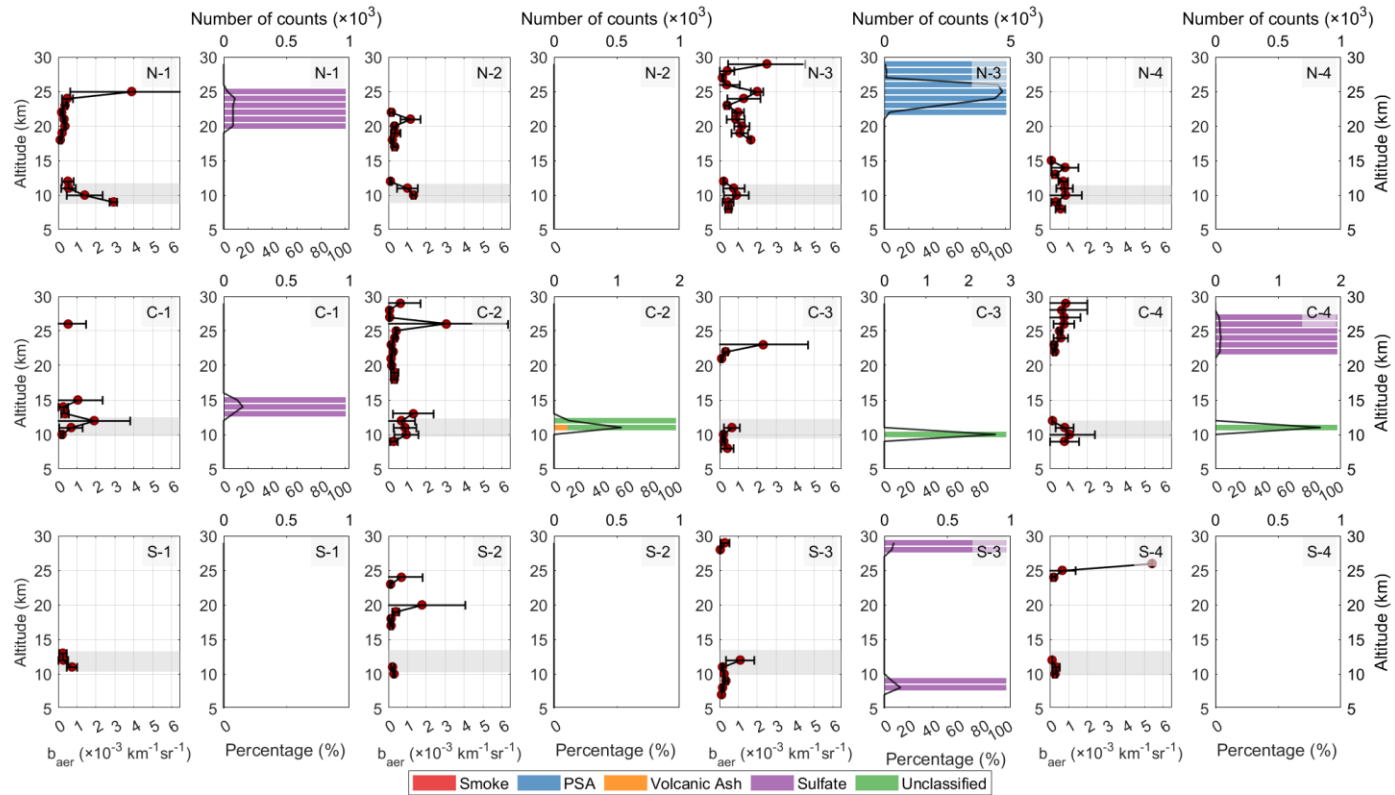


Supplement

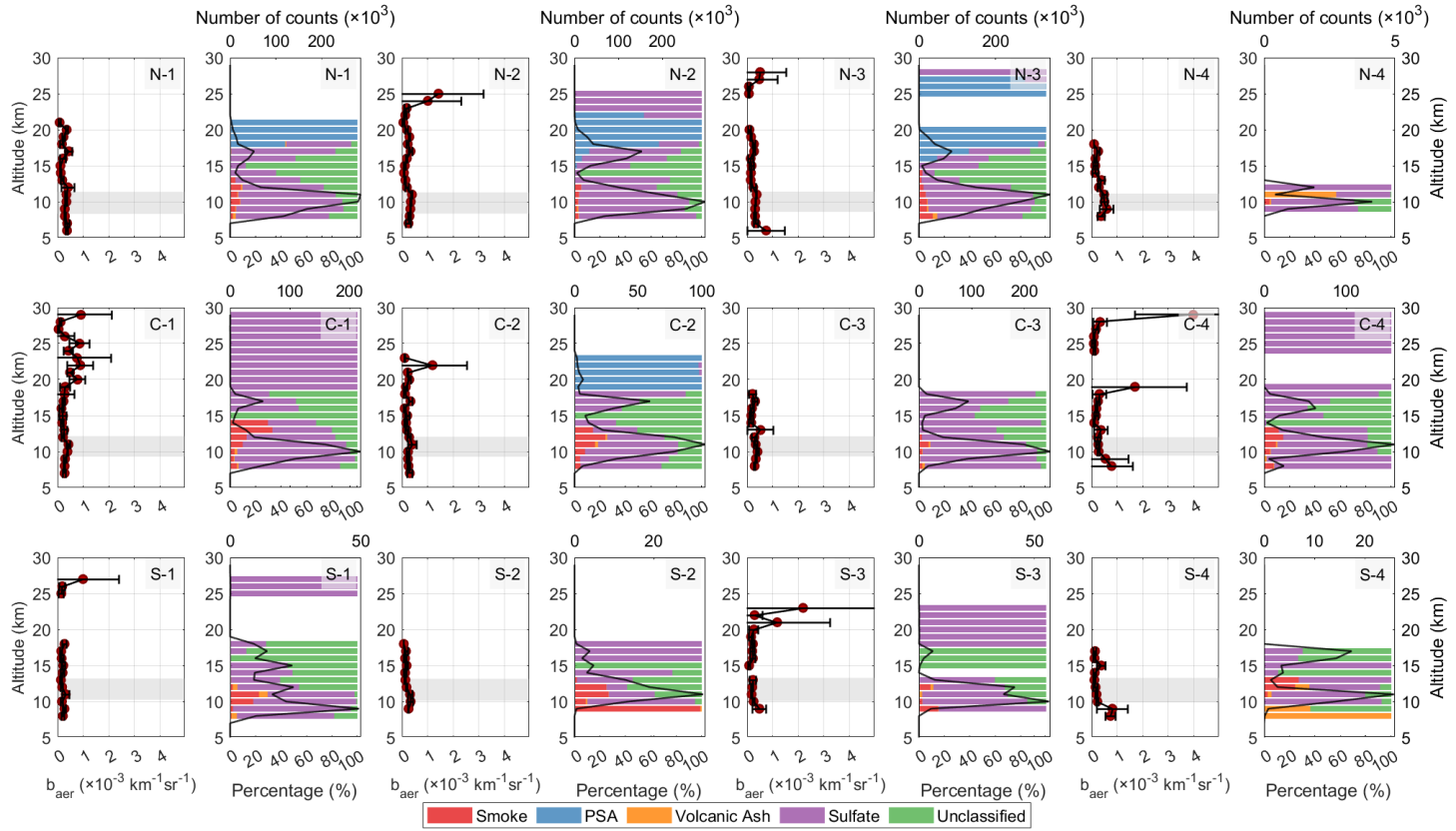
This supplementary material provides the complete dataset and preliminary analysis supporting the findings