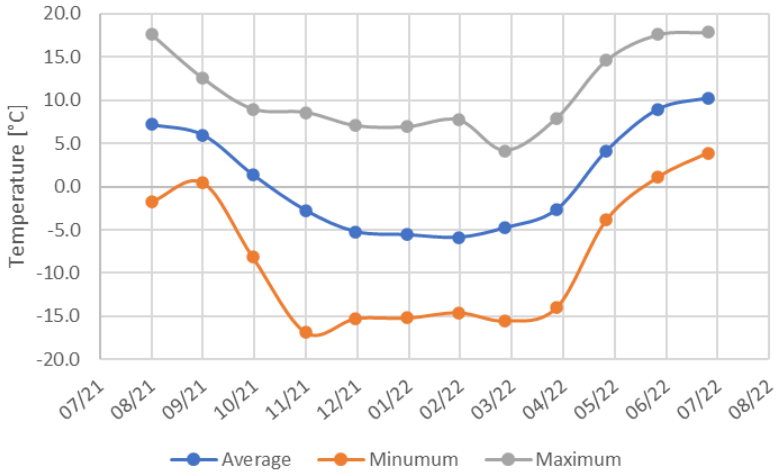
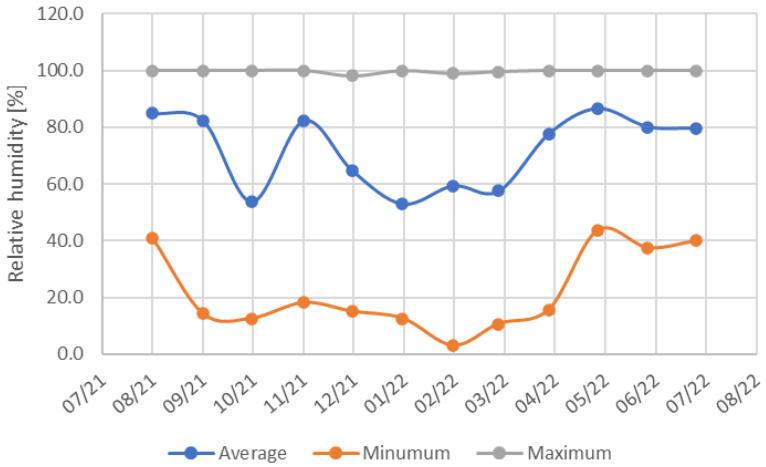
Supplementary Materials

A)



B)



C)

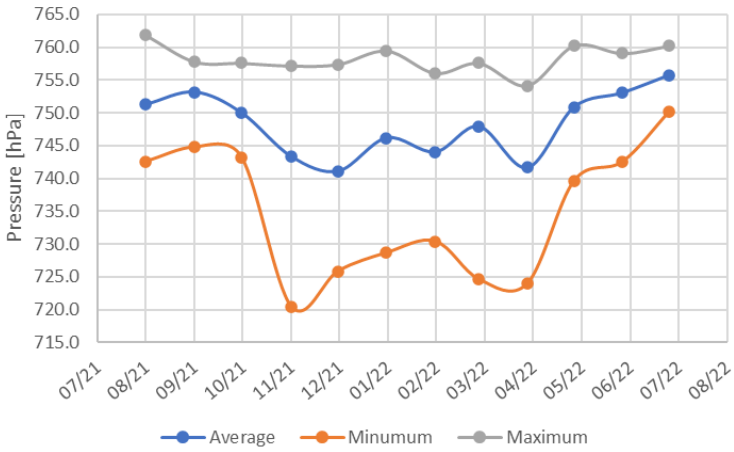


Figure S1: Average and extreme values of temperature (a), relative humidity (b) and pressure (c) data during the considered period.

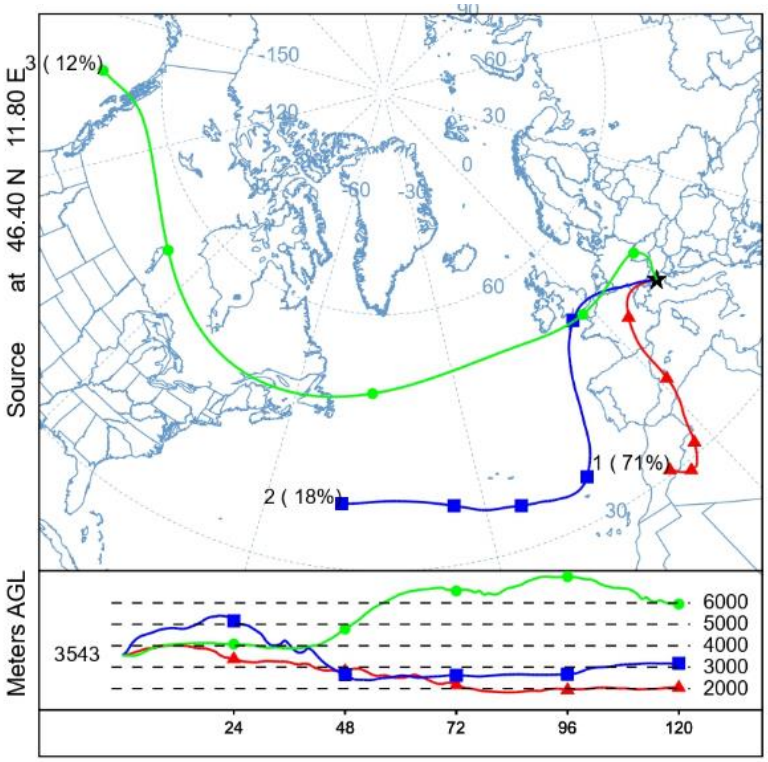


Figure S2. Cluster mean of back-trajectories during the Saharan Dust event of 15-19 March.

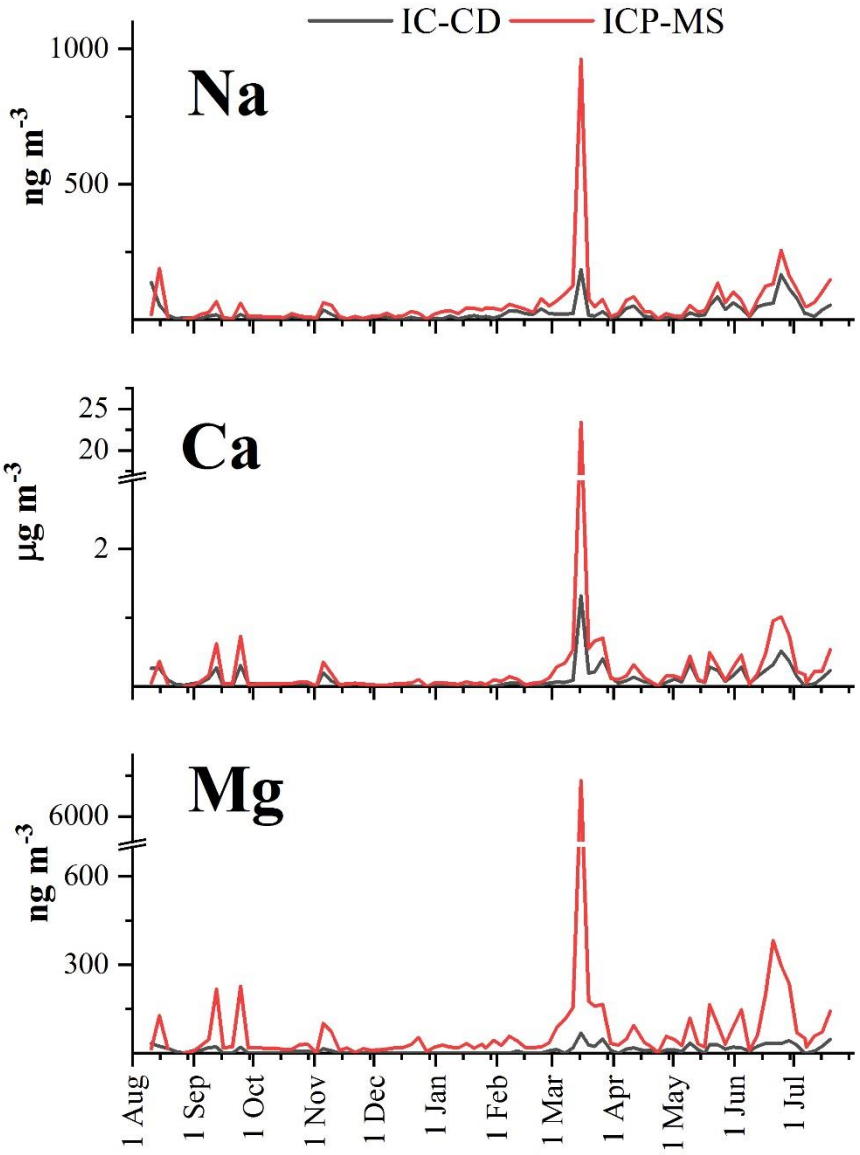


Figure S3. Comparison of sodium, calcium and magnesium concentrations performed using ion chromatography with conductivity detector (IC-CD) and inductively coupled plasma sector field mass spectrometry (ICP-SFMS).

