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Supplement of

Hydraulic Redistribution Decreases with Precipitation Magnitude and Frequency in a Dryland Ecosystem: A Data-Model Fusion Approach

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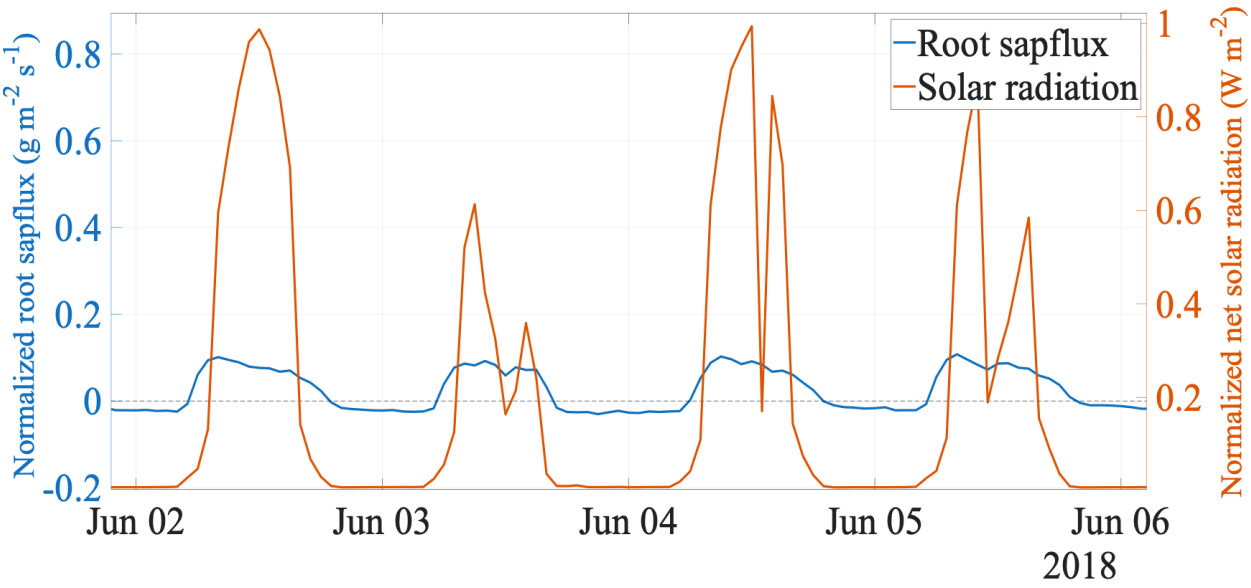

Figure S1: Diurnal patterns of normalized Juniper root sapflux (left axis) and normalized solar radiation (right axis). The graph illustrates that as solar radiation reaches close to zero during nightime, negative sapflux (HR) is observed in Juniper roots. All values are normalized to their respective maximum observed values.

