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Structural changes to forests during regeneration affect water flux partitioning, water ages and hydrological connectivity: Insights from tracer-aided ecohydrological modelling

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Table S1: Forcing data used for EcH_2O-iso

Forcing dataset(s)	Source	Temporal coverage	Notes
Precipitation	Interpolated using an inverse distance-weighted algorithm and five nearby (<10 km) gauges	Prior to July 2014	c.f. Capell et al. (2012)
	Up to three automated weather stations in the catchment	July 2014 onwards	-
Minimum and maximum air temperature	ERA-interim climate reanalysis	Prior to July 2014	See Dee et al. (2011)
	Up to three automated weather stations in the catchment	July 2014 onwards	-
Mean air temperature, relative humidity and windspeed	Balmoral weather station ~5 km away	Prior to July 2014	See Met Office (2017)
	Up to three automated weather stations in the catchment	July 2014 onwards	-
Short- and long-wave radiation	ERA-interim climate reanalysis	Full simulation period	See Dee et al. (2011)
Isotopic (δ^2H) composition of precipitation	ISCO 3700 sampler at catchment outlet	Full simulation period	Daily bulk samples were collected and preserved under a layer of paraffin. A Los Gatos DLT-100 was used for isotope analysis (δ^2H precision: ±0.4‰).

Table S2: The sampling ranges and 90%-spread calibrated ranges of soil, vegetation and channel parameters identified as sensitive in this application of EcH2O-iso. Additional information on parameter definitions can be found at: https://ech2o-iso.readthedocs.io/en/latest/Setup.html

