

Supporting Information

Brominated flame retardants and Dechlorane Plus in the marine atmosphere from Southeast Asia toward Antarctica

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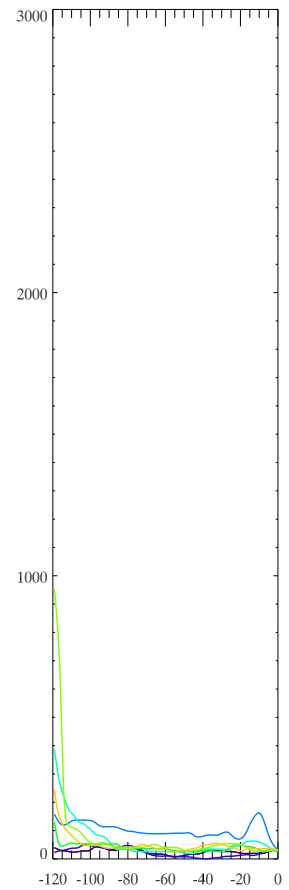
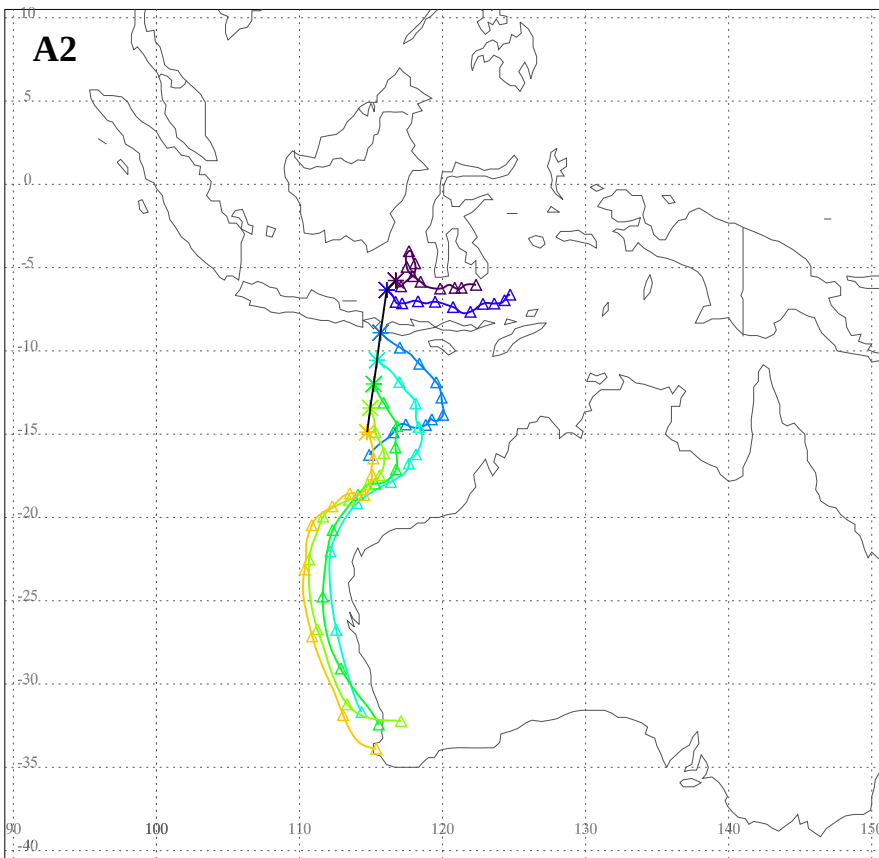
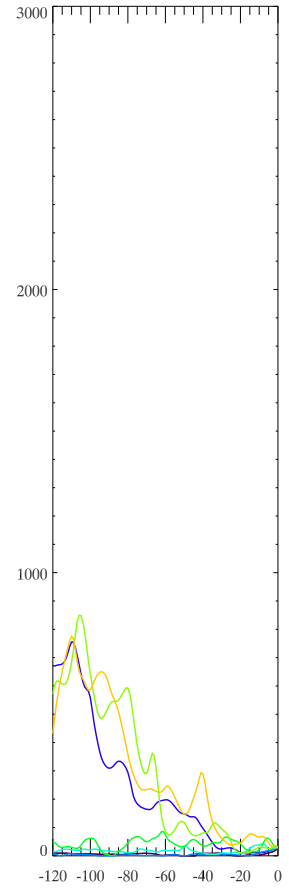
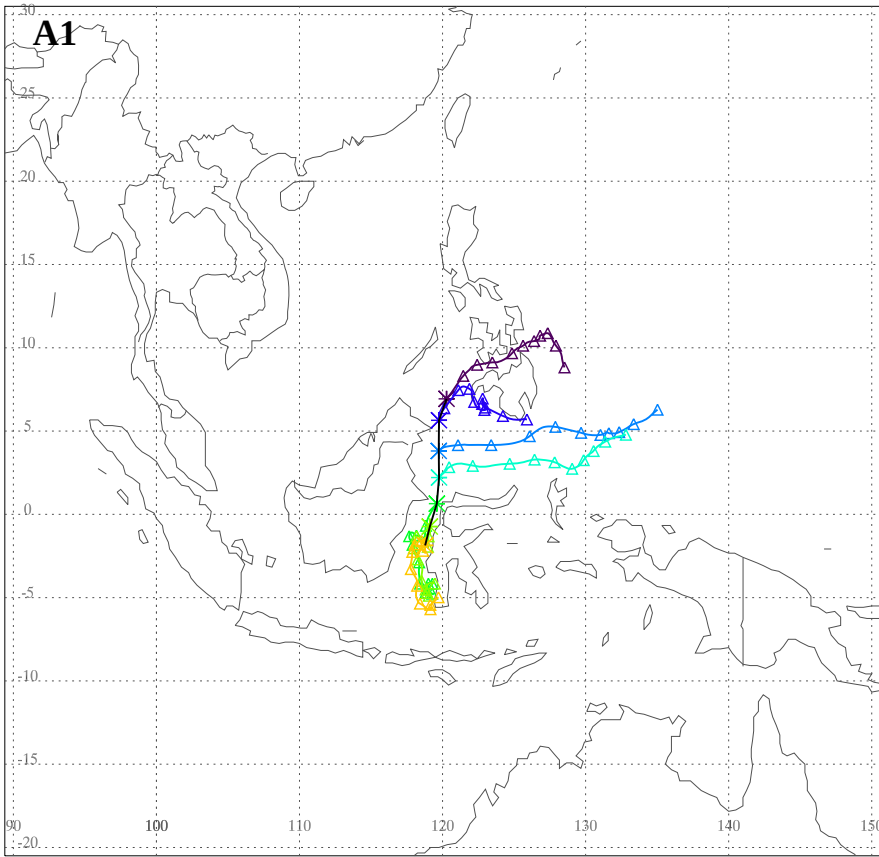
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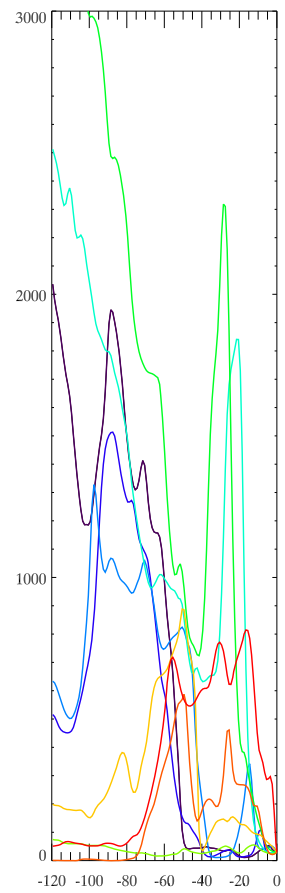
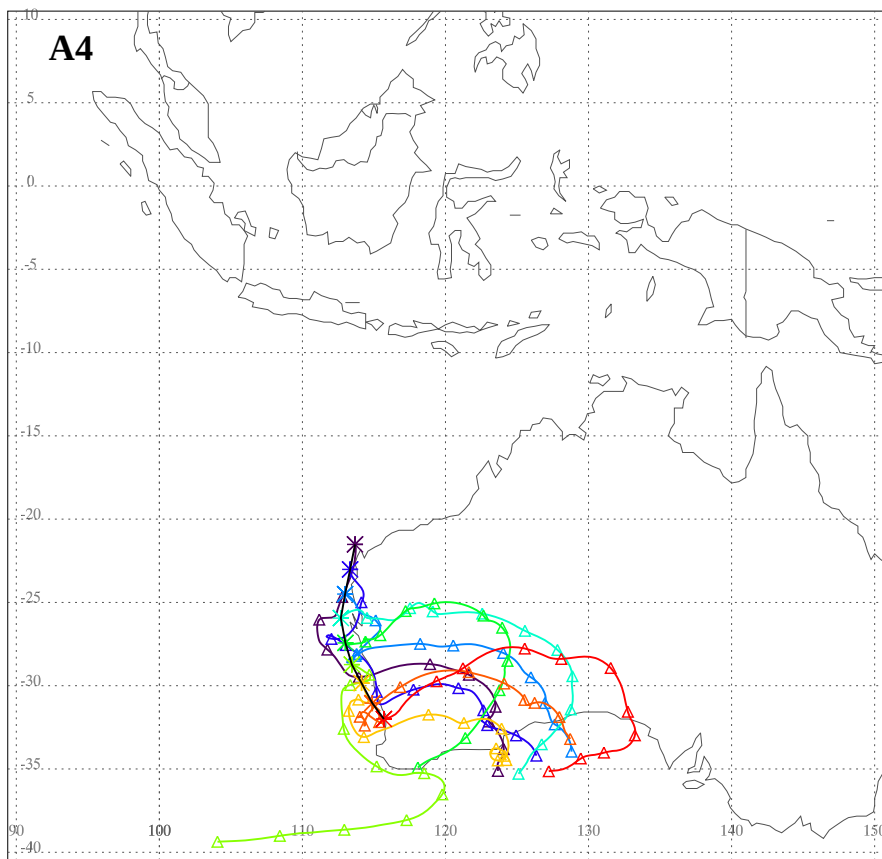
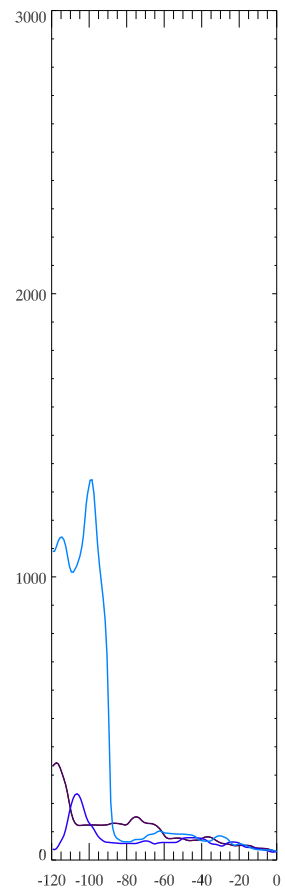
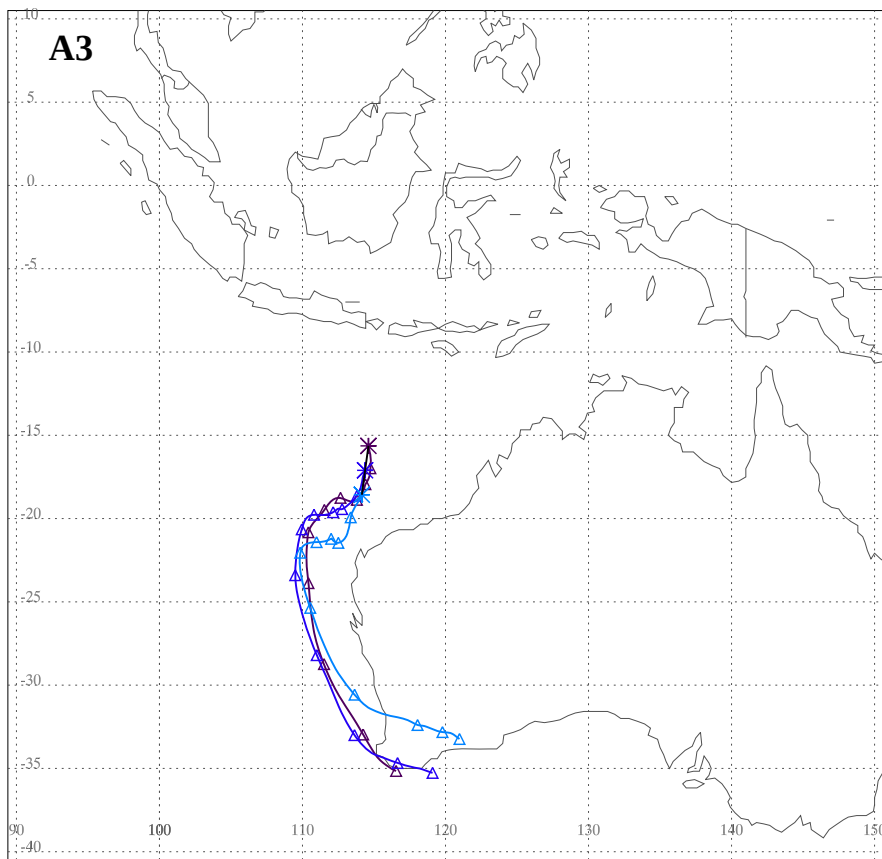
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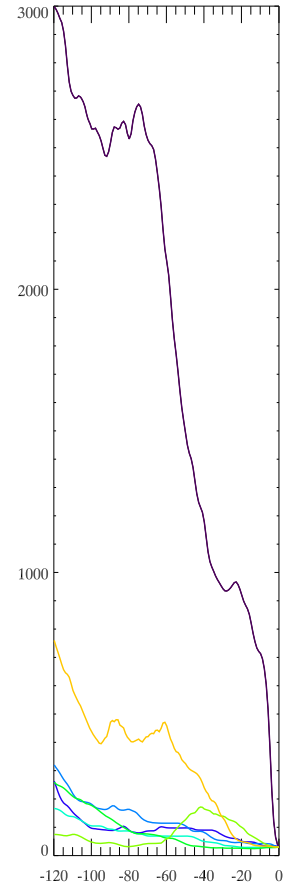
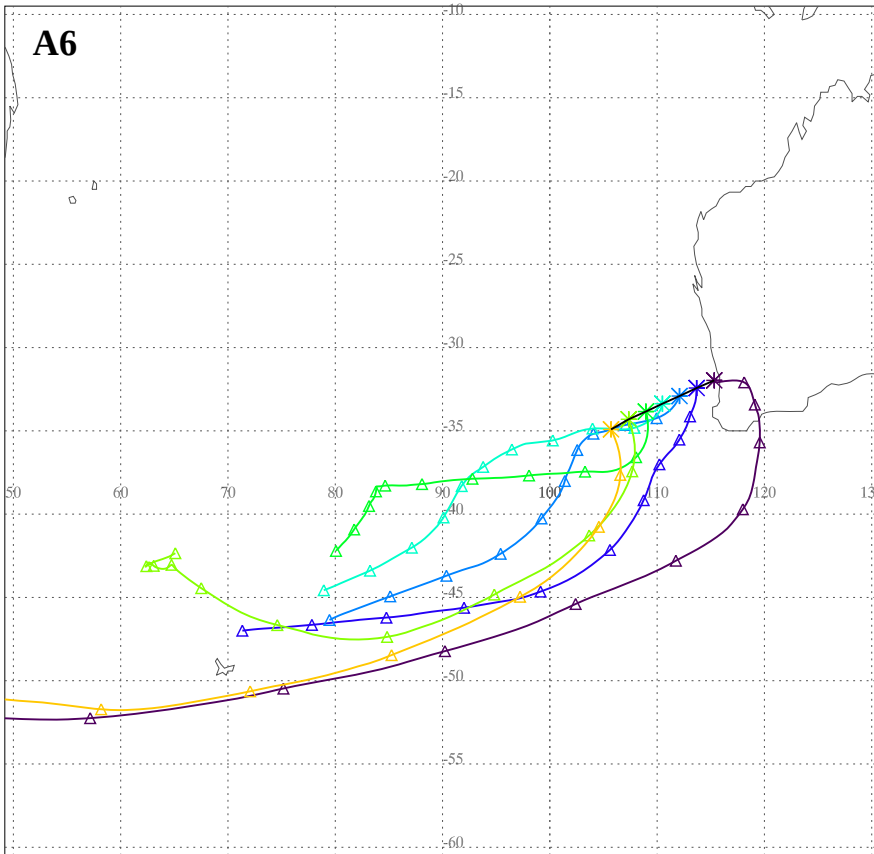
