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(57) Abstract :
ESTIMATION OF CATCHMENT-SCALE SOIL MOISTURE FROM TOPOGRAPHY ABSTRACT Soil moisture patterns and dynamics are important for numerous applications such as flood forecasting, climate modeling, and management of agricultural lands. Unfortunately, widespread observations of soil moisture are not currently available at the spatial scale of most of these applications. Given these data limitations and the complexity of soil moisture dynamics, there is a need to gain a better understanding of soil moisture patterns and to develop methods that can efficiently estimate these patterns from limited observations. In this invention, we use Empirical Orthogonal Function (EOF) analysis to study the Tarrawarra soil moisture dataset from Australia. EOF analysis partitions the observed variation into a series of time-invariant spatial patterns (EOFs) that can be multiplied by temporal varying (but spatially constant) coefficients and summed to reconstruct observed soil moisture patterns. Using this approach, we identify two spatial patterns underlying soil moisture variability at Tarrawarra, which supports previous contentions that the spatial patterns are controlled by local soil properties in wet and dry conditions and topographic characteristics during intermediate conditions. We also use the EOF analysis to identify points whose variability is most representative of each of the underlying spatial patterns and thus can be used to monitor these distinct modes of variability. Finally, we show that the EOF approach can be used to estimate soil moisture patterns for unobserved times if a field campaign has collected detailed soil moisture observations for a limited time period in the past.

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