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Novel approach for evaluating the linearity of the temperature increase (ΔT) against the logarithm of time to determine soil thermal conductivity data in the full moisture range

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De Vries linear model was used to estimate the soil thermal conductivity by using the linear relationship between the temperature increase (ΔT) against the logarithm of time (lnT). Most studies found that linearity was not always achievable if the moisture was not uniformly distributed in the sample and sometimes an S-shaped curve is observed. In this study, we will derive an accurate offset of the relationship ΔT –lnT from single heat probe measurements to estimate soil thermal conductivity. These measurements combined with the evaporation method to obtain thermal conductivity (λ) data covering the whole soil moisture range from saturation to air-dryness. The approach will be achieved by including a stochastic component to the linear model, rearranging it to a time-varying dynamic linear model (DLM), and using Kalman filtering and smoothing.