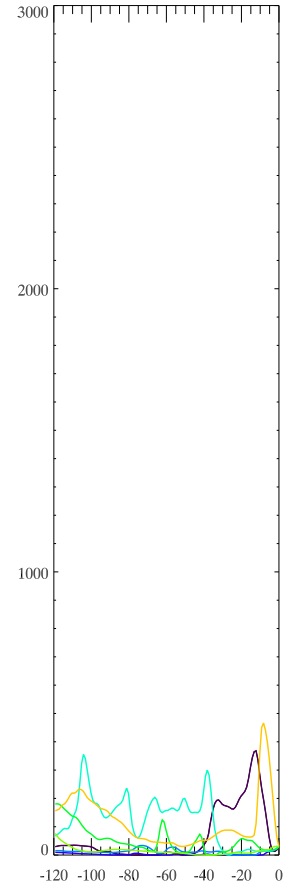
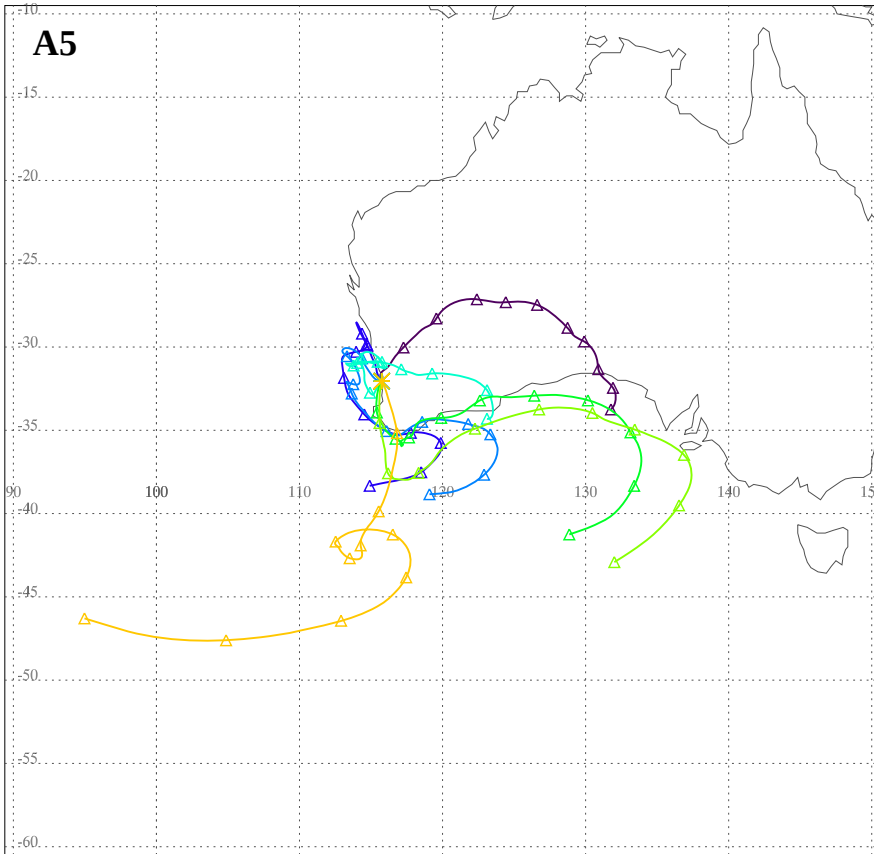
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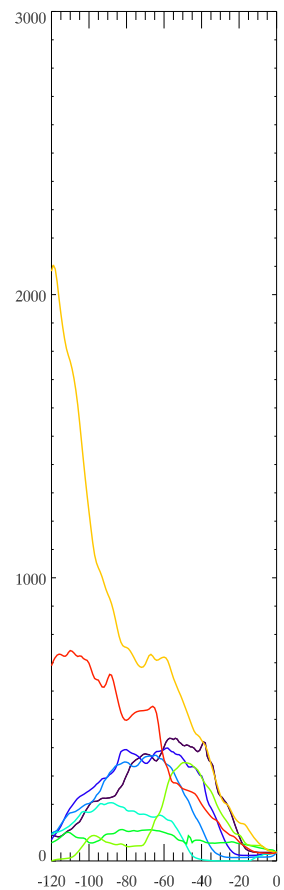
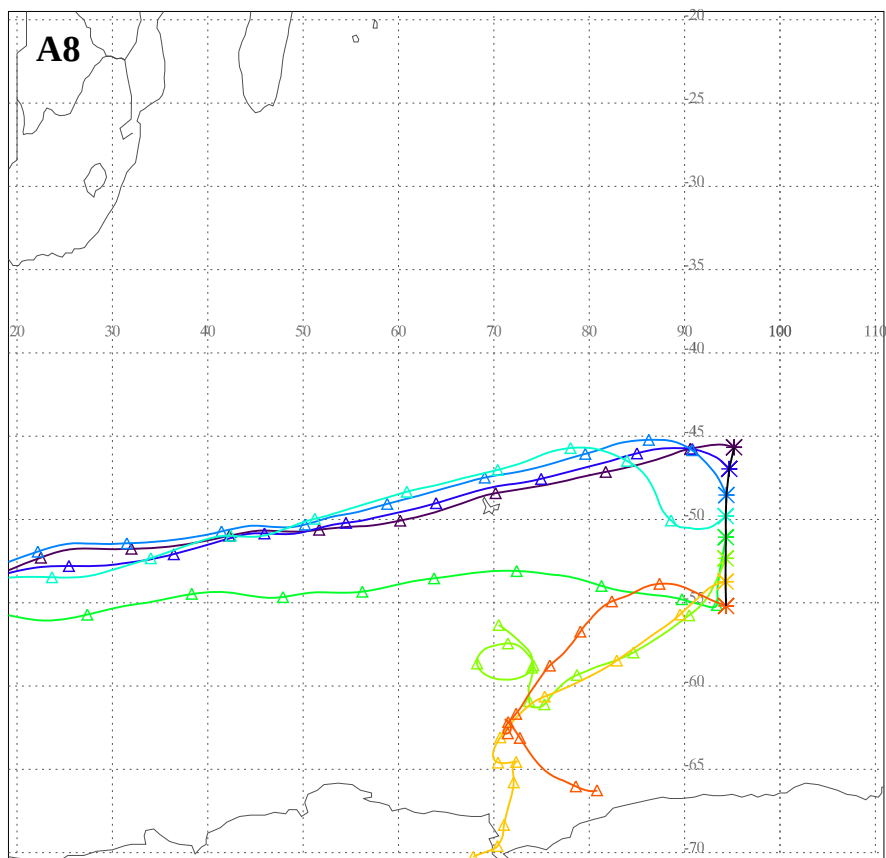
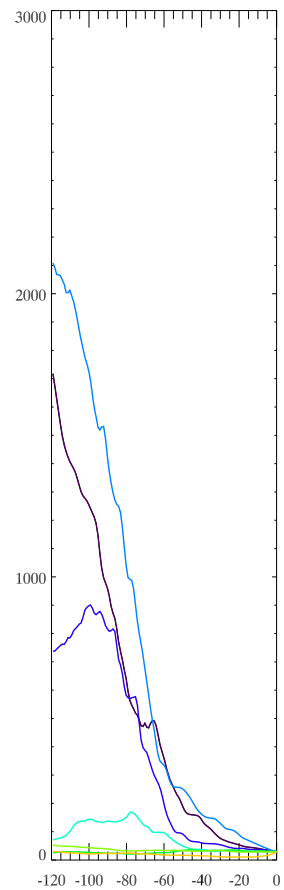
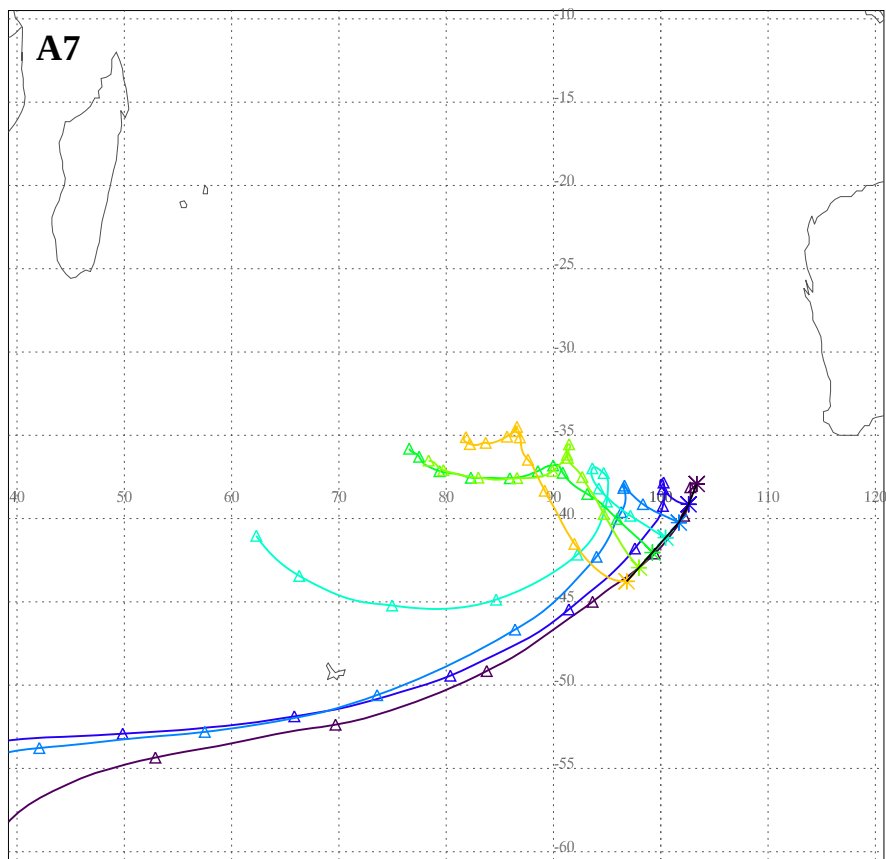
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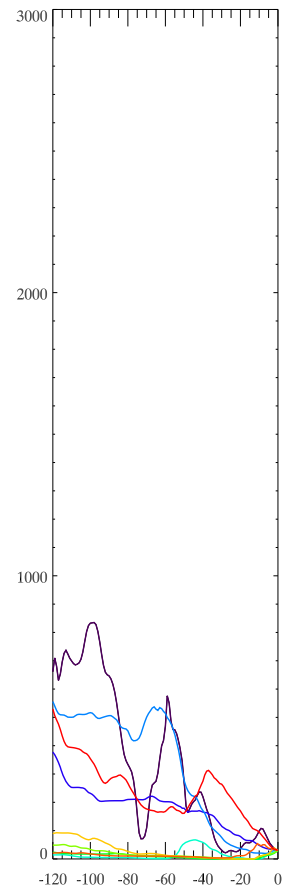
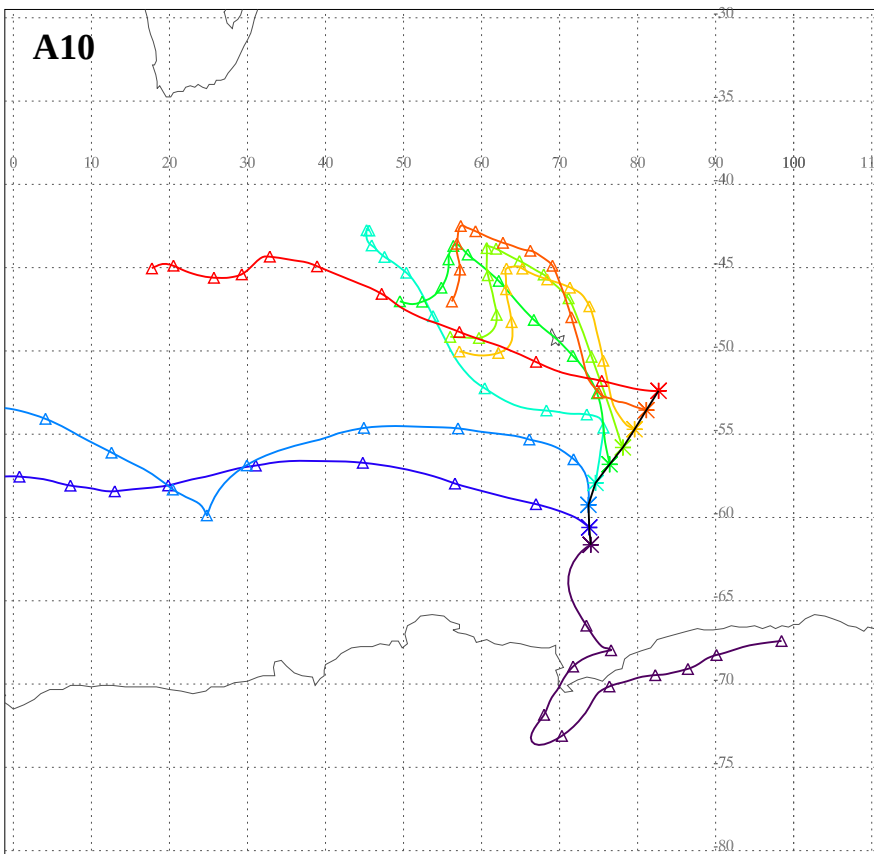
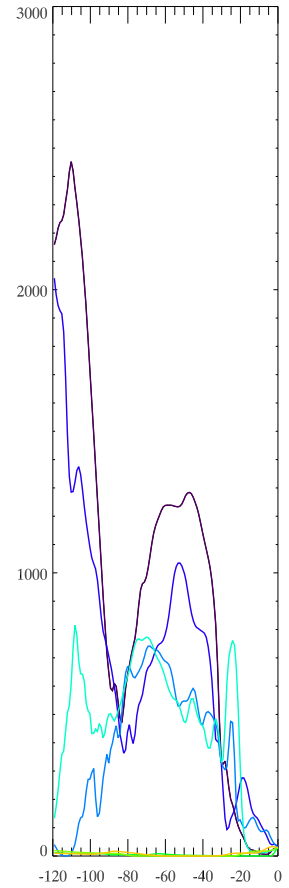
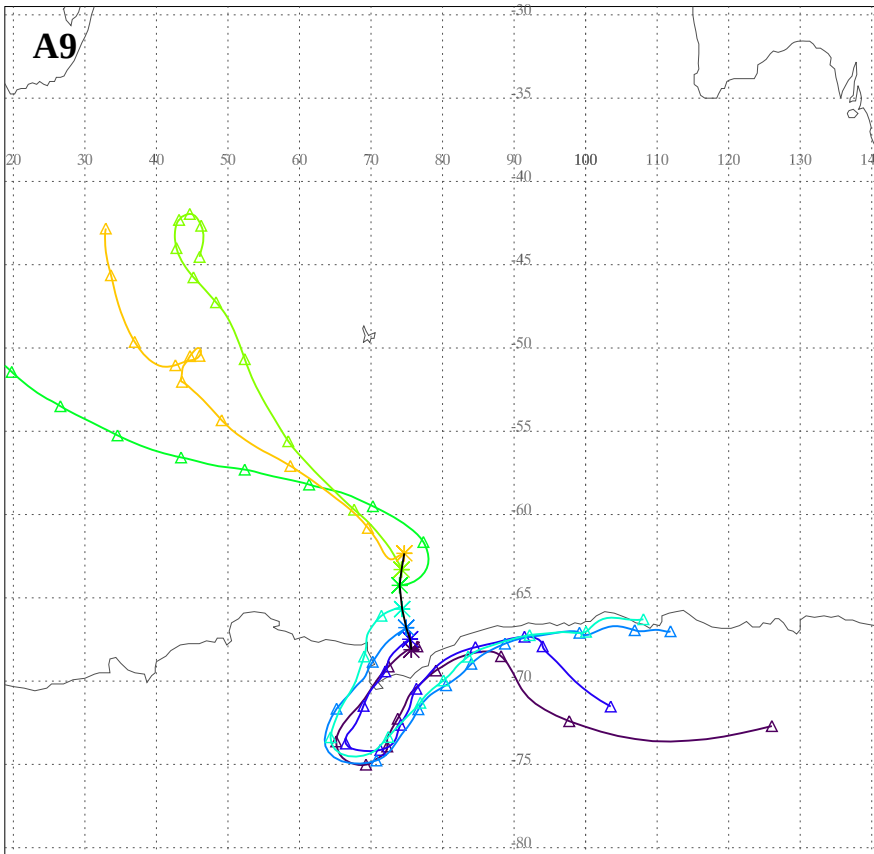
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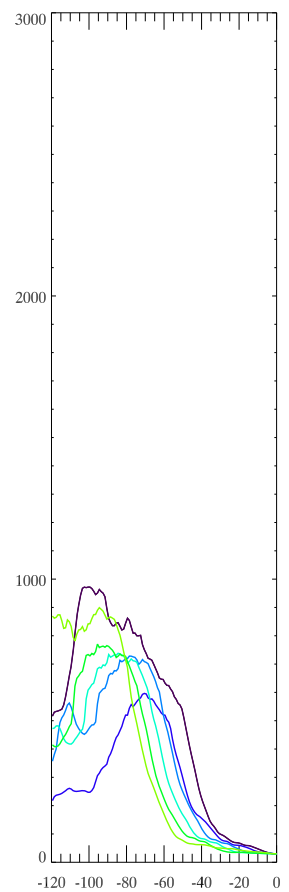
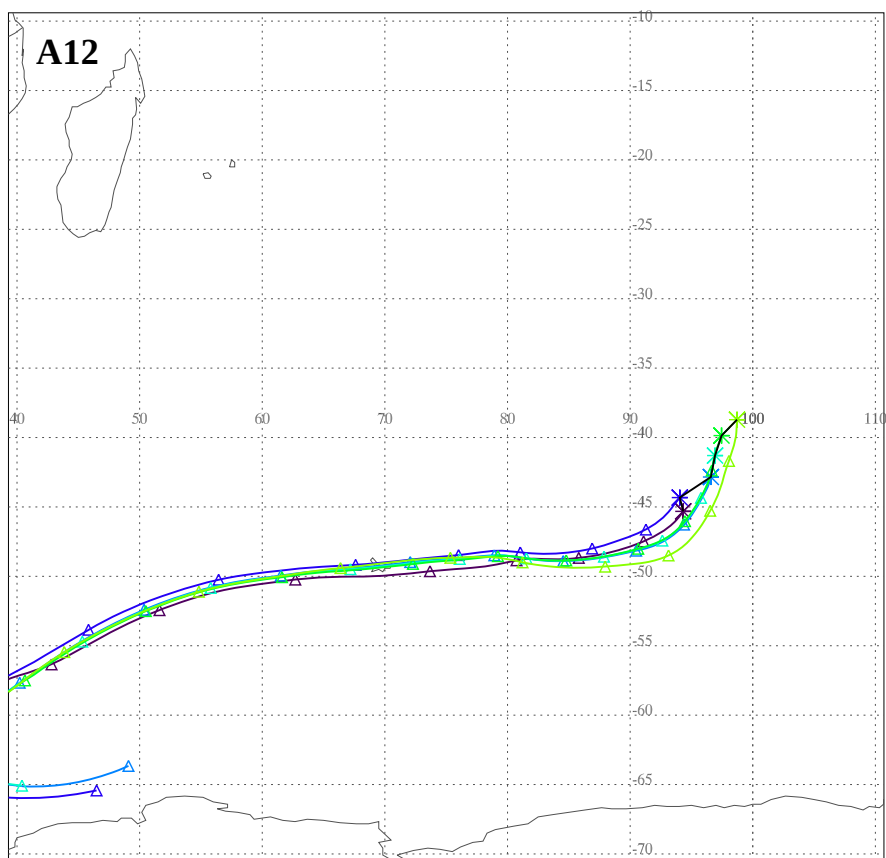
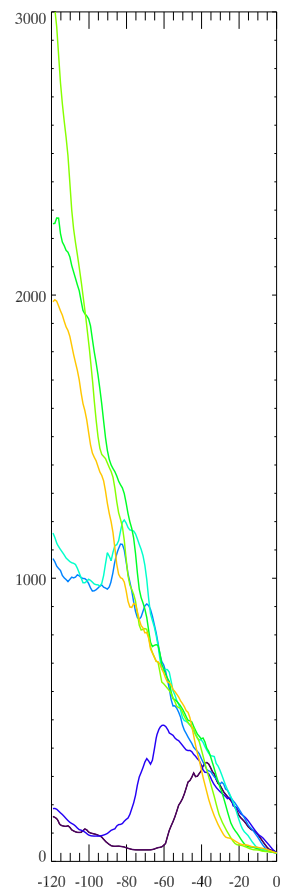
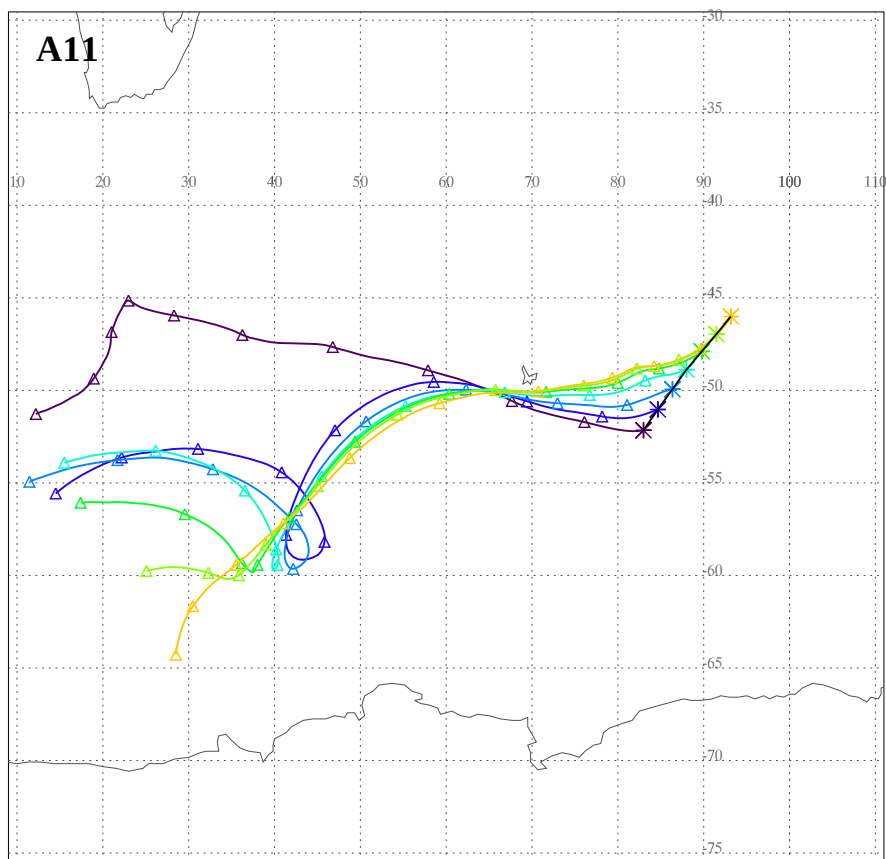