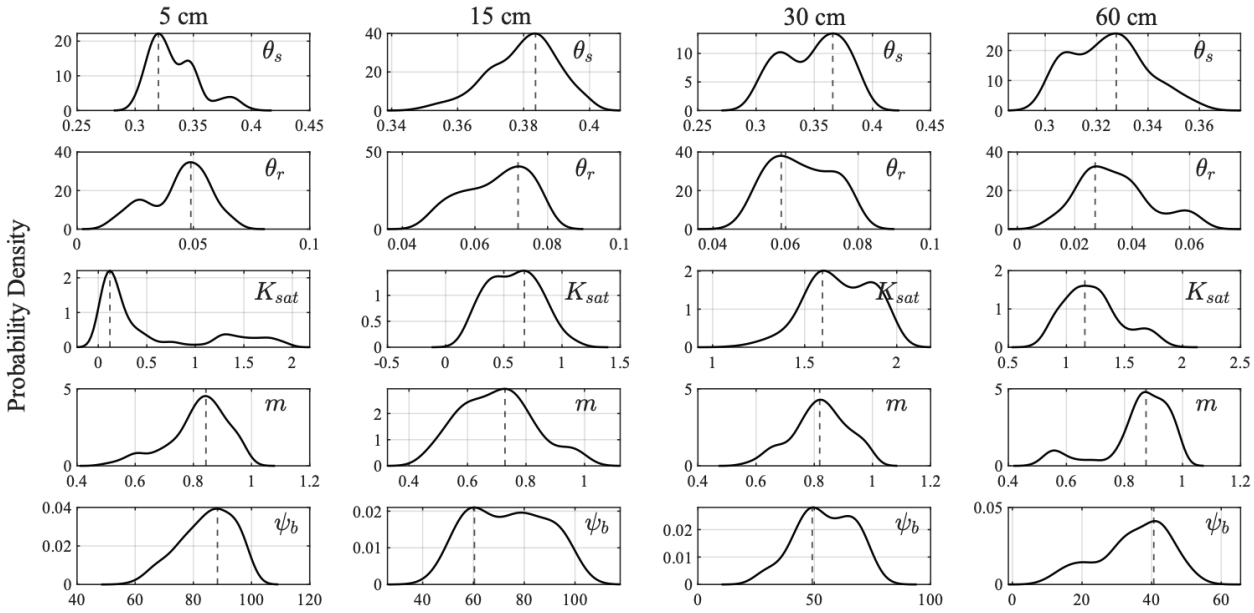

Figure S2: Posterior distributions of calibrated soil hydraulic parameters for the TECO+HR model across four soil depths (5, 15, 30, and 60 cm). Shown are saturated and residual soil water content (θ_s and θ_r, respectively), saturated hydraulic conductivity (K_{sat}), pore size distribution parameter (m), and air entry water potential (Ψ_b). Posterior distributions with sharp peaks and narrow spread suggest that parameters are well constrained.

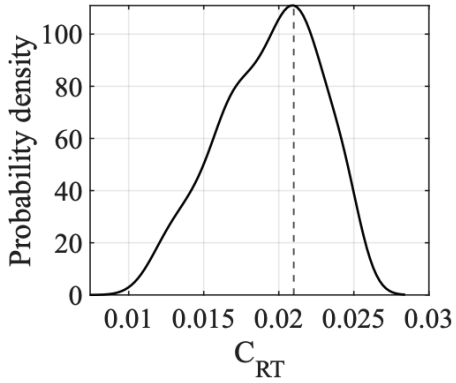

Figure S3: Posterior distribution of calibrated maximum radial soil-root conductance, C_{RT}.