of the main manuscript. The content follows the logical progression of the study, starting from annual vertical distributions and moving toward aggregated seasonal trends.

Section 1: The first 16 figures represent the initial step of the analysis. For each year from 2007 to 2022, we present the nighttime vertical distribution of the backscatter coefficient at 532 nm and the corresponding stratospheric aerosol subtypes. These profiles are provided for each of the study's defined sub-regions: Northern Europe (N1, N2, N3, N4), Central Europe (C1, C2, C3, C4), Southern Europe (S1, S2, S3, S4).

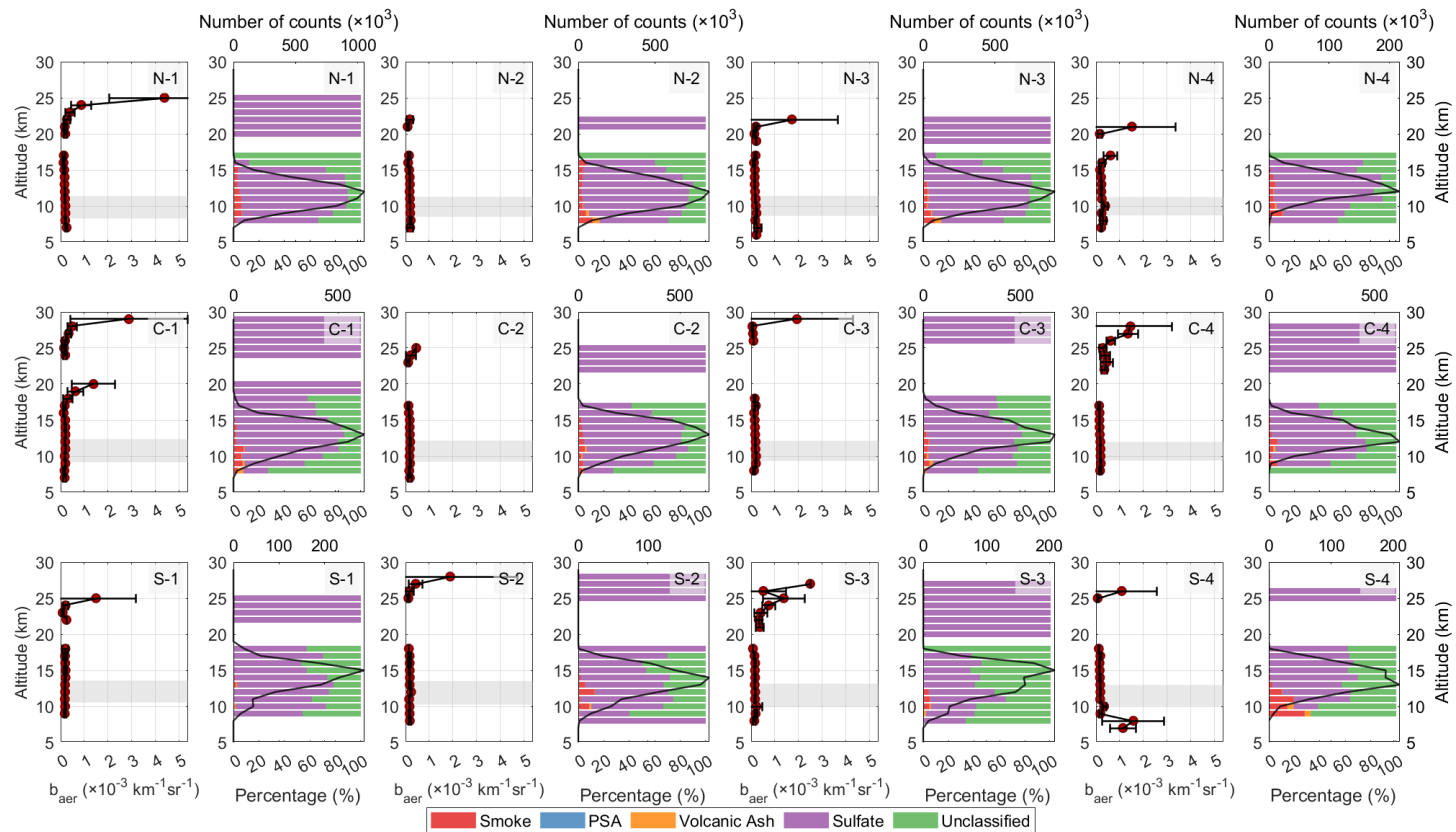
Year 2007



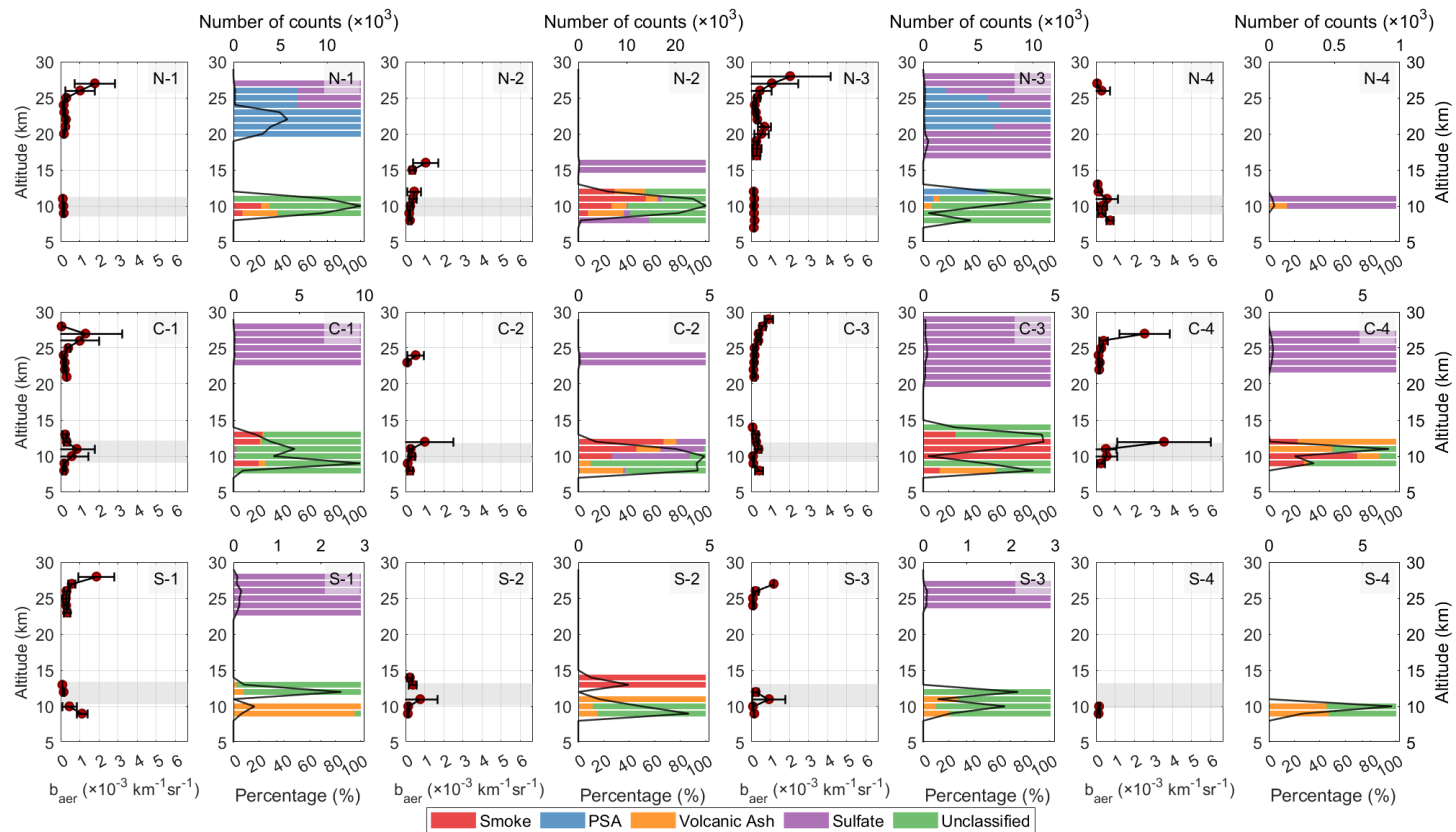
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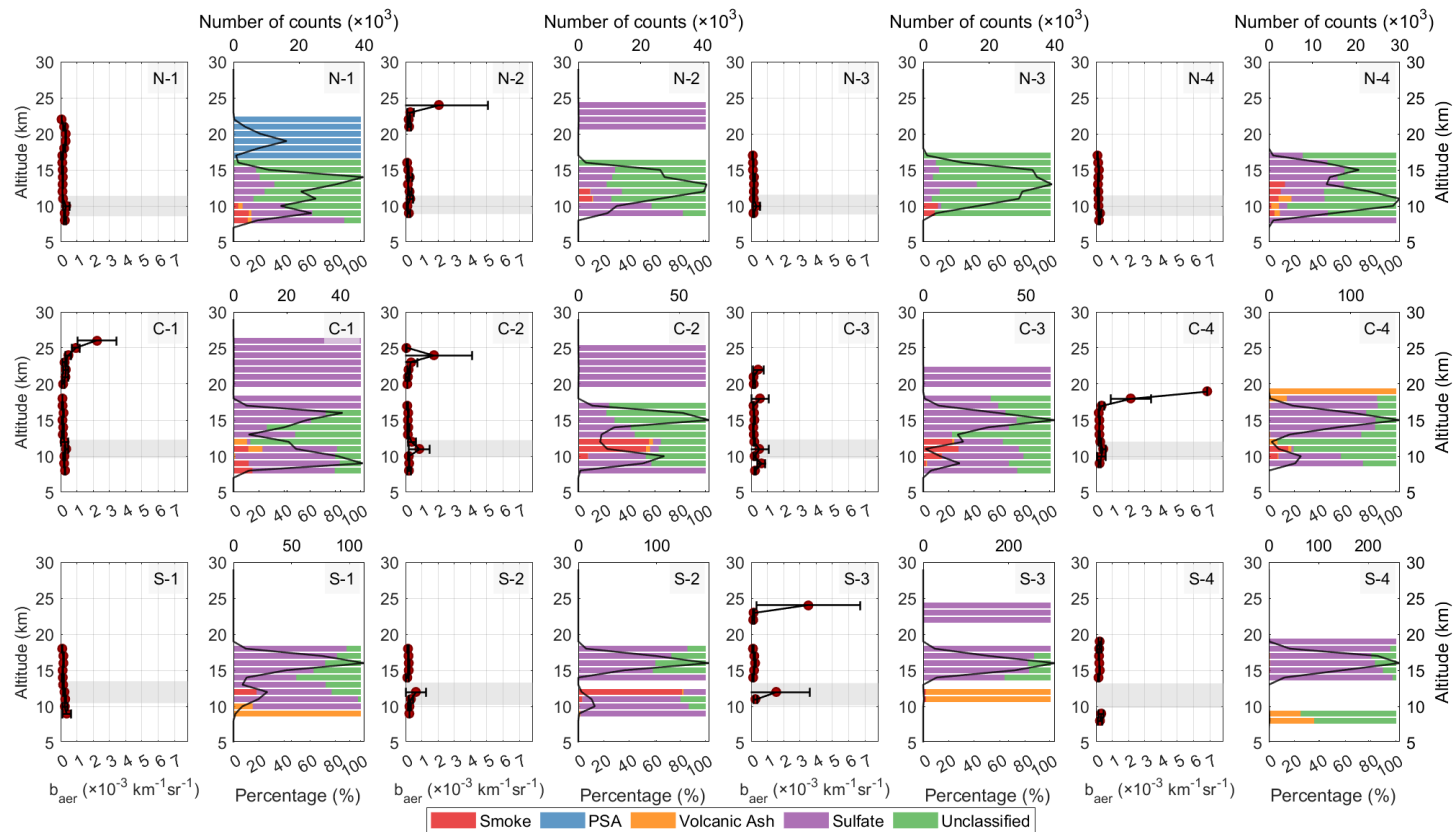
