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Supplement of

Measurement report: A comparative analysis of an intensive incursion of fluorescing African dust particles over Puerto Rico and another over Spain

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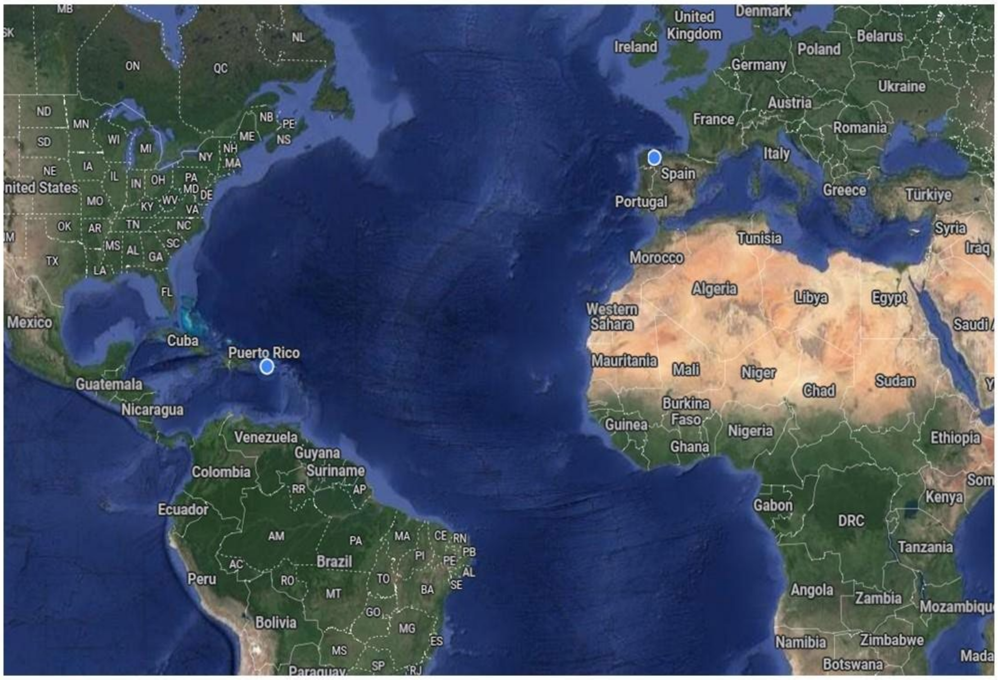

Figure S1. Study zone in Puerto Rico, the US territory and province of León, Spain. The blue circles on the map are the locations of the sampling sites. This figure was generated using © Google Earth Pro 7.3.