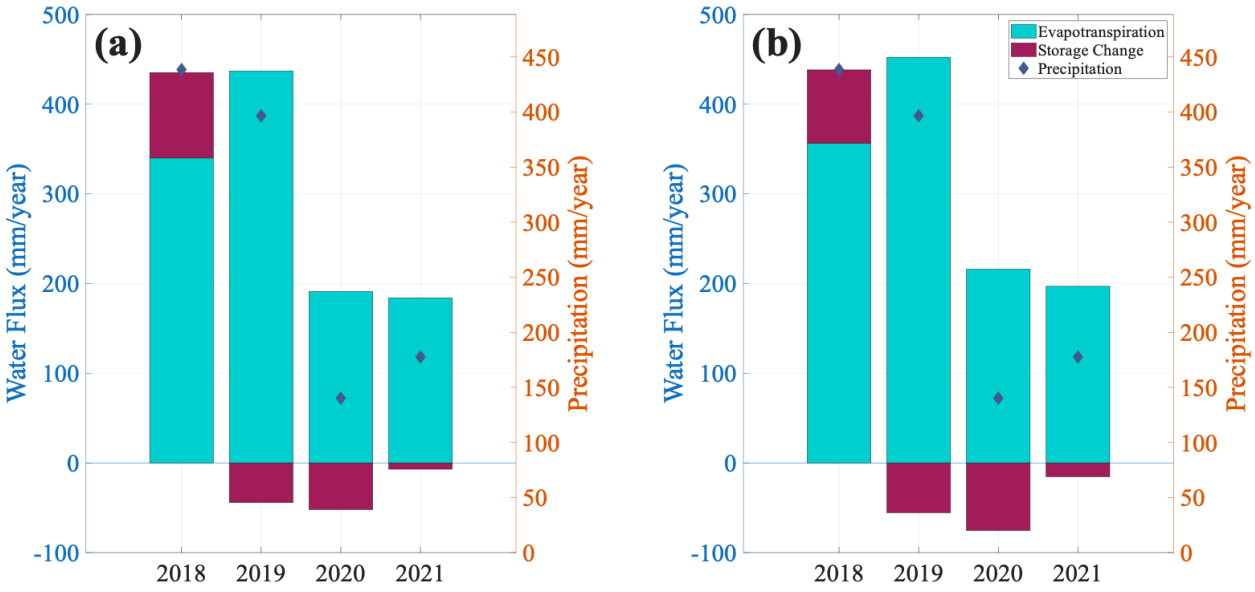

Figure S4. Annual water mass balance components (evapotranspiration and storage change) and precipitation for (a) the default TECO model and (b) the TECO+HR model from 2018 to 2021.

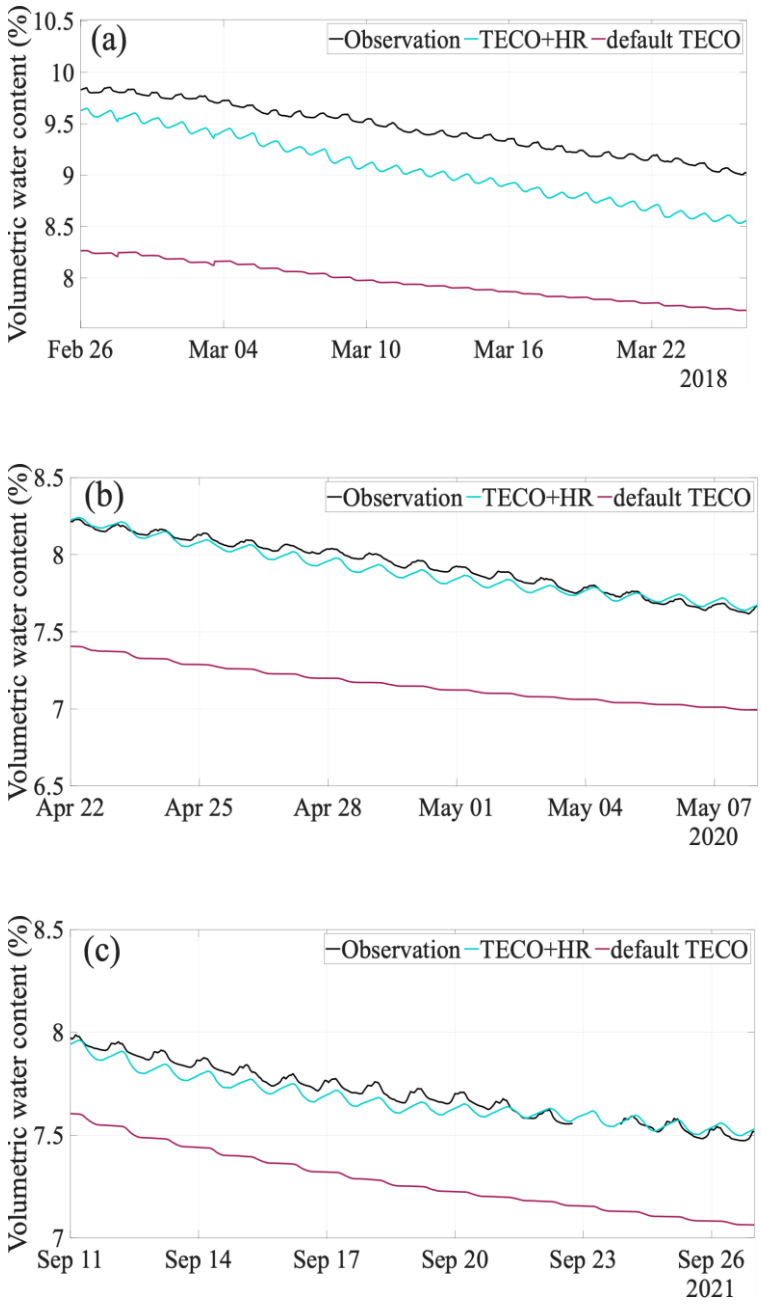

Figure S5: Observed and simulated diurnal soil moisture fluctuations integrated over the top 60 cm of soil profile during three representative dry periods in (a) 2018, (b) 2020, and (c) 2021. Black lines represent observations, cyan lines indicate the TECO+HR model, and magenta lines indicate the default TECO model.