Parameter	**Sampling range [90% spread calibrated range]**			
Soil	*Peat*	*Peaty gley*	*Podzol*	*Ranker*
Air entry pressure (m)	0.01-0.45	0.01-0.1	0.01-0.1	0.05-0.2
	[0.05-0.41]	[0.03-0.09]	[0.02-0.09]	[0.06-0.17]
Brooks-Corey lambda (-)	3.0-8.0	3.0-8.0	3.0-8.0	3.0-8.0
	[3.1-7.8]	[4.9-7.8]	[4.1-7.0]	[3.4-7.4]
Soil L1 depth (m)	0.05-0.15	0.05-0.15	0.05-0.15	0.05-0.15
	[0.05-0.13]	[0.05-0.14]	[0.06-0.13]	[0.06-0.14]
Soil L2 depth (m)	0.05-0.20	0.05-0.20	0.05-0.20	0.05-0.20
	[0.05-0.19]	[0.07-0.18]	[0.06-0.20]	[0.06-0.19]
Total soil depth (m)	0.5-40.0	0.5-40.0	0.5-10.0	0.5-5.0
	[0.7-36.4]	[1.1-27.2]	[1.7-8.3]	[0.7-4.6]
Saturated horizontal hydraulic	1.0×10^{-5}-1×10^{-2}	1.0×10^{-5}-1.0×10^{-3}	1.0×10^{-5}-1.0×10^{-3}	1.0×10^{-6}-1.0×10^{-4}
conductivity (ms^{-1})	[1.6×10^{-5}-3.6×10^{-3}]	[2.2×10^{-5}-8.5×10^{-4}]	[4.6×10^{-4}-9.1×10^{-4}]	[1.2×10^{-6}-8.2×10^{-5}]
Anisotropy (-)	1.0×10^{-3}-1.0	1.0×10^{-3}-0.6	1.0×10^{-3}-0.6	1.0×10^{-3}-0.6
	[1.6×10^{-3}-0.85]	[1.8×10^{-3}-0.35]	[1.3×10^{-3}-0.53]	[1.1×10^{-3}-0.22]
Conductivity exponential decay constant	1.0-5.0	1.0-5.0	1.0-5.0	1.0-5.0
(m^{-1})	[1.2-4.8]	[1.9-4.6]	[1.5-4.9]	[1.3-4.7]
Porosity ($m^3\ m^{-3}$)	0.8-0.98	0.7-0.9	0.4-0.7	0.4-0.6
	[0.81-0.93]	[0.74-0.89]	[0.50-0.69]	[0.42-0.57]
Porosity exponential decay constant (m^{-1})	5.0-10.0	5.0-10.0	3.0-5.0	0.5-1.0
	[5.4-9.7]	[5.5-9.3]	[3.2-4.9]	[0.6-1.0]
Vegetation	*Pre-existing pine*	*Heather*	*Sphagnum*	*Molinia grass*
LAI ($m^2\ m^{-2}$)	2.0-4.0	1.4-2.0	2.0-3.5	1.0-3.0
	[2.2-3.8]	[1.5-2.0]	[2.1-3.4]	[1.2-2.8]
Maximum canopy water storage (m LAI^{-1})	3.0×10^{-4}-3.0×10^{-3}	5.0×10^{-4}-2.0×10^{-3}	1.0×10^{-3}-1.0×10^{-2}	1.0×10^{-4}-5.0×10^{-4}
	[3.5×10^{-4}-2.7×10^{-3}]	[5.4×10^{-4}-1.7×10^{-3}]	[1.2×10^{-3}-7.9×10^{-3}]	[1.4×10^{-4}-4.7×10^{-4}]
Maximum stomatal conductance (ms^{-1})	3.3×10^{-3}-8.1×10^{-3}	5.2×10^{-3}-6.6×10^{-3}	1.3×10^{-2}-1.8×10^{-2}	6.4×10^{-3}-1.5×10^{-2}
	[3.6×10^{-3}-7.9×10^{-3}]	[5.3×10^{-3}-6.5×10^{-3}]	[1.3×10^{-2}-1.8×10^{-2}]	[6.6×10^{-3}-1.4×10^{-2}]
Stomatal sensitivity to light (-)	200-500	200-500	200-500	200-500
	[213-452]	[223-442]	[220-496]	[222-479]
Stomatal sensitivity to vapour pressure	1.0×10^{-3}-3.0×10^{-3}	1.0×10^{-3}-3.0×10^{-3}	1.0×10^{-3}-3.0×10^{-3}	1.0×10^{-3}-3.0×10^{-3}
deficit (-)	[1.9×10^{-3}-2.9×10^{-3}]	[1.1×10^{-3}-2.9×10^{-3}]	[1.1×10^{-3}-2.9×10^{-3}]	[1.1×10^{-3}-2.8×10^{-3}]
Soil water potential (-MPa):				
• Causing complete stomatal closure	1.5-6.0	1.5-6.0	1.5-6.0	1.5-6.0
	[1.8-5.8]	[1.8-5.7]	[1.8-5.6]	[1.6-5.8]
• No longer limiting stomatal conductance	0.1-1.0	0.1-1.0	0.1-1.0	0.1-1.0

	[0.14-0.95]	[0.20-0.96]	[0.22-0.89]	[0.14-0.92]
Minimum temperature of comfort (°C)	-5.0--3.0	-5.0--3.0	-5.0--3.0	-6.0--3.0
	[-5.0--3.1]	[-4.8--3.2]	[-4.8--3.3]	[-5.8--3.1]
Optimal temperature (°C)	10.0-25.0	15.0-25.0	10.0-18.0	12.0-18.0
	[11.0-24.2]	[15.3-24.4]	[10.3-17.3]	[12.2-17.2]
Maximum temperature of comfort (°C)	35.0-42.0	40.0-45.0	38.0-42.0	30.0-40.0
	[35.4-41.4]	[40.5-44.8]	[38.1-41.7]	[31.7-39.1]
Light attenuation coefficient (-)	0.3-0.6	0.3-0.6	0.3-0.6	0.3-0.6
	[0.33-0.58]	[0.36-0.58]	[0.39-0.60]	[0.33-0.58]
Vertical root distribution exponential	10.0-20.0	27.0-40.0	27.0-100.0	6.0-10.0
decay constant (m^{-1})	[10.9-19.5]	[28.1-39.2]	[32.5-82.8]	[6.6-10.0]
Channel				
Channel resistance to groundwater	0.01-0.05			
seepage (-)	[0.01-0.04]			
Manning's n	1.0-50.0			
	[4.8-49.1]			