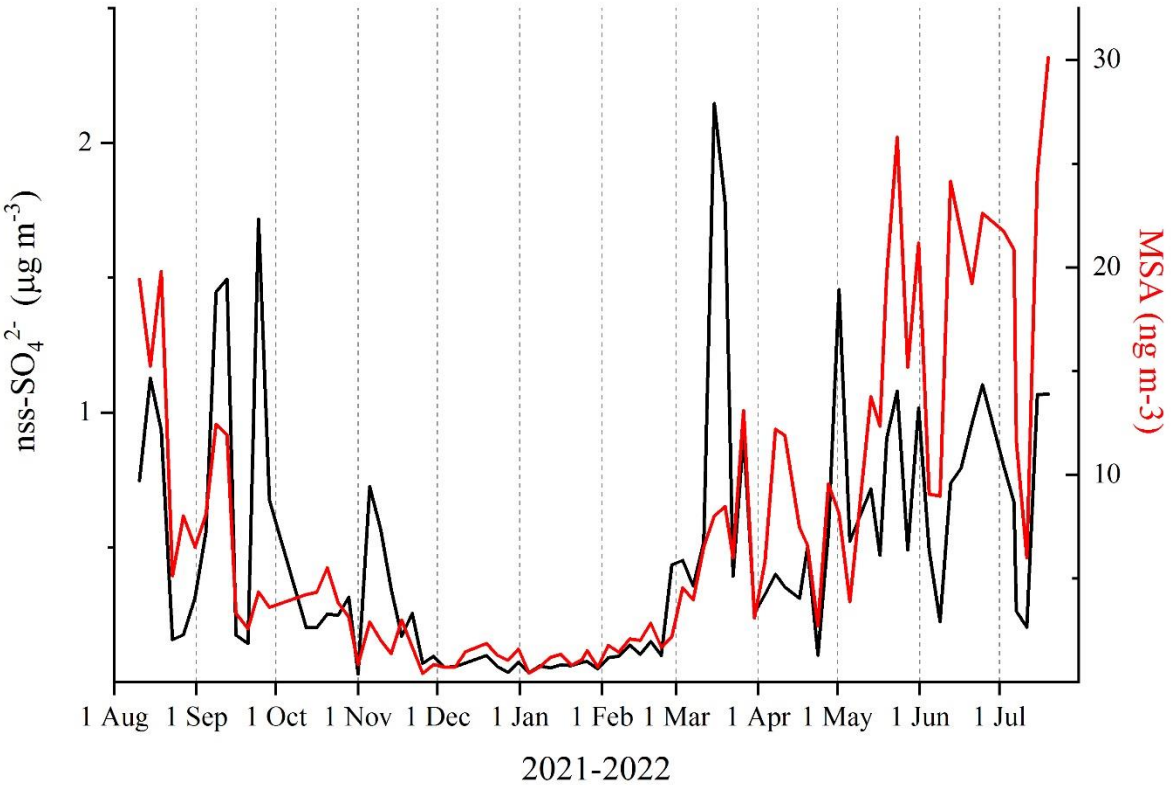


Figure S4. Comparison of non-sea salt sulfate (nss-SO_4^{2-}) and methansulfonic acid (MSA) during the entire sampling year at Col Margherita Observatory.

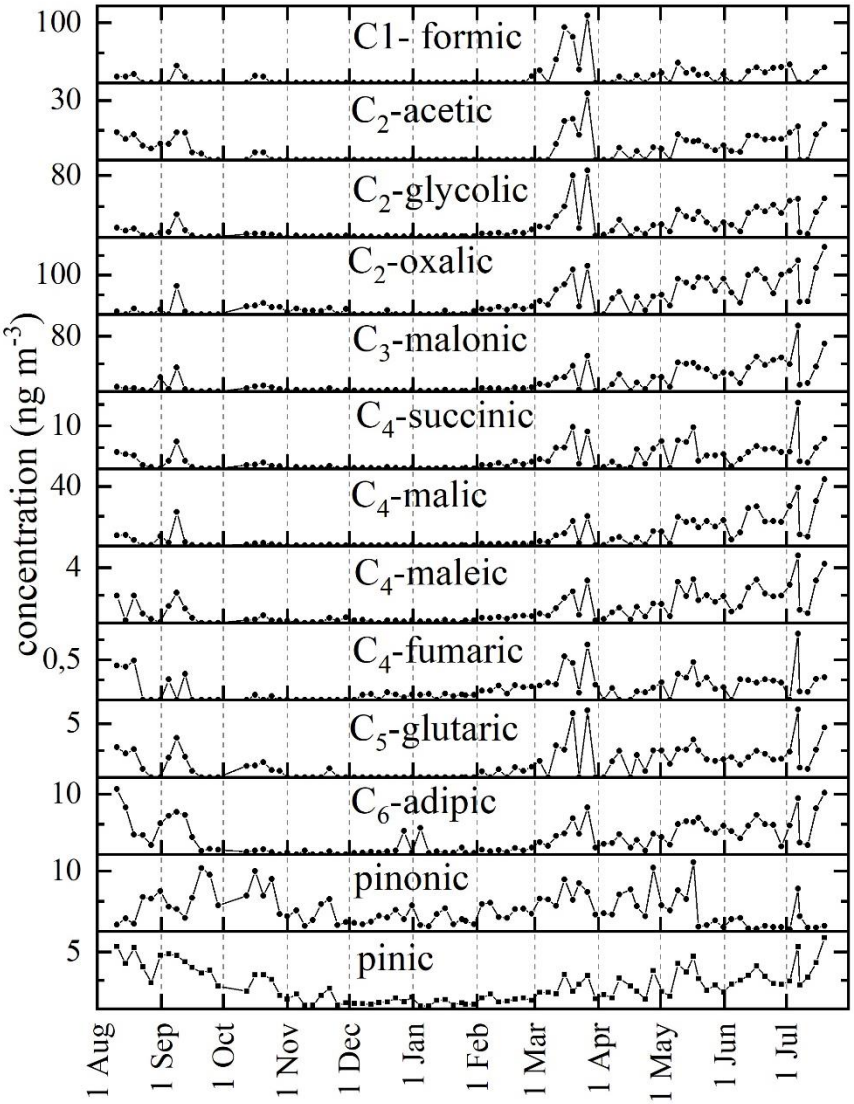


Figure S5. Annual trend of organic acids in the aerosol collected at MRG between August 2021 and July 2022