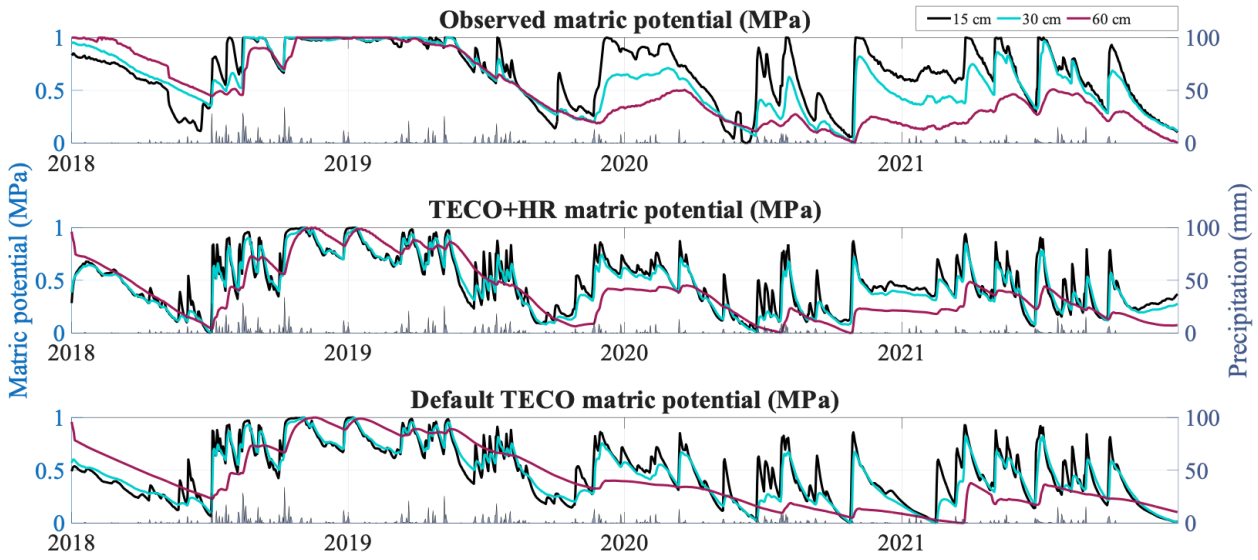

Figure S6: Time series of min-max normalized observed and simulated soil matric potential at 15, 30 and 60 cm soil depths. Panels compare (Top) observed data, (Middle) the TECO+HR model, and (Bottom) the default TECO model. Blue bars indicate daily precipitation.

