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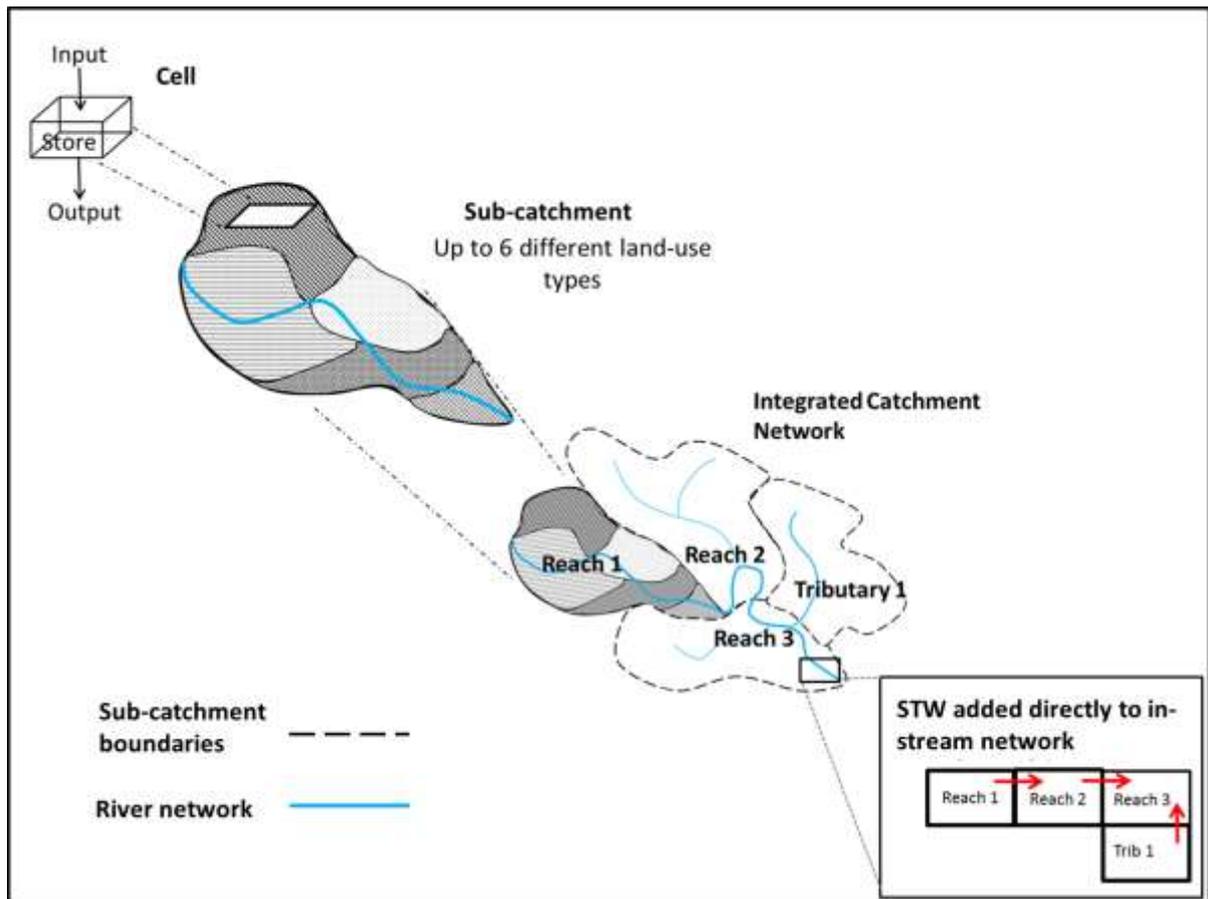