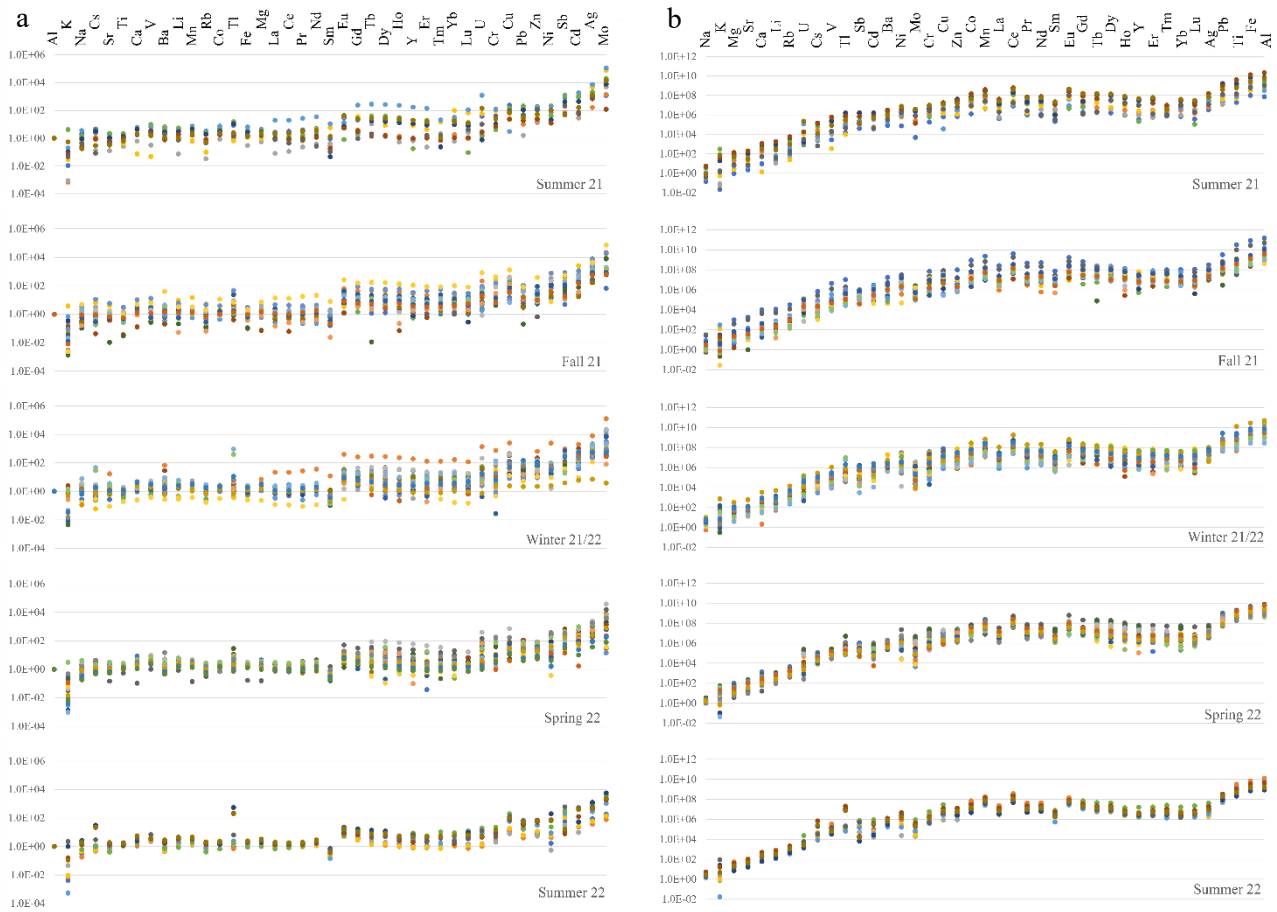


Figure S6. (a) EFs: enrichment factors calculated using Al as reference element. (b) MEFs: marine enrichment factors calculated using ssCa as reference element.

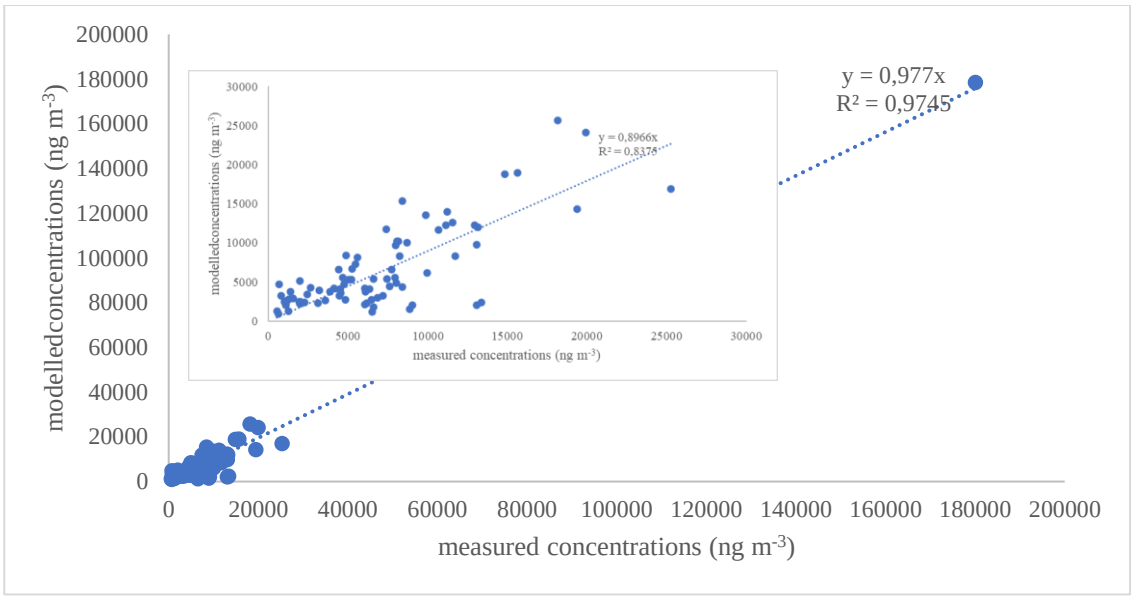
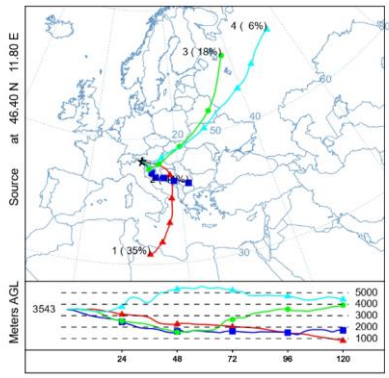
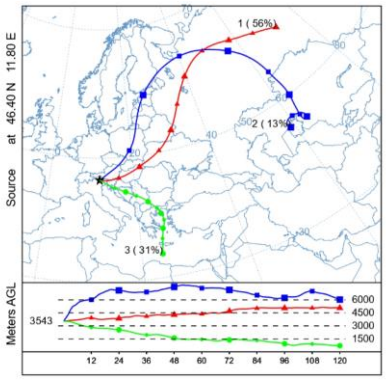


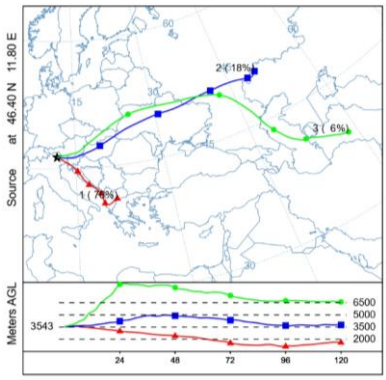
Figure S7. Comparison between measured and modelled concentrations obtained with PMF approach. In the box inside, the outlier point of Saharan Dust was excluded to evaluate the quality of reconstruction without the artifact due to the outlier point.