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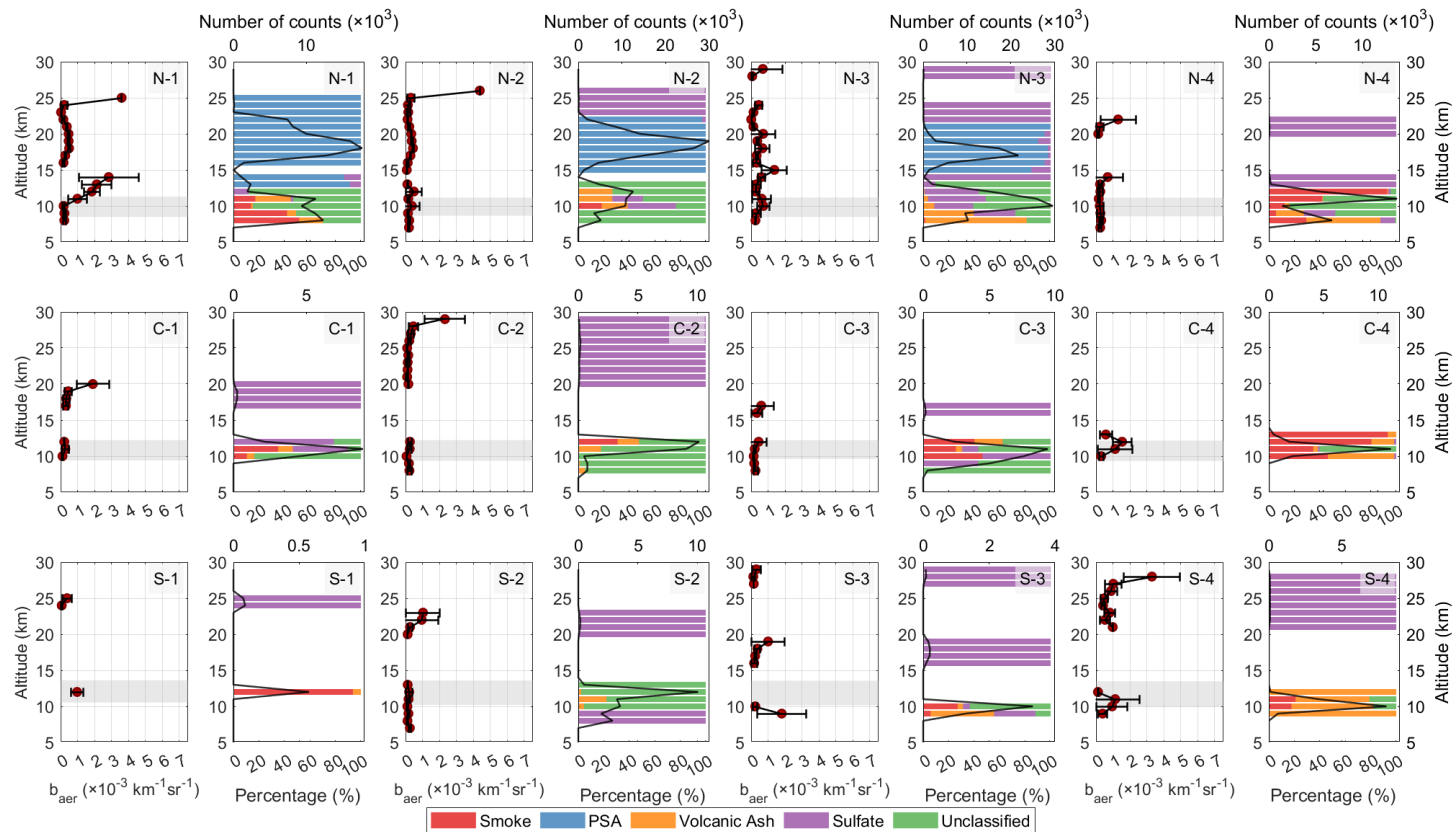
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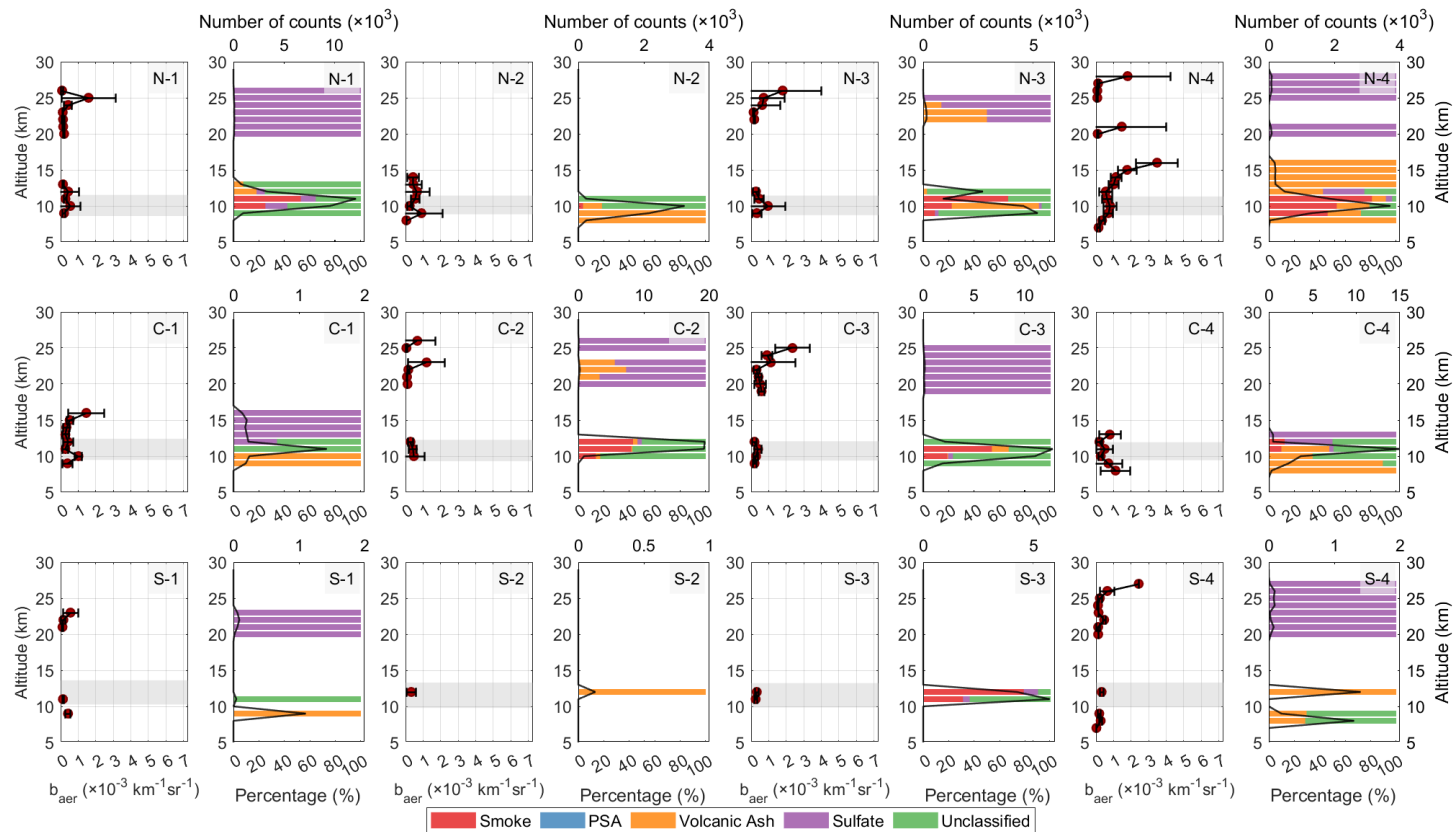
