

Evaluating recharge estimates based on groundwater head from different lumped models in Europe, Seidenfaden, I.K., Mansour, M., Bessiere, H. , Pulido-Velázquez, D.P., Atanskovic Samolov, K., Baena-Ruiz, L., Bishop, H., Dessì, B., Hinsby, K., Hunter Williams, N.H., Højberg, A., Kroon, T., Larva, O. , Martarelli, L. , Mowbray, R., Nielsen, A. J, Ohman, J., Petrovic Pantic, T., Stroj, A. , van der Keur, P., Zaadnoordijk, W.J., Electronic supplementary material – Hydrogeology Journal, corresponding author: Seidenfaden, I.K., Geological Survey of Denmark and Greenland, GEUS, ika@geus.dk

Table S1 Overview of pilot areas. *Climatic zone: M - Mediterranean, TO - Temperate Oceanic, TC - Temperate Continental, TT - Temperate Transitional; **Aquifer type: A – Alluvial, SP- Sedimentary Porous, SK – Sedimentary Karstic, SF – Sedimentary fissured, B – Bedrock; *** Quality of observation data between 1981 and 2010

PILOT INFORMATION				CLIMATE (Annual average)				AQUIFER		HYDROLOGY AFFECTED BY				GROUNDWATER LEVEL OBSERVATIONS	
Country	Name	Latitude	Time series no.	Climatic zone*	Precipitation (mm)	Potential evapotranspir- ation (mm)	Temperature (degree C)	Type**	Un=Unconfin- ed, Con= Confined	I=Insignificant, M=Moderate, H=High		+ Indicate that data are known and included		No. of filters analyzed	Temporal resolution
										Surface runoff	Tile drainage in the area	Stream discharge	Groundwater abstraction		
CR	Drava-Mura	46.34	73	TC	850	780	11.3	A	Un.	I	None	no	no	1	Day
CR	Vrana lake	43.90	77	M	900	1000	15	SK	Un.	I	None	-	yes (+)	1	Month
DK	Sunds	56.24	3-5	TO	760	675	8.6	SP	Both	I	H	yes (+)	yes (+)	3	Month
DK	Alhergaarde	56.11	6-7	TO	990	790	8.9	SP	Con.	I	M	yes (+)	yes (+)	2	Month
DK	Falster	54.83	9	TT	1022	609	8.5	SP	Con.	M	M	yes (+)	yes (+)	1	Month
FR	Somme	50.02	65	TO	631	718	10.9	SF	Un.	I	I	yes (+)	no	1	Day
FR	France_Ter	49.08	66	TO	605	777	11.2	SF	Un	M	None	no	no	1	Decadal
FR	France_Per	48.98	67	TO	605	755	11	SF	Un	-	None	no	no	1	Decadal
FR	France_Hno	48.84	68	TO	612	742	10.8	SF	Un	I	None	yes (+)	yes (+)	1	Day
FR	France_Mar	48.79	69	TO	605	755	11	SF	Un	-	None	no	No	1	Decadal
FR	France_Cha	48.37	70	TO	695	770	10.7	SF	Un	M	None	yes (+)	yes (+)	1	Decadal
FR	France_Bre	48.23	71	TO	1030	665	10.7	B	Un	H	None	yes (+)	no	1	Day
FR	France_Bou	47.53	72	TO	924	854	11	SP	Un	H	None	yes (+)	no	1	Day
IR	Allen	53.23	15	TO	853	543	13.8	SP?	Un.	H	None	no	no	1	Day
IR	MB07B	53.19	16	TO	868	544	13.8	SP?	Un.	I	None	no	no	1	Day
IR	MB30	53.16	17	TO	866	546	13.8	SP?	Un.	I	None	no	no	1	Day
IR	Tully	53.14	18	TO	852	542	13.8	SP?	Un.	I	None	yes	no	1	Day
IR	Vickerstown	53.05	20	TO	810	530	13.8	SP?	Un.	M	None	no	no	1	Day
IR	Ballyragget	52.8	31	TO	776	485	13.8	SP?	Un.	M	None	yes (+)	no	1	Day
IR	Freshford	52.74	33	TO	866	522	13.8	SP?	Un.	M	None	no	no	1	Day
IR	Borrismore	52.70	34	TO	860	530	13.8	SP?	Un.	M	None	no	no	1	Day
IT	Castel Franco	45.68	74	M	1240	1210	14	SP	Un.	M	None	no	no	1	Day
IT	Cittadella	45.65	75	M	1240	1210	14	SP	Un.	M	None	no	no	1	Day