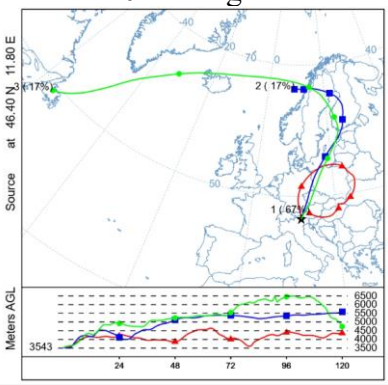
10-14 August



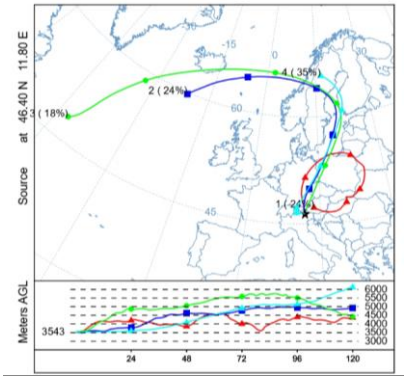
14-18 August



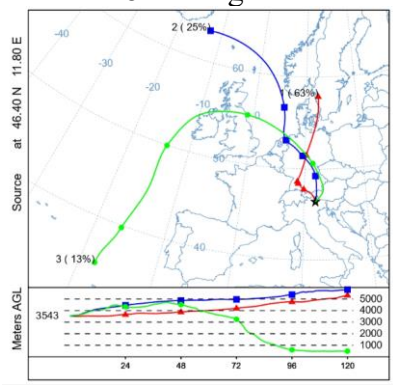
18-22 August



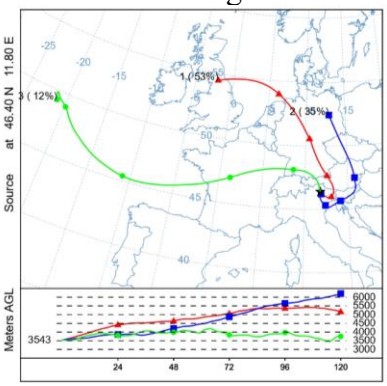
27-31 August



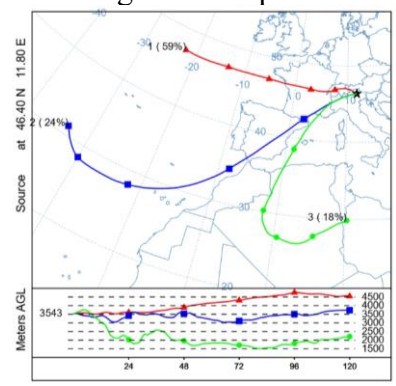
31 August – 4 September



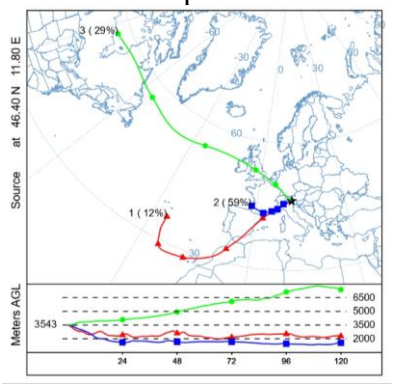
4-8 September



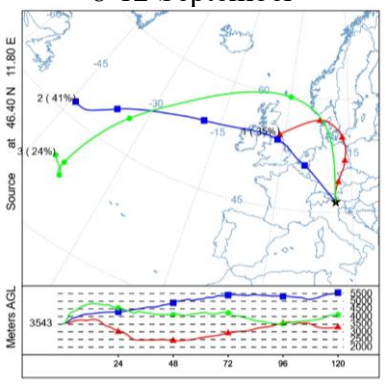
8-12 September



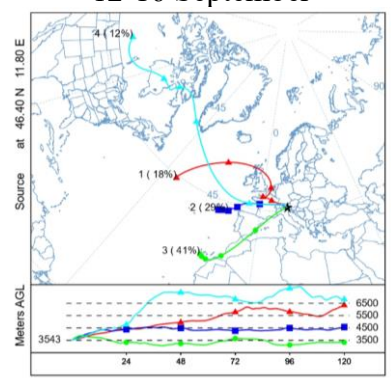
12-16 September



16-20 September



20-24 September



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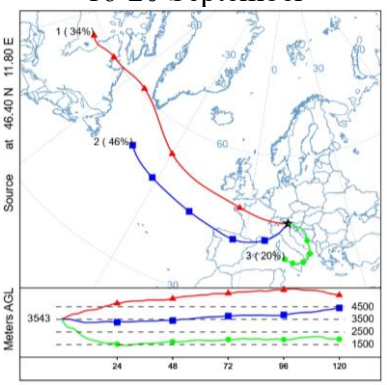
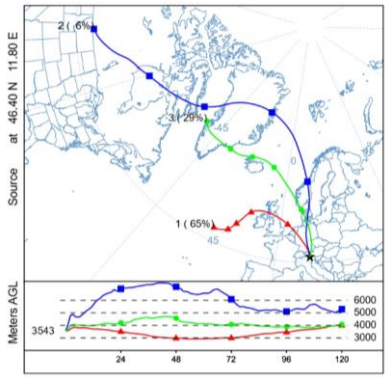


28 September – 10 October



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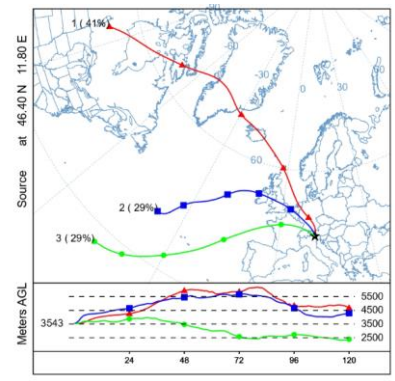

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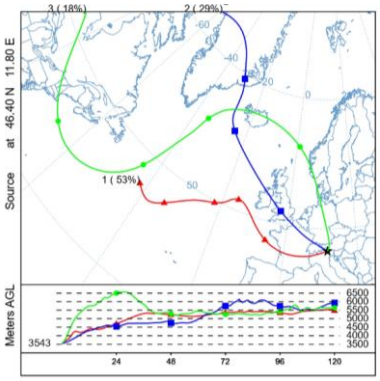

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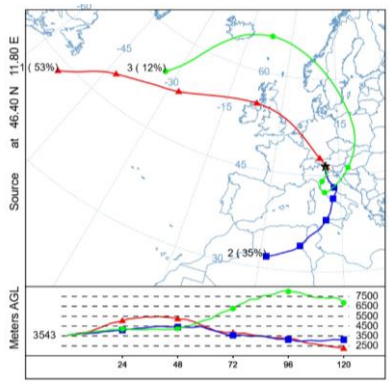

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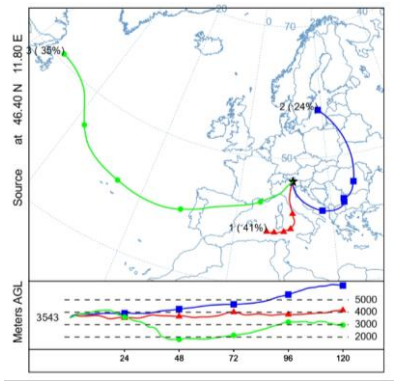
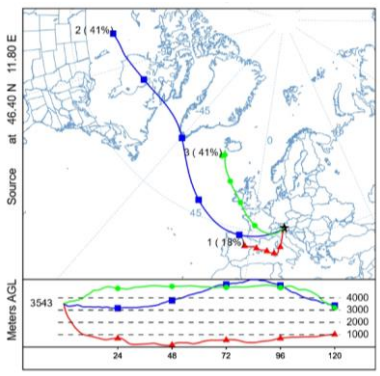
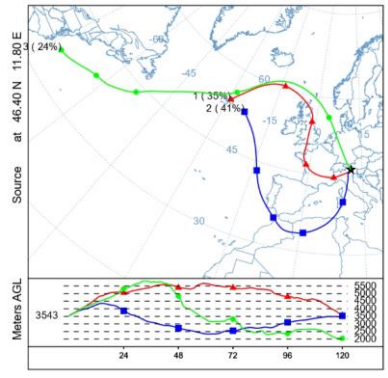


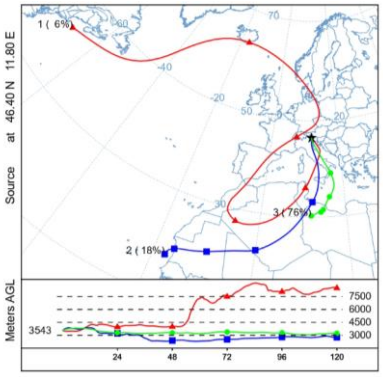
28 October – 1 November



1-5 November



5-9 November



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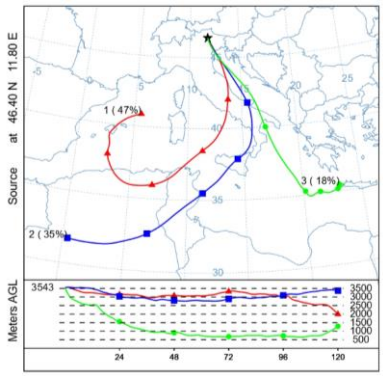