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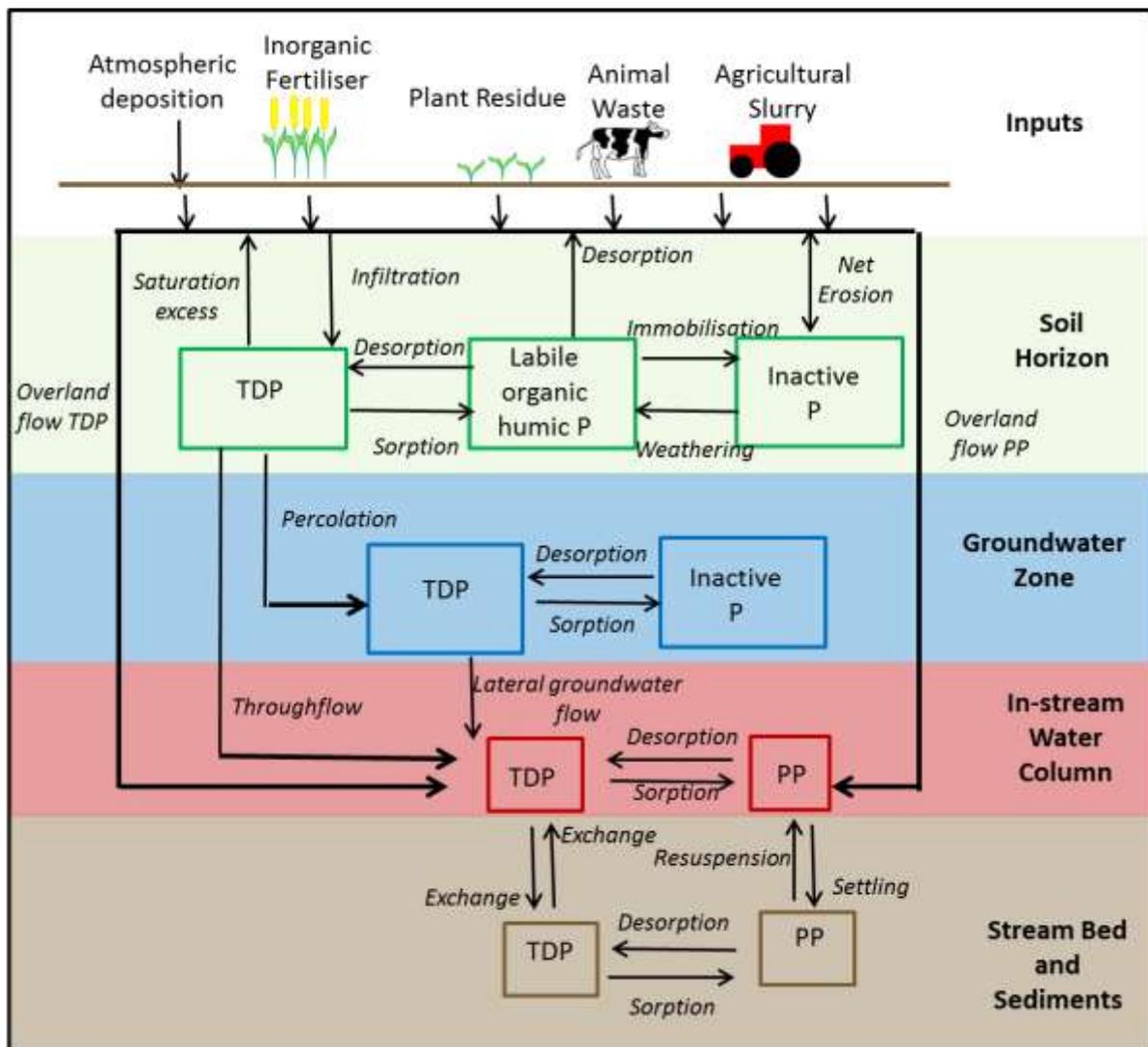
## **Flow pathways and nutrient transport mechanisms drive hydrochemical sensitivity to climate change across catchments with different geology and topography**

