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Vadose zone modeling to identify controls on groundwater recharge in an unconfined granular aquifer in a cold and humid environment with different meteorological data sources

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Table S1 Range of VWC values monitored and simulated by each sensor at the three sites

		Observed				Simulated			
SLZA		**10 cm**	**20 cm**	**50 cm**	**100 cm**	**10 cm**	**20 cm**	**50 cm**	**100 cm**
	Min	0.017	0.000	0.070	0.027	0.074	0.032	0.077	0.026
	Max	0.186	0.079	0.101	0.056	0.190	0.089	0.109	0.079
	Mean	0.120	0.051	0.083	0.037	0.118	0.049	0.083	0.037
SLZB		**10 cm**	**20 cm**	**50 cm**	**100 cm**	**10 cm**	**20 cm**	**50 cm**	**100 cm**
	Min	0.039	0.015	0.003	0.055	0.040	0.022	0.013	0.061
	Max	0.395	0.146	0.148	0.094	0.328	0.118	0.137	0.115
	Mean	0.146	0.052	0.055	0.071	0.142	0.054	0.058	0.072
STEL		**25 cm**	**50 cm**	**75 cm**	**100 cm**	**25 cm**	**50 cm**	**75 cm**	**100 cm**
	Min	0.126	0.037	0.042	0.040	0.208	0.037	0.043	0.046
	Max	0.365	0.076	0.081	0.081	0.368	0.079	0.084	0.092
	Mean	0.294	0.048	0.052	0.056	0.301	0.049	0.054	0.058

Table S2 Initial van Genuchten-Mualem (VGM) parameters as input values to the vadose zone model

IRRES site	**Depth (cm)**	θr	θs	α **(1/cm)**	n	K_s **(cm/day)**
SLZA	0-15	0.040	0.39	0.043	2.74	375
	16-30	0.043	0.39	0.041	3.16	1036
	31-70	0.048	0.38	0.037	3.84	950
	71-300	0.051	0.38	0.034	4.42	950
SLZB	0-15	0.035	0.39	0.048	2.22	216
	16-30	0.037	0.39	0.046	2.39	241
	31-60	0.044	0.39	0.040	3.26	820
	60-300	0.051	0.38	0.034	4.42	950
STEL	0-40	0.034	0.40	0.049	2.08	362
	41-65	0.046	0.38	0.039	3.49	1296
	66-80	0.046	0.38	0.039	3.49	1296
	81-300	0.050	0.38	0.035	4.21	1900

Table S3 Calibration bounds for the van Genuchten-Mualem (VGM) parameters used in model calibration

IRRES site	Layer	θr (-)	θs (-)	α (1/cm)	n (-)	K_s (cm/day)	l (-)
SLZA	1	0.001-0.1	-	0.01-0.40	1.1-3.0	100-700	-1 to 1
	2	0.001-0.1	-	0.01-0.40	1.1-4.5	700-2000	-1 to 1
	3	0.001-0.1	-	0.01-0.50	2.0-4.5	700-2000	-1 to 1
	4	0.001-0.1	-	0.01-0.50	2.0-4.5	700-2000	-1 to 1
SLZB	1	0.001-0.05	0.39-0.60	0.01-0.40	1.1-3.5	100-500	-1 to 1
	2	0.001-0.05	-	0.01-0.40	1.1-3.5	100-1000	-1 to 1
	3	0.001-0.05	-	0.01-0.40	1.5-4.5	500-1500	-1 to 1
	4	0.001-0.1	-	0.01-0.40	2.0-4.5	500-2000	-1 to 1
STEL	1	0.01-0.20	0.35-0.50	0.005-0.5	1.1-3.5	100-700	-1 to 1
	2	0.001-0.05	-	0.01-0.40	3.0-4.5	700-2500	-1 to 1
	3	0.001-0.05	-	0.01-0.40	3.0-4.5	700-2500	-1 to 1
	4	0.001-0.05	-	0.01-0.40	3.0-4.5	700-2500	-1 to 1

Table S1 Optimized van Genuchten-Mualem (VGM) parameters for the three sites at each soil layer defined in the model

IRRES site	depth (cm)	θr (-)	θs (-)	α (1/cm)	n (-)	K_s (cm/day)	l (-)
SLZA	0-15	0.073	0.390	0.075	1.94	161	0.049
	16-30	0.032	0.387	0.036	3.54	1714	0.068
	31-70	0.076	0.382	0.033	4.5	1782	0.418
	71-300	0.020	0.376	0.023	3.82	1350	0.311
SLZB	0-15	0.040	0.442	0.020	3.32	160	0.024
	16-30	0.022	0.393	0.048	2.55	400	0.474
	31-60	0.004	0.386	0.035	2.75	508	0.523
	60-300	0.058	0.376	0.034	4.39	1154	0.502
STEL	0-40	0.011	0.378	0.041	1.12	143	1
	41-65	0.037	0.385	0.029	4.15	2498	0.001
	66-80	0.042	0.385	0.034	4.38	2373	0.010
	81-300	0.043	0.379	0.038	4.47	2497	0.857

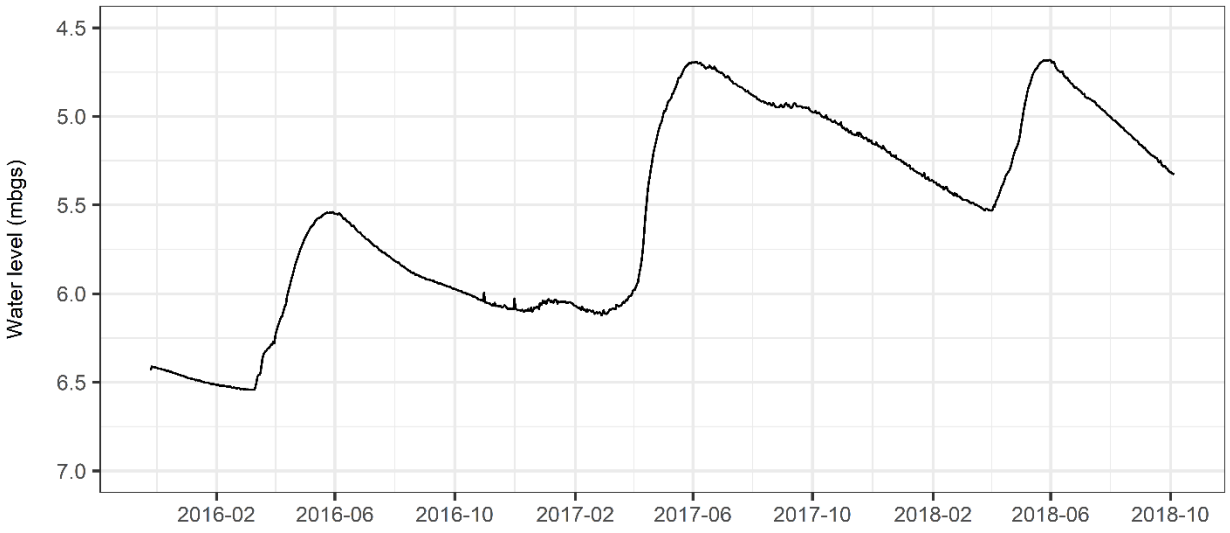

Fig. S1 Measured groundwater levels (depth below the ground surface) at the SLZ site from 2016 to 2018

Fig. S2 Measured groundwater levels (depth below the ground surface) at the STEL site from 2016 to 2018