

SUPPORTING INFORMATION:

Soil-Air Exchange Controls on Background Atmospheric Concentrations of Organochlorine Pesticides

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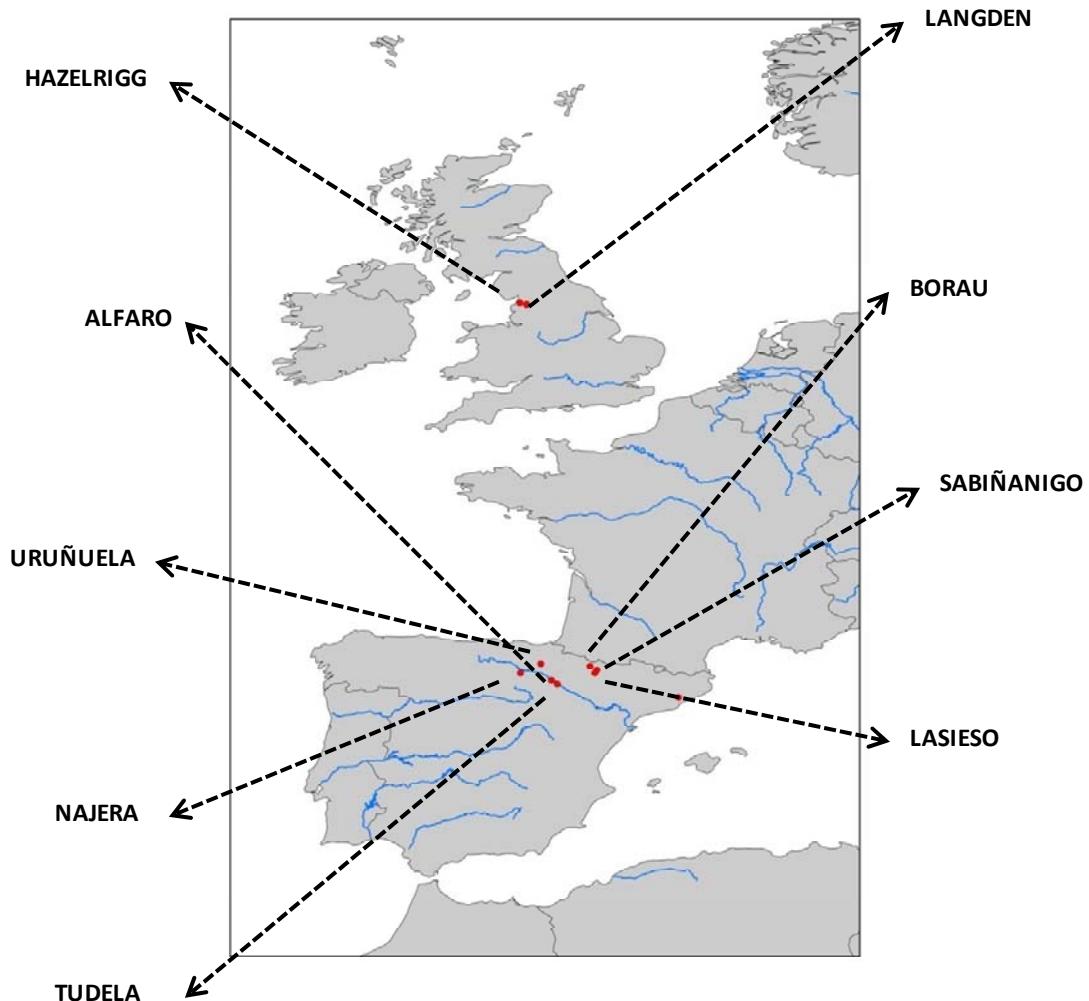
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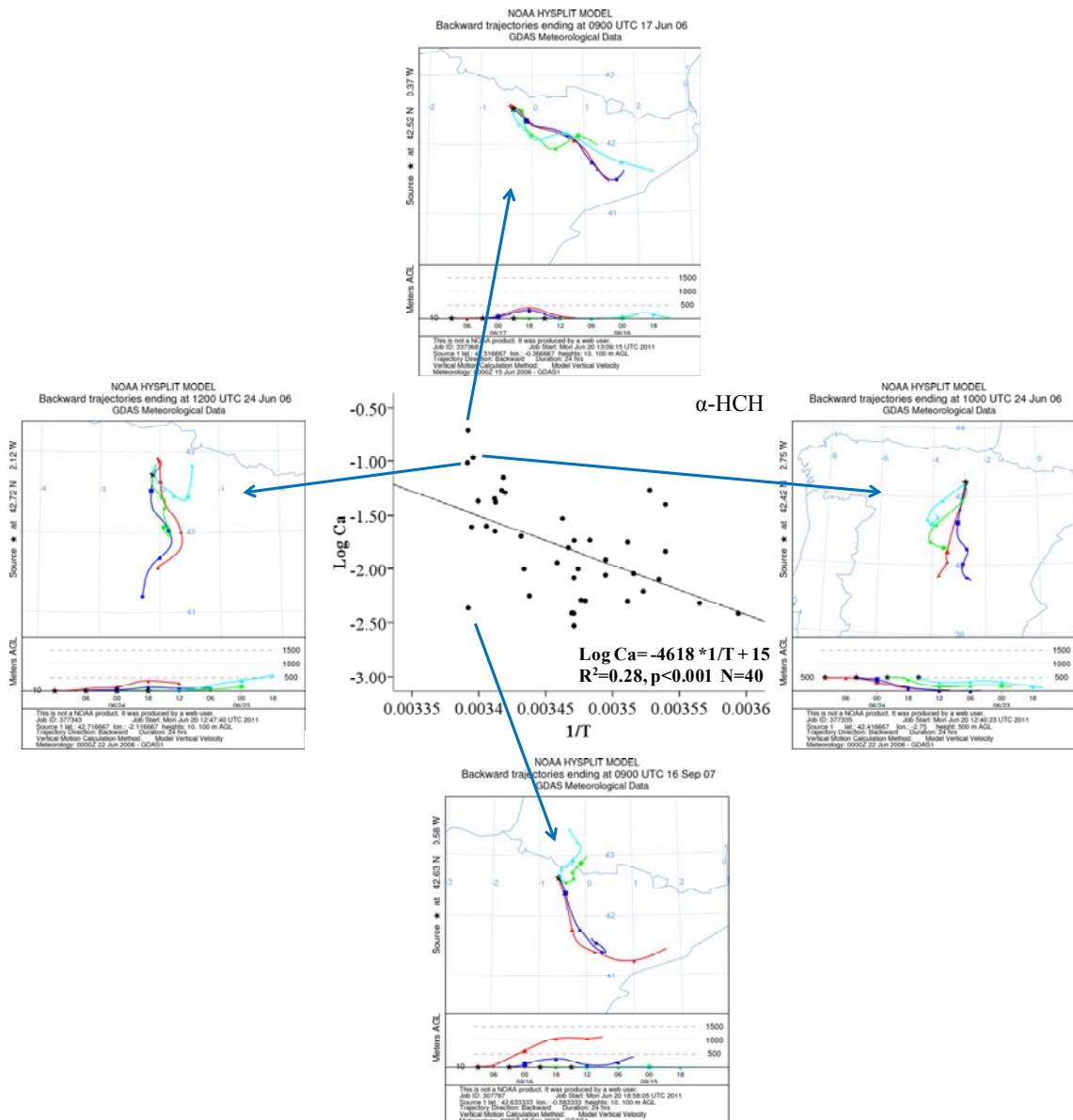