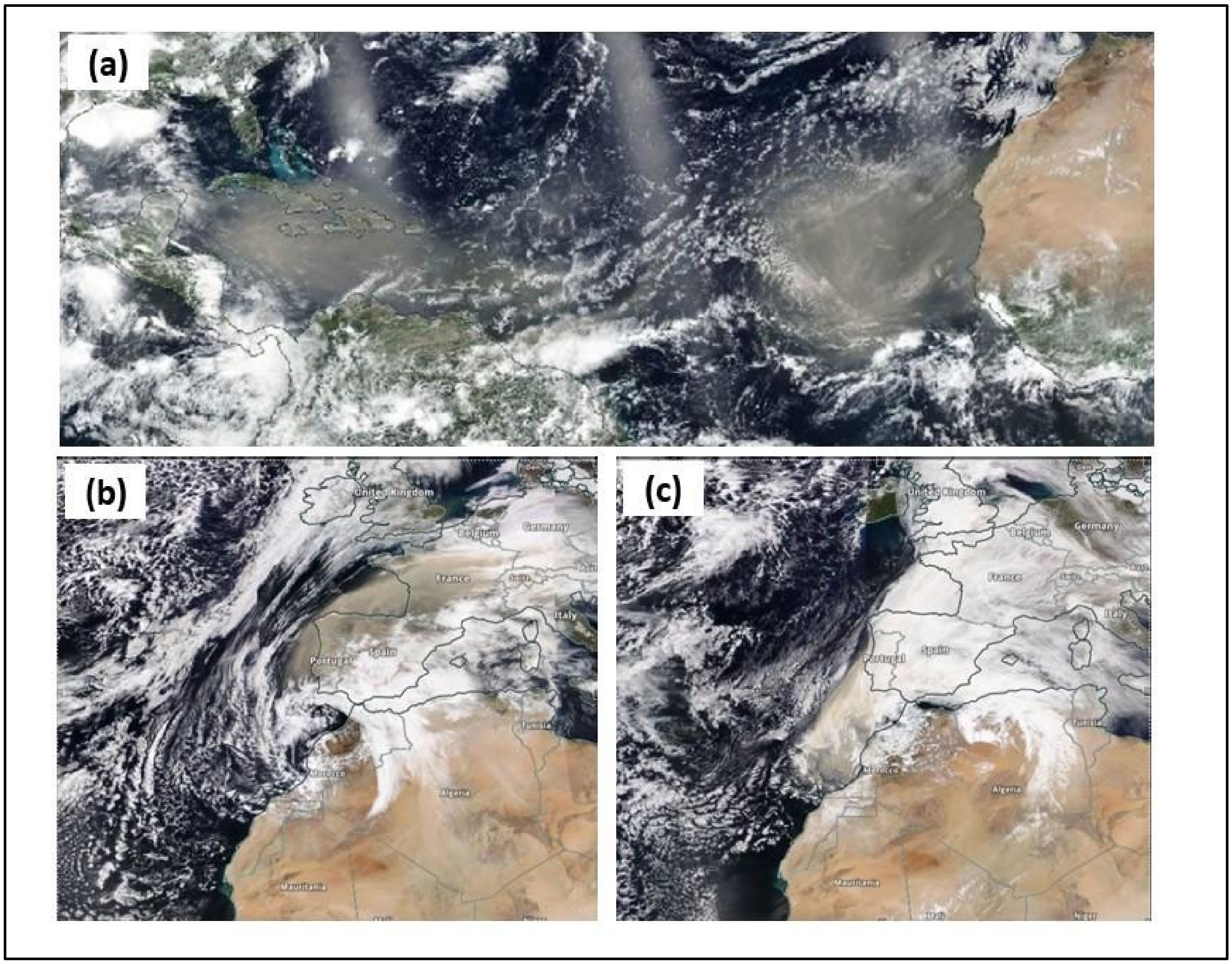

Figure S2. Suomi NPP satellite image showing (a) the first dust pulse affecting the Caribbean (Puerto Rico) while a second dust pulse is observed leaving Africa over the North Atlantic on 23 June 2020 (DOY 175), (b) the dust storm that impacted the León site on 16 March 2022 (DOY 75) and (c) on 17 March 2022 (DOY 76).

Methodology for processing WIBS measurements.

When processing WIBS measurements, there are several steps to filter and correct the data: 1) removal of background fluorescence, 2) removal of non-FAPs that fluoresce and 3) correcting for "dead-time" losses of FAP that pass undetected particles during the period (dead-time) when the Xenon lamp recharging. Each time a particle is detected some fraction of the flash lamp light leaks through the detector filters (Perring et al., 2015). Using the Perring et al. (2015) approach we create frequency distributions of the FL-1, FL-2 and FL-3 fluorescence intensity measured by the detectors (Fig. S3a) and identify the peak and standard deviation around that peak. In Fig. S3a the vertical lines mark one standard deviation (σ) beyond the maxima (reprinted from Calvo et al., 2018, Appendix A1). Given that many non-FAP will fluoresce at relatively low levels, we decided to accept only those FAP whose fluorescence was > 9σ, using the same threshold as Morrison et al. (2020), so that our results could be compared directly with those from their dust study. This procedure effectively removes the background noise and fluorescing non-FAPs.