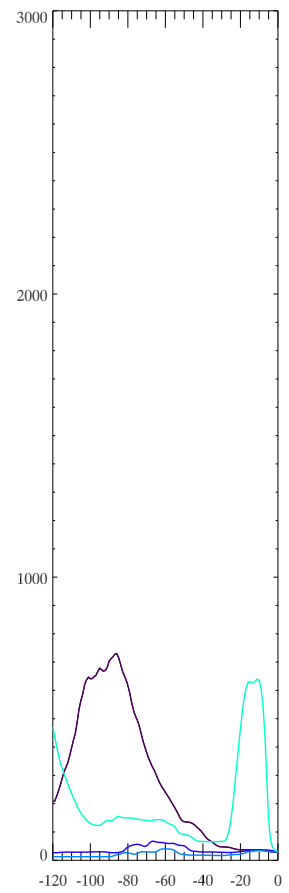
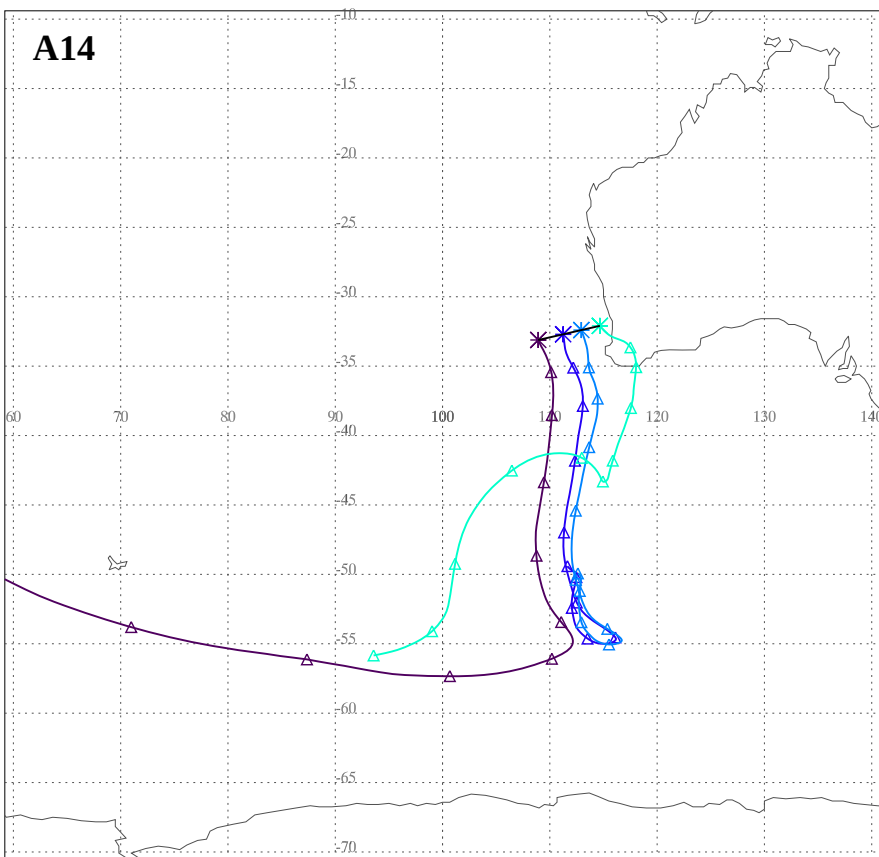
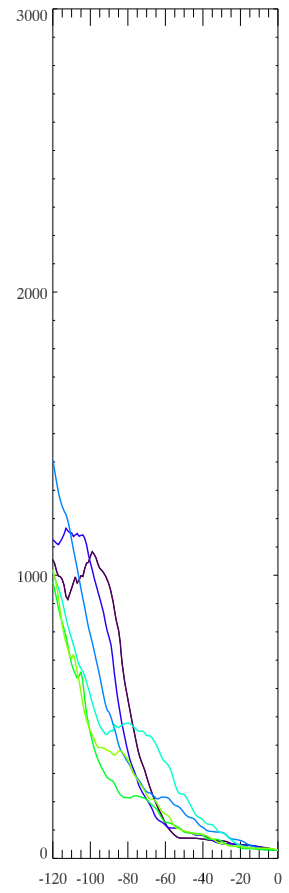
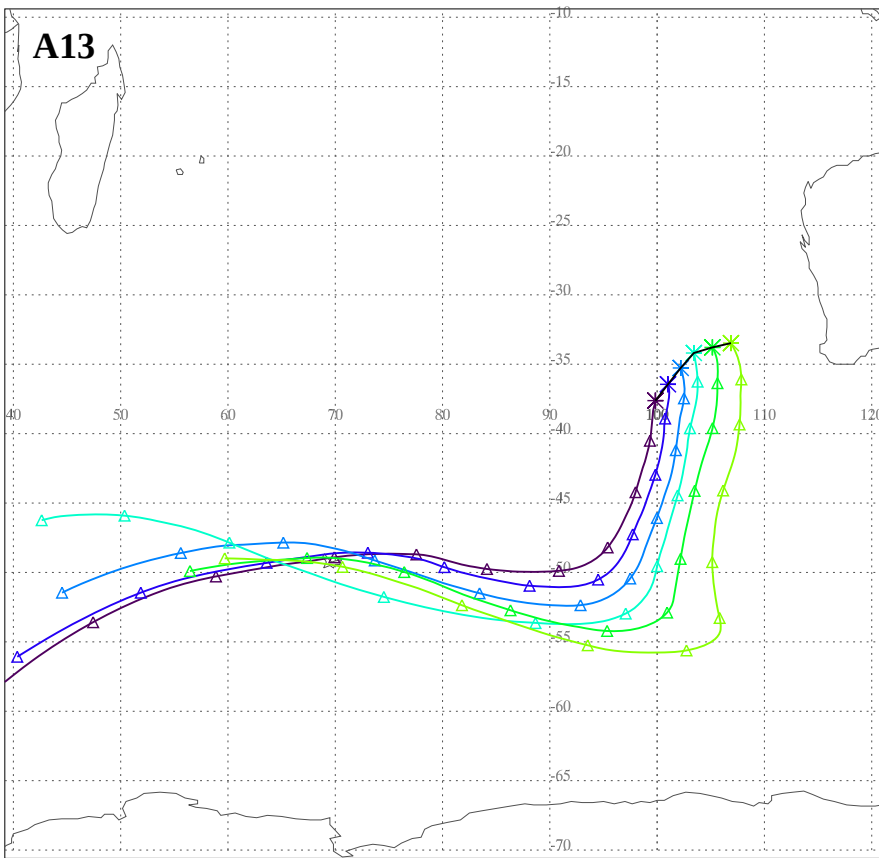