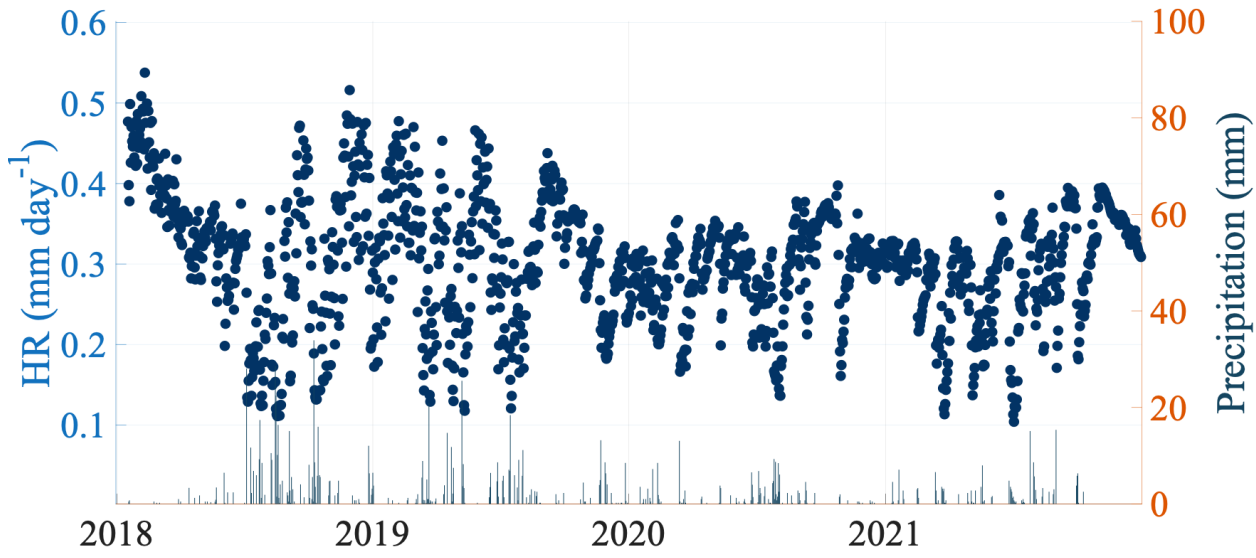

Figure S7: Long-term daily net HR trend (upto 60 cm soil depth) from January 2018 to December 2021. The blue vertical lines represent precipitation (right y-axis).

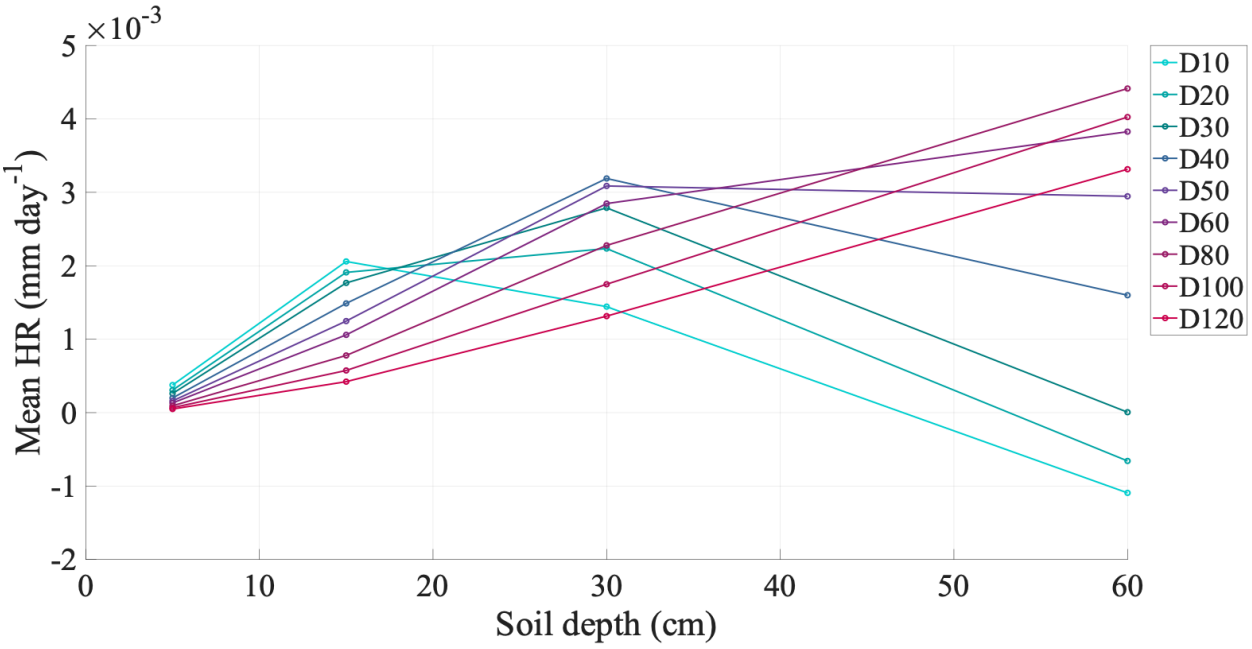

Figure S8: Mean Hydraulic Redistribution (HR) across soil depths for different rooting depths. Mean HR (mm day⁻¹) as a function of soil depth (cm), calculated by averaging daily HR values over a four-year period from 2018 to 2021. Each line represents different rooting depths (D10 to D120), indicating the influence of rooting depth on HR dynamics.