

Table S1 Temporal trends in soil solution at the European scale for plots common to both depths. The change in concentration for a ten-year period is shown relative to the year 2000 and as absolute concentration. Bc:Al_{tot} trends are shown for soils with soil pH_{CaCl₂} < 5.0. Bc = Σ(Ca²⁺ + Mg²⁺ + K⁺), AA = Σ(SO₄²⁻ + NO₃⁻ + Cl⁻). Note trends in Bc, AA or ANC differ from the sum of individual ions as not all time series had all ions for all months and years.

Variable	Unit	10-20 cm			40-80 cm		
		Ten year change			Ten year change		
		Significance	Relative to 2000 (%)	Absolute	Significance	Relative to 2000 (%)	Absolute
pH		ns	+0.8	+0.04	ns	+1.3	+0.07
Ca ²⁺	$\mu\text{eq L}^{-1}$	***	-55	-57	**	-57	-67
Mg ²⁺		(*)	-40	-27	*	-37	-26
K ⁺		**	-56	-7.1	**	-37	-4.5
Na ⁺		(*)	-10	-9.5	ns	-21	-26
SO ₄ ²⁻		***	-55	-65	***	-41	-71
NO ₃ ⁻		ns	-15	-2.7	ns	-28	-3.9
Cl ⁻		ns	-12	-11.5	ns	-12	-12
Bc		**	-46	-97	**	-48	-113
AA		***	-35	-111	***	-30	-117
ANC		ns	-4	-15	ns	-56	-108
Al _{tot}	mg L^{-1}	**	-20	-0.14	(*)	-21	-0.10
DOC		ns	-8	-0.97	(*)	-14	-0.78
Bc:Al _{tot}		*	-24	-0.65	ns	-23	-1.18

*** p<0.001, **p<0.01, *p<0.05, (*) p<0.1, ns = not significant

Table S2 Trends in bulk precipitation and throughfall (%) relative to the year 2000 and absolute concentration for a ten-year period. Results are from a linear mixed model as per soil solution trends, but without covariance structures. $Bc = \Sigma(Ca^{2+} + Mg^{2+} + K^+)$, $AA = \Sigma(SO_4^{2-} + NO_3^- + Cl^-)$. Potential acidity (Ac_{pot}) is the difference between the sum of non-marine strong acid anions and ammonium minus non-marine Bc . ($Ac_{pot} = nmSO_4^{2-} + nmCl^- + NO_3^- + NH_4^+ - nmBC$)

		Bulk Precipitation			Throughfall		
Variable	Unit	Significance	Ten year change		Significance	Ten year change	
			Relative to 2000 (%)	Absolute		Relative to 2000 (%)	Absolute
pH		*	+4.2	+0.2	**	+6.7	+0.3
Ca^{2+}	$\mu eq\ L^{-1}$	ns	-22	-3.2	*	-21	-7.5
Mg^{2+}		*	-37	-3.8	*	-17	-4.2
K^+		*	-26	-1.0	ns	-3	-0.9
Na^+		ns	-18	-6.5	ns	-4	-2.5
Cl^-		ns	-11	-4.1	ns	-6	-4.2
SO_4^{2-}		***	-46	-13	***	-60	-35
NO_3^-		**	-21	-4.8	**	-25	-7.6
NH_4^+		***	-37	-7.0	***	-40	-7.6
N_inorg		***	-31	-14	***	-33	-17
Bc		*	-33	-11	*	-14	-14
AA		***	-26	-26	***	-27	-48
Ac_{pot}		(*)	-49	-31	**	-107	-64
ANC		ns	-117	-19	*	+170	+27
Volume	mm	ns	+2	+15	ns	+3	+16

*** $p<0.001$, ** $p<0.01$, * $p<0.05$, (*) $p<0.1$, ns = not significant

Table S3 Trends in soil solution stratified by environmental factors. Only trends that were significantly different between factor levels are shown. For throughfall, the levels are expressed as the magnitude of the change for a ten-year period. Significance for each factor level is indicated as follows: *** $p<0.001$, ** $p<0.01$, * $p<0.05$, (*) $p<0.1$, ns = not significant