Supplementary figures

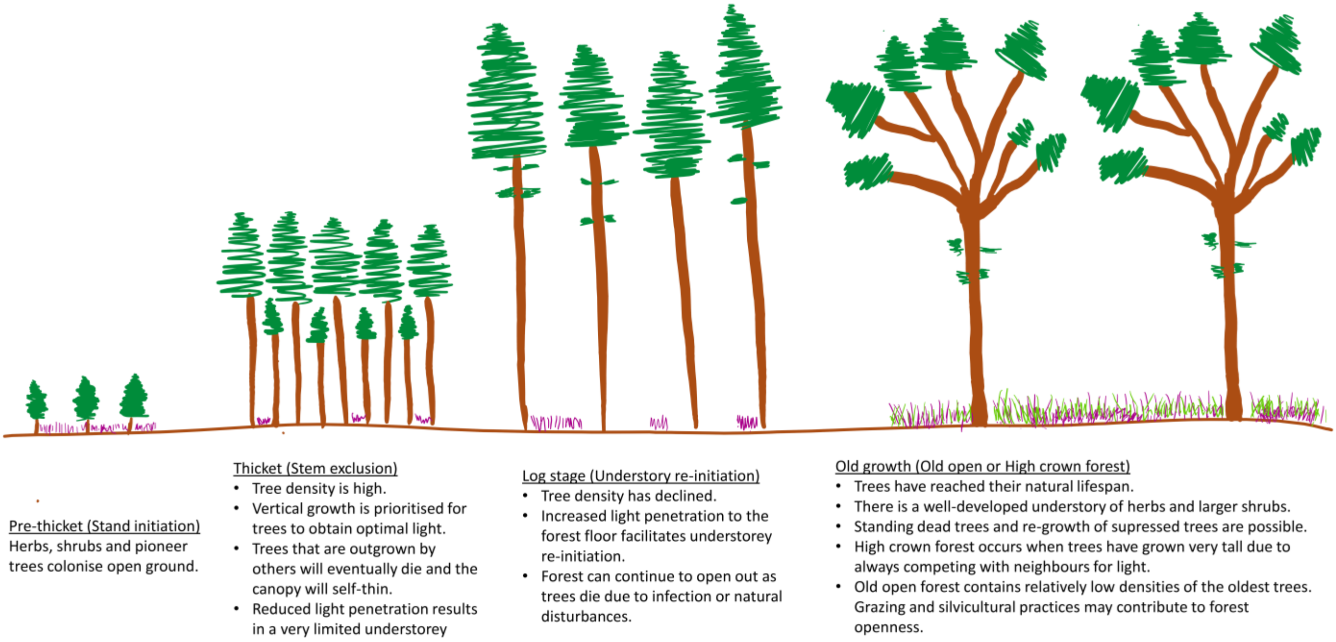


Figure S1: Summary of natural pinewood regeneration. After Summers (2018) and Summers et al. (2008).

