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Catchment classification based on storage estimations at the catchment scale

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The volume and form of stored water at the catchment scale are fundamental information on the vulnerability of water cycle against human activity and climate change. For example, a catchment storing large amount of groundwater and a catchment with shallow soil water are expected to response differently against land-use change or global warming. In addition, a relationship between river flow and stored water volume has been widely used as the basic function for many rainfall-runoff models; and therefore, it should be evaluated based on available hydrologic records. However, since subsurface storage volume is very difficult, if not possible, to measure directly, there are not many attempts on the quantification or on the use of the storage information for catchment classifications. Although recently more studies are conducted for the storage estimations at the hillslope scale based on soil moisture and subsurface water level measurements, and at the continental scale based on remotely sensing techniques, not many studies tried to estimate storages at the meso-catchment scale (~100km2). In this study, taking advantage of a dense gauging network in a forest watershed in California, we estimated storage volume changes based on following two techniques. One uses water balance analyses to estimate total storage changes from the beginning of a rainy season to the end of a rainy season. The other applies hydrograph recession analyses and corresponding baseflow records to estimate dynamic storage changes. As a result, we found statistically efficient relationships between the storage indices estimated from 17 sub-watersheds and their topographic indices (average slope and slope length). The proposed storage estimations and their topographic relationships provide useful information for understanding hydrologic cycle under human impact and climate change.

Keywords: recession analysis, water balance, topographic analysis, catchment comparison, catchment hydrology, rainfall-runoff process