Profiling pollen and biomass burning particles over Payerne, Switzerland using laser-induced fluorescence lidar and *in situ* techniques during the 2023 PERICLES campaign

Supplementary Material

Instrument	Parameters retrieved	Spatio-temporal resolution
LIF Lidar	Aerosol backscatter coefficient (355 nm) Fluorescence backscatter (470 nm) Fluorescence channels (450-650 nm)	Spatial: 7.5 m Temporal: 100 s
WIBS-5-NEO	Single-particle fluorescence, size, asymmetry factor	Temporal: 60 min
SwisensPoleno	Pollen type discrimination and concentration	Temporal: 10 min
Hirst Volumentric Trap	Discrimination of different types of pollen and concentration	Temporal: 60 min
AE33 Aethalometer	Elemental black carbon and organic carbon concentration	Temporal: 1 min
ToF-ACSM	chemical composition of sulphate (SO_4^{2+}), nitrate (NO^{3-}), ammonium (NH_4^+) and chloride (Cl^-)	Temporal: 10 min
Rapid-E	Real time particle size, shape, and fluorescence classification	Temporal: 1 min
Coriolis sampler	Collection of biological particles for offline analysis (e.g. DNA, PH)	Temporal: 10 - 60 min
Radiosondes	Temperature, pressure, relative humidity (RH), wind speed/direction (vertical profile)	Vertical profiles per launch (e.g. 2/day)