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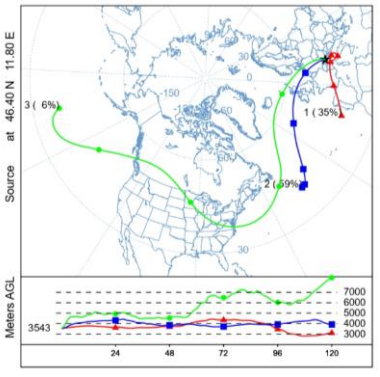
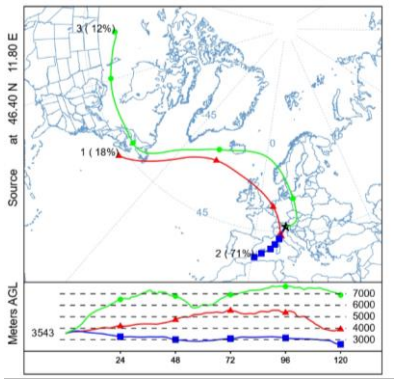


17-21 November



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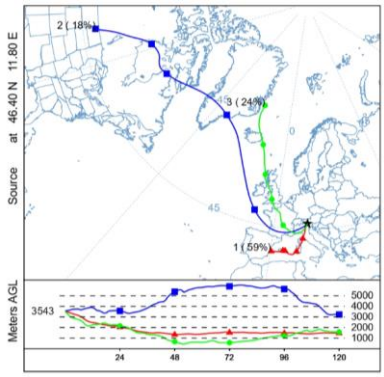

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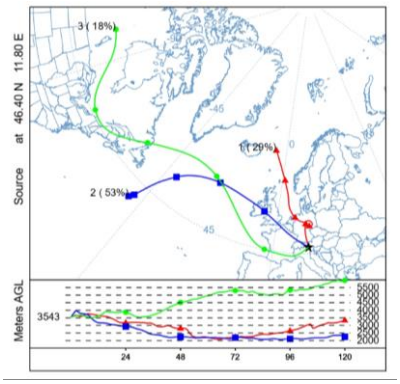
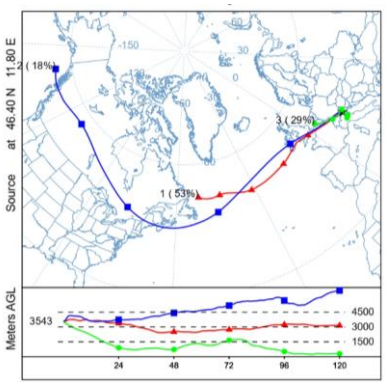
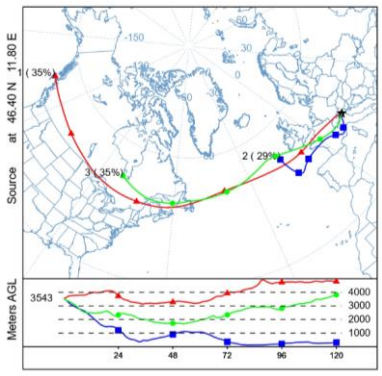