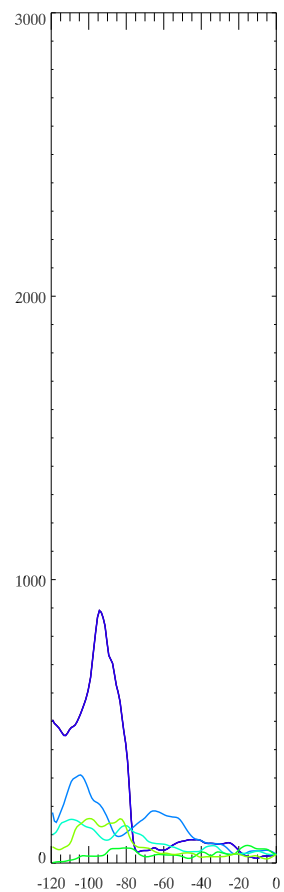
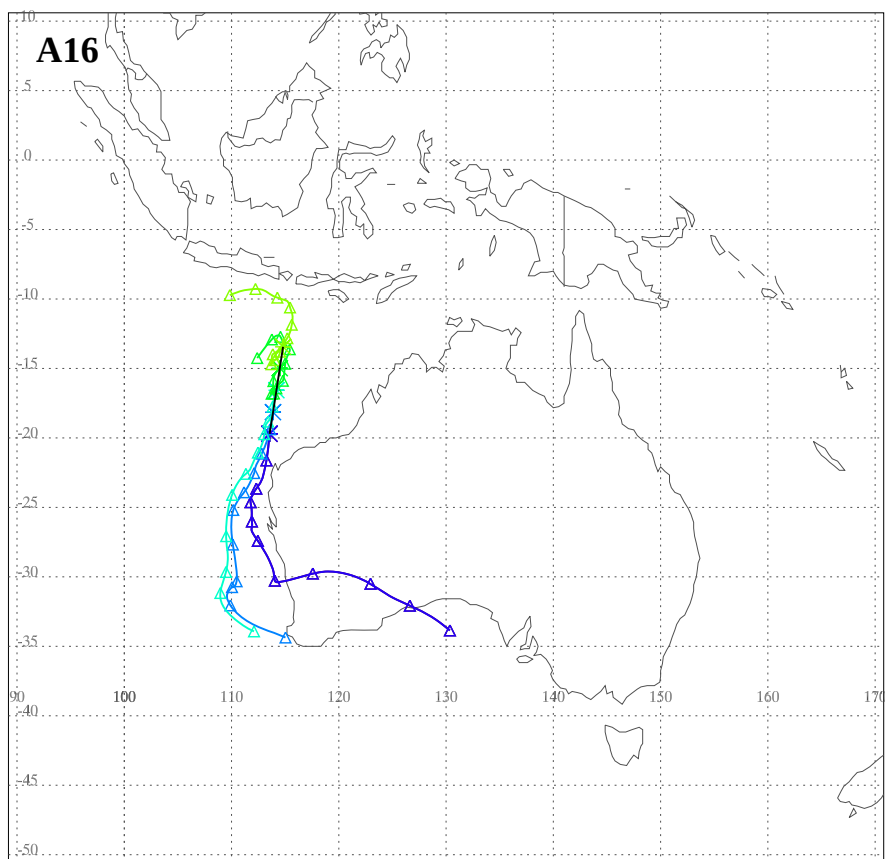
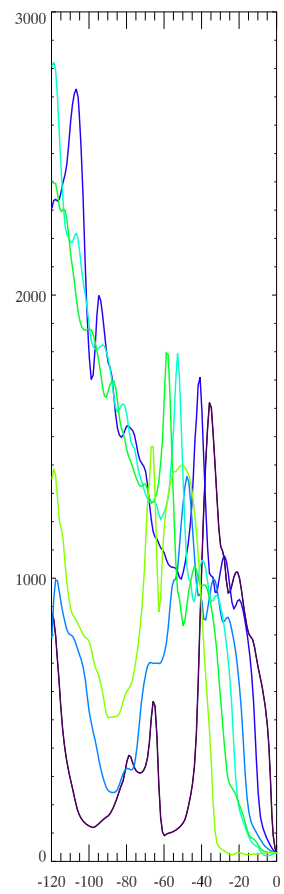
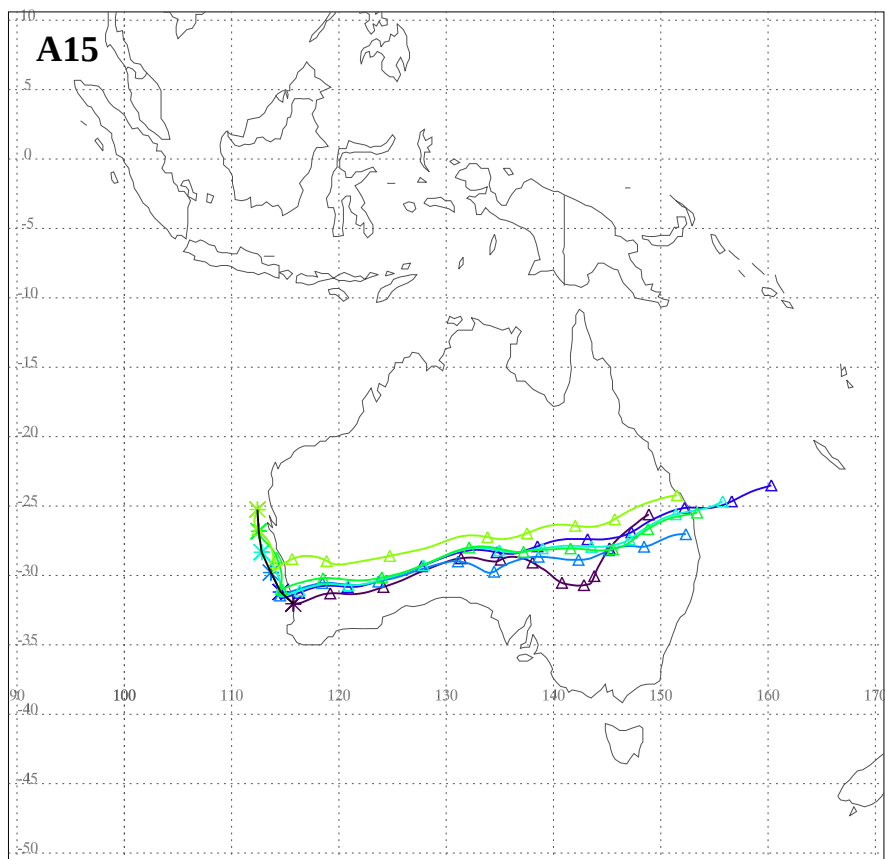