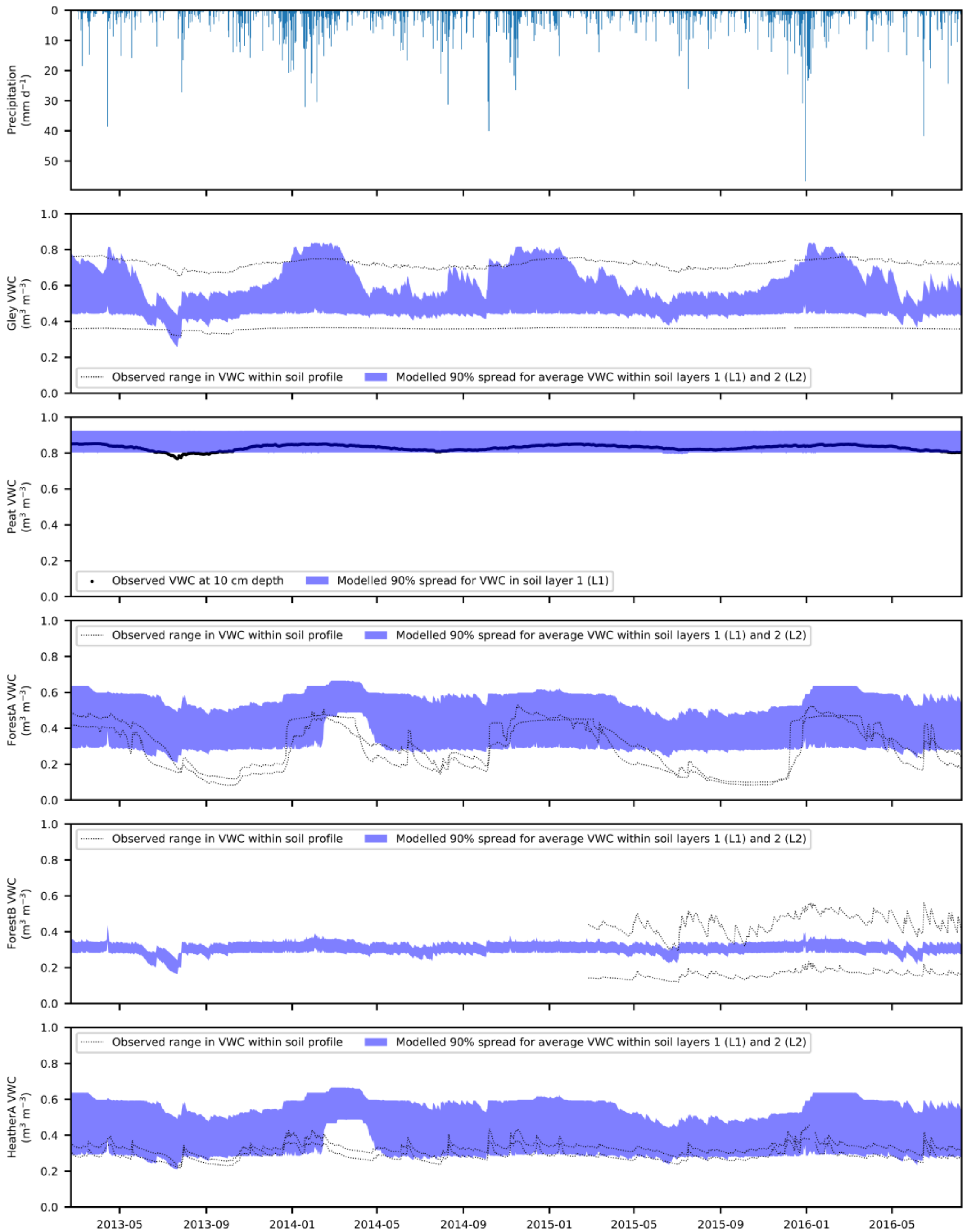


Figure S2: Time series of observed and simulated volumetric water content (VWC) at sites not shown in Figure 3. 90% spread of simulations are from the 30 behavioural model runs.