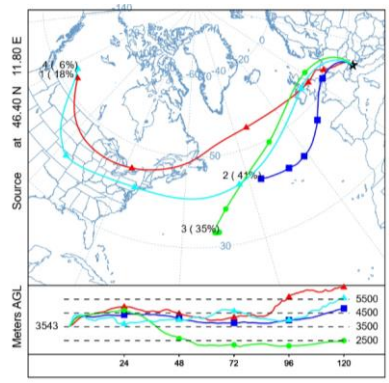
29 November – 3 December



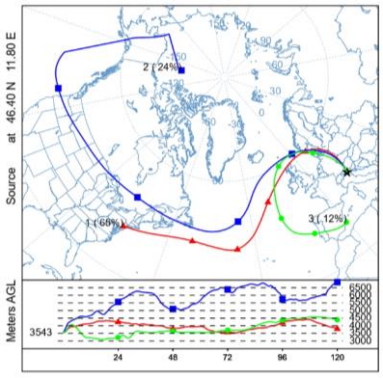
3-7 December



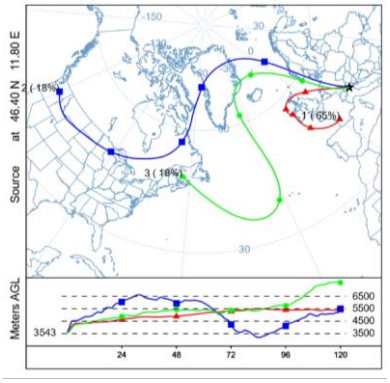
7-11 December



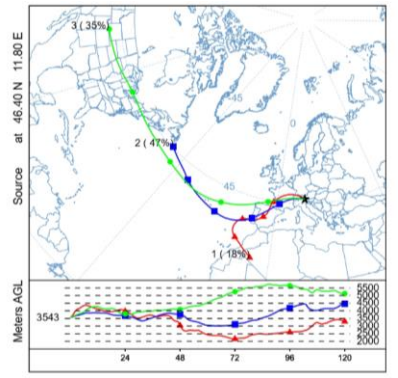
11-15 December



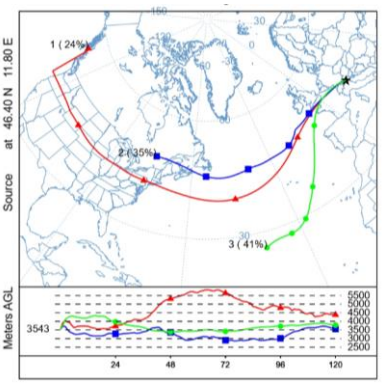
15-19 December



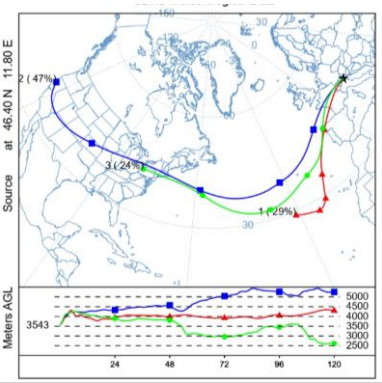
19-23 December



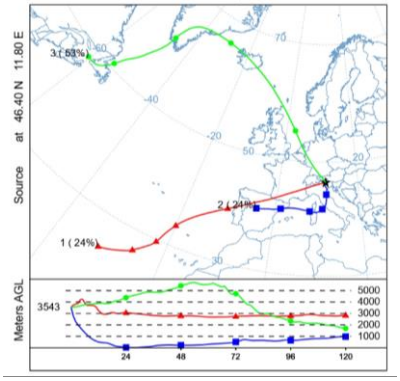
23-27 December



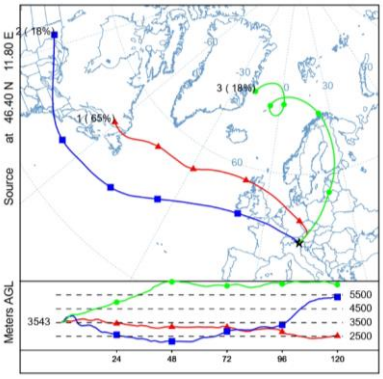
27-31 December



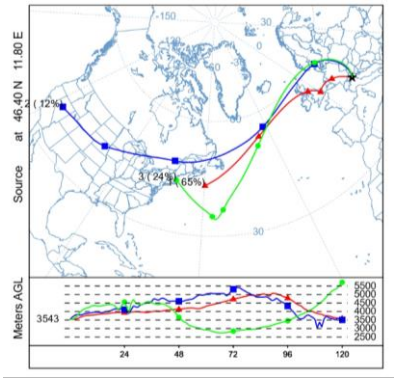
31 December – 4 January



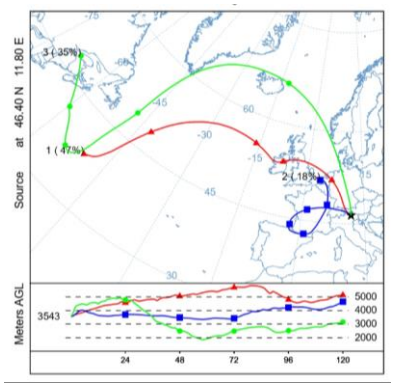
4-8 January



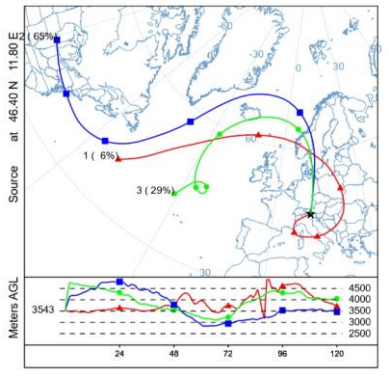
8-12 January



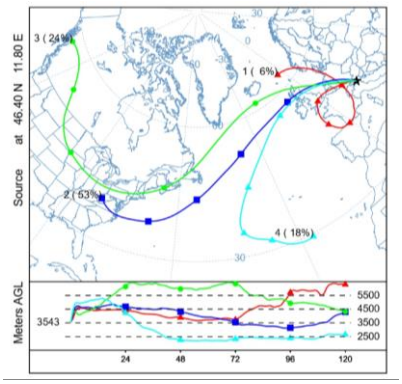
12-16 January



16-20 January



20-24 January



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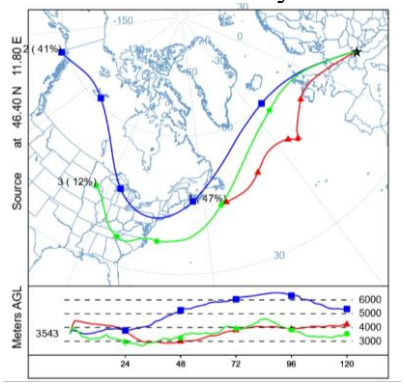
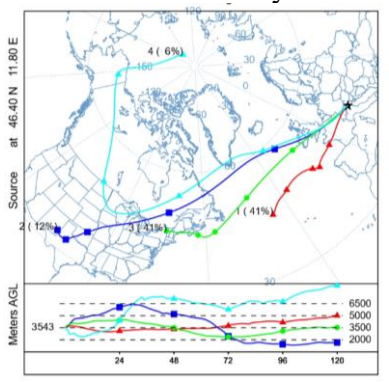
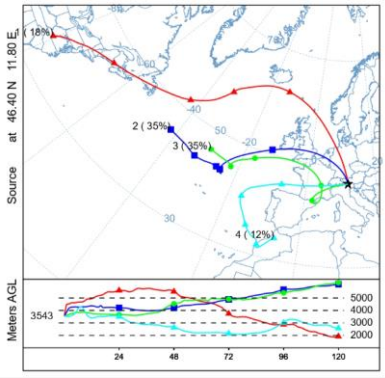


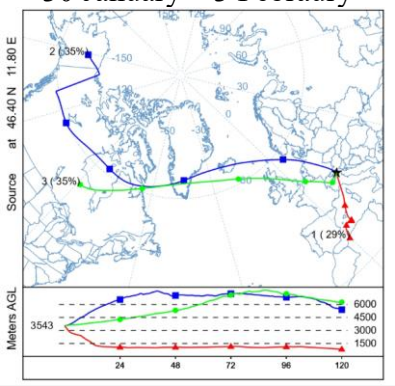
30 January – 3 Febraury



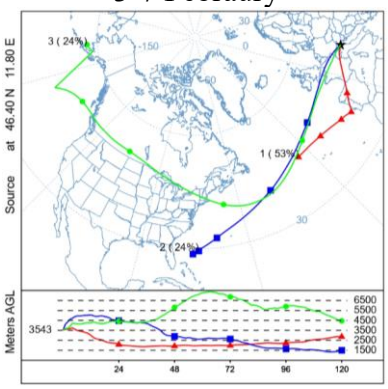
3-7 Febraury



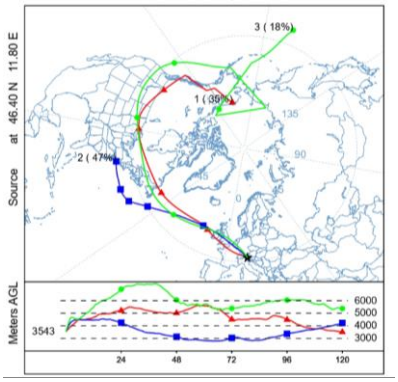
7-11 Febraury



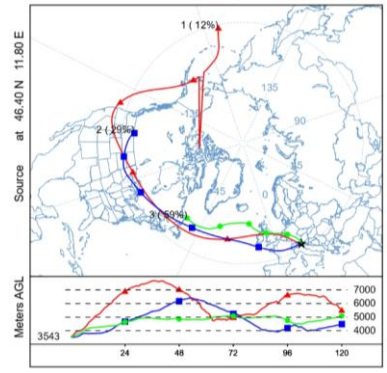
11-15 Febraury



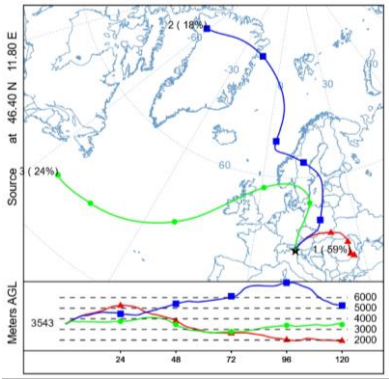
15-19 Febraury



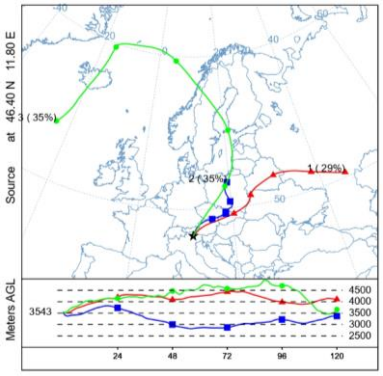
19-23 Febraury



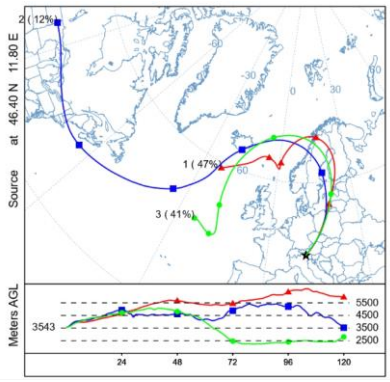
23-27 Febraury



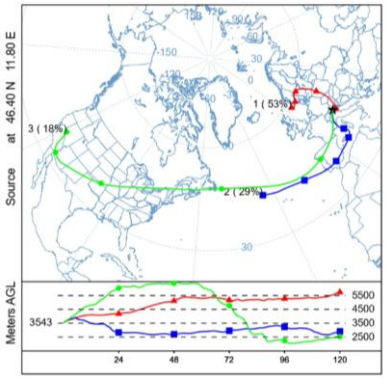
27 Febraury – 3 March



3-7 March



7-11 March



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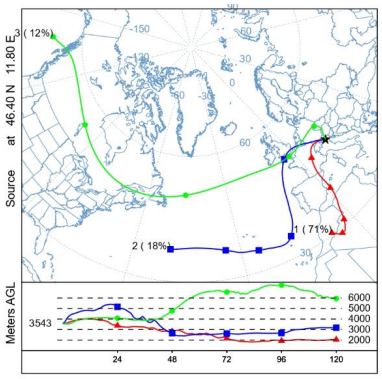

