

On informal hypothesis testing in hydrology: the example of the “two water worlds” hypothesis

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Rigorous hypothesis tests provide useful tools for making statistical inferences about hydrological processes and have indeed led to major advances in the field of hydrology. However, the formulation of such (typically rather simple) tests with valid assumptions is not always realistic for complex hydrological problems with limited data. Moreover, ill-defined hypothesis tests can lead to meaningless results and increased risks of drawing ambiguous conclusions. In such cases, data plots can be more powerful than p-values. Nevertheless, the formulation and evaluation of (working) hypotheses can offer an important framework to structure data collection and analyses of a more exploratory nature. Here we demonstrate the power of such an approach using the example of the topical “two water worlds” hypothesis in (eco)hydrology. Several recent studies in this field have suggested that there may be “ecohydrological separation” of distinct soil water pools (“water worlds”) comprising plant-available water on one hand and water that drains to streams on the other. However, contrary to findings in most other climates, preliminary investigations in humid northern environments did not find strong evidence to support the hypothesis, which has further highlighted the complex nature of subsurface soil water storage processes and vegetation water use. While unambiguously rejecting or verifying the “two water worlds” hypothesis might be an unrealistic aim, studies addressing it more informally have so far led to new insights into e.g. soil-vegetation water interactions, the potential drivers of such separation and advances in our commonly used data collection and analyses techniques.