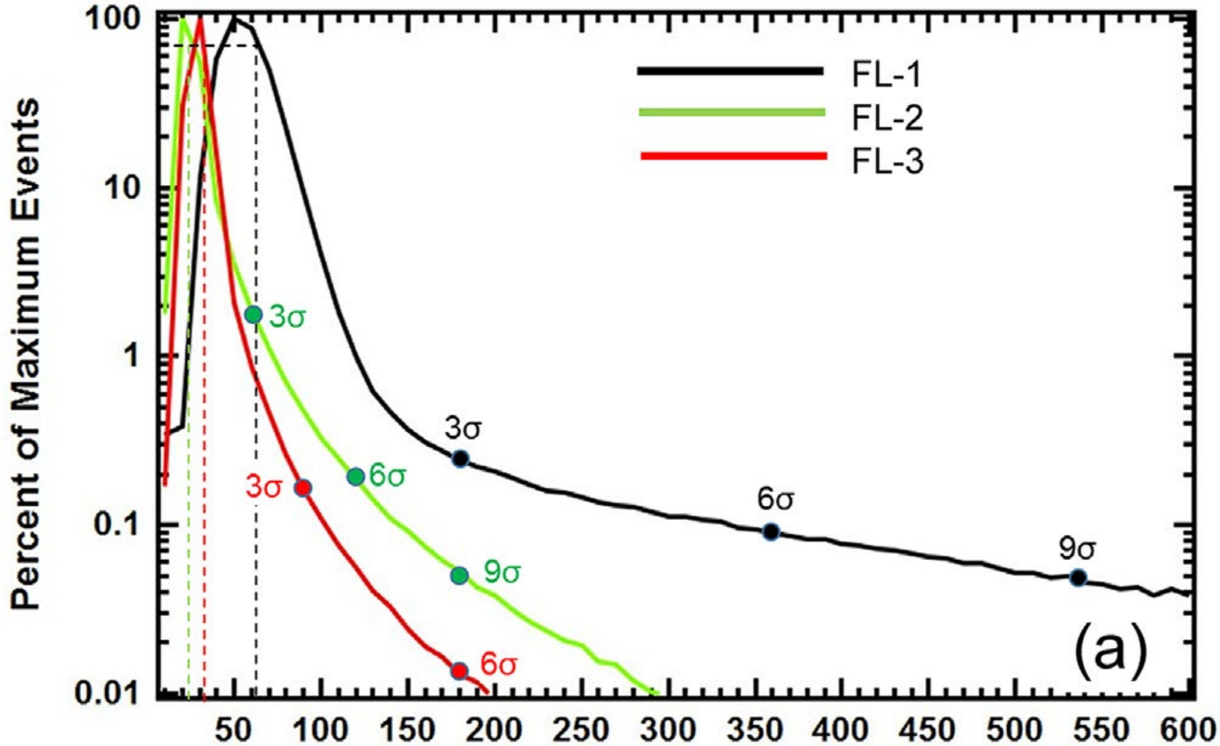

Figure S3. (a) Frequency histograms of the fluorescence intensity measured with detectors FL-1, -2 and -3 of all particles sampled during the 30 days field campaign. The vertical bars indicate one standard deviation (σ) from the mean value. The colored markers show 3, 6 and 9 σ.