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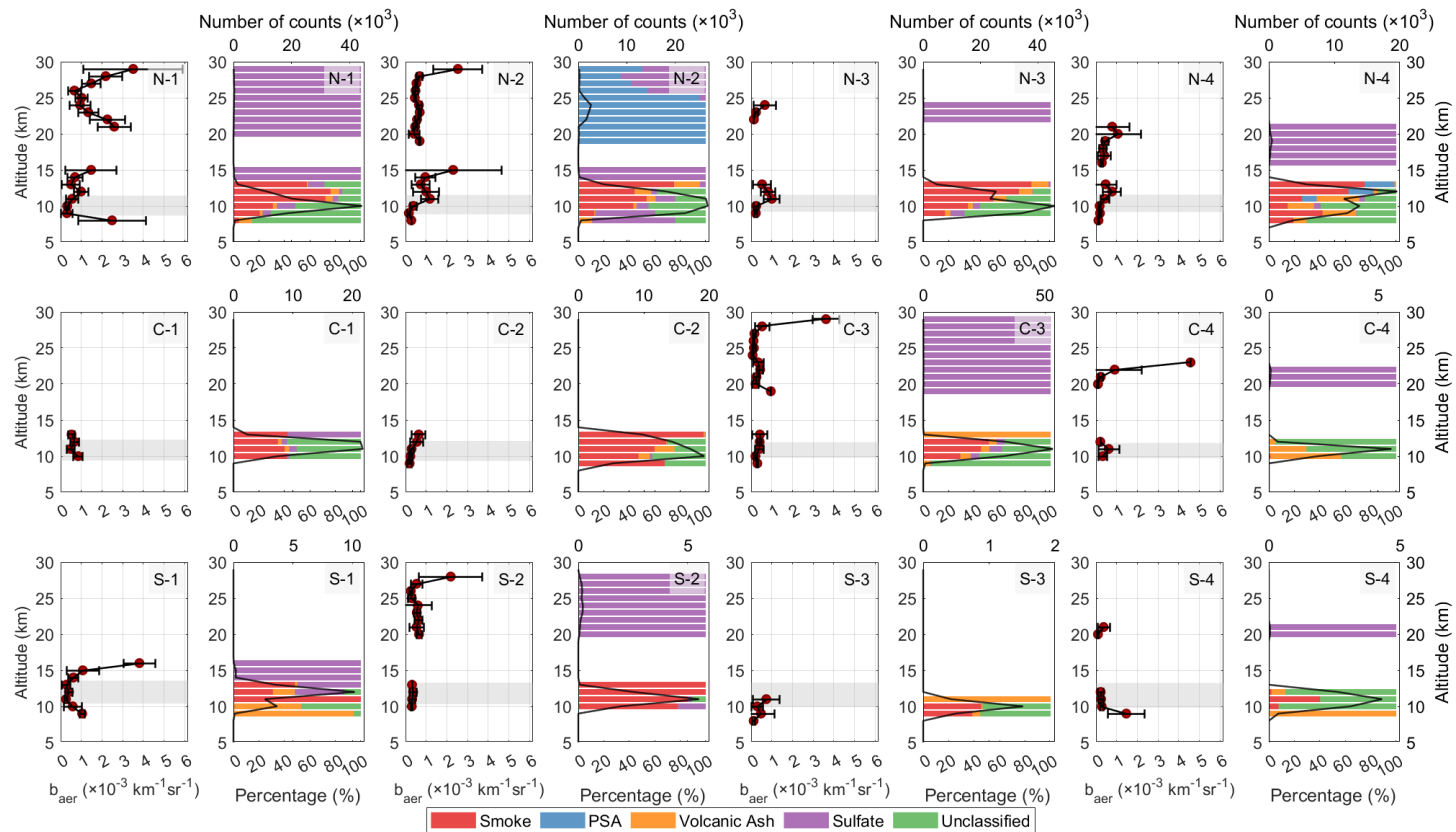
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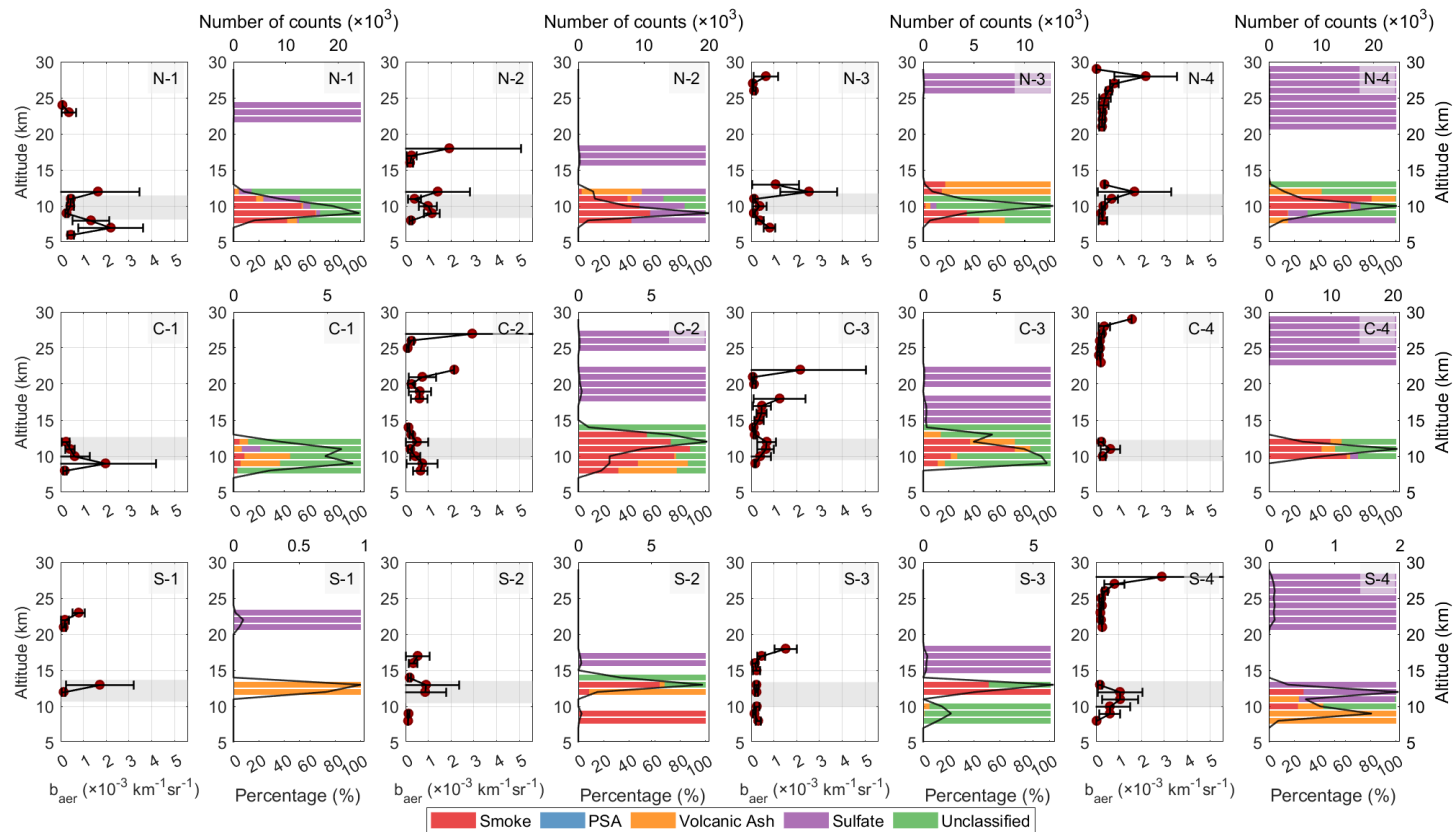
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