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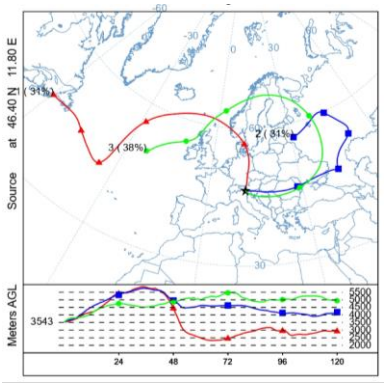
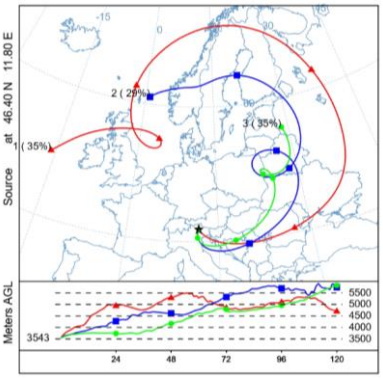


19-22 March



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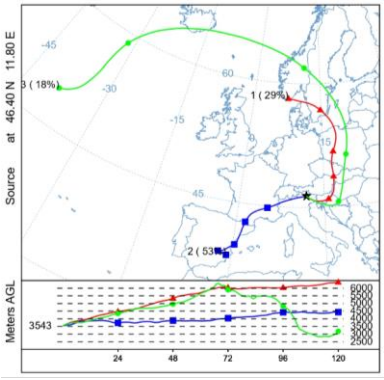

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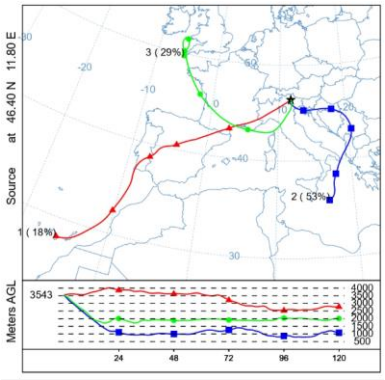
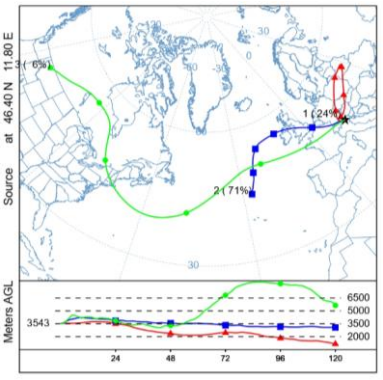
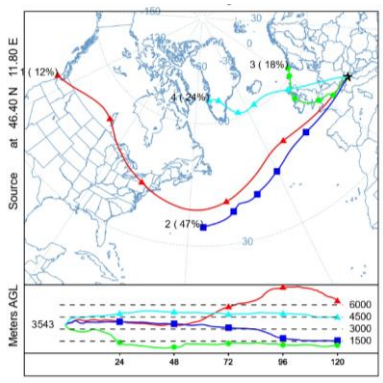


30 March – 3 April



3-7 April



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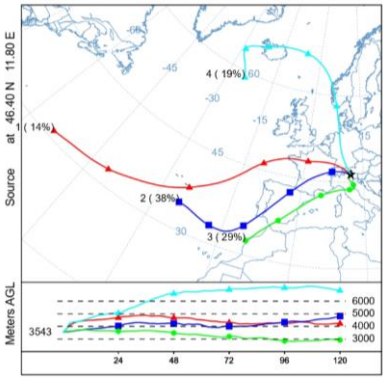

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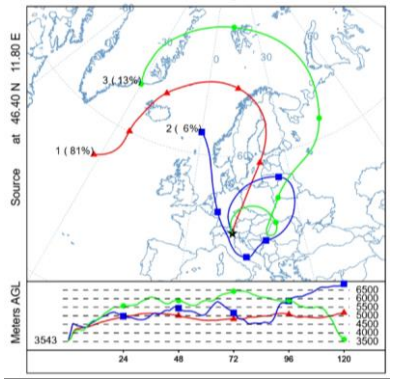

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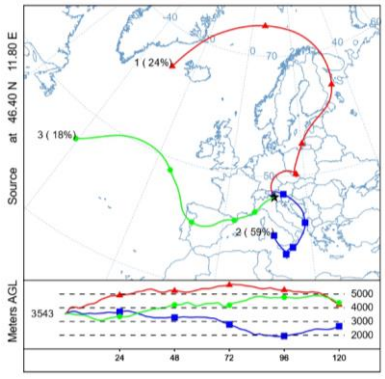

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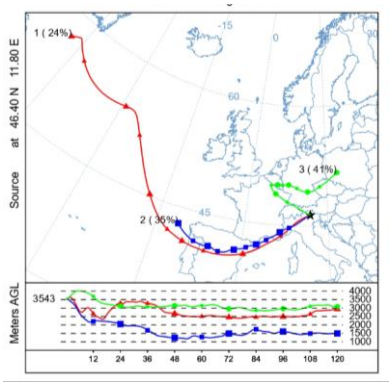

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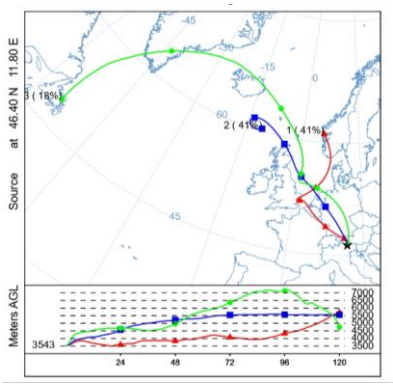
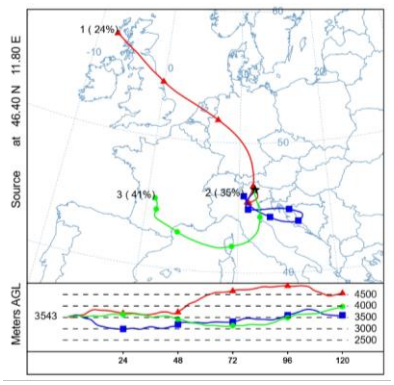


27 April – 1 May



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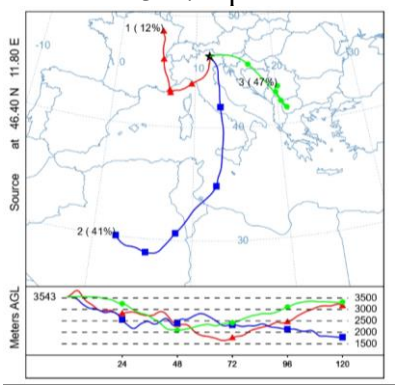

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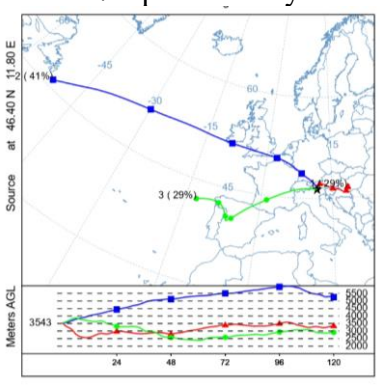

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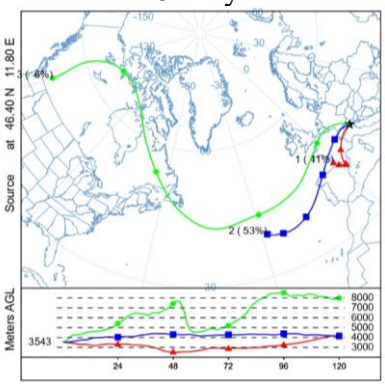

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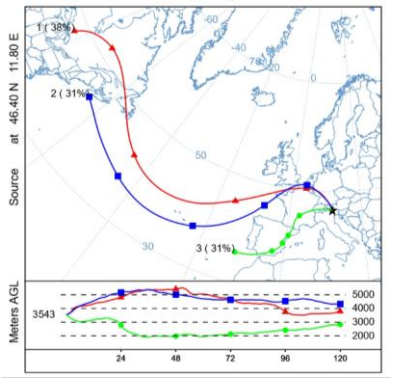

