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Supplement of

Saharan dust transport event characterization in the Mediterranean atmosphere using 21 years of in-situ observations

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Supplementary material

S1. Data treatment procedure

Table S1. Summary of the key procedures for the data analysis as described in Section 2.3, 2.4 and 2.5

Step	Instrument	Analysis	Product
Identification of dust transport days (Section 2.3)			
1	OPC	24 h average coarse concentration	Time series
2	OPC	21 days moving average applied 3 times	Noise dampened time series
3	OPC	Subtraction third iteration of moving average from 24 h average time series	High frequency component (HF)
4	OPC	Check when HF component it above 95 % confidence interval of all HF components	Potential dust transport days
5	OPC + back-trajectories	Check if back-trajectories of potential dust days passed over the Saharan desert	Final list of dust transport days
Calculation of the PMcoarse concentration (Section 2.4)			
1	OPC	Calculation of PMcoarse concentration using a particle size dependent density	Time series
Calculation of the PMcoarse enhancement (Section 2.5)			
1	OPC	30 days moving average of the background PMcoarse concentration	Time series
2	OPC	Difference between PMcoarse concentration during dust transport days and the background PMcoarse concentration	PMcoarse enhancement
3	OPC	Fraction between PMcoarse enhancement and background	Enhancement factor (EF)

S2. Relative humidity measurements at Monte Cimone in 2007

The conditions of sampling are extremely important since they control particle transmission efficiency. A full set of recommendations is provided by ACTRIS-RI in the following document: https://www.actris-ecac.eu/files/ACTRIS_standard_procedures_for_aerosol_in-situ_measurements.pdf (last accessed 02/07/2025). At CMN, from 2002 to 2007, aerosol sampling was conducted using a downward-facing inlet without active heating, operating at a low flow rate of <20 lmin−1. In 2008, a new and larger inlet was installed to accommodate more aerosol measurements, featuring a heated design (set at 25°C) and a higher flow rate of 150 lmin−1. During the earlier sampling period (pre-2008), although active heating was not used, the low sampling flow allowed for passive heating by room air. This passive heating effectively raised the temperature of the inlet line above ambient conditions, keeping the relative humidity (RH) sufficiently low to enable droplet evaporation Measurements conducted in 2007 at the end of the inlet line indicate that the sampling line was approximately 15 K warmer than the ambient, leading to a significant RH reduction, up to - 80 % (Figure S1). Overall, only 13 % of data collected in 2007 had RH between 40–45 %, indicating that the system operated under conditions suitable for reliable aerosol sampling, in both clear-sky and cloud conditions (Figure S2), following ACTRIS-RI recommendations.

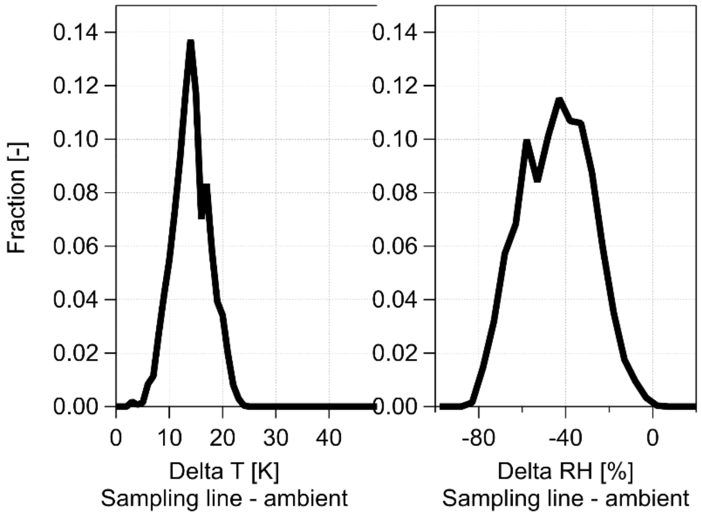

Figure S1 Histogram representing the change in temperature (T) and relative humidity (RH) in the sampling line compared to ambient conditions. Data represents the sampling line and ambient conditions at the Monte Cimone observatory in 2007.

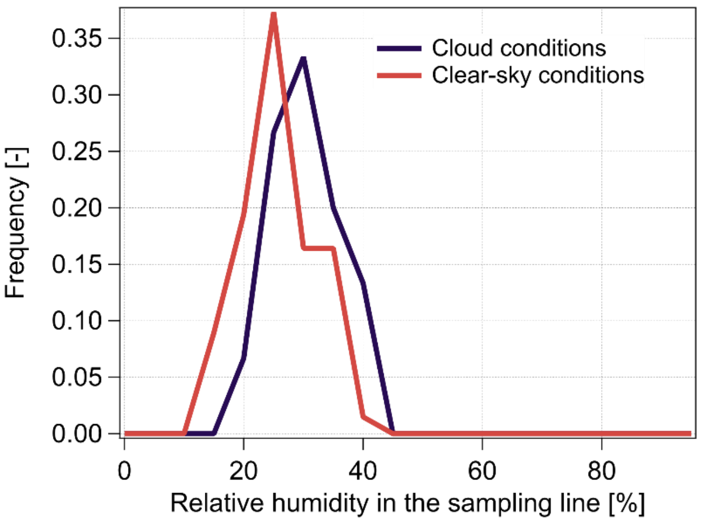

Figure S2 Relative humidity measured in the sampling line at the Monte Cimone observatory in 2007 during cloud and clear-sky conditions.