**J. Crossman et al.**

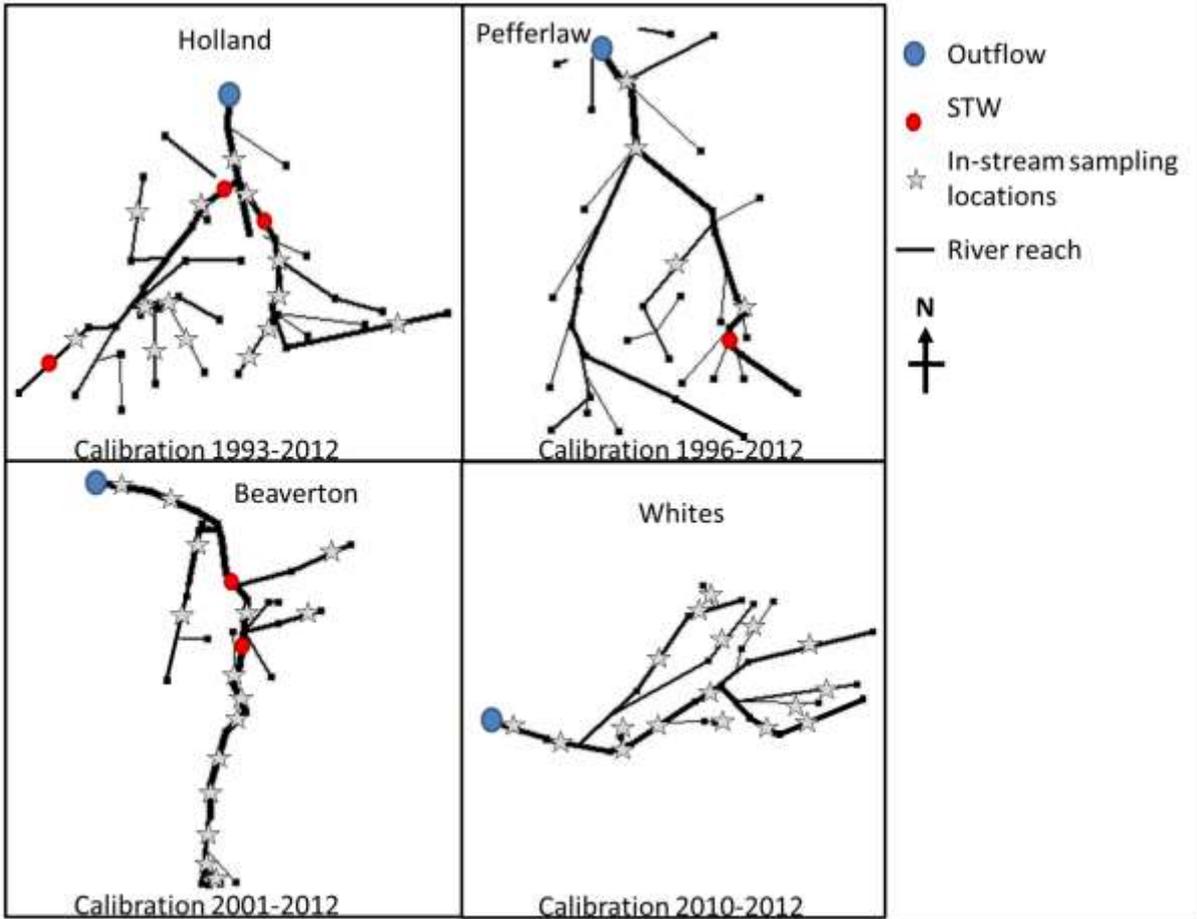
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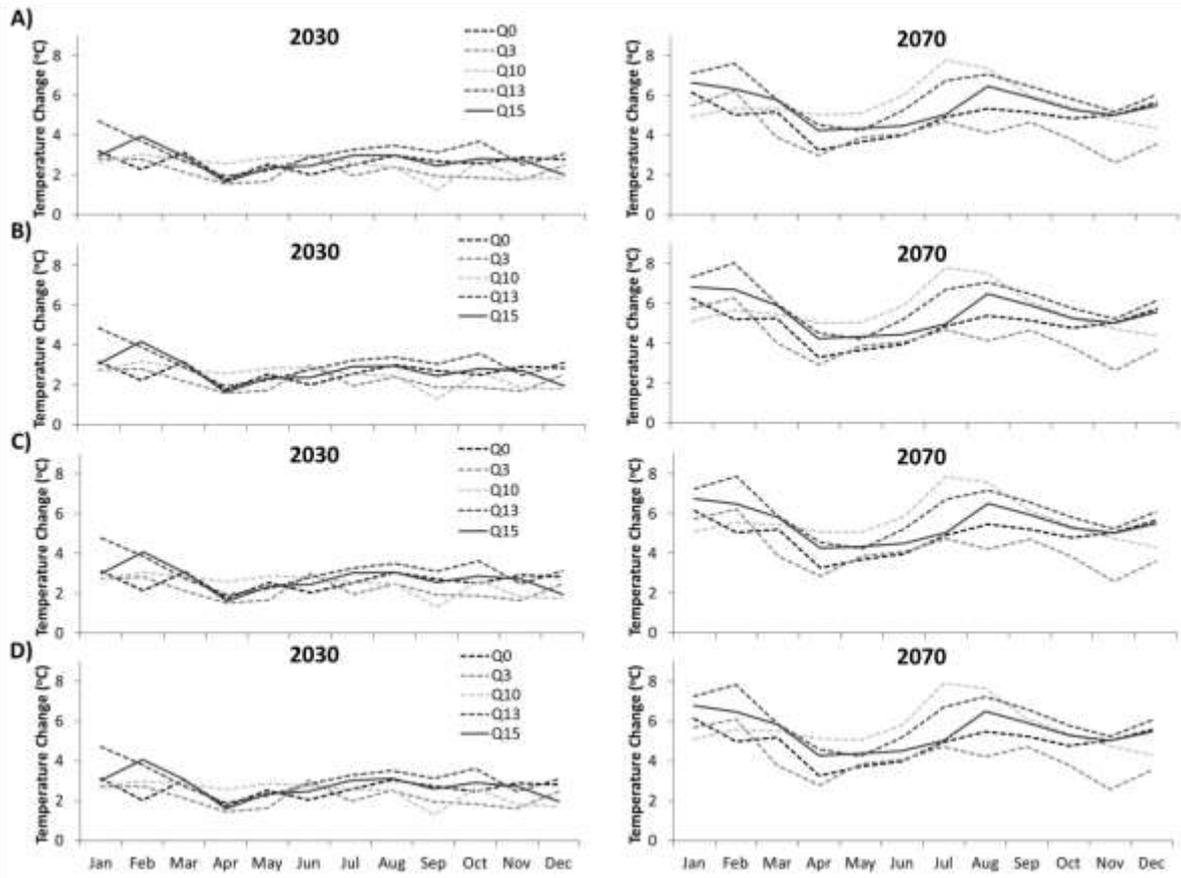
SI1: Illustration of mechanisms of data flow through the INCA model (adapted from Crossman et al., 2012)