Evaluating recharge estimates based on groundwater head from different lumped models in Europe, Seidenfaden, I.K., Mansour, M., Bessiere, H. , Pulido-Velázquez, D.P., Atanskovic Samolov, K., Baena-Ruiz, L., Bishop, H., Dessì, B., Hinsby, K., Hunter Williams, N.H., Højberg, A., Kroon, T., Larva, O. , Martarelli, L. , Mowbray, R., Nielsen, A. J, Ohman, J., Petrovic Pantic, T., Stroj, A. , van der Keur, P., Zaadnoordijk, W.J., Electronic supplementary material – Hydrogeology Journal, corresponding author: Seidenfaden, I.K., Geological Survey of Denmark and Greenland, GEUS, ika@geus.dk

NL	NL-B11	52.95	21-24	TO	806	566	9.8	SP	Both	I	M	no	no	4	24/y
NL	NL-B14	52.84	26-30	TO	788	619	10.5	SP	Both	I	H	no	no	5	24/y
NL	NL-B32	52.05	35	TO	856	581	10.6	SP	Un.	I	M	no	no	1	24/y
NL	NL-dR4	51.74	37-40	TO	740	597	10.5	SP	Both	I	M	no	no	5	Day
NL	NL-dR9	51.71	42-43	TO	740	597	10.5	SP	Both	I	M	no	no	2	Day
NL	NL-dR8	51.67	44-48	TO	740	597	10.5	SP	Both	I	M	yes	no	5	Day
NL	NL-B45	51.64	49-51	TO	740	597	10.5	SP	Un.	I	M	no	no	3	24/y
NL	NL-B50	51.51	54-56	TO	800	595	10.6	SP	Both	I	M	no	no	3	24/y
SE	Posavina	44.79	76	TC	52	75	11.8	A	Con.	H	None	yes (+)	no	1	Month
SP	U. Guadiana	38.94	78	M	465	1200	14.7	SK	Un.	I	None	no	no	1	Month
SW	Kinda	57.98	1	TC	700	563	6.3	A	Un.	I	None	no	no	1	Month
SW	Böda	57.28	2	TC	500	610	7.7	A	Un.	I	M	no	no	1	Month
UK	UK_TrS_Newb	55.11	8	TO	1294	475	12.8	SP	Un.	I	I	no	no	1	Day
UK	UK_TrS_Skir	54.69	10	TO	886	467	11.5	SP	Con.	I	I	no	no	1	Day
UK	UK_Ma_Swan	54.57	11	TO	644	482	13.1	SF	Con.	I	I	no	no	1	Day
UK	UK_TrS_Furn	54.13	12	TO	1131	590	13.2	SP	Both	I	I	no	no	1	Day
UK	UK_Ch_Ayle	53.53	13	TO	655	502	13.6	SF	Un.	I	I	no	no	1	Day
UK	UK_De_Huck	53.3	14	TO	964	479	11.5	SK	Un.	I	I	no	no	1	Day
UK	UK_De_Alst	53.1	19	TO	1170	577	11.5	SK	Un.	I	I	no	no	1	Day
UK	UK_Ju_New	52.85	25	TO	610	510	13.7	SK	Both	I	I	no	no	1	Day
UK	UK_TrS_Heat	52.78	32	TO	794	520	13.6	SP	Un.	I	I	no	no	1	Day
UK	UK_Ch_Ther	52.02	36	TO	686	515	14.5	SF	Con	I	I	no	no	1	Day
UK	UK_Ju_Ampn	51.72	41	TO	793	625	14	SK	Un.	I	I	no	no	1	Day
UK	UK_Ch_Ston	51.6	52	TO	721	520	14.4	SF	Un.	I	I	no	no	1	Day
UK	UK_Ju_Didm	51.58	53	TO	858	518	13.6	SK	Con.	I	I	no	no	1	Day
UK	UK_De_Pant	51.46	57	TO	1160	703	13.7	SK	Un.	I	I	no	no	1	Day
UK	UK_Ch_Rock	51.45	58	TO	856	510	14	SF	Un.	I	I	no	no	1	Day
UK	UK_Ch_Well	51.27	59	TO	792	522	14.5	SF	Un.	I	I	no	no	1	Day
UK	UK_Ch_Clan	51.23	60	TO	806	536	13.6	SF	Un.	I	I	no	no	1	Day
UK	UK_Ch_Litt	51.2	61	TO	796	529	14	SF	Un.	I	I	no	no	1	Day
UK	UK_Ch_WestW	50.96	62	TO	917	526	14.3	SF	Un.	I	I	no	no	1	Day
UK	UK_Ch_Chil	50.9	63	TO	1046	526	14.5	SF	Un.	I	I	no	no	1	Day
UK	UK_Ch_Westd	50.77	64	TO	774	542	14.1	SF	Un.	I	I	no	no	1	Day

