome such a limit, this study aims to complete the information provided by flow duration curves introducing a link between Flow Duration Curves (FDCs) and recession curves and aims to show the chronological sequence of flows with a particular focus on low flow data. The analysis is carried out on 25 catchments located in North-Eastern Italy for which daily data are provided. The results identify groups of catchments as hydrologically homogeneous, having the lower part of the FDCs (corresponding streamflow interval is streamflow Q between 300 and 335, namely: Q(300), Q(335)) smoothly reproduced by a common recession curve. In conclusion, the results are useful to provide more reliable answers to water request, especially for those catchments which show similar hydrological response and can be used for a focused regionalization approach on low flow data. A mathematical link between streamflow duration curves and recession curves is herein provided, thus furnishing streamflow duration curves information upon a temporal sequence of data. In such a way, by introducing assumptions on recession curves, the chronological sequence upon low flow data can also be attributed to FDCs, which are known to lack this information by nature.

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