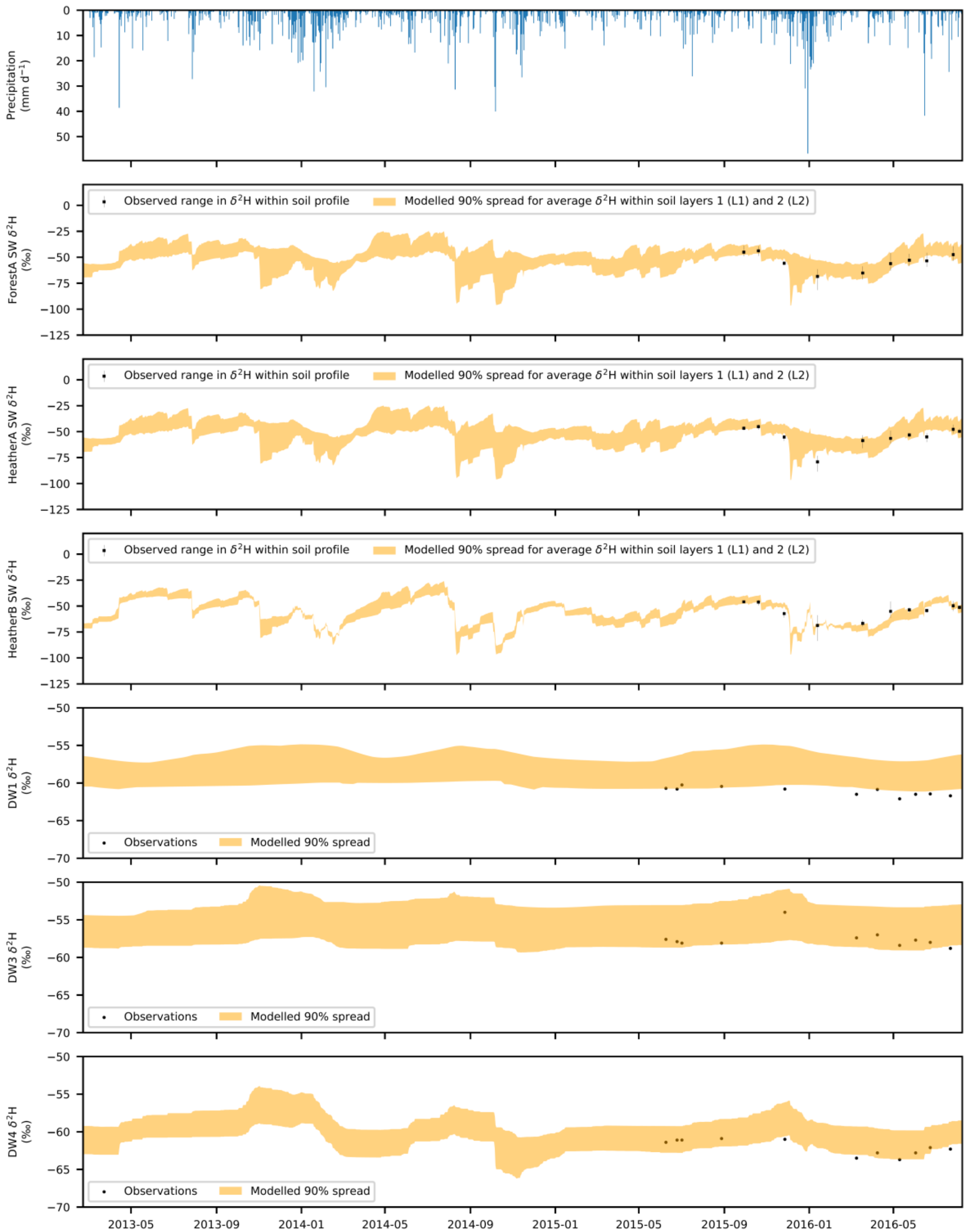