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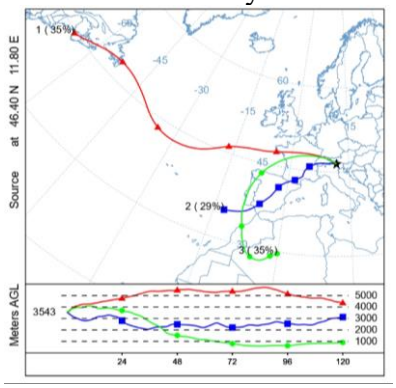

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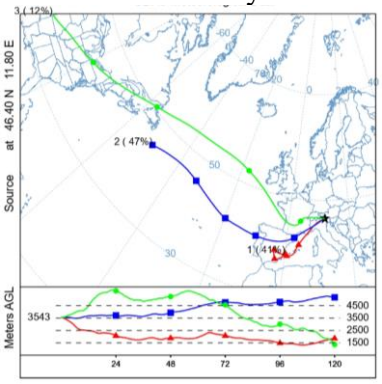

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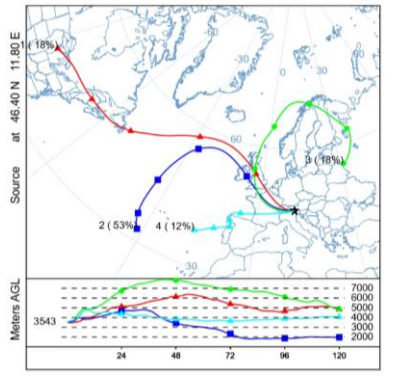
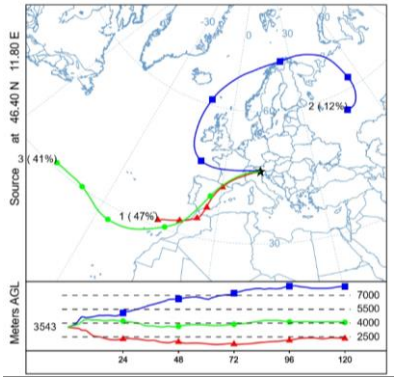
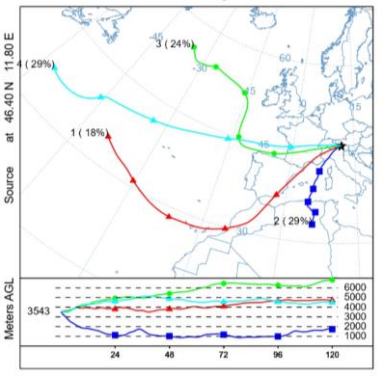


27-31 May



31 May – 4 June



4-8 June

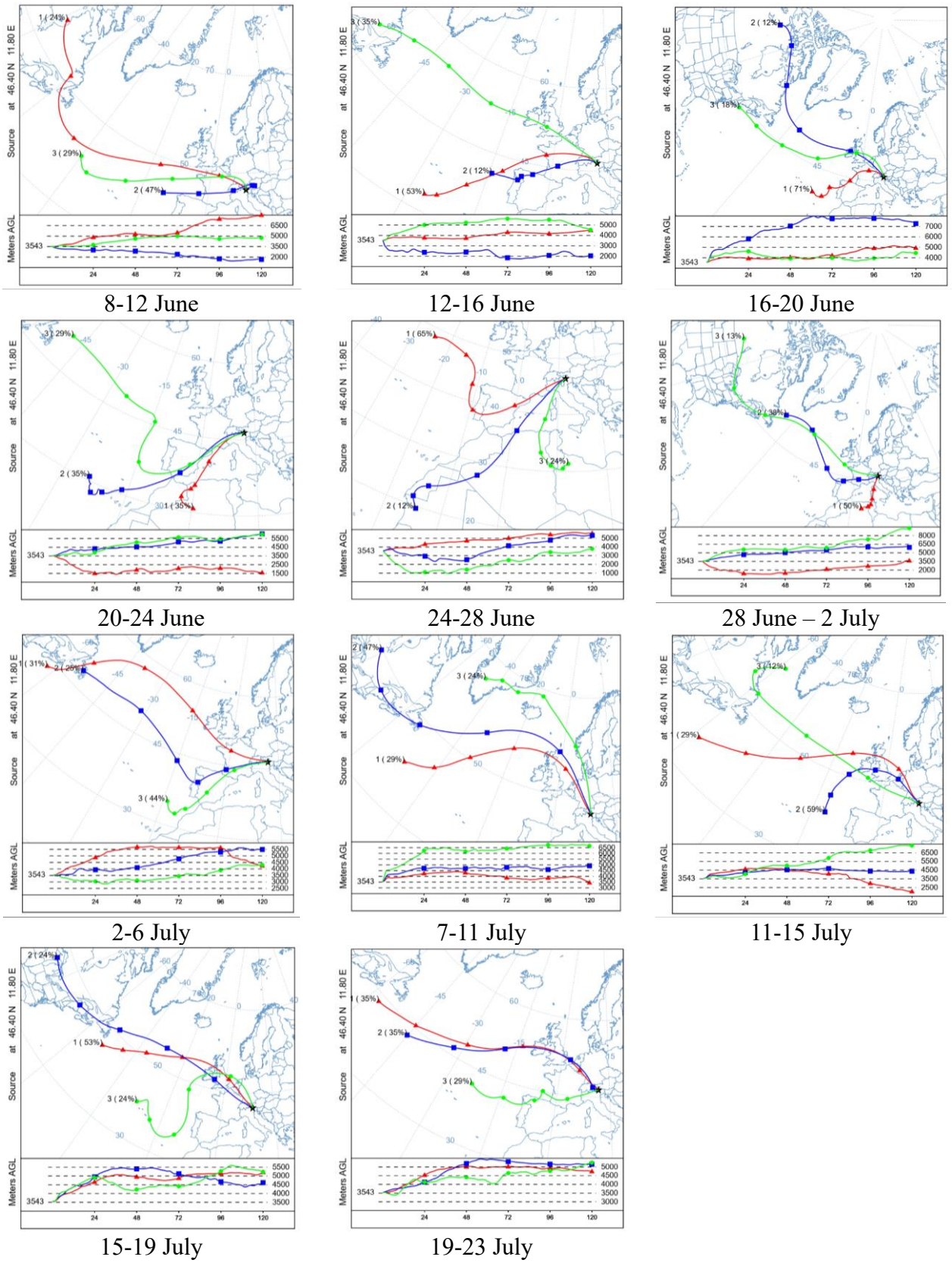


Figure S8. 5-days back-trajectories of air masses calculated for each sample. The starting point is considered the elevation of Col Margherita Station plus 1000 m in to avoid the surrounding orography.

Table S1. Linearity of each species plotted the observed data with the modelled ones.

Species	Intercept	Slope	R^2
PM_{10}	533.497	0.757	0.961
Na^+	-3.036	0.802	0.440
Na	-40.600	1.666	0.921
NH_4^+	42.962	0.502	0.700
K^+	1.018	0.688	0.615
Mg^{2+}	-2.301	1.095	0.566
Mg	31.087	0.480	0.984
Ca^{2+}	-13.345	0.838	0.854
Cl^-	2.757	0.386	0.780
NO_3^-	65.848	0.179	0.290
SO_4^{2-}	116.850	0.538	0.508
MSA^-	0.315	0.852	0.845
Br^-	0.370	0.511	0.446
CA	11.724	0.373	0.596
D-FAA	0.148	0.501	0.655
L-FAA	0.368	0.647	0.594
PC	0.086	0.053	0.171
PDαP	2.571	0.201	0.073
Levoglucosan	0.703	0.082	0.290
Mannitol	0.137	0.430	0.505
Glucose	0.263	0.459	0.560
Ti	4.832	0.347	0.988
Mn	0.938	0.624	0.992
Mo	1.670	0.076	0.054
Cu	-1.991	1.648	0.388
Pb	-0.287	1.018	0.581
V	0.125	0.477	0.992
U	0.012	0.398	0.425
Ag	0.047	-0.011	0.004
Sb	0.018	0.151	0.299
Fe	56.711	0.407	0.989
La	0.042	0.460	0.990
Ce	0.087	0.448	0.989
Sm	0.007	0.597	0.991
Eu	0.002	0.443	0.983
Ho	-0.0003	0.662	0.951
Yb	0.003	0.462	0.971