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Diurnal methods for evapotranspiration and recharge estimations

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Diurnal fluctuations in soil moisture, shallow water table or streamflow rate as short-term changes may help to understand better hydro-ecology. One of the most important diurnal fluctuation-inducing factors is the water consumption of vegetation in growing season. Using the information of this evapotranspiration (ET) induced signal (shape, magnitude) the effects of prolonged dry periods can also be quantifiable.

In this paper beside a systematic categorization of the relevant studies, models also have been reviewed and critically evaluated that calculate recharge and evapotranspiration from soil moisture, groundwater and streamflow signal. Compared to traditional ET estimation methods these diurnal signal based approaches may excel in that they generally employ a small number of parameters to measure, are typically simple to use, and yet can yield results even on a short time-scale. From other viewpoint temperature-based methods of ET are simple too, but they cannot be applied or become inaccurate over shorter time periods. While, traditional approaches (such as Bowen-ratio based) are accurate for shorter time steps but they require a number of measurable atmospheric input variables.

The traditional diurnal fluctuation based White-method provides a common approach of ET estimation when relying on the diurnal fluctuations of groundwater levels and, less frequently, of soil moisture values. The White-method, however modified many times, especially in the last decade, can be readily employed in preliminary riparian zone studies due to its simplicity. With streamflow data, the differences between the curves that connect the daily maxima and the actual streamflow rates serve as the basis for riparian ET estimation. Between these two basic ET estimation methods, as mentioned by several authors, a magnitude difference may exist. Presumably the White-method, relying on the groundwater signal, is more accurate because the so-derived ET rates compare favourably with traditional ET-estimation (Penman-Monteith or Bowen-ratio based) methods. It is felt that the information content residing in the diurnal cycle of the hydrological variables is still not explored to its full potential, therefore further exploration is highly recommended.

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