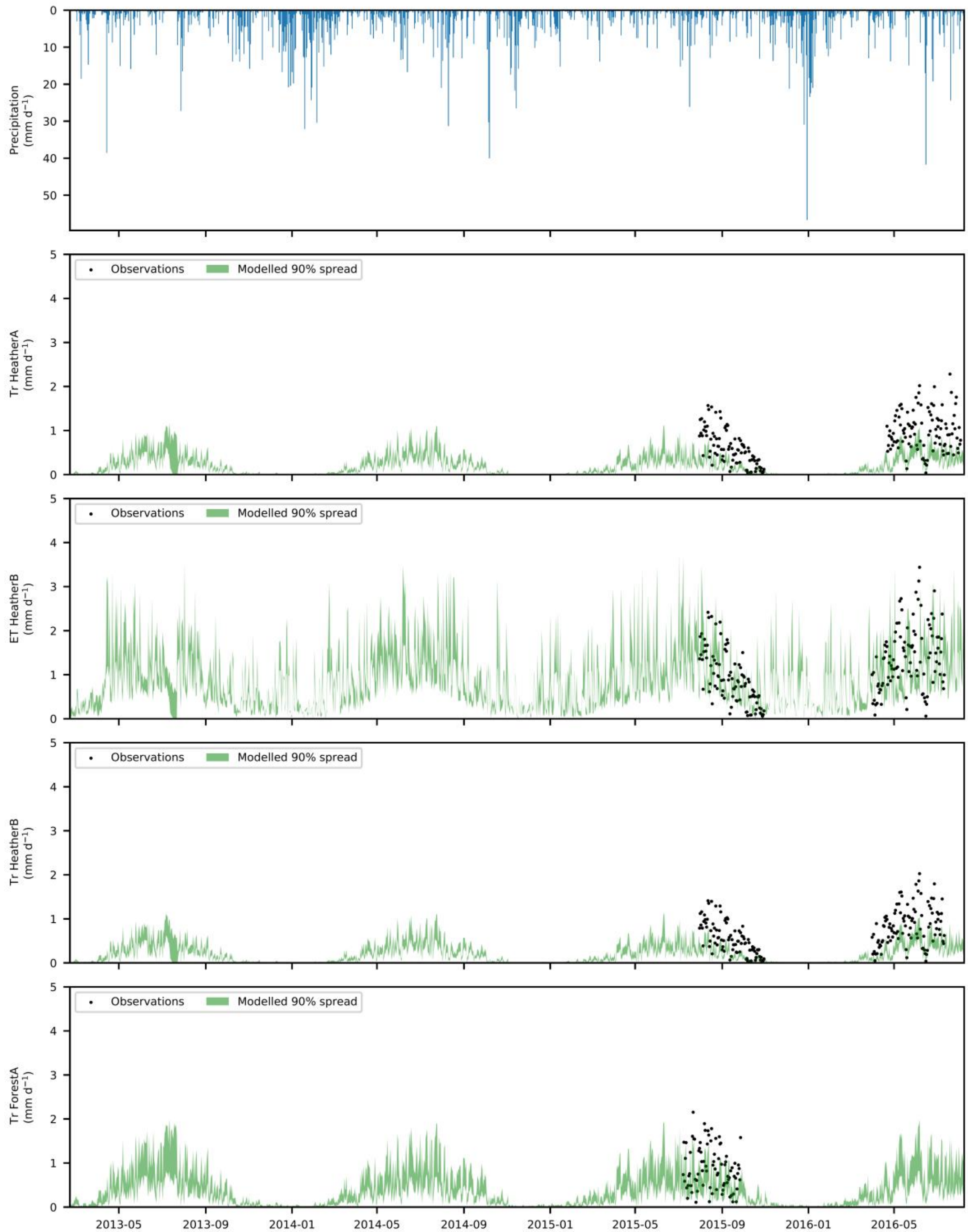