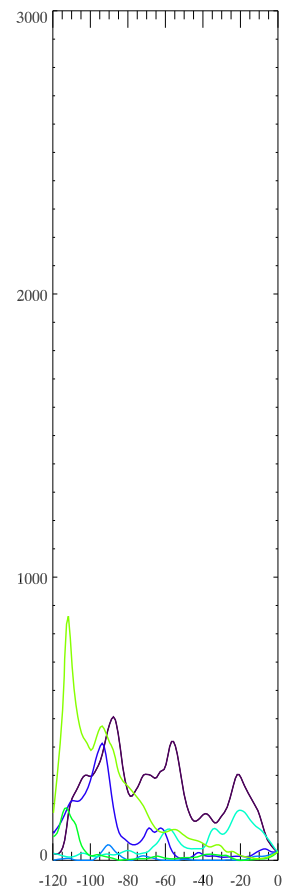
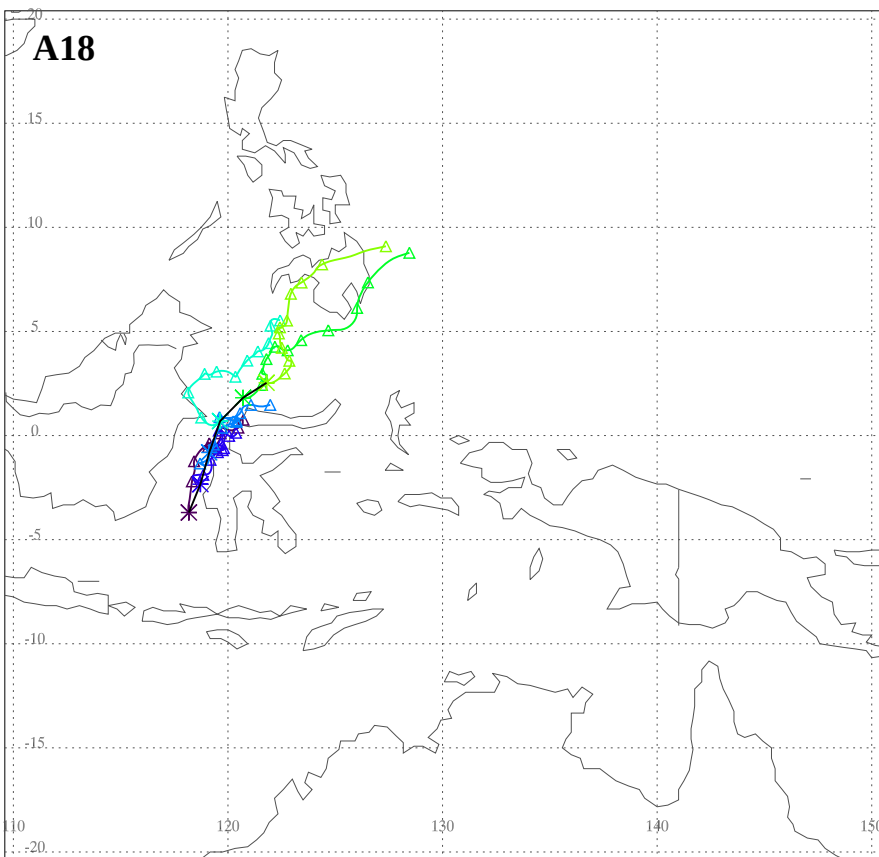
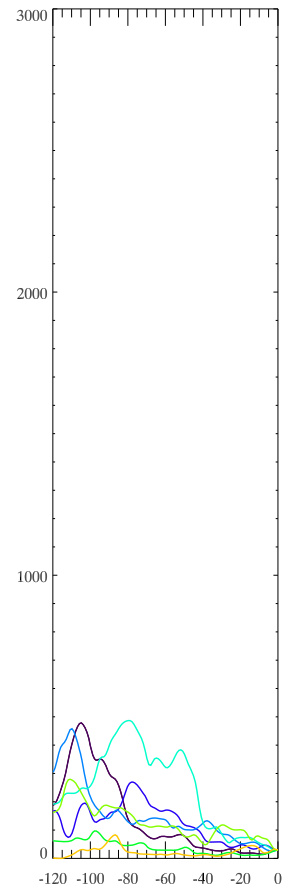
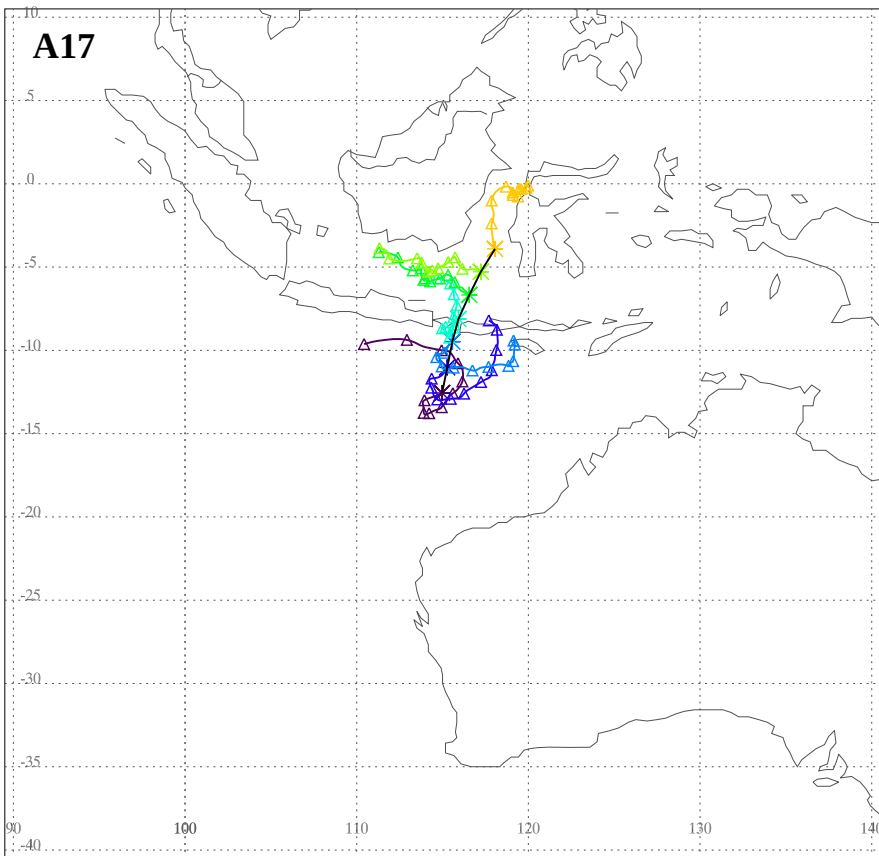