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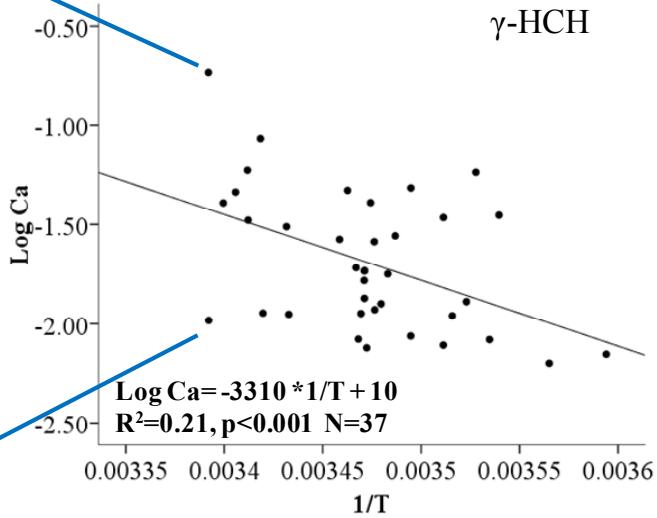
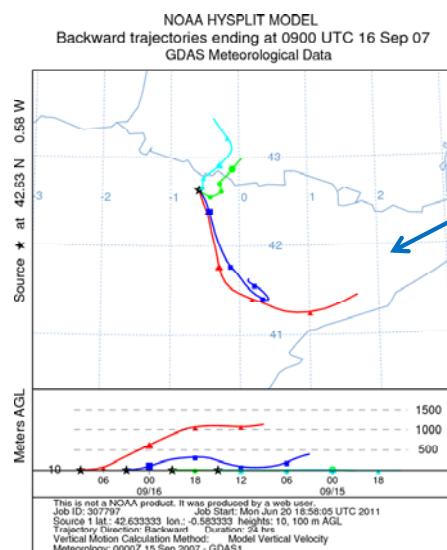
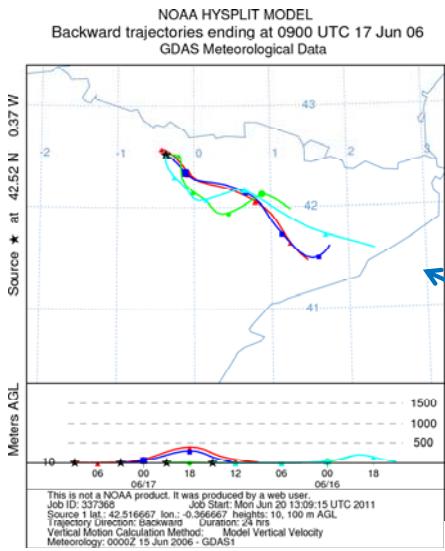
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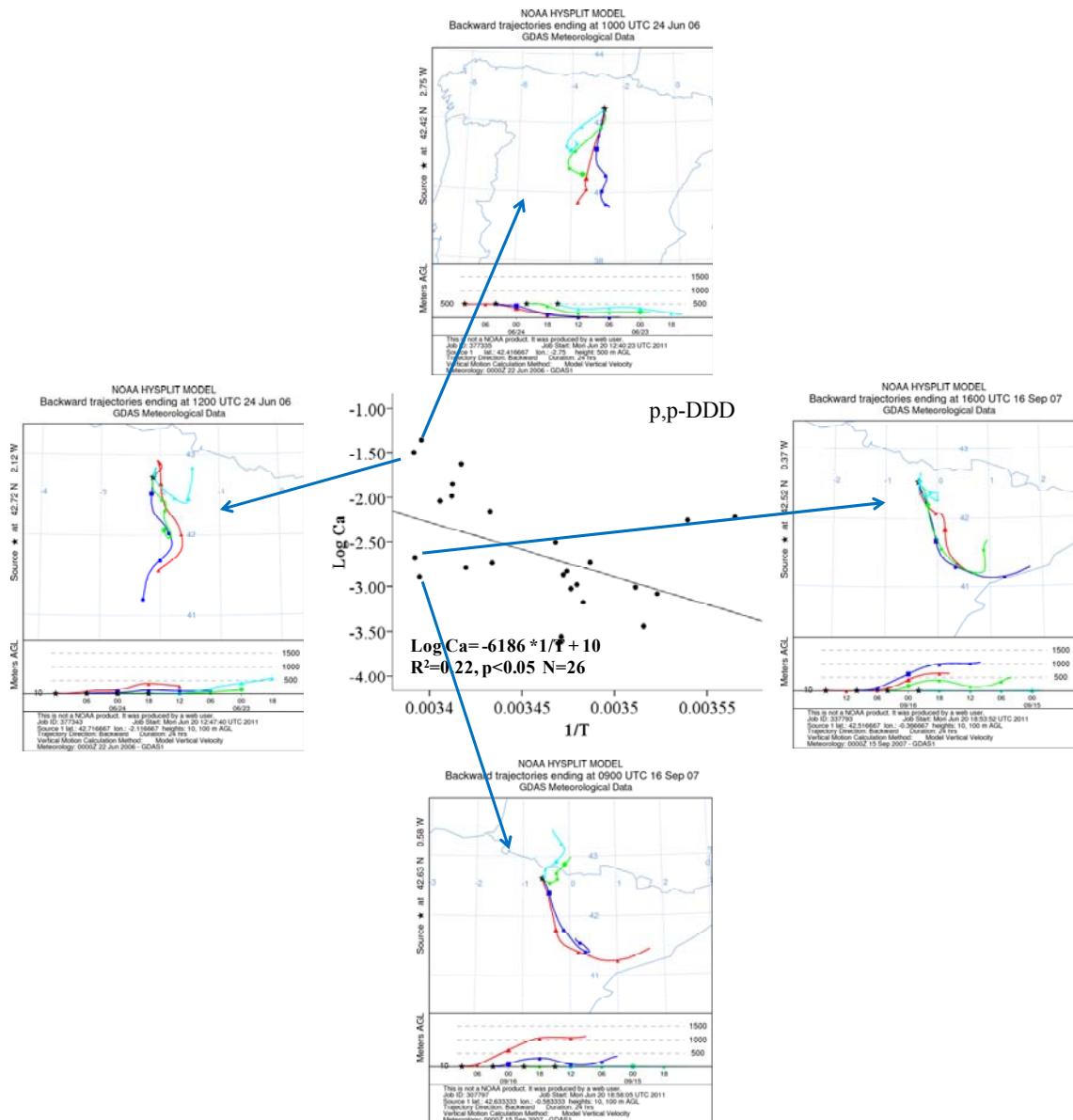