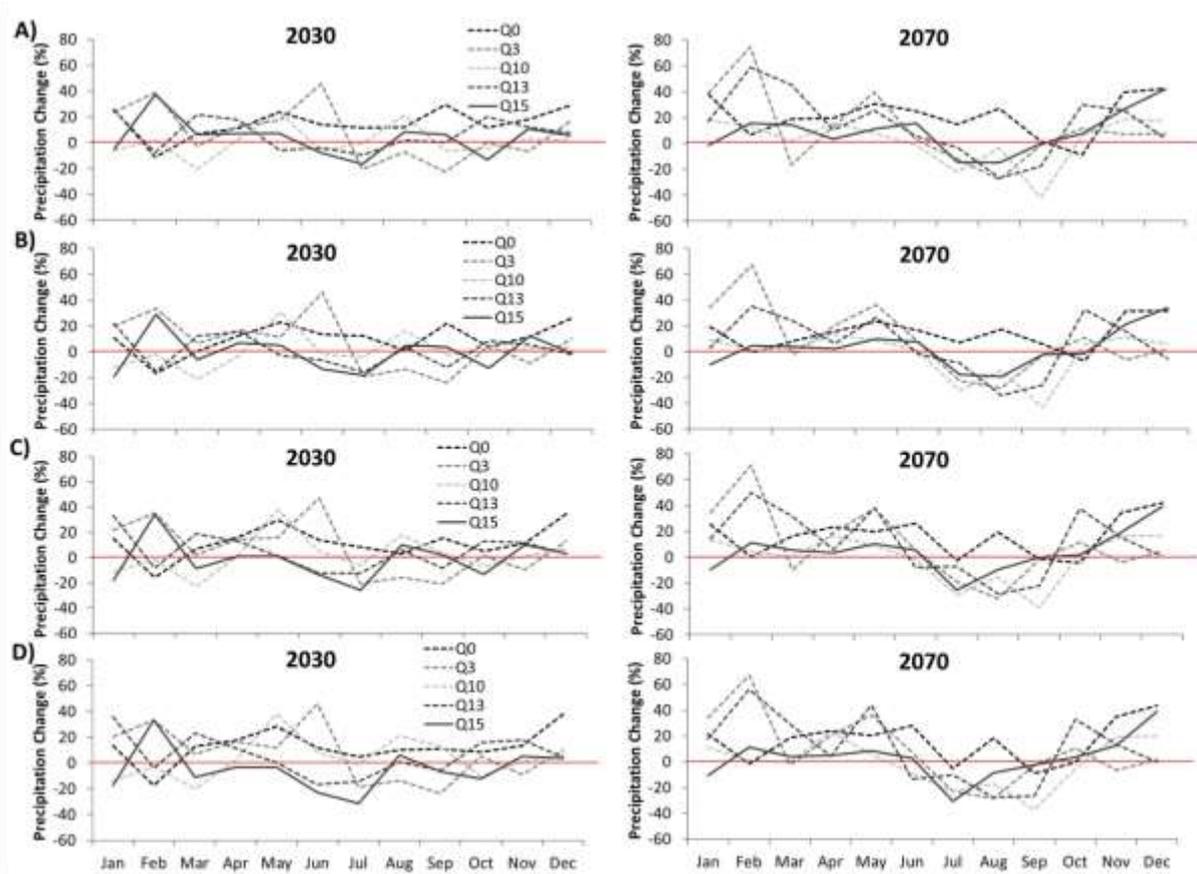
S12: Conceptual diagram of the nutrient flow pathways within the INCA-P model (adapted from Crossman et al., 2012)



SI3: INCA-P model structure for each study catchment, including location of sewage treatment work (STW) inputs

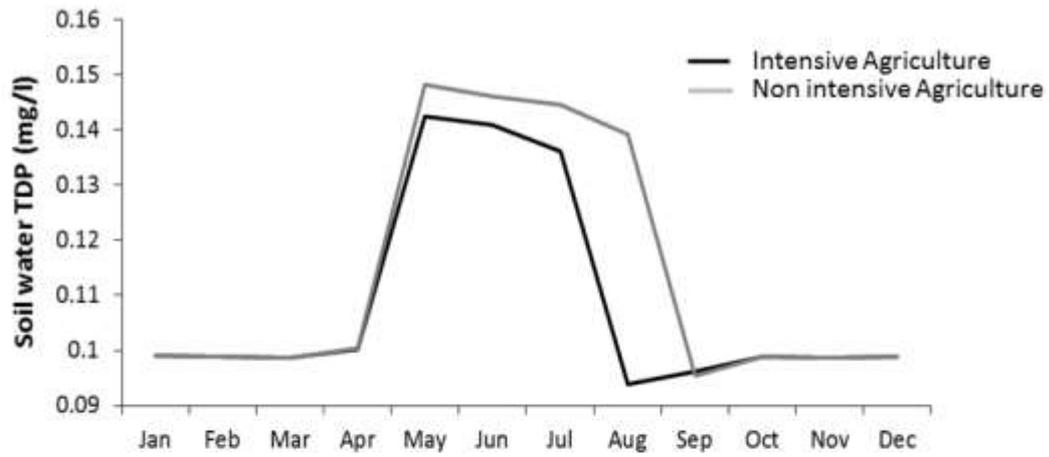


SI 4: Monthly delta change (temperature) of each ensemble member applied to the observed data sets of a) Holland b) Black c) Pepperlaw d) Beaverton e) Whites