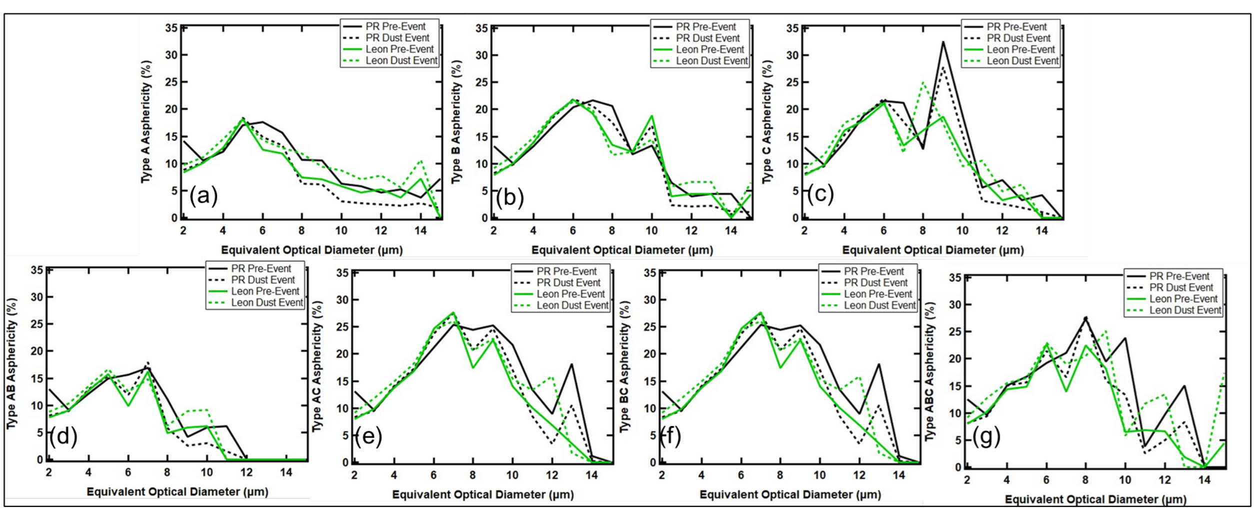

Figure S4. Average size distributions in PR and León, before and during AD events AD events for the asphericity of FAP (a) Type A, (b) Type B, (c) Type C, (d) Type AB, (e) Type AC, (f) Type BC, (g) Type ABC

Meteorological Measurements

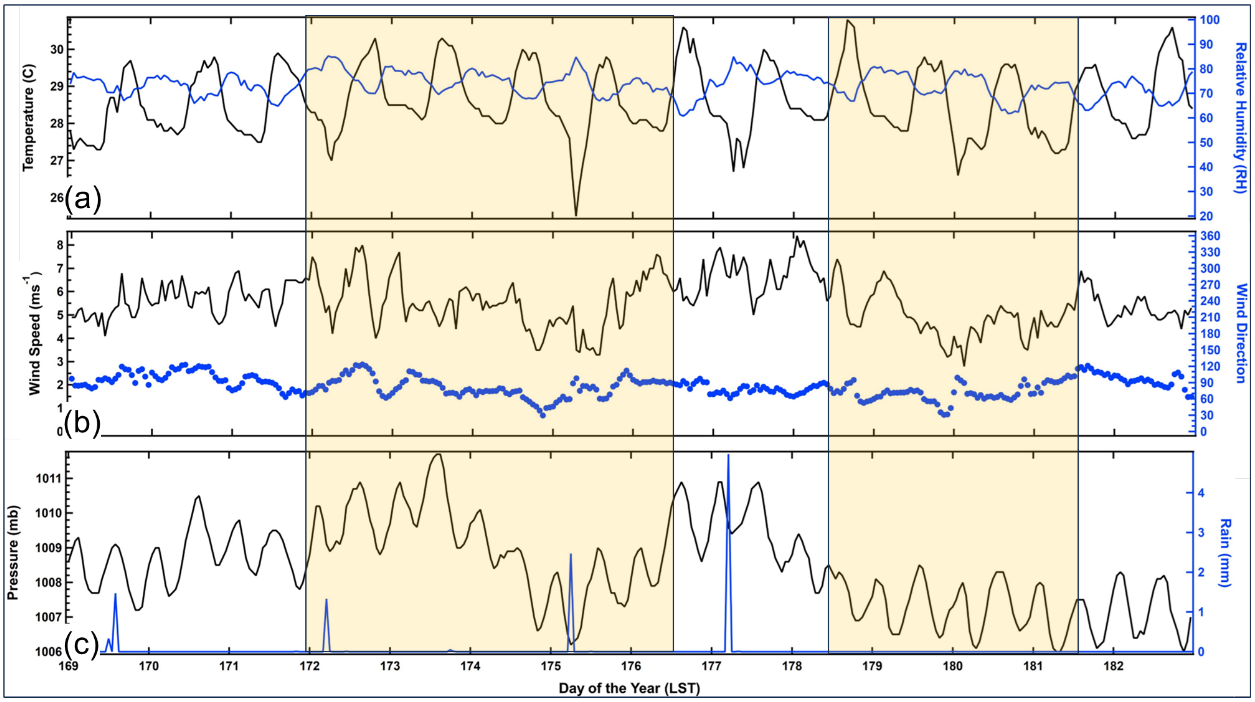

Figure S5. Time series of the meteorological parameters in PR during the month of June 2020. The shaded areas are those time periods when AD was in the PR region.