Meteorological station	Air temperature, precipitation, relative humidity, wind speed/direction, pressure, global radiation, sunshine duration	Temporal: 10 min
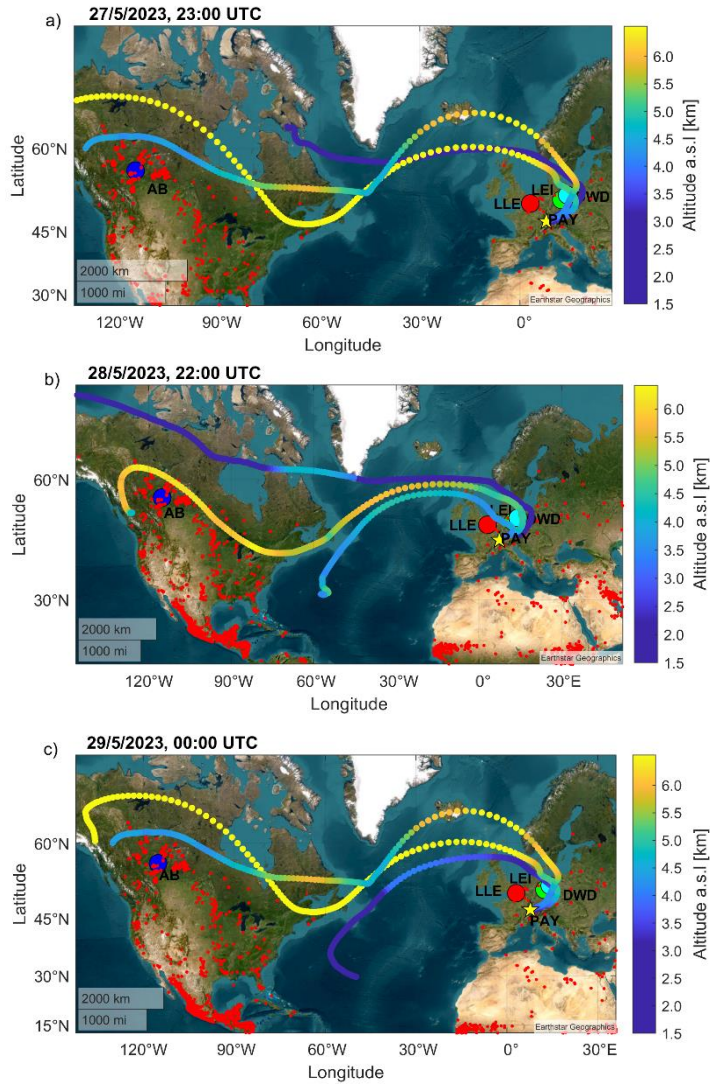
Figure S1. 10-day air mass backward trajectories obtained by the HYSPLIT model ending over Payerne (shown by a yellow star) at **(a)** 1.5, 2.5 and 4.8 km at 23:00 UTC on 27 May 2023, **(b)** 1.5, 2.5 and 3.0 km at 22:00 UTC on 28 May 2023 and **(c)** 1.7, 2.5 and 3.8 km at 00:00 UTC on 29 May 2023. Active fires detected by MODIS are shown by small red dots. The position of the lidar stations at Lille (LLE), Leipzig (LEI), Linderberg (DWD) and Payerne (PAY) are also shown.
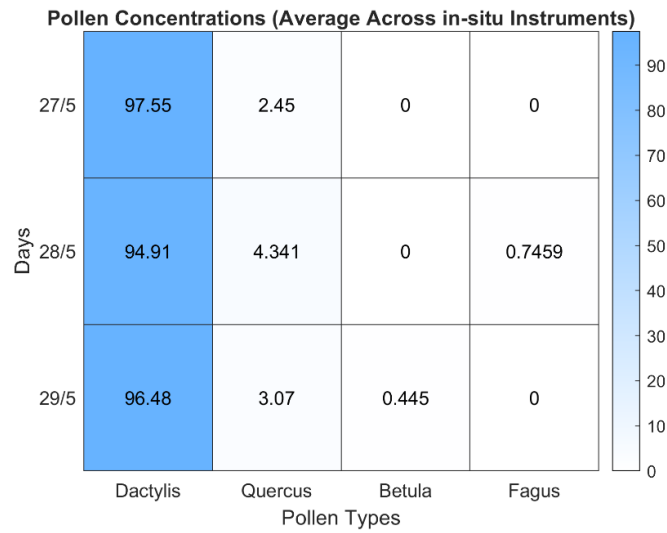
Figure S2. Pollen concentrations in percentages averaged across *in situ* instruments (Poleno and Hirst) between 27 and 29 May 2023.
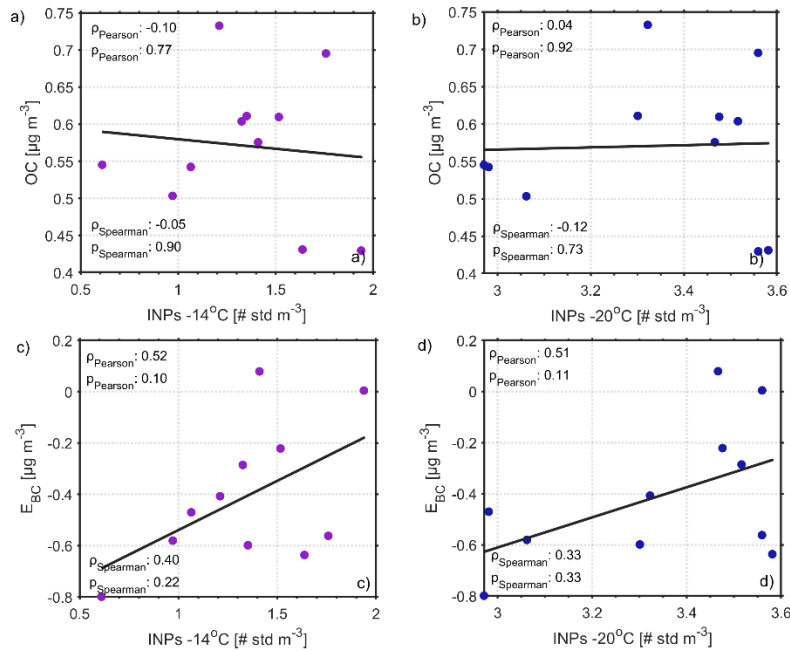
Figure S3. Correlations between **(a)** INPs at −14ºC and OC, **(b)** INPs at −20ºC and OC, **(c)** INPs at −14ºC and OC and **(d)** INPs at −20ºC for the time period between 12 and 15 June 2023.
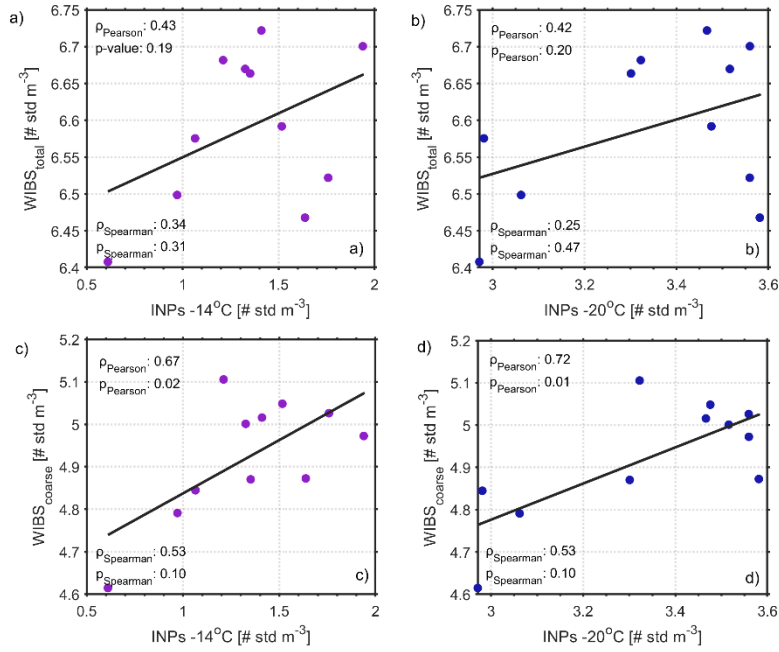
Figure S4. Correlations between **(a)** INPs at −14°C and WIBS_total, **(b)** INPs at −20°C and WIBS_tota, **(c)** INPs at −14°C and WIBS_coarse and **(d)** INPs at −20°C and WIBS_coarse for the time period between 12 and 15 June 2023.