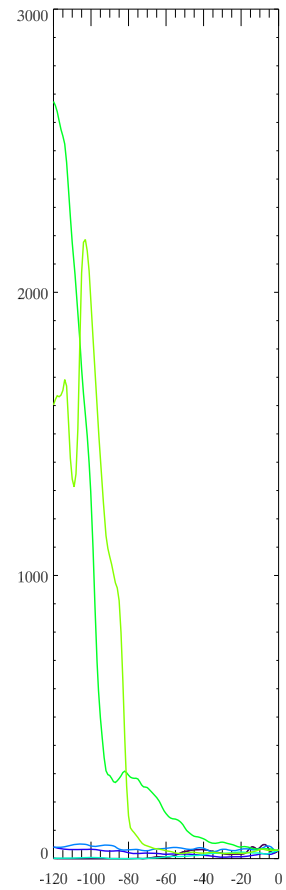
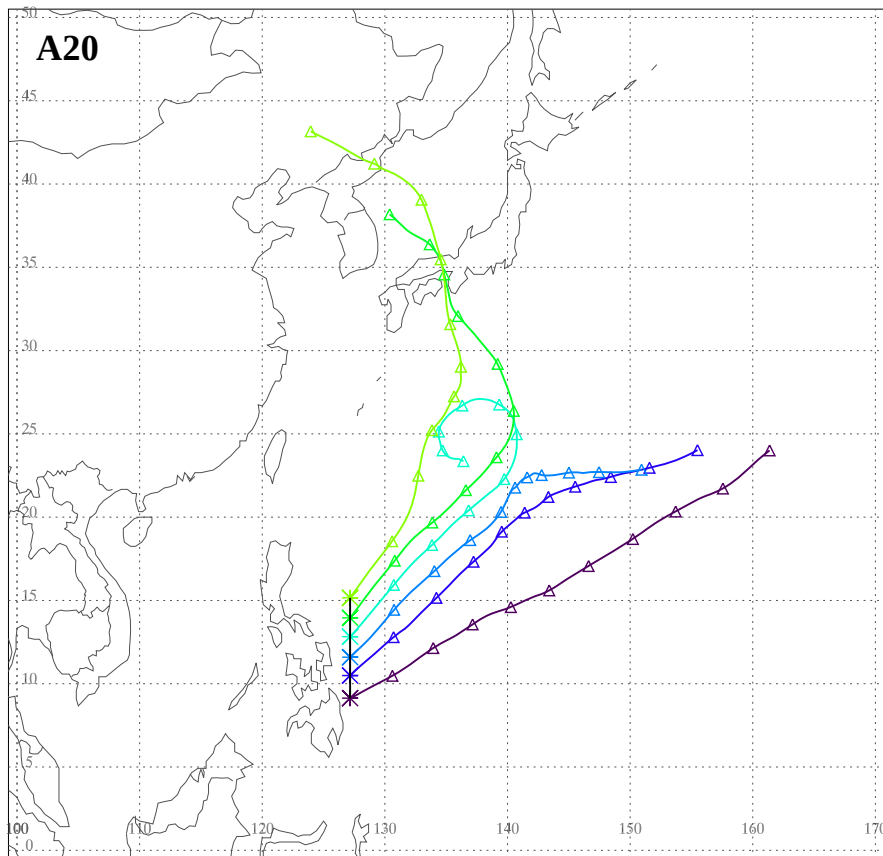
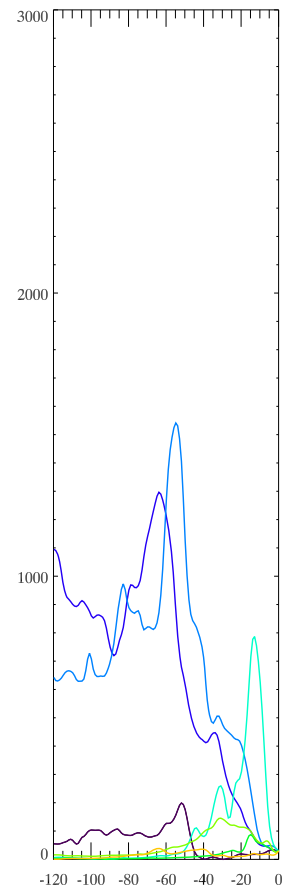
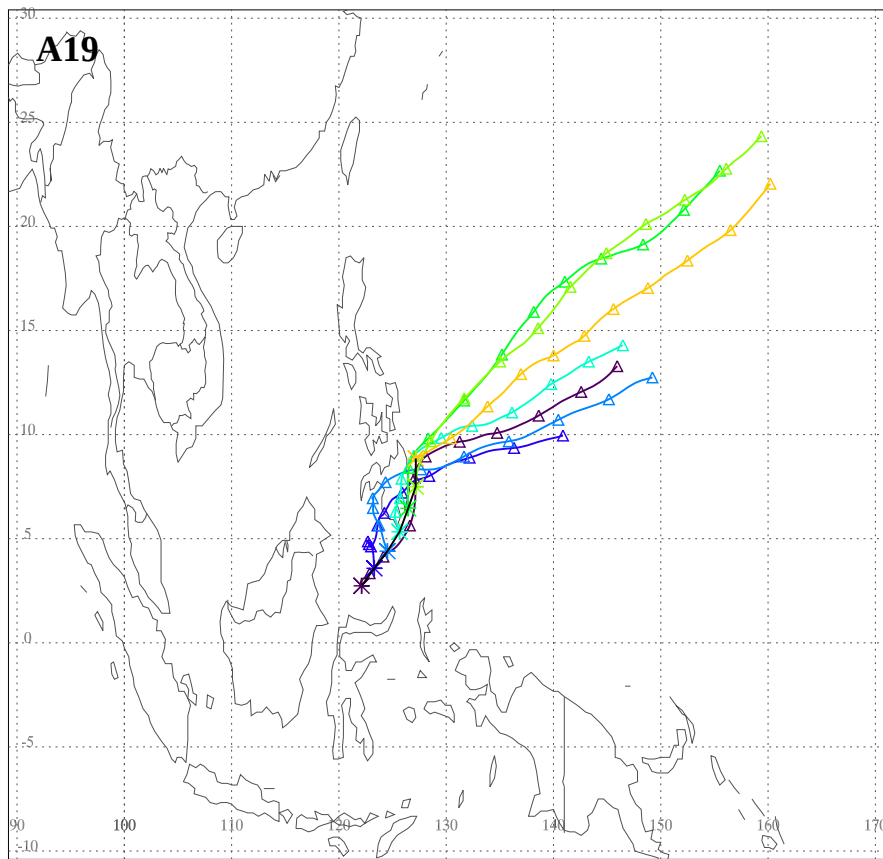