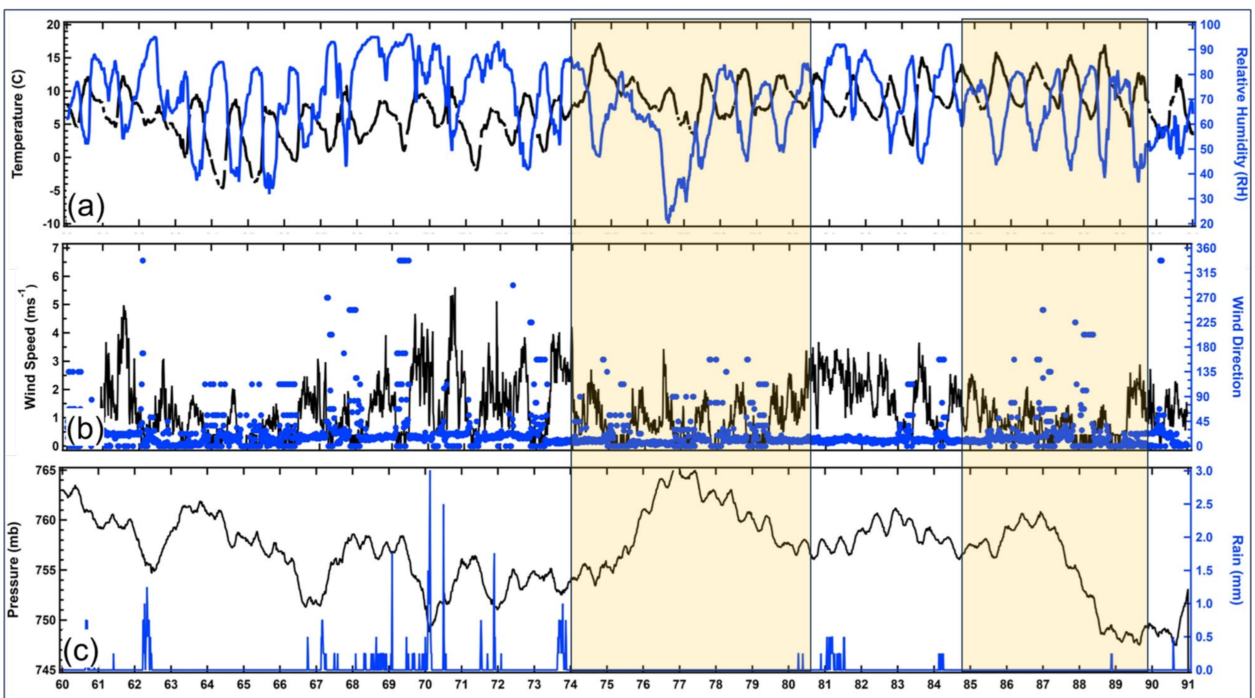

Figure S6. Time series of the meteorological parameters in León during the month of March 2022. The shaded areas are those time periods when AD was in the León region.

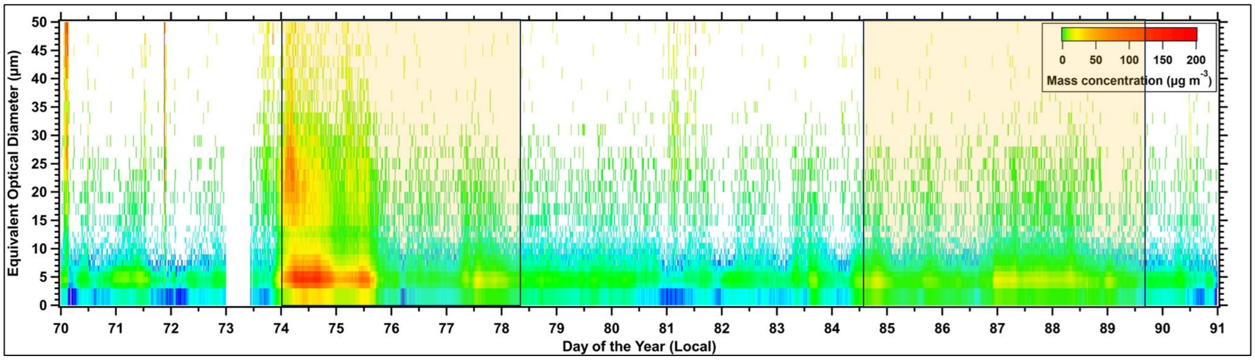

Figure S7. Time series in León of the mass concentration size distributions measured with the FM-120. The shaded areas demarcate the time periods when AD was in the region.