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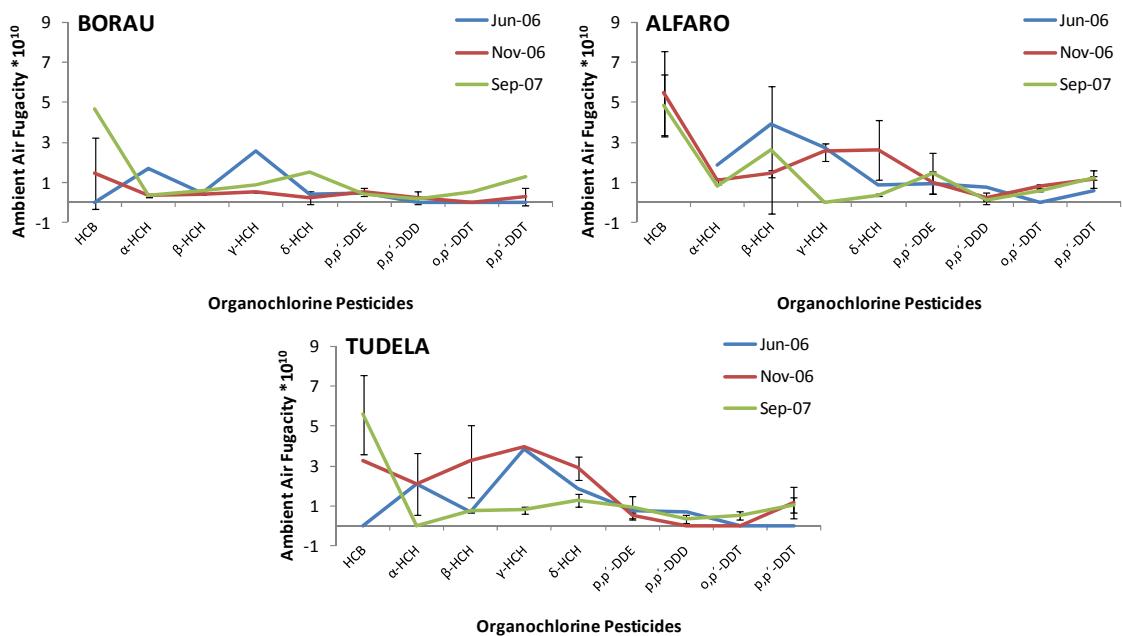
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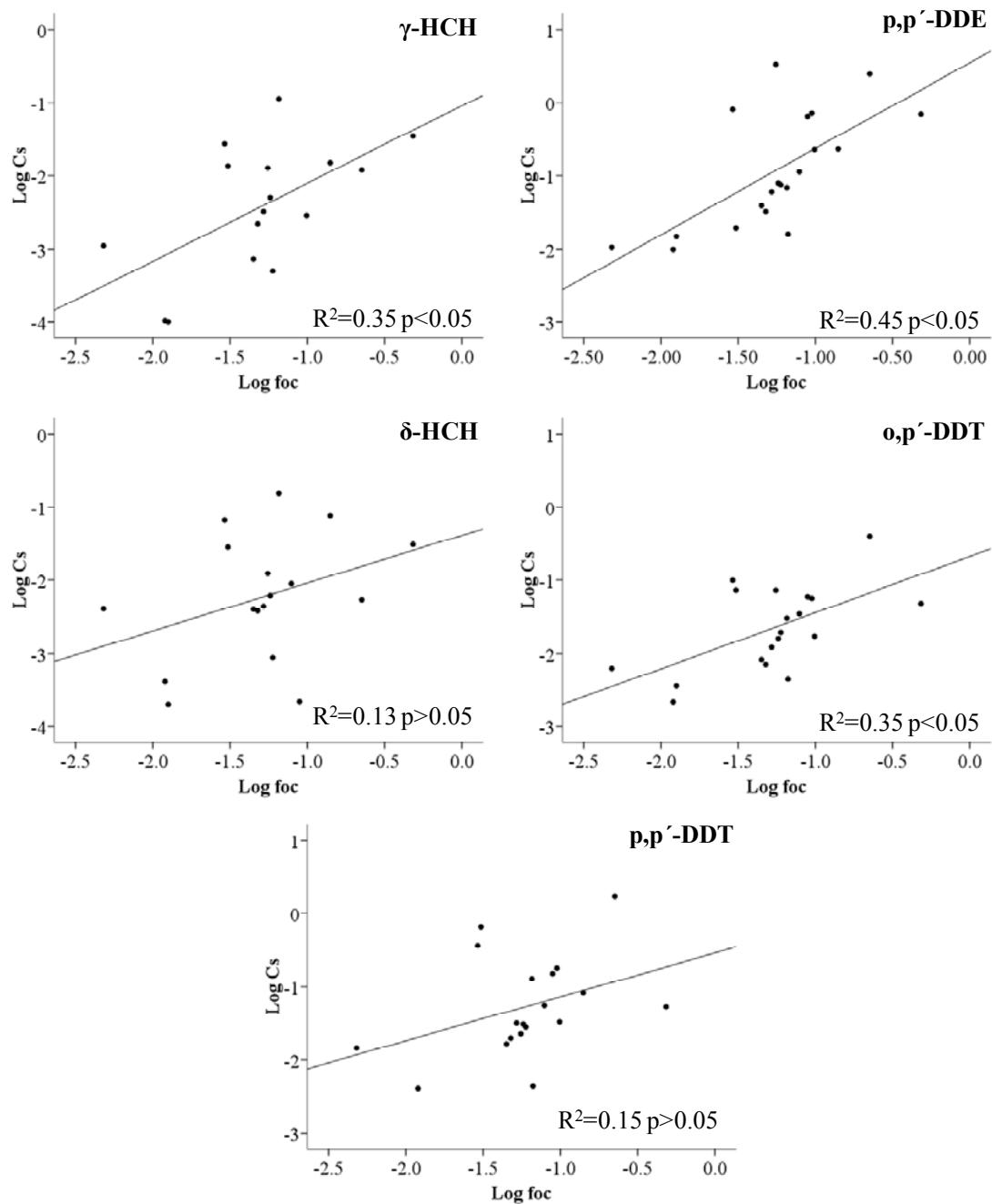
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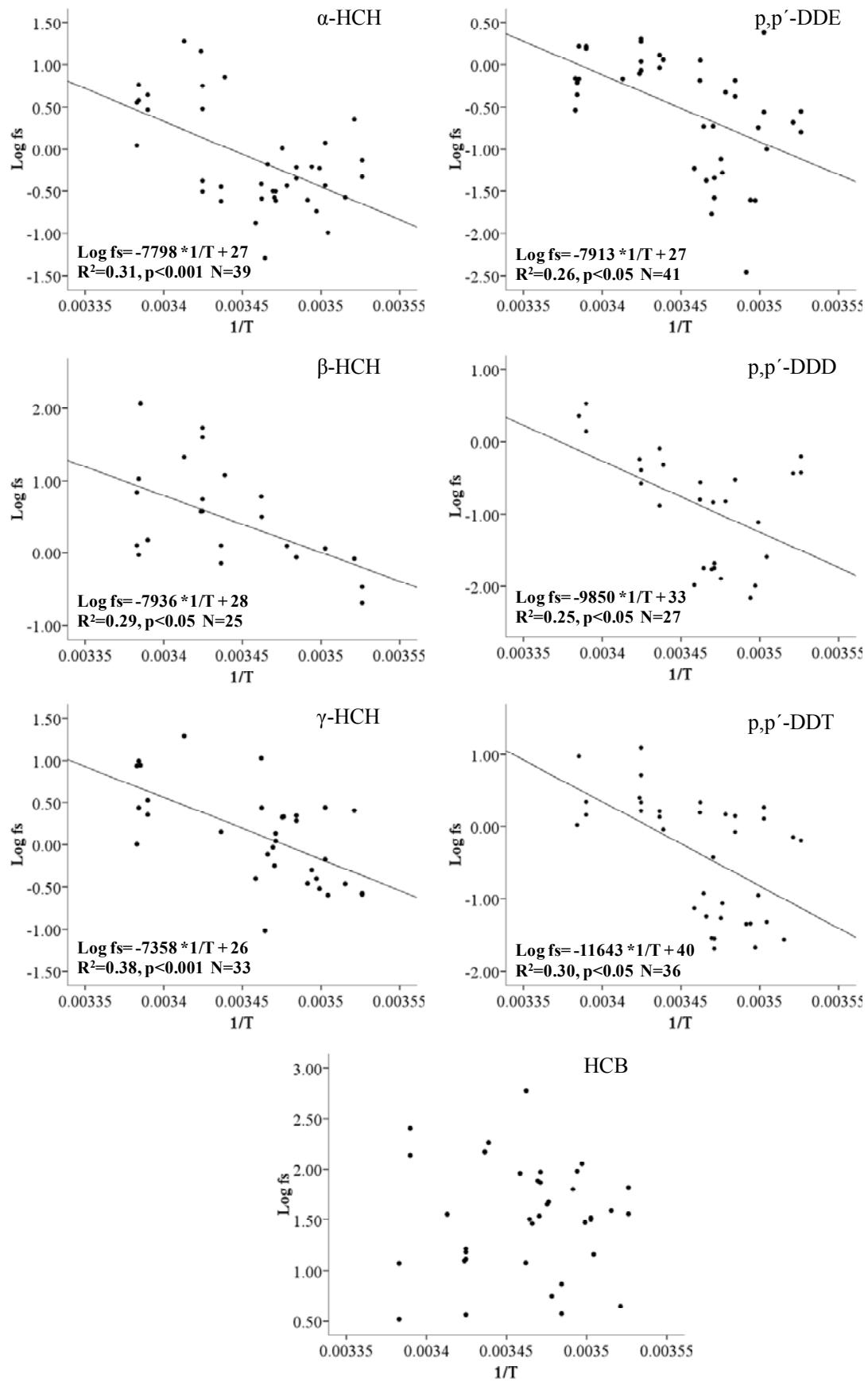
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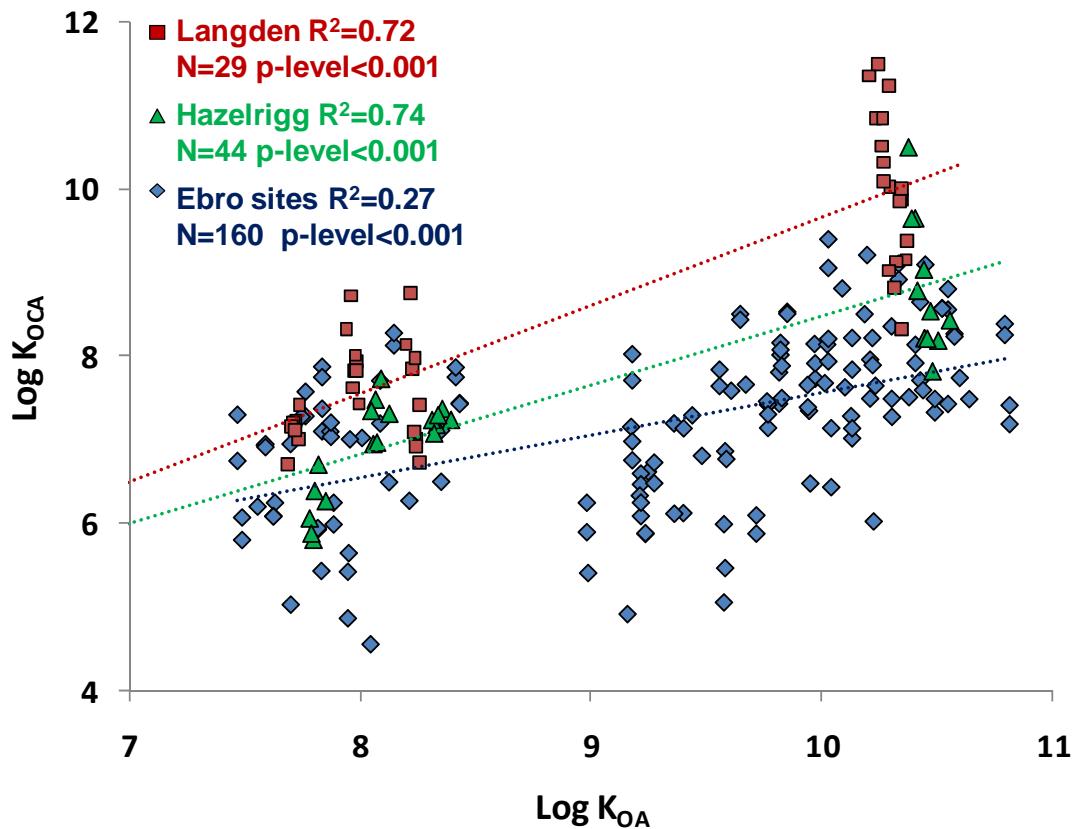