Figure S1. Plots of 120h air mass back trajectories (left) and altitudinal profiles in meters (right). (BTs) were calculated using NOAA's HYSPLIT model. BTs were calculated for arrival times in 6 h steps at the corresponding position of the ship along the cruise leg. The black line indicates the ships cruise leg during sampling.

TABLE S1. Detailed information on air sampling. Latitude and longitude represent the mean sampling station. Air temperature and wind speed are mean values.

	Date	Latitude (°N)	Longitude (°E)	Volume (m ³)	Wind speed (m s ⁻¹)	T _A (°C)
A1	14.-15.11.2010	-2.22	118.15	485.3	3.5	28.0
A2	16.-17.11.2010	-10.54	115.43	513.9	7.3	29.1
A3	18.11.2010	-17.64	114.26	191.0	7.8	27.7
A4	19.-21.11.2010	-27.45	113.01	769.6	10.9	24.7
A5	21.-22.11.2010	-32.05	115.74	591.8	12.0	17.4
A6	24.-25.11.2010	-33.37	110.49	499.4	11.9	17.5
A7	26.-27.11.2010	-41.15	100.44	536.0	9.2	13.0
A8	28.-29.11.2010	-50.38	94.27	533.9	13.2	5.2
A9	26.-28.2.2011	-65.73	74.38	521.0	8.7	4.0
A10	28.2.-2.3.2011	-56.80	76.42	706.3	13.4	2.7
A11	2.-4.3.2011	-48.57	88.58	629.2	9.5	8.8
A12	4.-5.3.2011	-41.43	96.90	458.8	8.6	12.9
A13	5.-7.3.2011	-34.02	103.96	486.6	10.7	17.1
A14	7.-8.3.2011	-32.50	112.35	389.7	17.1	21.4
A15	17.-18.3.2011	-28.70	112.93	511.5	7.9	26.8
A16	19.-20.3.2011	-16.98	114.10	485	4.2	30.1
A17	20.-21.3.2011	-8.12	115.93	506.8	4.7	28.8
A18	21.-23.3.2011	0.33	119.47	378.1	6.7	26.1
A19	23.-24.3.2011	5.32	125.64	472.2	9.4	27.1
A20	24.-26.3.2011	12.72	127.16	490.7	19.2	26.8

TABLE S2. Mean absolute blank values of HFRs detected in the blanks (pg). Other HFRs were not detected in any blanks. n.d. = not detected; n.a. = not analyzed

	Air column	Air filter
BDE-99	13 ± 12	n.d.
BDE-183	130 ± 29	n.d.
BDE-209	n.a.	210 ± 190
PBBz	n.d.	3.0 ± 6.6
DPTE	66 ± 5.4	66 ± 3.2
HBB	92 ± 110	n.d.
Dec602	25 ± 29	8.2 ± 11
TBPH	120 ± 160	n.d.
synDP	30 ± 6.0	n.d.
antiDP	34 ± 2.7	n.d.

TABLE S3. MDLs of HFRs in pg m^{-3} . MDLs were calculated from mean field blank values plus three times the standard deviation or, if no blank values detected, based on instrumental S/N ratios of 3. Mean sample volumes of 500 m^3 for air columns and 250 m^3 for air filters were assumed. n.a. = not analyzed.

	air	
	column	filter
BDE-28	0.008 ^a	0.015 ^a
BDE-47	0.015 ^a	0.030 ^a
BDE-66	0.015 ^a	0.031 ^a
BDE-85	0.016 ^a	0.032 ^a
BDE-99	0.096	0.022 ^a
BDE-100	0.013 ^a	0.026 ^a
BDE-153	0.013 ^a	0.026 ^a
BDE-154	0.009 ^a	0.018 ^a
BDE-183	0.43	0.029 ^a
BDE-209	n.a.	3.4
PBBz	0.002 ^a	0.092
PBT	0.003 ^a	0.007 ^a
PBEB	0.003 ^a	0.005 ^a
DPTE	0.17	0.30
HBB	0.84	0.006 ^a
TBPH	1.2	0.025 ^a
EHTBB	0.008 ^a	0.015 ^a
BTBPE	0.023 ^a	0.046 ^a
aCl10DP	0.001 ^a	0.002 ^a
aCl11DP	0.001 ^a	0.003 ^a
synDP	0.096	0.003 ^a
antiDP	0.084	0.003 ^a
Dec 602	0.22	0.17
Dec 603	0.002 ^a	0.004 ^a
Dec 604	0.018 ^a	0.035 ^a

^acalculated based on instrumental S/N ratios

TABLE S4. Individual concentrations of HFRs detected in the gaseous (gas.) and particulate (part.) phase of the atmosphere in pg m^{-3} . Other analyzed HFRs were not detected