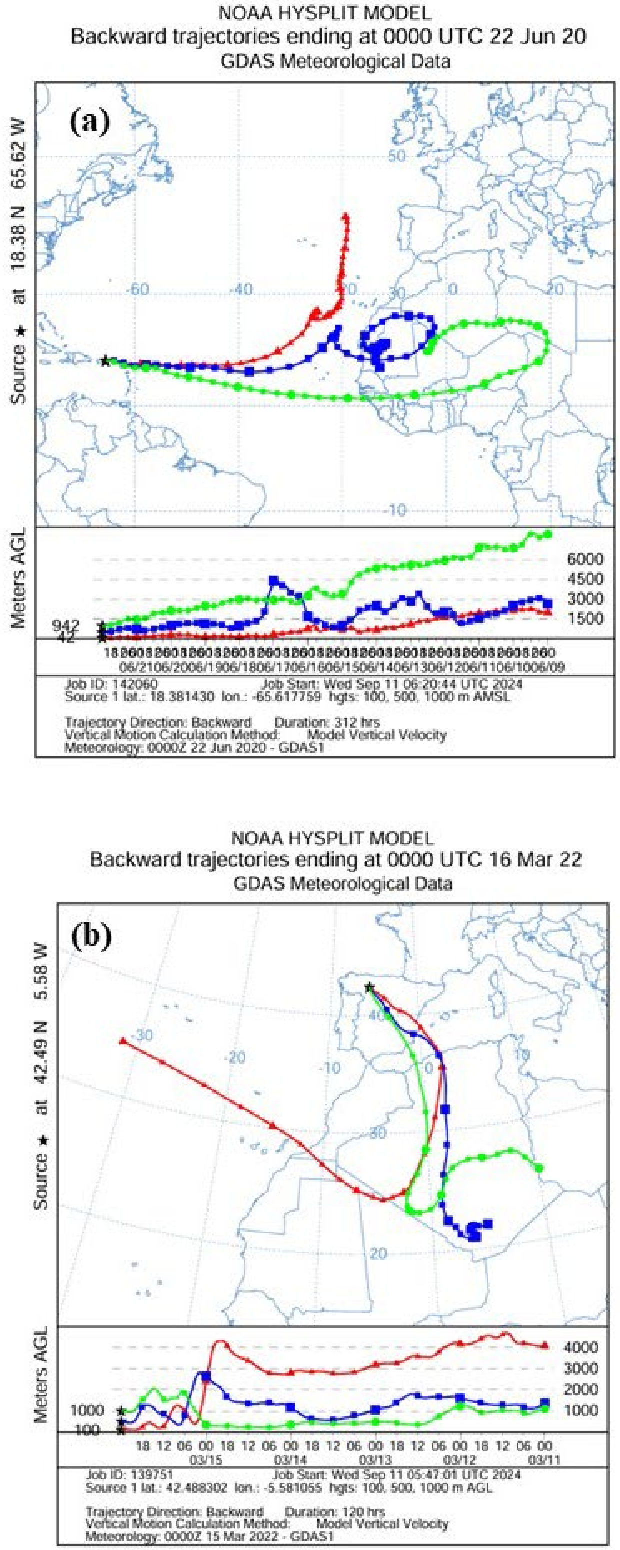

Figure S8. HYSPLIT air mass back trajectories drawn at three heights (e.g., 100, 500 and 1000 m) for thirteen days over PR on DOY 175, 2020 (a) and five days over Leon on DOY 75, 2022 (b). The air mass height reduced

when the air mass moved from Northwest Africa to Puerto Rico and Leon. It shows significant dust deposition at the locations under study (Record amount of PM10 observed at both the sites). As for the Caribbean (Puerto Rico), the historic African dust plume in the Caribbean was modulated by meteorology. The MEERA-2 meteorology associated with the dust episode, which focuses on geopotential height and wind vectors in detail, is discussed in Yu et al., 2021.

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