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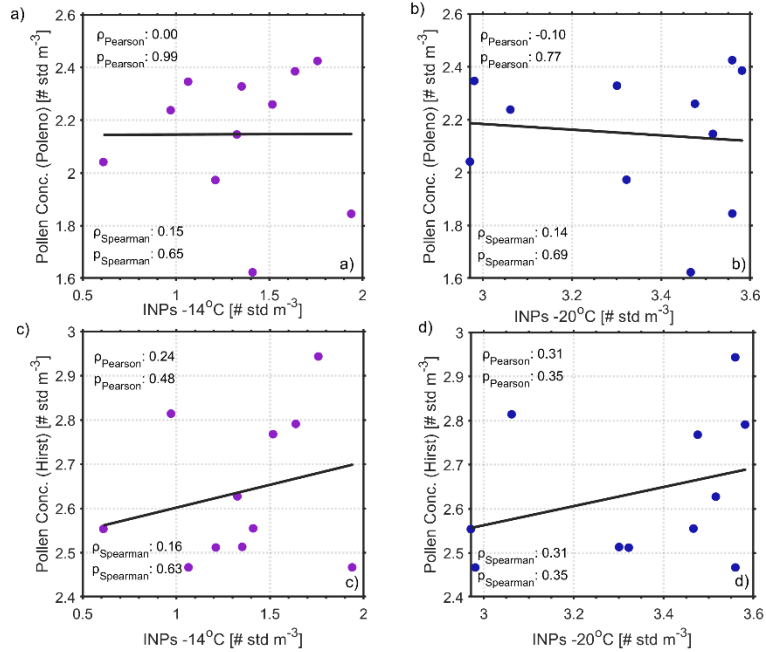


Figure S5. Correlations between **(a)** INPs at −14°C and pollen concentration (SwisensPoleno), **(b)** INPs at −20°C and pollen concentration (SwisensPoleno), **(c)** INPs at −14°C and pollen concentration (Hirst) and **(d)** INPs at −20°C and pollen concentration (Hirst) for the time period between 12 and 15 June 2023.