		BDE-28	BDE-47	BDE-99	BDE-100	BDE-154	BDE-153	BDE-183	BDE-209 ^a
A1	gas.	0.35	0.32	0.20	0.02	0.16	0.18	n.d.	
	part.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
A2	gas.	0.30	0.14	0.10	n.d.	n.d.	n.d.	n.d.	
	part.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.34	4.0
A3	gas. ^b								
	part.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
A4	gas.	0.21	0.09	n.d.	n.d.	n.d.	n.d.	n.d.	
	part.	n.d.	0.02	0.05	n.d.	n.d.	n.d.	n.d.	n.d.
A5	gas. ^b				n.d.	n.d.	n.d.	n.d.	
	part.	n.d.	0.05	0.09	n.d.	n.d.	n.d.	0.29	3.7
A6	gas.	n.d.	0.08	n.d.	n.d.	n.d.	n.d.	n.d.	
	part.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
A7	gas.	0.13	0.06	n.d.	n.d.	n.d.	n.d.	n.d.	
	part.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
A8	gas.	n.d.	0.05	n.d.	n.d.	n.d.	n.d.	n.d.	
	part.	n.d.	0.04	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
A9	gas. ^b				n.d.	n.d.	n.d.	n.d.	
	part.	n.d.	0.08	0.06	n.d.	n.d.	n.d.	n.d.	n.d.
A10	gas.	0.08	0.05	n.d.	n.d.	n.d.	n.d.	n.d.	
	part.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
A11	gas.	0.16	0.02	n.d.	n.d.	n.d.	n.d.	n.d.	
	part.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
A12	gas.	n.d.	0.06	0.73	n.d.	n.d.	n.d.	n.d.	
	part.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
A13	gas.	0.31	0.09	n.d.	n.d.	n.d.	n.d.	n.d.	
	part.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	6.5
A14	gas.	0.32	0.18	n.d.	n.d.	n.d.	n.d.	n.d.	
	part.	n.d.	0.05	0.10	n.d.	n.d.	n.d.	n.d.	n.d.
A15	gas.	0.24	0.49	0.45	0.06	n.d.	n.d.	n.d.	
	part.	n.d.	n.d.	0.05	n.d.	n.d.	n.d.	n.d.	n.d.
A16	gas.	1.3	0.22	0.26	0.04	0.18	0.18	n.d.	
	part.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	4.7
A17	gas.	n.d.	0.31	0.22	n.d.	n.d.	n.d.	n.d.	
	part.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	4.2
A18	gas.	n.d.	0.16	0.23	n.d.	n.d.	n.d.	n.d.	
	part.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
A19	gas.	0.17	0.14	n.d.	n.d.	n.d.	n.d.	n.d.	
	part.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
A20	gas.	n.d.	0.14	n.d.	n.d.	n.d.	n.d.	n.d.	
	part.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.

^afor BDE-209, only the particulate phase was analyzed

^bnot analyzed

n.d. = not detected

Continuation of Table S4

		PBBz	PBT	DPTE	HBB	EHTBB	TBPH	synDP	antiDP	Dec603
A1	gas.	3.4	1.9	1.9	18.3	n.d.	n.d.	0.71	0.57	n.d.
	part.	n.d.	n.d.	0.32	0.21	n.d.	0.16	0.30	0.19	n.d.
A2	gas.	0.72	0.71	0.44	2.2	n.d.	n.d.	0.68	0.13	n.d.
	part.	n.d.	n.d.	n.d.	0.13	0.15	0.22	0.63	1.2	n.d.
A3	gas. ^b									
	part.	n.d.	0.36	n.d.	0.33	n.d.	n.d.	0.46	0.38	n.d.
A4	gas.	2.3	1.4	0.41	4.7	n.d.	n.d.	0.29	0.07	n.d.
	part.	n.d.	n.d.	n.d.	0.12	n.d.	0.10	0.24	0.14	n.d.
A5	gas. ^b									
	part.	n.d.	n.d.	n.d.	0.14	n.d.	0.16	0.28	0.24	0.13
A6	gas.	0.39	0.57	0.26	1.1	n.d.	n.d.	0.14	0.00	n.d.
	part.	n.d.	n.d.	n.d.	0.13	n.d.	0.21	0.16	0.15	n.d.
A7	gas.	0.52	1.2	0.37	1.2	n.d.	n.d.	n.d.	n.d.	n.d.
	part.	n.d.	n.d.	n.d.	0.12	n.d.	0.47	0.13	0.14	n.d.
A8	gas.	0.31	0.56	0.42	0.79	n.d.	n.d.	0.27	0.24	n.d.
	part.	n.d.	n.d.	n.d.	0.15	n.d.	n.d.	0.26	0.18	n.d.
A9	gas. ^b									
	part.	n.d.	n.d.	n.d.	0.12	0.14	0.43	0.17	0.14	n.d.
A10	gas.	0.35	0.95	0.49	0.94	n.d.	n.d.			n.d.
	part.	n.d.	n.d.	n.d.	0.10	n.d.	0.98	1.6	0.56	n.d.
A11	gas.	0.36	0.67	0.21	0.82	n.d.	n.d.	0.08	0.07	n.d.
	part.	n.d.	n.d.	n.d.	0.11	0.13	0.98	0.12	0.12	n.d.
A12	gas.	0.34	0.90	0.41	1.3	n.d.	n.d.	0.20	0.20	n.d.
	part.	n.d.	n.d.	n.d.	0.16	n.d.	1.5	0.19	0.17	n.d.
A13	gas.	0.88	1.8	1.1	1.2	n.d.	n.d.	0.11	0.10	n.d.
	part.	n.d.	n.d.	n.d.	0.16	0.21	0.46	0.17	0.16	n.d.
A14	gas.	0.85	1.4	1.0	2.0	n.d.	n.d.	0.24	0.13	n.d.
	part.	n.d.	n.d.	n.d.	0.16	n.d.	0.51	0.29	0.19	n.d.
A15	gas.	3.5	2.0	0.54	16.4	n.d.	n.d.	0.38	0.28	0.08
	part.	n.d.	n.d.	n.d.	0.18	n.d.	0.17	0.33	0.24	n.d.
A16	gas.	4.3	2.8	0.53	25.7	n.d.	n.d.	0.87	0.22	0.08
	part.	n.d.	n.d.	n.d.	n.d.	n.d.	0.66	n.d.	n.d.	n.d.
A17	gas.	3.9	2.2	0.77	18.9	n.d.	n.d.	1.1	0.37	0.13
	part.	n.d.	n.d.	0.34	0.14	n.d.	0.58	0.90	0.66	0.26
A18	gas.	2.7	1.4	0.75	12.9	n.d.	n.d.	5.8	4.4	n.d.
	part.	n.d.	n.d.	n.d.	0.16	n.d.	0.75	0.51	0.21	n.d.
A19	gas.	0.98	0.79	0.61	3.6	n.d.	n.d.	0.69	0.53	n.d.
	part.	n.d.	n.d.	n.d.	0.16	n.d.	2.8	0.28	0.19	n.d.
A20	gas.	1.8	0.94	0.50	5.4	n.d.	n.d.	1.5	1.5	n.d.
	part.	n.d.	n.d.	n.d.	0.13	n.d.	1.3	0.18	0.32	n.d.

^bnot analyzed

n.d. = not detected

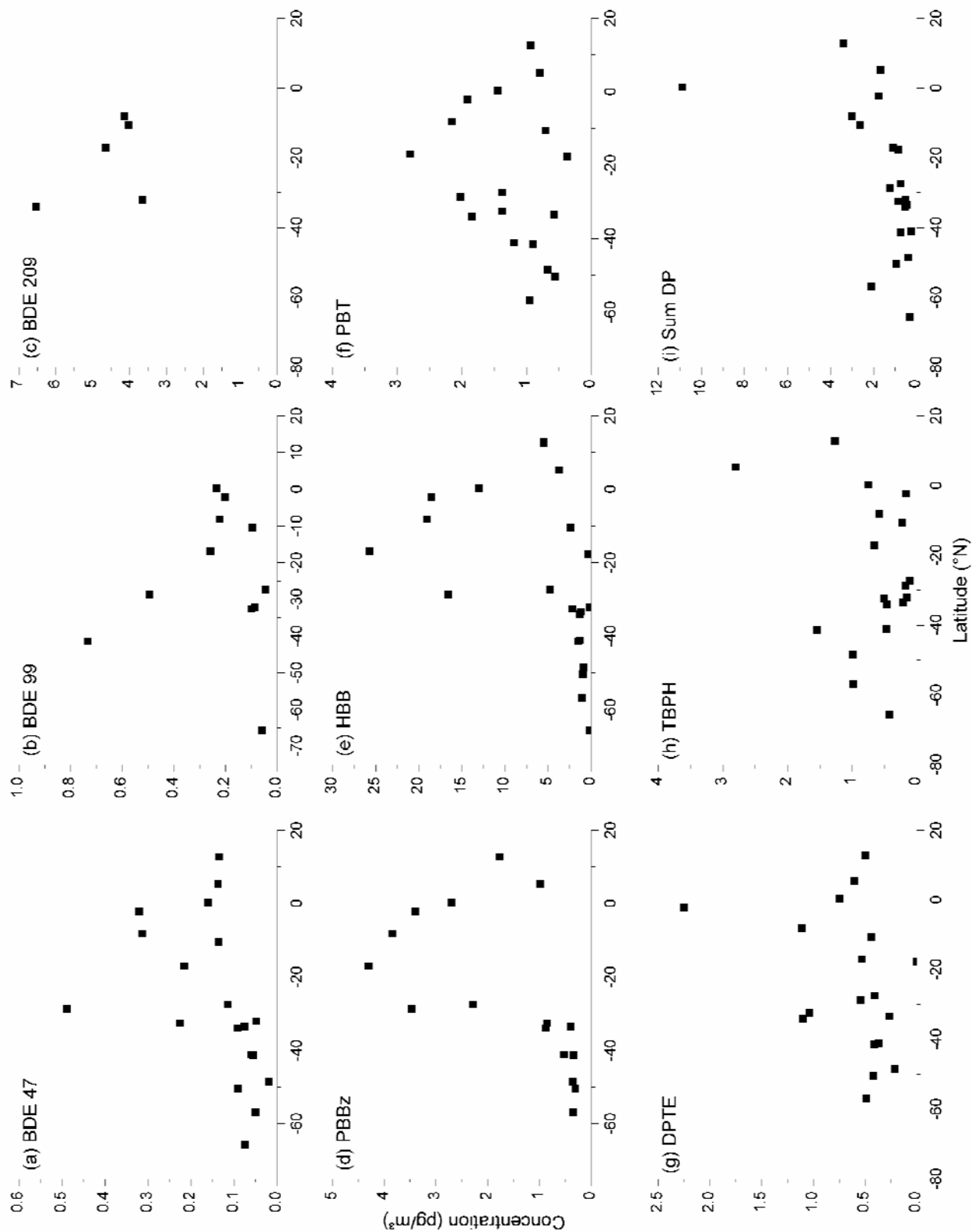


Figure S2. Concentrations of the major individual HFRs vs. the northern Latitude.