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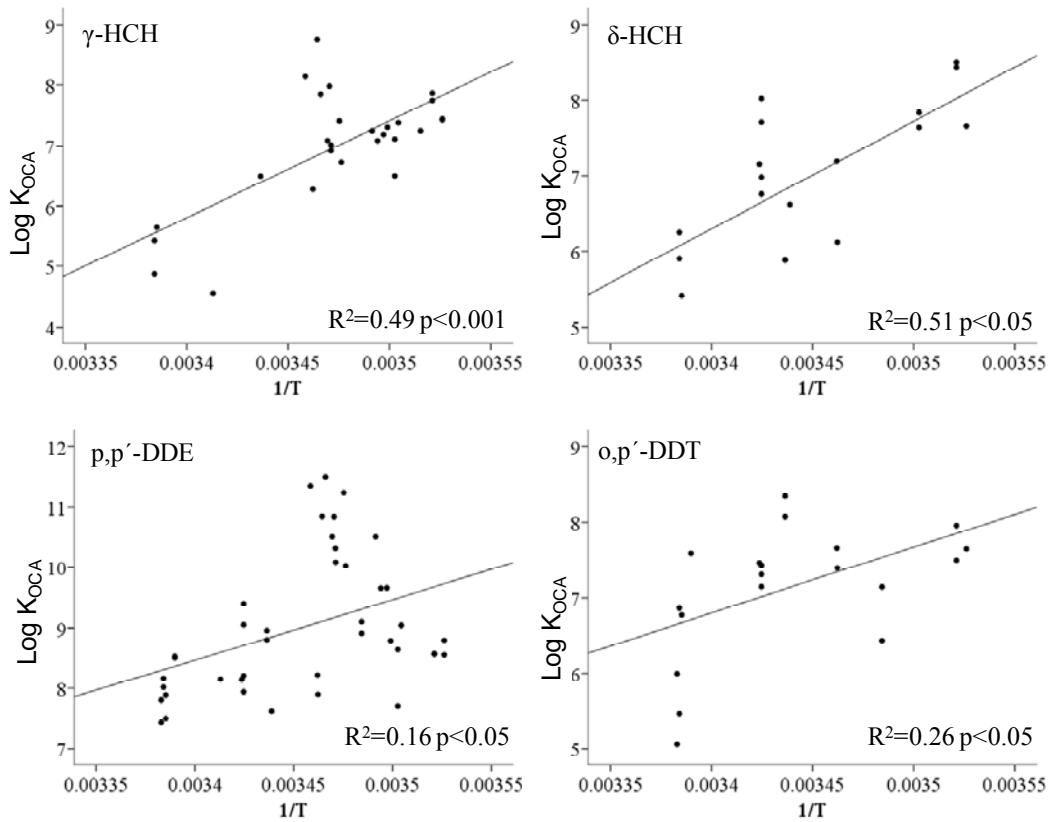
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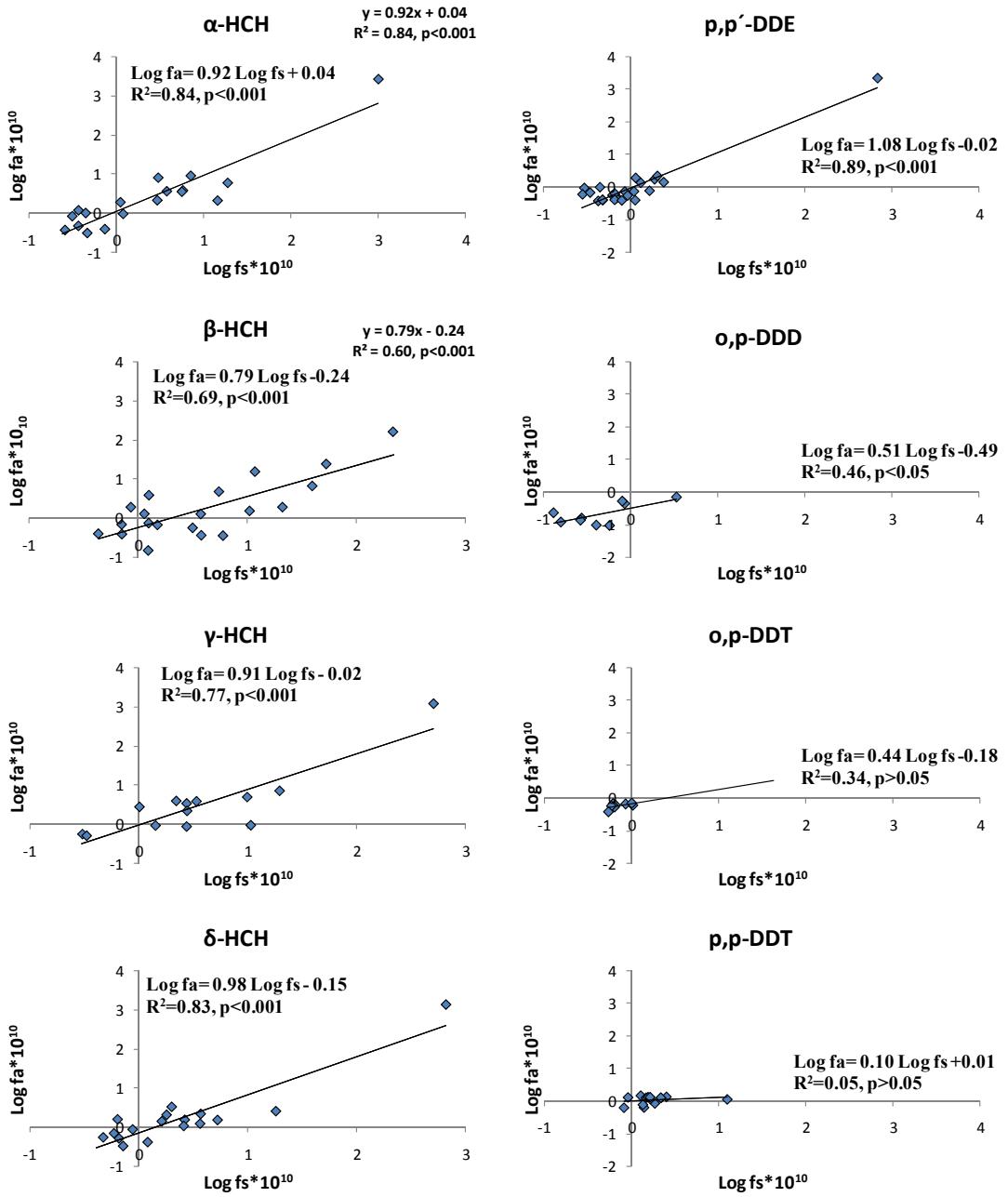
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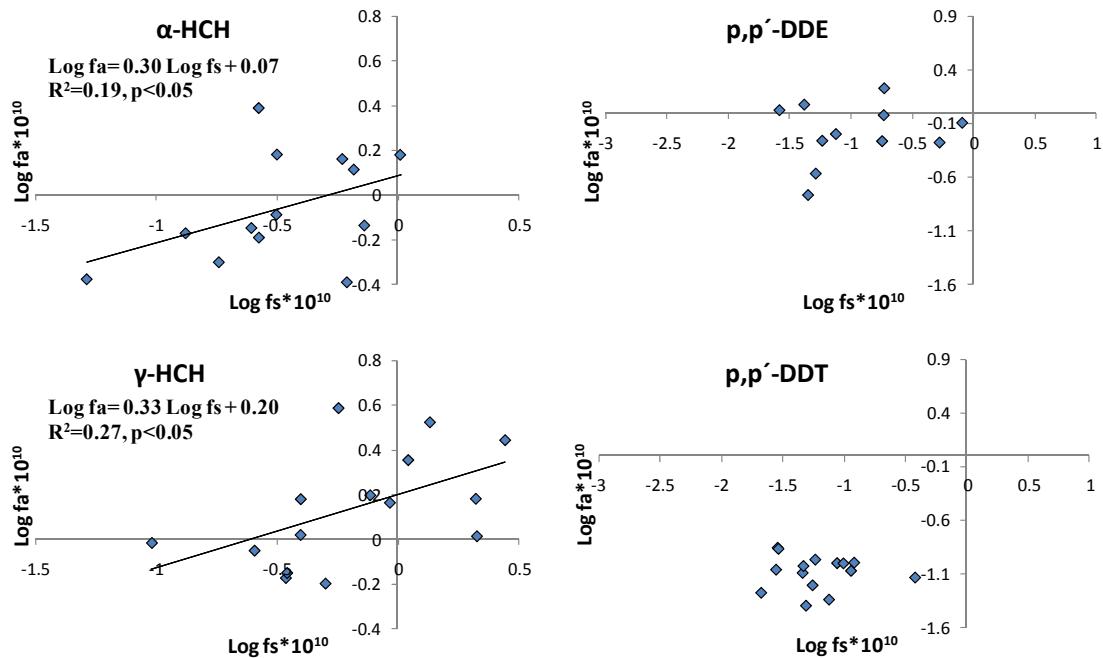