Evaluating recharge estimates based on groundwater head from different lumped models in Europe, Seidenfaden, I.K., Mansour, M., Bessiere, H. , Pulido-Velázquez, D.P., Atanskovic Samolov, K., Baena-Ruiz, L., Bishop, H., Dessì, B., Hinsby, K., Hunter Williams, N.H., Højberg, A., Kroon, T., Larva, O. , Martarelli, L. , Mowbray, R., Nielsen, A. J, Ohman, J., Petrovic Pantic, T., Stroj, A. , van der Keur, P., Zaadnoordijk, W.J., Electronic supplementary material – Hydrogeology Journal, corresponding author: Seidenfaden, I.K., Geological Survey of Denmark and Greenland, GEUS, ika@geus.dk

Table S2 Overview of pilot areas with national or local model estimations of recharge in mm/year. Q – indicated that stream discharge was part of the objective function during calibration. I – Indicates that Aquimod in this case estimates inter-aquifer leakage and results should therefore only be compared with the final column Local model (Inter-aquifer leakage).

Name	METTRAN	AQUIMOD	GARDENIA	National model	Local model (Recharge)	Local model (Inter-aquifer leakage)
1.Sw_Kin	202	344	46	239	-	-
2.Sw_Bod	228	119	-	105	-	-
3.DK_Su1	741	-	-	547	393	13
4.DK_Su2	792	-	320 ^Q	547	393	42
5.DK_Su3	834	11 ^I	364 ^Q	547	393	105
6.DK_Ah1	570	-	496 ^Q	530	324	13
7.DK_Ah2	570	9 ^I	523 ^Q	530	324	40
8.UK_Ne	1011	317	-	402	-	-
9.DK_Fal	-	-	93 ^Q	354	93	10
10.UK_Sk	499	183	-	391	-	-
11.UK_Swa	224	85	279	128	-	-
12.UK_Fu	624	533	-	304	-	-
13.UK_Ayl	-	154	-	168	-	-
14.UK_Huc	-	362	-	654	-	-
19.UK_Als	369	402	720	622	-	-
25.UK_New	262	105	-	93	-	-
32.UK_He	498	205	391	119	-	-
36.UK_The	-	89	-	141	-	-
41.UK_Amp	140	235	-	239	-	-
44.NL-d8-1	336	137	274	276	197	-
52.UK_Sto	-	194	-	317	-	-
53.UK_Did	-	327	479	322	-	-
57.UK_Pan	711	455	-	493	-	-
58.UK_Roc	476	284	-	302	-	-
59.UK_Wel	486	255	-	337	-	-
60.UK_Cla	-	282	-	264	-	-
61.UK_Lit	358	264	-	311	-	-