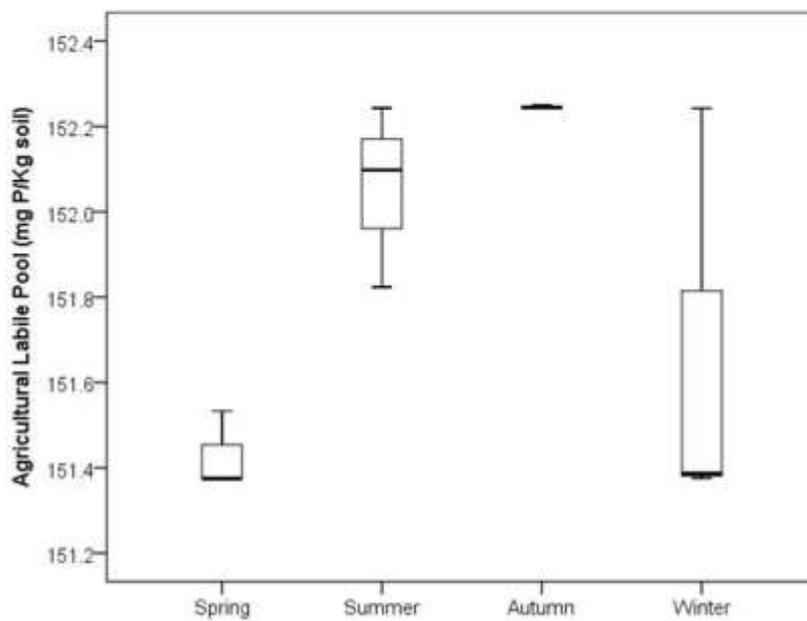


SI 5: Monthly delta change (precipitation) of each ensemble member applied to the observed data sets of a) Holland b) Black c) Pepperlaw d) Beaverton e) Whites

A)



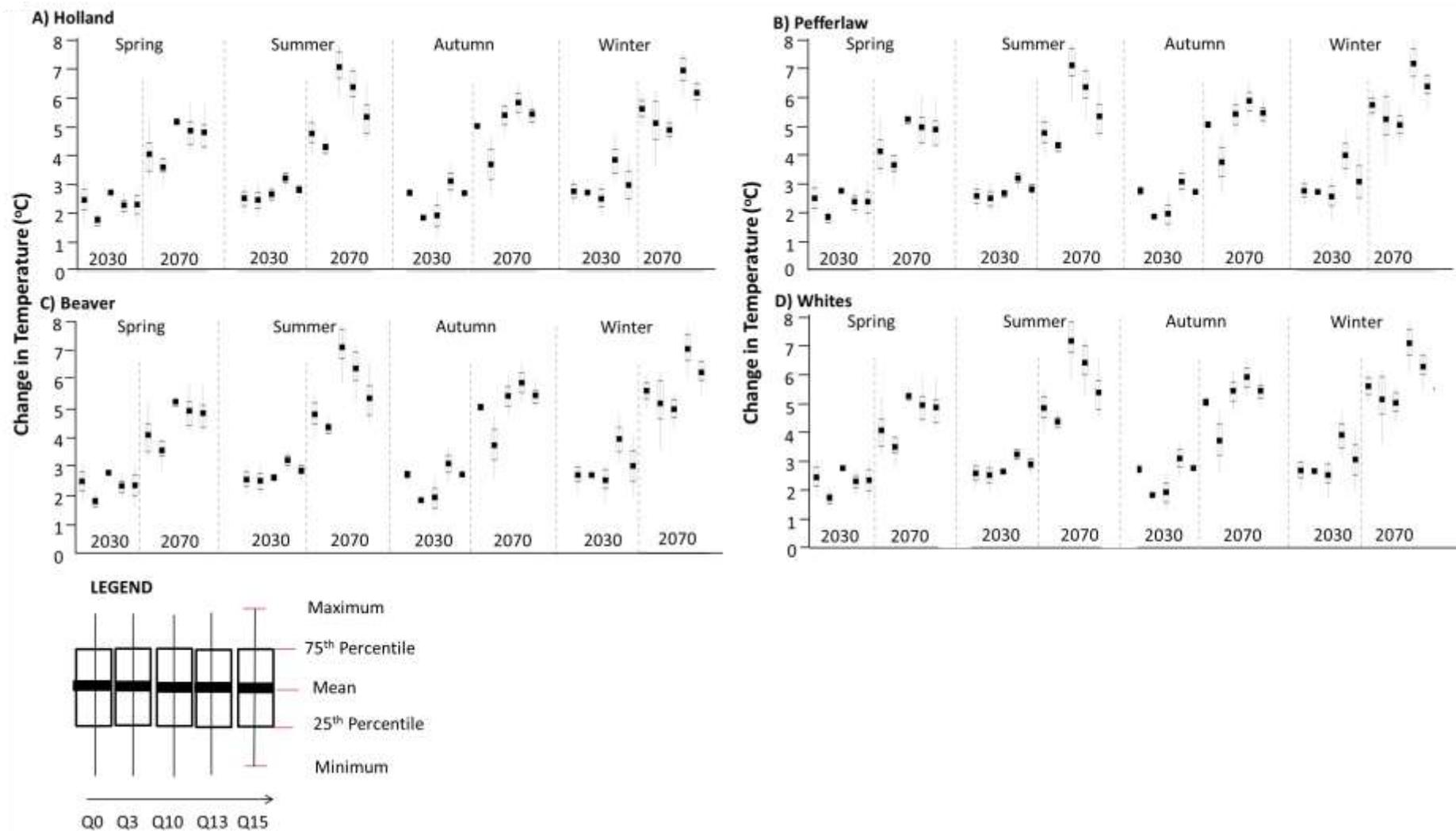
B)