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161 **Annex 2. List of tables**

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	Lat	Long	Sampling site	Sampling period	Nº air samples	Nº soil samples
Borau	42°38N	0°35W	Rural	*13-15/06/2006	3	1
				*17-19/11/2006	4	1
				*16/09/2007	2	1
Alfaro	42°11N	1°47W	Rural	*19-21/06/2006	3	1
				*14-16/11/2006	4	1
				*17-19/09/2007	4	1
Tudela	42°04N	1°36W	Semi-rural	*19-21/06/2006	4	1
				*14-16/11/2006	4	1
				*17-19/09/2007	4	1
Sabiñanigo	42°31N	0°22W	Semi-rural	*16-18/06/2006	3	1
				*17-19/11/2006	3	1
				*14-16/09/2007	4	1
Najera	42°25N	2°45W	Rural	*22-24/06/2006	4	1
Uruñuela	42°43N	2°7W	Rural	*22-24/06/2006	4	1
Lasieso	42°42N	0°43W	Rural	*16-18/06/2006	4	1
				*17-19/11/2006		1
				*14-16/09/2007		1
Hazelrigg	54°1N	2°46W	Semi-rural	*12-17/08/2008	8	1
				*18-29/08/2008	10	1
Langden	53°95N	2°56W	Rural	*17-24/09/2008	12	1
Total number of Samples					84	20