Evaluating recharge estimates based on groundwater head from different lumped models in Europe, Seidenfaden, I.K., Mansour, M., Bessiere, H. , Pulido-Velázquez, D.P., Atanskovic Samolov, K., Baena-Ruiz, L., Bishop, H., Dessì, B., Hinsby, K., Hunter Williams, N.H., Højberg, A., Kroon, T., Larva, O. , Martarelli, L. , Mowbray, R., Nielsen, A. J, Ohman, J., Petrovic Pantic, T., Stroj, A. , van der Keur, P., Zaadnoordijk, W.J., Electronic supplementary material – Hydrogeology Journal, corresponding author: Seidenfaden, I.K., Geological Survey of Denmark and Greenland, GEUS, ika@geus.dk

62.UK_WeW	297	366	-	374	-	-
63.UK_Chi	694	423	543	403	-	-
65.Fr_Som	511	-	183 ^Q	-	233	-
73.Cr_Dra	388	-	-	-	185	-
78.Sp_Ugu	420	70	-	-	66	-

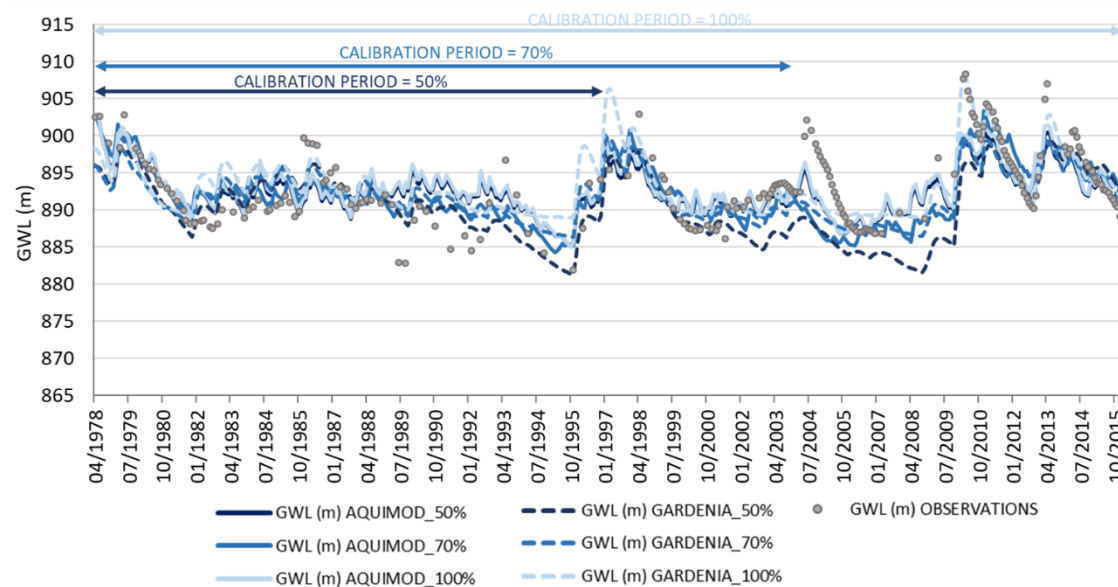


Fig. S1 Observed and simulated groundwater levels (m) with GARDENIA and AQUIMOD in Campo de Montiel (Spain)

Evaluating recharge estimates based on groundwater head from different lumped models in Europe, Seidenfaden, I.K., Mansour, M., Bessiere, H. , Pulido-Velázquez, D.P., Atanskovic Samolov, K., Baena-Ruiz, L., Bishop, H., Dessì, B., Hinsby, K., Hunter Williams, N.H., Højberg, A., Kroon, T., Larva, O. , Martarelli, L. , Mowbray, R., Nielsen, A. J, Ohman, J., Petrovic Pantic, T., Stroj, A. , van der Keur, P., Zaadnoordijk, W.J., Electronic supplementary material – Hydrogeology Journal, corresponding author: Seidenfaden, I.K., Geological Survey of Denmark and Greenland, GEUS, ika@geus.dk