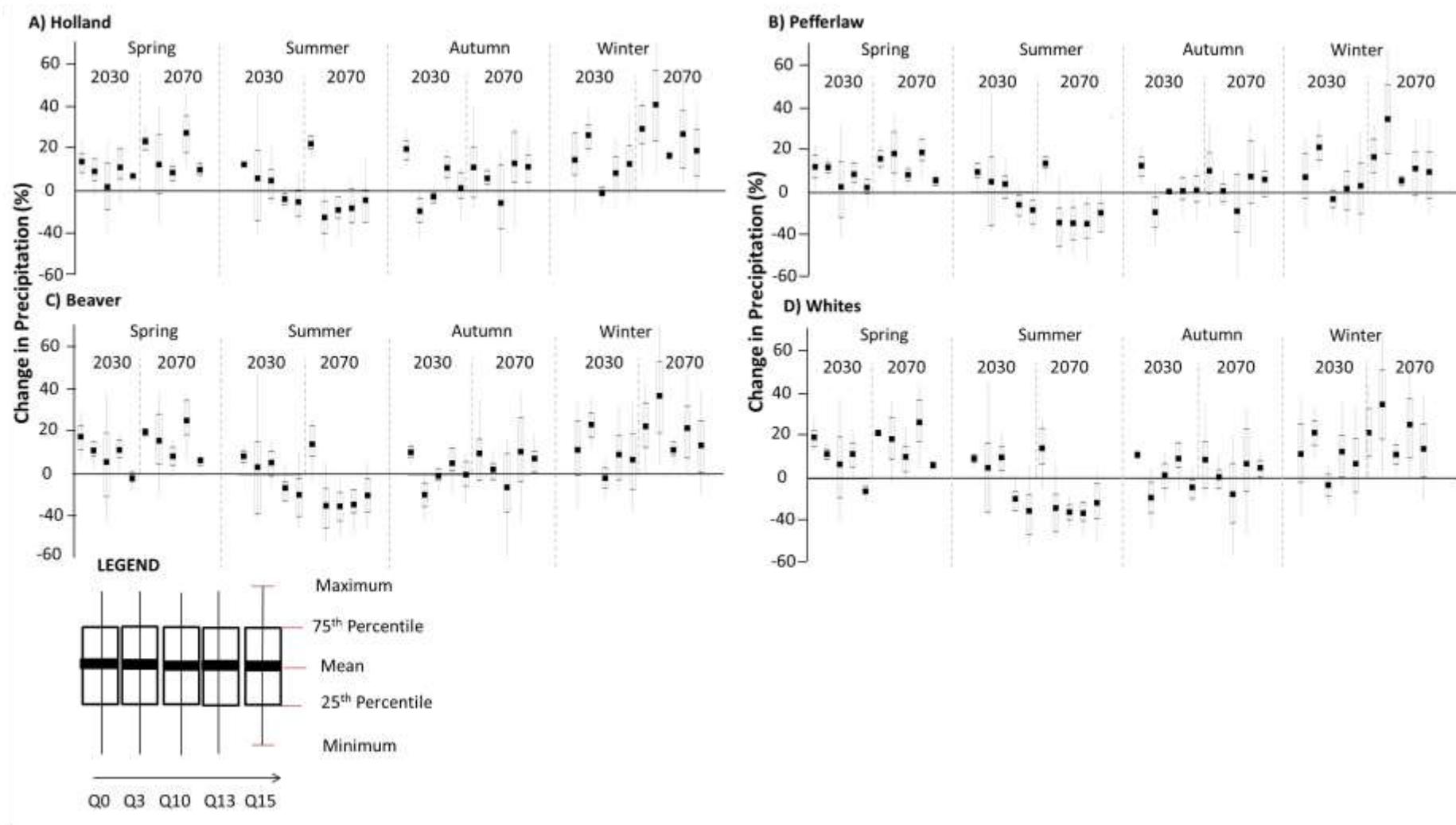
SI 6: Seasonal variability in agricultural soils of in A) soil water TDP concentration and B) labile P pool

Date	Catchment	change in temperature (°C)			Uncertainty (°C)			Change in precipitation (%)			Uncertainty (%)		
		10 % level	50 % level	90 % level	10% level	50 % level	90 % level	10 % level	50 % level	90 % level	10% level	50 % level	90 % level
2030	Holland	1.69	2.55	3.17	0.64	1.12	0.89	-16.01	4.22	25.37	14.74	12.77	25.50
	Pefferlaw	1.69	2.54	3.17	0.60	1.09	1.05	-18.88	1.83	22.28	9.85	14.09	19.56
	Beaverton	1.64	2.55	3.12	0.60	1.16	1.03	-20.62	2.71	28.11	12.01	10.76	22.54
	Whites	1.62	2.59	3.14	0.60	1.13	1.06	-20.10	3.98	27.36	16.36	18.31	24.79
2070	Holland	3.56	5.03	6.69	1.75	1.91	1.76	-23.70	7.63	39.33	31.69	13.88	24.30
	Pefferlaw	3.62	5.07	6.76	1.76	1.97	1.74	-28.05	4.18	31.52	34.97	13.99	25.42
	Beaverton	3.60	5.07	6.73	1.76	1.98	1.75	-27.85	4.26	37.26	33.19	16.82	21.27
	Whites	3.59	5.10	6.75	1.77	2.02	1.84	-26.98	3.45	35.62	26.03	19.06	29.05

SI7: PPE ensemble average model projections and associated uncertainty of temperature change (°C) and precipitation change (%) at the 10%, 50% and 90% probability levels (2 s.f.).