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164 **Table S1. Sampling sites and sampling details**

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	BORAU	SABIÑANIGO		TUDELA	ALFARO	NAJERA		URUÑUELA		LASIESO	
		Mean	SD			Mean	SD	Mean	SD	Mean	SD
HCB	Nd	nd		nd	nd	nd		nd		nd	
α-HCH	0.020	0.132	0.086	0.025	0.022	0.081	0.038	0.069	0.038	0.044	0.002
β-HCH	0.006	0.033	0.014	0.008	0.047	0.126	0.087	0.188	0.151	0.096	0.110
g-HCH	0.031	0.135	0.070	0.046	0.033	<loq		<loq		0.050	0.013
d-HCH	0.005	0.052	0.029	0.022	0.010	0.034	0.006	0.025	0.001	0.016	0.001
o,p' -DDE	<loq	<loq		<loq	<loq	<loq		<loq		<loq	
p,p'-DDE	0.006	0.007	0.001	0.010	0.012	0.028	0.004	0.016	0.009	0.010	0.004
p,p'-DDD	<loq	<loq		0.009	0.010	0.033	0.014	0.023	0.012	<loq	<loq
o,p'-DDT	<loq	<loq		<loq	<loq	0.006	0.009	<loq		<loq	<loq
p,p'-DDT	<loq	<loq		<loq	0.009	0.005	0.008	0.008	0.012	<loq	<loq
ΣHCHs	0.062	0.352		0.102	0.113	0.242		0.282		0.206	
ΣDDTs	0.006	0.007		0.019	0.031	0.083		0.047		0.010	
Air T (K)	278.24	283.46		284.33	284.16	293.57	1.31	293.94	1.28	293.63	0.75
Precipitation (mm)	5.25	0.2		0.4	1.65	0	-	3.3	4.67	7.0	8.20

Table S2a. Ambient air concentration (mean±SD) in ng m⁻³, ambient air temperature and precipitation for Ebro sampling sites in June 2006. <loq: data below quantification limit. Nd: not determined due to chromatographic problems.

	BORAU		SABIÑANIGO		TUDELA		ALFARO	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
HCB	0.018	0.022	0.022		ND		0.065	0.024
α-HCH	0.004	0.001	0.054		0.026	0.020	0.013	0.002
β-HCH	0.005	0.000	0.006		0.040	0.023	0.018	0.002
γ-HCH	0.007	0.000	0.058		ND		0.031	0.006
d-HCH	0.003	0.004	0.019		0.036	0.008	0.032	0.018
α, p' -DDE	<loq		<loq		<loq		<loq	
p, p'-DDE	0.007	0.003	0.009		0.007	0.002	0.013	0.007
p, p'-DDD	0.003	0.004	<loq		<loq		0.003	0.004
α, p'-DDT	<loq		<loq		<loq		0.012	0.001
p, p'-DDT	0.005	0.007	<loq		0.018	0.012	0.017	0.006
ΣHCHs	0.019		0.137		0.101		0.093	
ΣDDTs	0.015		0.009		0.024		0.045	
Air T (K)	278.24	1.60	283.46		284.33	2.56	284.16	3.82
Precipitation (mm)	5.25	0.21	0.2		0.4	0.57	1.65	2.33

Table S2b. Ambient air concentration (mean±SD) in ng m⁻³, ambient air temperature and precipitation for Ebro sampling sites in November 2006. <loq: data below quantification limit