Variable	factor level layer	Base Saturation		Throughfall Ac _{pot}		Throughfall Bc		Throughfall N_inorg			
		$\leq 10\% / > 10\%$	$\leq 20\% / > 20\%$	10-20 cm	40-80 cm	10-20 cm	40-80 cm	10-20 cm	40-80 cm		
Ca^{2+}	significance	***/**						(*)/**			
	change (%)	-68/-43						-52/-72			
	change ($\mu\text{eq L}^{-1}$)	-38/-117						-50/-83			
Mg^{2+}	significance			(*)/**	*/*			*/***			
	change (%)					-26/-45	-17/-33	-26/-49			
	change ($\mu\text{eq L}^{-1}$)					-21/-34	-15/-14	-21/-37			
K^+	significance	**/*				(*)/*					
	change (%)	-46/-23				-72/-46					
	change ($\mu\text{eq L}^{-1}$)	-6.1/-2.5				-11/-4.4					
Na^+	significance										
	change (%)										
	change ($\mu\text{eq L}^{-1}$)										
Cl^-	significance					*/ns		*/ns			
	change (%)					-19/-3.7		-12/2			
	change ($\mu\text{eq L}^{-1}$)					-23/-2.9		-9/-18			
SO_4^{2-}	significance	***/*									
	change (%)	-47/-34									
	change ($\mu\text{eq L}^{-1}$)	-96/-62									
NO_3^-	significance										
	change (%)										
	change ($\mu\text{eq L}^{-1}$)										

Al_{tot}	significance change (%) change (mg L ⁻¹)	***/**/ -40/-1.6 -0.9/-0.004		(*)/ns -26/-7.9 -0.26/-0.03	
pH	significance change (%) change (pH unit)			*/*/ 2.6/-27 -0.01/0.12	
DOC	significance change (%) change (mg L ⁻¹)	*/*/ -21/-9.5 -81/-17			
Bc	significance change (%) change (μeq L ⁻¹)	**/*/ -53/-38 -77/-182	*/**/ -34/-48 -104/-96		(*)/**/ -42/-60 -88/-140
AA	significance change (%) change (μeq L ⁻¹)				*/**/ -31/-48 -99/-168
Bc:Al	significance change (%) change (absolute)	ns/*/ -6.9/-28 -0.003/-5.3	(*)/*/ -8.5/-25 -0.4/-1.2		
ANC	significance change (%) change (μeq L ⁻¹)	*/*/ +42/-3.2 +81/-17	ns/**/ +24/-21 +52/-117		

Table S4 Average soil pH and base saturation (BSat) and throughfall changes for levels of stratifying categories: forest type, soil pH class and throughfall SO_4^{2-} .

	Factor	Unit	10-20 cm		40-80 cm	
Functional type			Conif	Decid	Conif	Decid
Soil	$\text{pH}_{\text{CaCl}_2}$ BSat	%	3.57 17	3.72 34	4.28 27	4.24 54
Throughfall	SO_4^{2-} BC N inorg Ac_{pot}	relative change for a 10 year period % $\mu\text{eq L}^{-1} \text{year}^{-1}$	-65 -17 -29 -6.6	-58 -19 -17 -7.1	-63 -14 -23 -5.6	-56 -11 -23 -8.9
soil pH category			pH≤4.0	pH>4.0	pH≤4.5	pH>4.5
Soil	$\text{pH}_{\text{CaCl}_2}$ BSat	%	3.45 13	4.37 42	4.11 19	4.91 62
Throughfall	SO_4^{2-} BC N inorg Ac_{pot}	relative change for a 10 year period % $\mu\text{eq L}^{-1} \text{year}^{-1}$	-66 -21 -26 -9	-57 -14 -26 -4	-65 -17 -21 -8	-53 -4 -25 -5
SO_4^{2-} trend			≥60%	<60%	≥60%	<60%
Soil	$\text{pH}_{\text{CaCl}_2}$ BSat	%	3.48 18	3.83 28	4.22 29	4.30 39
Throughfall	SO_4^{2-} BC N inorg Ac_{pot}	relative change for a 10 year period % $\mu\text{eq L}^{-1} \text{year}^{-1}$	-79 -29 -26 -9	-45 -6 -24 -4	-76 -26 -28 -9	-45 0 -18 -4