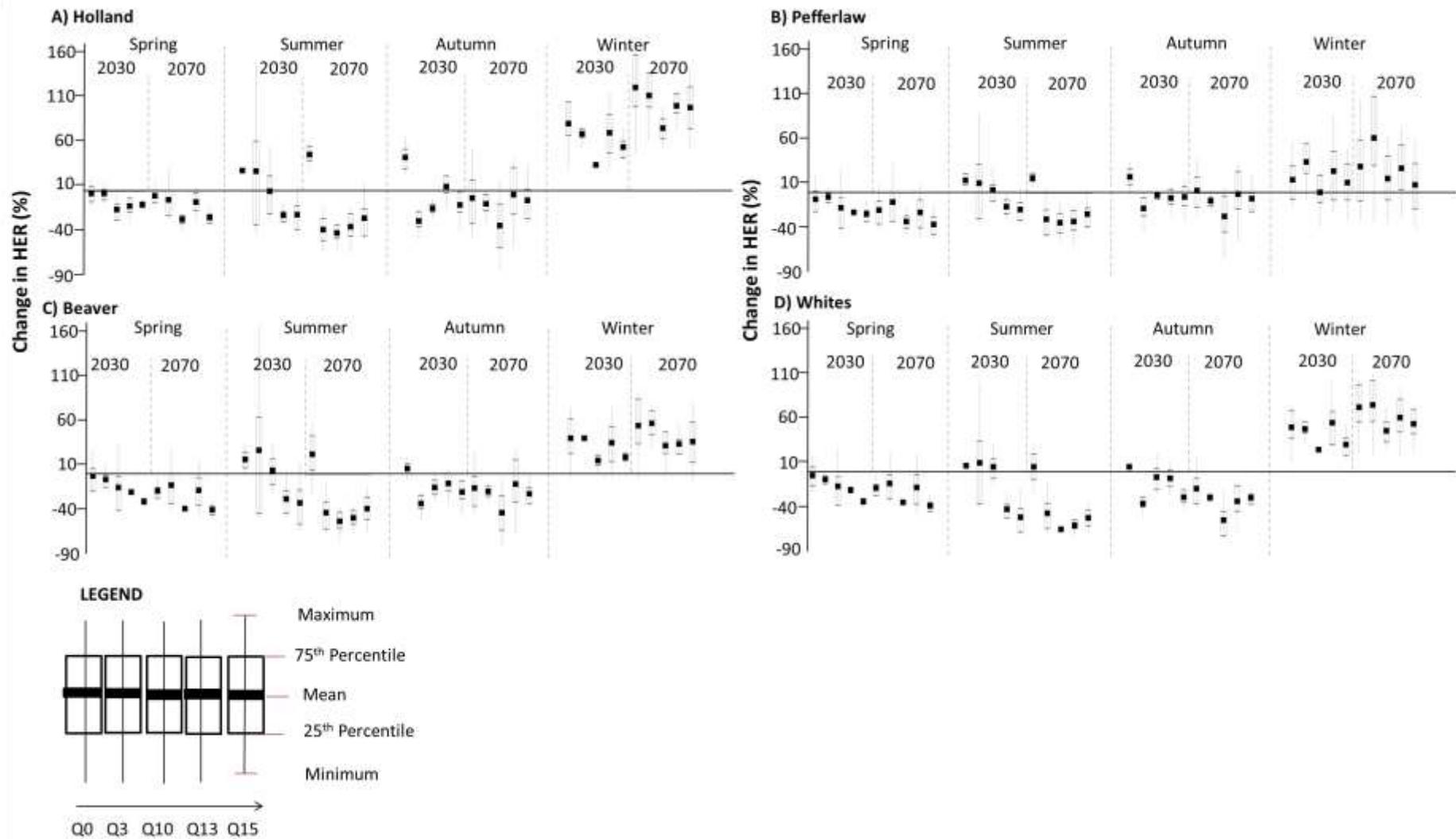
SI 8: Boxplot of seasonal changes in temperature across all QUMP members in a) Holland b) Pefferlaw c) Beaverton and d) Whites