	BORAU	SABIÑANIGO		ALFARO		TUDELA	
	Mean	Mean	SD	Mean	SD	Mean	SD
HCB	0.054	0.055	0.003	0.057	0.018	0.066	0.023
α-HCH	0.004	0.038	0.019	0.010		<loq	
β-HCH	0.007	0.010	0.008	0.031	0.038	0.009	0.000
g-HCH	0.010	<loq		<loq		0.010	0.002
d-HCH	0.018	0.007	0.002	0.004	0.001	0.016	0.004
o,p' -DDE	<loq	<loq		<loq		<loq	
p,p'-DDE	0.005	0.005	0.000	0.019	0.013	0.012	0.007
p,p'-DDD	0.002	0.001	0.000	0.002	0.000	0.005	0.003
o,p'-DDT	0.008	0.009	0.000	0.009	0.001	0.008	0.003
p,p'-DDT	0.018	0.019	0.000	0.018	0.001	0.015	0.006
ΣHCHs	0.035	0.055		0.046		0.034	
ΣDDTs	0.111	0.035		0.048		0.041	
Air T (K)	288.83	293.50	1.52	289.60	2.29	289.83	2.10
Precipitation (mm)	na	0.3	0.42	0.4	0.57	0.75	1.06

Table S2c. Ambient air concentration (mean±SD) in ng m⁻³, ambient air temperature and precipitation for Ebro sampling sites in September 2007.<loq: data below quantification limit, na= non-available data

	Hazelrigg		Langden	
	Mean	SD	Mean	SD
HCB	0.037	0.013	0.034	0.010
α-HCH	0.014	0.008	0.009	0.004
β-HCH	0.041		<loq	
γ-HCH	0.024	0.012	0.014	0.010
δ-HCH	<loq		<loq	
o,p' -DDE	0.002	0.001	0.001	0.000
p,p'-DDE	0.011	0.007	0.009	0.001
o,p'-DDD	0.001	0.000	0.001	0.000
p,p'-DDD	0.001	0.000	0.001	0.000
o,p'-DDT	<loq		<loq	
p,p'-DDT	0.001	0.000	0.001	0.000
ΣHCHs	0.078		0.023	
ΣDDTs	0.016		0.012	
Air T (K)	288.22	0.48	285.70	0.64
Precipitation (mm)	0.41	0.54	0.03	0.00

Table S2d. Ambient air concentration (mean±SD) in ng m⁻³, ambient air temperature and precipitation for UK sampling sites.

<loq: data below quantification limit

	BORAU			SABIÑANIGO			LASIESO			ALFARO			TUDELA			URUÑUELA	NAJERA
	Jun-06	Nov-06	Sep-07	Jun-06	Nov-06	Sep-07	Jun-06	Nov-06	Sep-07	Jun-06	Nov-06	Sep-07	Jun-06	Nov-06	Sep-07	Jun-06	Jun-06
HCB	0.0439	0.0447	0.0397	0.0400	0.0443	0.0989	0.0036	0.0089	0.0086	0.0508	0.0474	0.1559	0.1697	0.1503	0.4853	<loq	0.1174
α -HCH	<loq	<loq	<loq	<loq	0.2442	0.0037	<loq	<loq	<loq	<loq	0.0324	0.0277	<loq	<loq	0.0105	0.0249	<loq
β -HCH	0.0002	0.0002	0.0277	0.0013	<loq	0.0077	<loq	n	0.0039	<loq	<loq	0.0081	<loq	<loq	0.0108	0.0554	<loq
γ -HCH	0.0022	0.0051	0.0032	0.0005	0.1149	<loq	0.0001	0.0001	0.0011	<loq	0.0151	0.0029	<loq	<loq	0.0120	0.0271	0.0136
δ -HCH	0.0038	0.0062	0.0044	0.0009	0.1570	0.0090	0.0004	0.0002	0.0041	<loq	0.0767	<loq	<loq	<loq	0.0054	0.0672	0.0281
o,p'-DDE	<loq	<loq	0.0014	0.0019	0.0449	0.0016	0.0003	<loq	0.0002	<loq	0.1015	0.0001	0.0042	0.0049	0.0279	0.3618	0.2232
p,p'-DDE	0.0324	0.0792	0.0607	0.0747	0.0690	0.1126	0.0099	0.0150	0.0106	0.0161	0.2320	0.2274	0.6494	0.7226	2.4911	0.8141	0.0195
p,p'-DDD	0.0015	0.0076	0.0052	<loq	0.0795	<loq	0.0001	<loq	<loq	<loq	0.1049	<loq	<loq	0.0118	0.0948	0.1147	0.2409
o,p'-DDT	0.0072	0.0162	0.0122	0.0195	0.0303	0.0347	0.0022	0.0036	0.0063	0.0045	0.0000	0.0173	0.0598	0.0568	0.4004	0.0994	0.0729
p,p'-DDT	0.0197	0.0305	0.0315	0.0279	0.1302	0.0557	0.0040	<loq	0.0145	0.0043	0.0829	0.0327	0.1531	0.1817	1.7154	0.3691	0.6607
Σ HCHs	0.0062	0.0114	0.0354	0.0026	0.5161	0.0204	0.0005	0.0003	0.0091	<loq	0.1242	0.0387	<loq	<loq	0.0387	0.1745	0.0417
Σ DDTs	0.0608	0.1334	0.1110	0.1240	0.3538	0.2046	0.0166	0.0186	0.0316	0.0249	0.5212	0.2775	0.8665	0.9778	4.7297	1.7591	1.2173
%TOC	4.78	5.75	5.21	5.97	6.54	7.88	1.20	1.26	0.48	6.66	14.07	9.88	8.92	9.5	22.53	2.92	3.06
%N	0.49	0.58	0.51	0.44	0.47	0.57	0.12	na	na	0.66	1.33	0.93	0.55	0.60	1.00	0.27	0.22
Soil T	295.4	283.6	294.8	293.0	284	287.7	295.5	285.4	299.3	295.6	285.5	292.0	295.0	287.0	291.0	292.0	290.8
pH	7.96	7.87	8.2	7.81	7.66	8.00	8.38	8.18	8.60	7.83	8.13	8.30	7.93	8.14	8.20	8.20	8.03
Redox	250	298	305	242	266	nd	214	298	298	253	240	240	231	254	261	239	238
SWC %	3.36	30.06	4.29	14.62	28.87	5.97	3.38	16.50	5.57	19.92	27.87	17.53	9.16	15.07	22.29	18.85	16.89
Altitude	910	910	910	790	790	790	720	720	720	302	302	302	269	269	499	265	

Table S3a. Soil concentration in (ng gdw⁻¹) and soil physico-chemical properties (%TOC: soil organic carbon, %N: soil nitrogen, Soil T: Soil temperature, soil pH, soil redox, soil water content (SWC) and site altitude for selected sites along the Ebro river basin. <loq: data below quantification limit, Nd: not measured data due to sensor problems. Na: non-available data