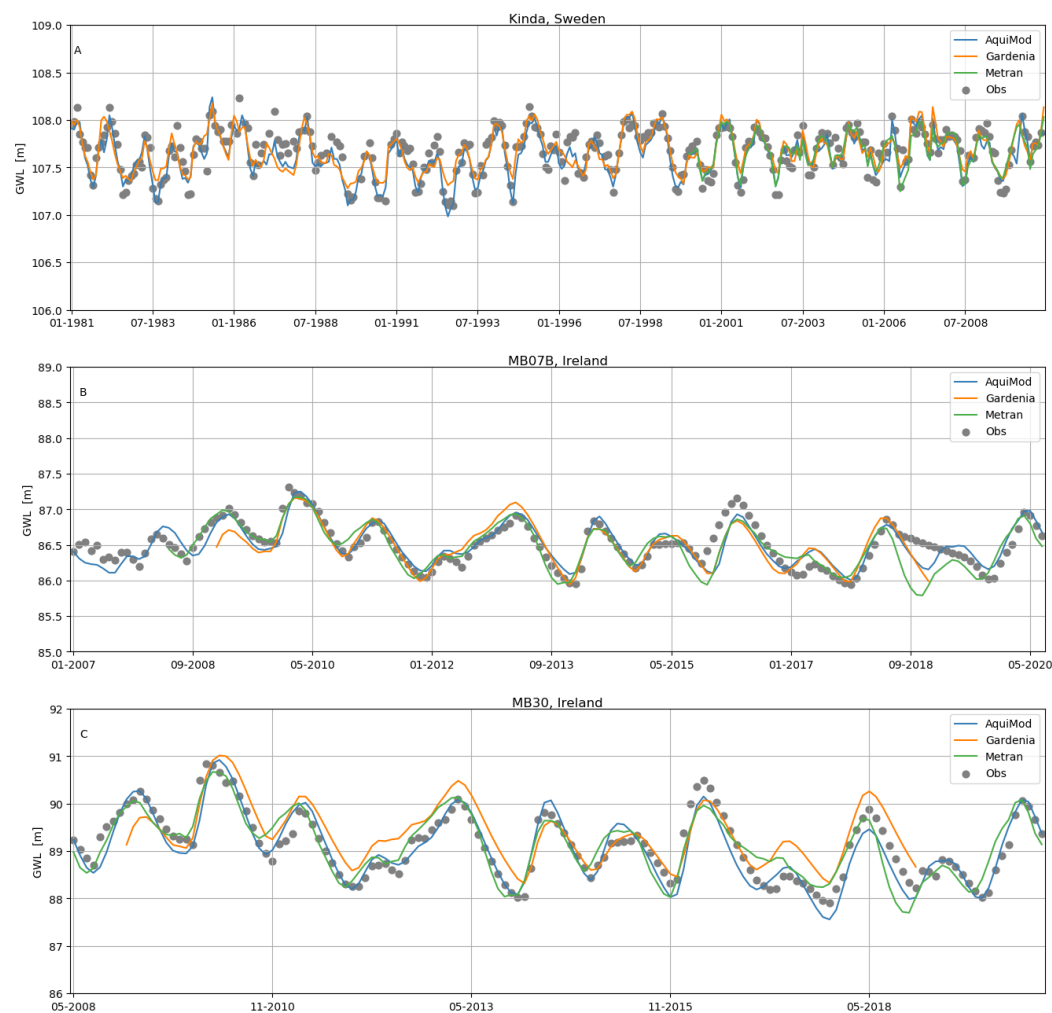


Fig. S2 Observed and simulated groundwater levels (m) with GARDÉNIA and Aquimod. Selected results are shown for the three time series at two case studies: Sweden (A) and Ireland (B and C).