Figure S3: Time series of observed and simulated soil water (SW) and deeper groundwater (DW) isotopes at sites not shown in Figure 3. 90% spread of simulations are from the 30 behavioural model runs.



25 **Figure S4: Time series of observed and simulated evapotranspiration (ET) and transpiration (Tr) at sites not shown in Figure 3. 90% spread of simulations are from the 30 behavioural model runs.**

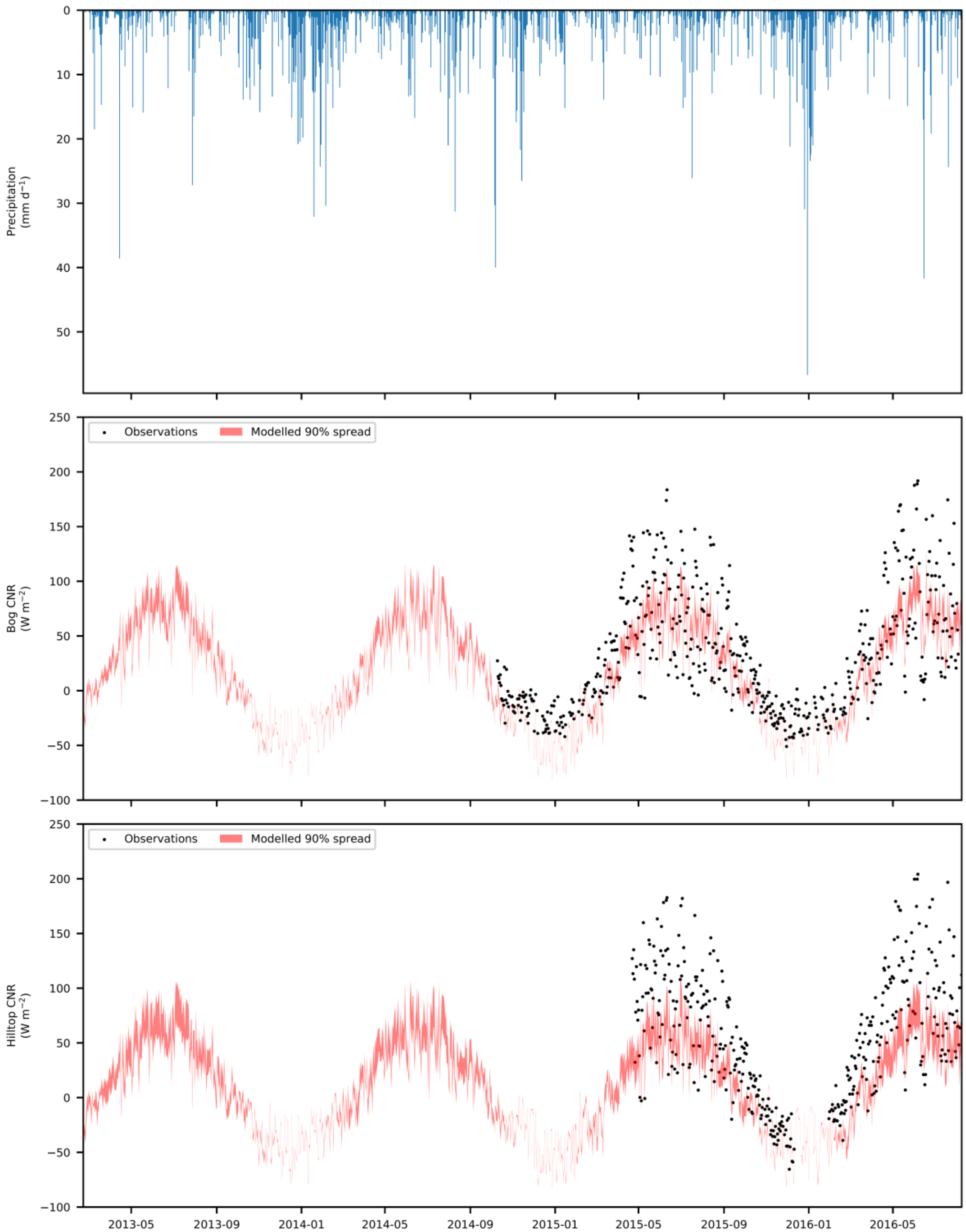


Figure S5: Time series of observed and simulated net radiation (CNR) at sites not shown in Figure 3. 90% spread of simulations are from the 30 behavioural model runs.

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