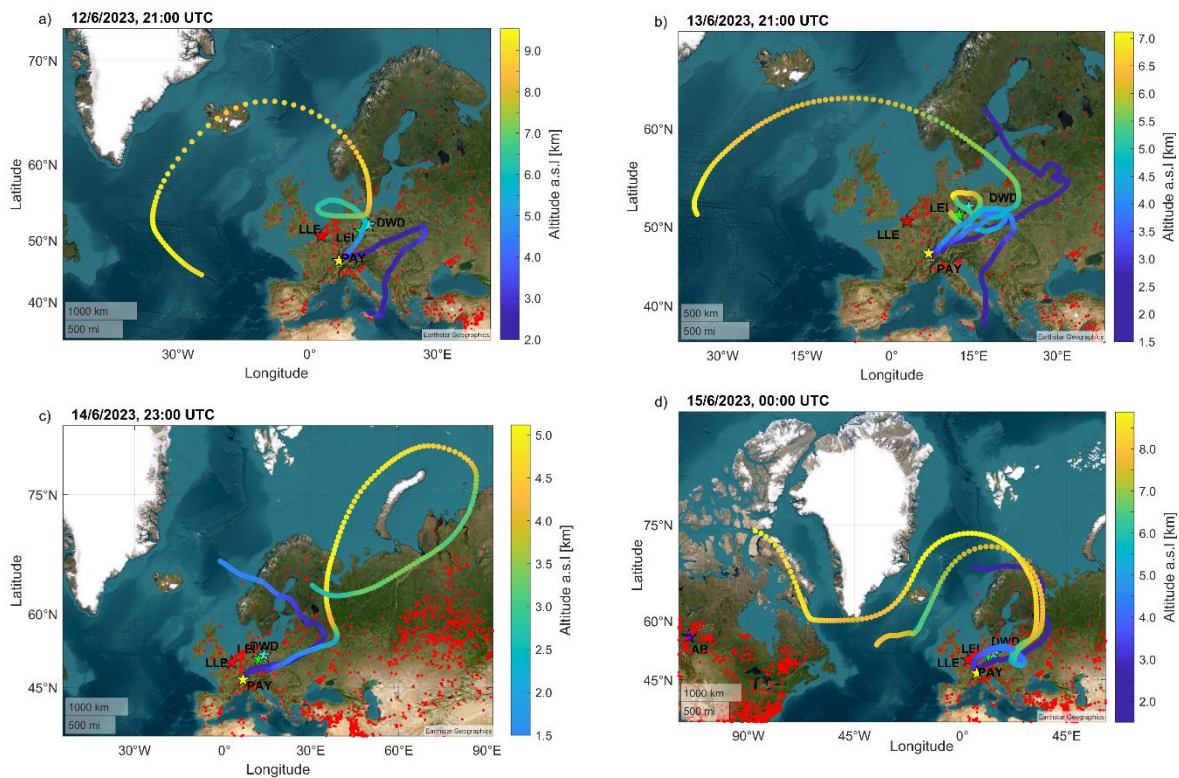
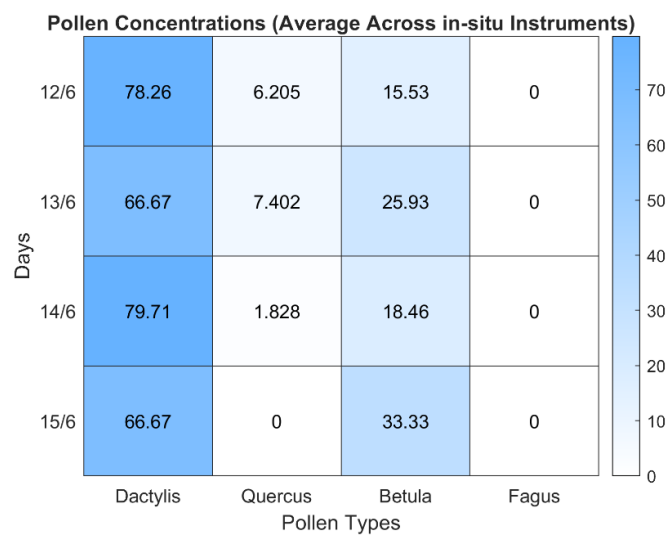



Figure S6. 10-day backward trajectories obtained by HYSPLIT model for different altitudes ending over Payerne (shown by a yellow star) at **(a)** 2.0 and 3.5 km height at 21:00 UTC on 12 June 2023, **(b)** 1.5, 2.2, 3.0 and 3.8 km at 21:00 UTC on 13 June 2024, **(c)** 1.8 and 2.5 km at 23:00 UTC on 14 June 2024 and **(d)** 1.5, 3.1 and 3.6 km at 00:00 UTC on 15 June 2023. Active fires detected by MODIS are shown by small red dots. The position of the lidar stations at Lille (LLE), Leipzig (LEI), Linderberg (DWD) and Payerne (PAY) are also shown.

30 **Figure S7.** Pollen concentrations in percentages averaged across in situ instruments (SwisensPoleno and Hirst) between 12 and 15 June 2023.