Evaluating recharge estimates based on groundwater head from different lumped models in Europe, Seidenfaden, I.K., Mansour, M., Bessiere, H. , Pulido-Velázquez, D.P., Atanskovic Samolov, K., Baena-Ruiz, L., Bishop, H., Dessì, B., Hinsby, K., Hunter Williams, N.H., Højberg, A., Kroon, T., Larva, O. , Martarelli, L. , Mowbray, R., Nielsen, A. J, Ohman, J., Petrovic Pantic, T., Stroj, A. , van der Keur, P., Zaadnoordijk, W.J., Electronic supplementary material – Hydrogeology Journal, corresponding author: Seidenfaden, I.K., Geological Survey of Denmark and Greenland, GEUS, ika@geus.dk

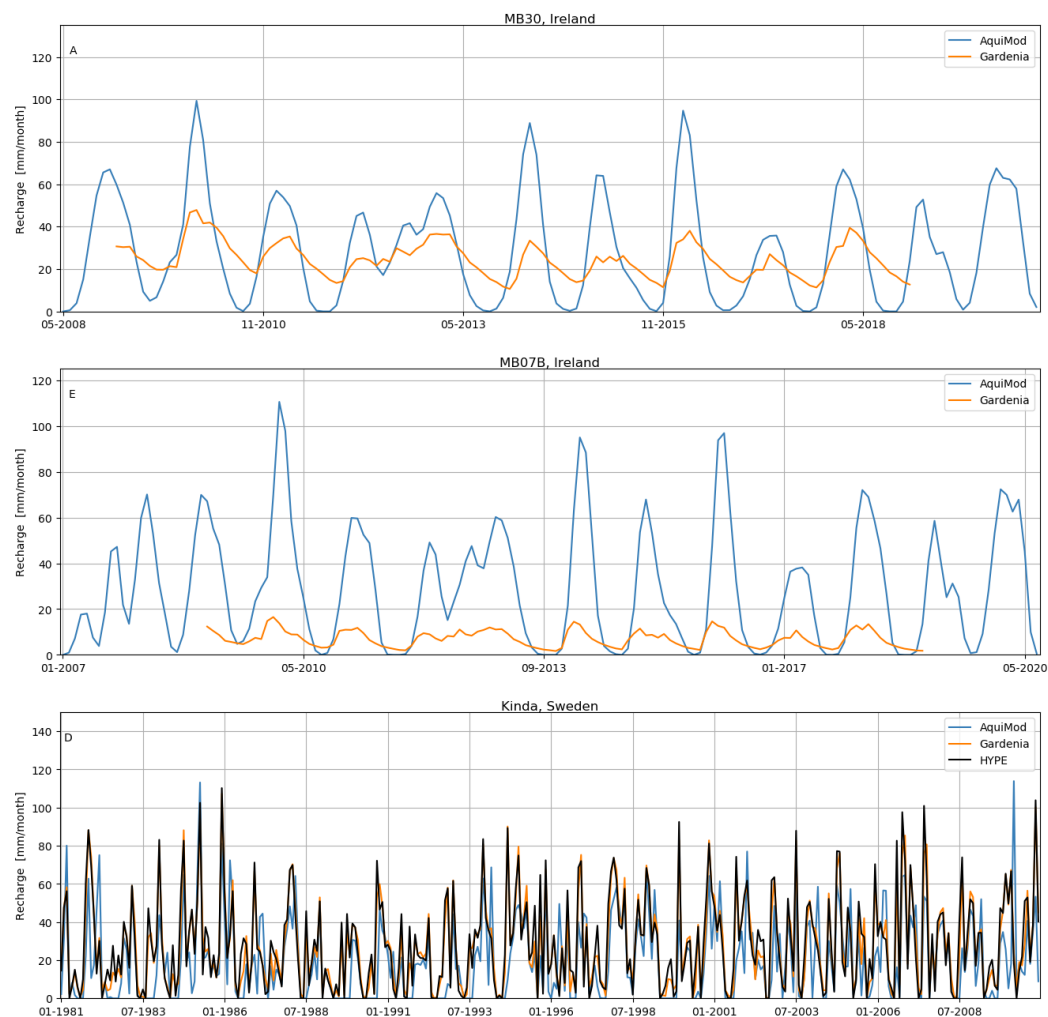


Fig. S3 Simulated recharge (mm/year) with GARDÉNIA and AquiMod. Selected results are shown for the three time series at two case studies: Sweden (A) and Ireland (B and C).