	Hazelrigg	Hazelrigg	Langden
HCB	0.0792	0.1044	0.4127
α-HCH	0.0014	0.0064	0.0320
β-HCH	<loq	<loq	<loq
γ-HCH	0.0007	0.0128	0.0349
δ-HCH	0.0040	0.0124	0.0307
o,p' -DDE	0.0083	0.0187	0.0560
p,p'-DDE	0.0391	3.3920	0.7008
o,p'-DDD	<loq		
o,p'-DDT	0.0083	0.0726	0.0483
p,p'-DDT	0.0165	0.0226	0.0533
ΣHCHs	0.0061	0.0316	0.0975
ΣDDTs	0.0722	3.5058	0.8584
%TOC	4.48	5.54	48.33
%N	0.20	0.30	1
Soil T	289.10	289.7	286.4
pH	5.87	5.94	4.5
Redox	427	400	407
SWC %	47.45	56.20	81.80
Altitude	94.2	94.2	190

Table S3b. Soil concentration in (ng g dw⁻¹) and soil physico-chemical properties
 (%TOC: soil organic carbon, %N: soil nitrogen, Soil T: Soil temperature, soil pH,
 soil redox, soil water content (SWC) and site altitude in UK s sites. <loq: data
 below quantification limit.

	HCB	Σ DDT	Σ HCH	Σ PCBs	Σ PAHs
HCB	1.00				
Σ DDT	0.67**	1.00			
Σ HCH	0.42*	0.54*	1.00		
Σ PCBs	0.71**	0.64**	0.24*	1.00	
Σ PAHs	0.57**	0.48*	0.30*	0.49**	1.00

*p<0.05, **p<0.001, the data were log-transformed before analysis.

Table S4. Correlation coefficients for all soils

	R ²	A	p	b	p	N
HCB			>0.05		>0.05	
α-HCH	0.14	-0.80	<0.05	-0.72	<0.05	39
β-HCH	0.12	-0.46	>0.05	-0.86	0.09	25
γ-HCH	0.15	-0.51	>0.05	-0.66	>0.05	34
d-HCH			>0.05		>0.05	
o,p' -DDE			>0.05		>0.05	
p,p'-DDE			>0.05		>0.05	
p,p'-DDD			>0.05		>0.05	
o,p'-DDT	0.19	-0.63	>0.05	-0.86	<0.05	20
p,p'-DDT	0.12	-1.12	>0.05	-0.70	<0.05	35

Table S5a. Soil fugacity regressed against f_{OC}; a, b are the fitting parameters in the equation Log fs=a +b(log f_{OC}) p the level of significance and N the number of samples considered

	R ²	A	p	b	p	N
HCB			>0.05		>0.05	
α-HCH	0.16	1.65	<0.05	-1.37	<0.05	39
β-HCH			>0.05		>0.05	
g-HCH	0.21	1.91	<0.05	-1.38	<0.05	34
d-HCH			>0.05		>0.05	
o,p'-DDE	0.26	0.23	>0.05	-1.56	<0.05	15
p,p'-DDE	0.32	2.26	<0.05	-2.25	<0.001	41
p,p'-DDD	0.42	2.08	<0.05	-2.35	<0.001	26
o,p'-DDT			>0.05		>0.05	
p,p'-DDT	0.59	3.12	<0.001	-2.79	<0.001	35

Table S5b. Soil fugacity regressed against f_{OC}/f_N; a, b are the fitting parameters in the equation Log fs=a +b(log f_{OC}/f_N) p the level of significance and N the number of samples considered

	R ²	A	p	b	p	N
HCB			>0.05		>0.05	
α-HCH	0.19	-1.77	<0.05	0.25	<0.05	39
β-HCH			>0.05		>0.05	
g-HCH	0.30	-1.67	<0.05	0.27	<0.05	34
d-HCH			>0.05		>0.05	
o,p'-DDE	0.47	-4.46	<0.001	0.45	<0.05	15
p,p'-DDE	0.50	-3.70	<0.001	0.45	<0.001	41
p,p'-DDD	0.67	-4.10	<0.001	0.47	<0.001	26
o,p'-DDT			>0.05			
p,p'-DDT	0.80	-3.92	>0.001	0.51	<0.001	35

Table S5c. Soil fugacity regressed against pH; a, b are the fitting parameters in the equation Log fs=a +b(pH) p the level of significance and N the number of samples considered

	R²	A	p	b	p	N
HCB	0.16	8.38	<0.001	-0.75	<0.05	35
α-HCH	0.17	9.37	<0.001	-0.78	<0.05	26
β-HCH	ne					
g-HCH	0.26	9.94	<0.001	-1.23	<0.05	27
d-HCH			>0.05		>0.05	
o,p'-DDE	0.57	14.22	<0.001	-2.22	<0.05	15
p,p'-DDE	0.60	15.25	<0.001	-2.52	<0.001	41
p,p'-DDD	ne					
o,p'-DDT			<0.05		<0.05	
p,p'-DDT	0.55	12.68	<0.001	-1.84	<0.001	36

Table S6a. K_{OCA} regressed against altitude, a, b are the fitting parameters in the equation Log K_{OCA} =a +b(log altitude), p the level of significance, ne (not enough data for statistic analysis) and N the number of samples considered

	R²	A	p	b	p	N
HCB			>0.05		>0.05	
α-HCH			>0.05		>0.05	
β-HCH	Ne					
g-HCH			>0.05		>0.05	
d-HCH			>0.05		>0.05	
o,p'-DDE	Ne					
p,p'-DDE	0.29	5.61	<0.001	2.81	<0.001	41
p,p'-DDD	Ne					
o,p'-DDT	0.31	2.73	<0.001	4.00	<0.05	20
p,p'-DDT	0.19	6.21	<0.001	1.61	<0.05	36

Table S6b. K_{OCA} regressed against f_{OC}/f_N; a, b are the fitting parameters in the equation Log K_{OCA} =a +b(log f_{OC}/f_N), p the level of significance, ne (not enough data for statistic analysis) and N the number of samples considered.

	R ²	A	p	b	p	N
HCB			>0.05		>0.05	
α-HCH			>0.05		>0.05	
β-HCH	Ne					
g-HCH	0.23	9.04	<0.05	-0.31	<0.05	27
d-HCH	0.30	20.86	<0.05	-2.45	<0.05	18
o,p'-DDE	Ne					
p,p'-DDE	0.48	13.21	<0.001	-0.60	<0.001	41
p,p'-DDD	Ne					
o,p'-DDT			>0.05		>0.05	
p,p'-DDT	0.26	10.27	<0.001	-0.30	<0.05	36

Table S6c. K_{OC} regressed against soil pH; a, b are the fitting parameters in the equation Log K_{OC} =a +b (pH), p the level of significance, ne (not enough data for statistic analysis) and N the number of samples considered.