

Hydrogeological controls of groundwater - land surface interactions

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Interaction of groundwater with the land surface impacts a wide range of climatic, hydrologic, ecologic and geomorphologic processes. Many site-specific studies have successfully focused on measuring and modelling groundwater-surface water interaction, but upscaling or estimation at catchment or regional scale appears to be challenging. The factors controlling the interaction at regional scale are still poorly understood. In this contribution, a new 2-D (cross-sectional) analytical groundwater flow solution is used to derive a dimensionless criterion that expresses the conditions under which the groundwater outcrops at the land surface (Bresciani et al., 2016). The criterion gives insights into the functional relationships between geology, topography, climate and the locations of groundwater discharge along river systems. This sheds light on the debate about the topographic control of groundwater flow and groundwater-surface water interaction, as effectively the topography only influences the interaction when the groundwater table reaches the land surface. The criterion provides a practical tool to predict locations of groundwater discharge if a limited number of geomorphological and hydrogeological parameters (recharge, hydraulic conductivity and depth to impervious base) are known, and conversely it can provide regional estimates of the ratio of recharge over hydraulic conductivity if locations of groundwater discharge are known. A case study with known groundwater discharge locations located in South-West Brittany, France shows the feasibility of regional estimates of the ratio of recharge over hydraulic conductivity.

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