

Spatio-temporal analysis of discharge regimes based on hydrograph classification techniques in an agricultural catchment

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Abstract:

The stream, discharges and groundwater hydro-graphs is an integration in spatial and temporal variations for small-scale hydrological response. Characterizing discharges response regime in a drainage farmland is essential to irrigation strategies and hydrologic modeling. Especially for agricultural basins, diurnal hydro-graphs from drainage discharges have been investigated to achieve drainage process inferences in varying magnitudes. To explore the variability of discharge responses, we developed an impersonal method to characterize and classify discharge hydrograph based on features of magnitude and time-series. A cluster analysis (hierarchical k-means) and principal components analysis techniques are used for discharge time-series and groundwater level hydro-graphs to analyze their event characteristics, using 8 different discharge and 18 groundwater level hydro-graphs to test. As the variability of rainfall activity, system location, discharge regime and soil moisture pre-event condition in the catchment, three main clusters of discharge hydro-graph are identified from the test. The results show that : (1) the hydro-graphs from these drainage discharges had similar shapes but different magnitudes for individual rainstorm; the similarity is also showed in overland flow discharge and spring system; (2) for each cluster, the similarity of shape insisted, but the rising slope are different due to different antecedent wetness condition and the rain accumulation meanwhile the difference of regression slope can be explained by system location and discharge area; and (3) surface water always has a close proportional relation with soil moisture throughout the year, while only after the soil moisture exceeds a certain threshold does the outflow of tile drainage systems have a direct ratio relationship with soil moisture and a inverse relationship with the groundwater levels. Finally, we discussed the potential application of hydrograph classification in a wider range of hydrological settings.