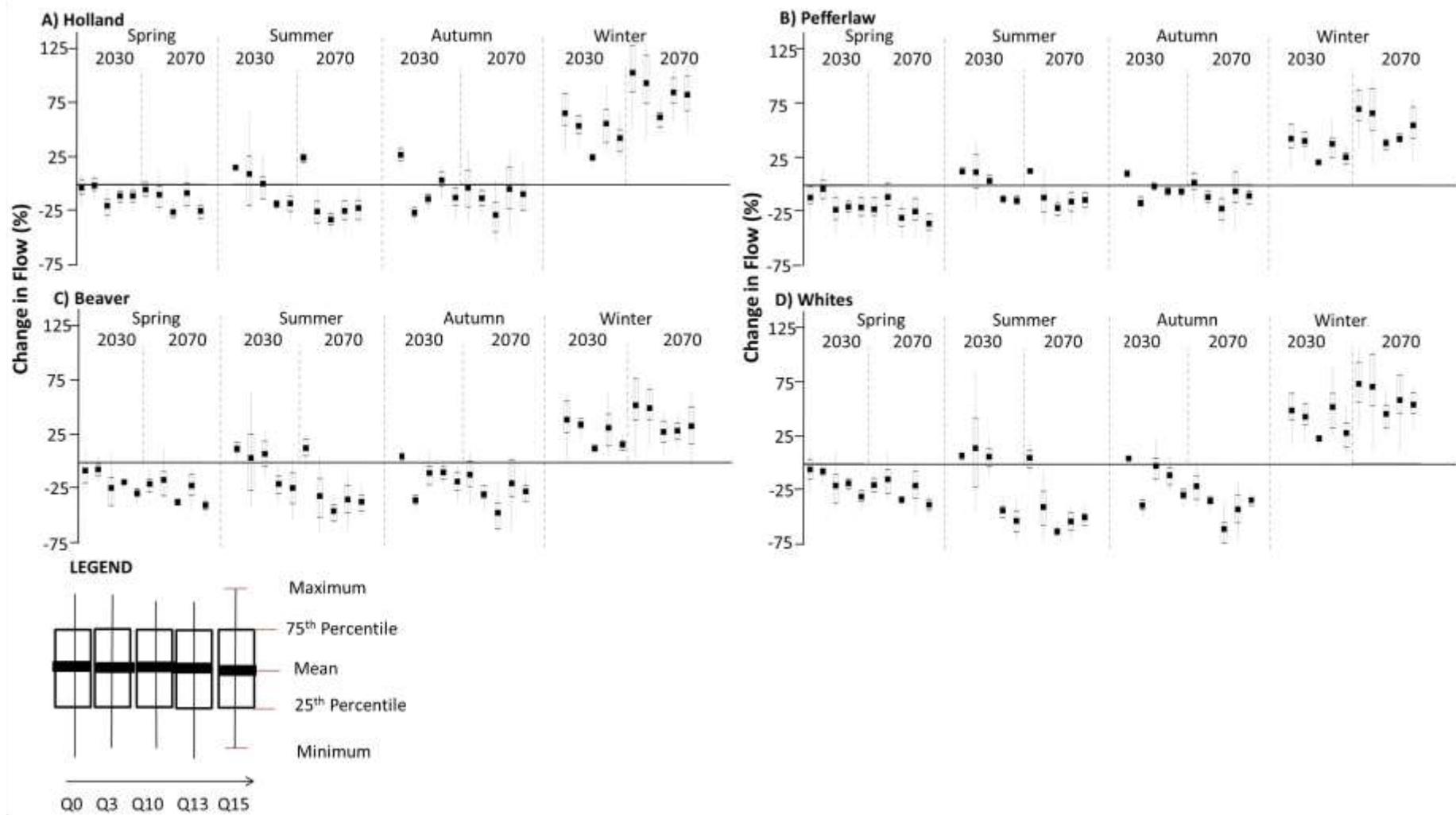
SI 9: Boxplot of seasonal changes in precipitation across all QUMP members in a) Holland b) Pefferlaw c) Beaverton and d) Whites

Date	Catchment	Change in flow (%)			Uncertainty (%)		
		10 % level	50 % level	90 % level	10% level	50 % level	90 % level
2030	Holland	-24.44	-0.70	59.01	18.14	31.16	44.58
	Pefferlaw	-23.23	-2.06	36.69	22.95	34.28	45.68
	Beaverton	-37.23	-2.76	30.19	20.57	42.13	50.91
	Whites	-42.93	-2.10	51.34	13.77	18.78	25.33
2070	Holland	-37.06	-5.82	91.57	11.43	33.56	41.68
	Pefferlaw	-41.52	-8.20	49.14	27.53	30.59	39.08
	Beaverton	-57.75	-20.35	43.91	44.08	33.64	37.45
	Whites	-67.26	-29.19	69.54	34.21	33.16	43.83

SI 10: Ensemble model projections and associated uncertainty of change in discharge at the 10%, 50% and 90% probability levels (2.s.f).



SI 11: Boxplot of seasonal changes in HER across all QUMP members in a) Holland b) Pefferlaw c) Beaverton and d) Whites



SI 12: Boxplot of seasonal changes in flow across all QUMP members in a) Holland b) Pefferlaw c) Beaverton and d) Whites

Date	Catchment	Change in TP concentration (%)			Uncertainty (%)			% change in monthly loads			Uncertainty (%)		
		10 % level	50 % level	90 % level	10% level	50 % level	90 % level	10 % level	50 % level	90 % level	10% level	50 % level	90 % level
2030	Holland	-6.80	-0.79	5.32	8.01	5.28	6.83	-27.33	3.54	67.90	7.82	30.44	42.58
	Pefferlaw	-10.00	-1.13	10.49	5.08	9.03	4.83	-27.92	-2.35	34.41	4.30	28.13	23.37
	Beaver	-18.39	-3.54	6.02	22.63	4.74	11.30	-41.40	-10.32	27.49	4.39	30.58	41.42
	Whites	-20.79	-2.17	12.27	30.09	21.24	13.52	-53.14	-2.56	65.95	11.89	50.41	48.04
2070	Holland	-10.26	-0.83	8.35	11.85	5.72	3.82	-47.24	-6.99	110.78	6.38	51.81	45.83
	Pefferlaw	-15.94	-5.72	9.64	10.51	12.40	8.41	-40.02	-11.15	54.62	4.71	40.48	26.48
	Beaver	-30.63	-6.71	4.88	21.01	8.70	5.09	-70.39	-25.34	49.41	8.00	35.34	47.05
	Whites	-36.31	-9.71	10.16	36.76	18.26	10.28	-78.02	-39.66	86.35	9.29	51.33	61.92

SI 13: Ensemble model projections and associated uncertainty of change in TP loads at the 10%, 50% and 90% probability levels (2.s.f).