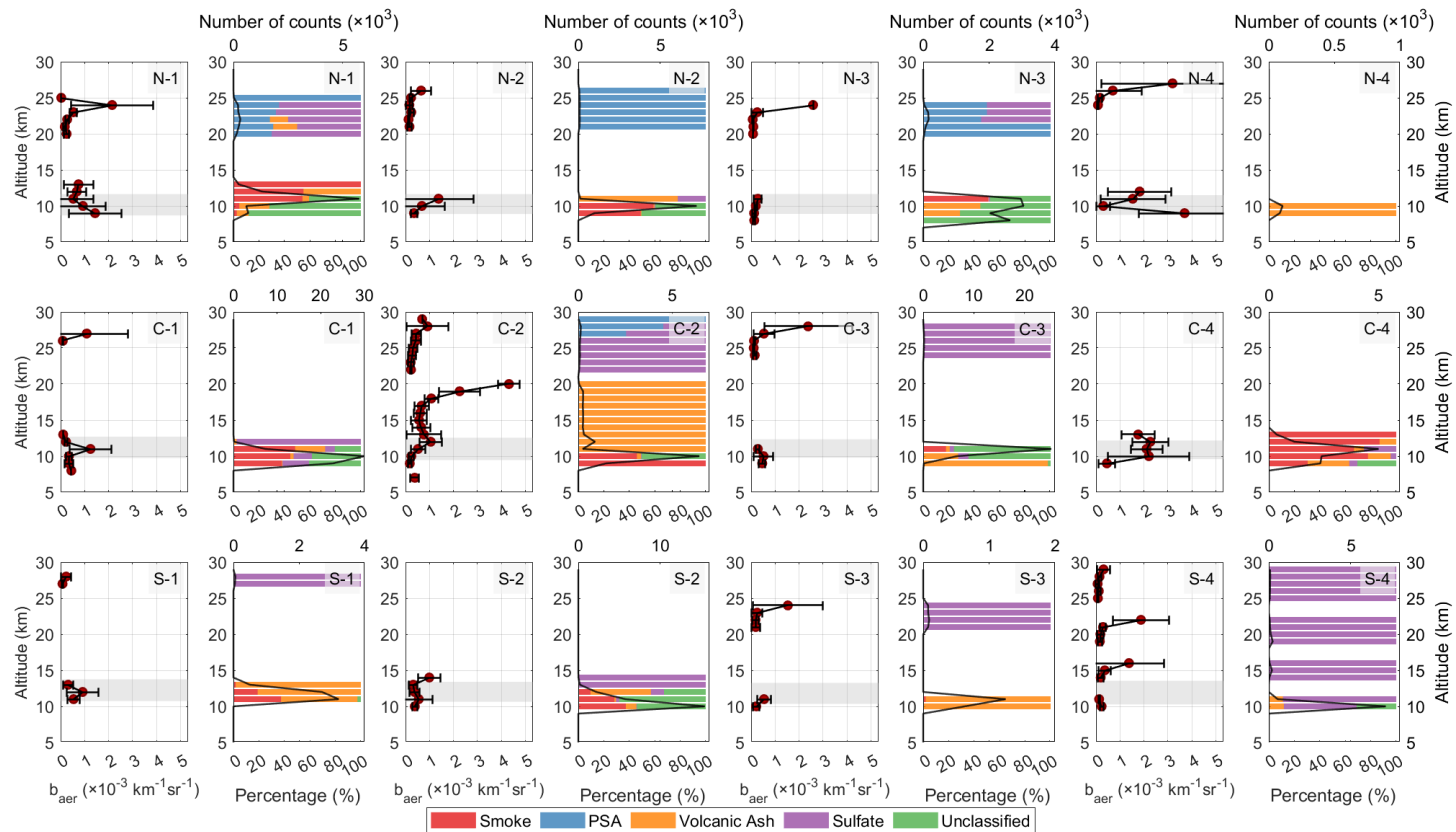
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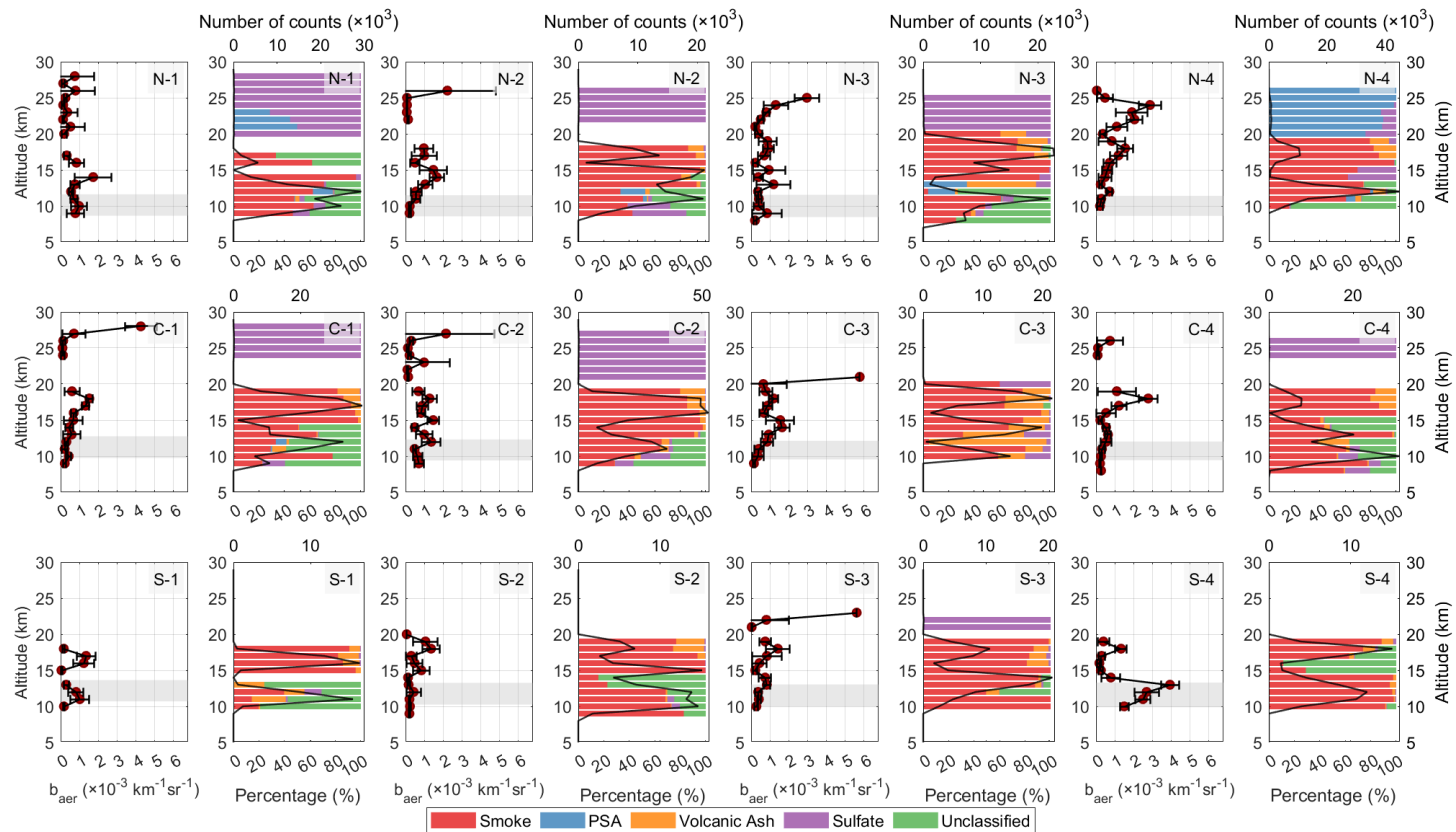
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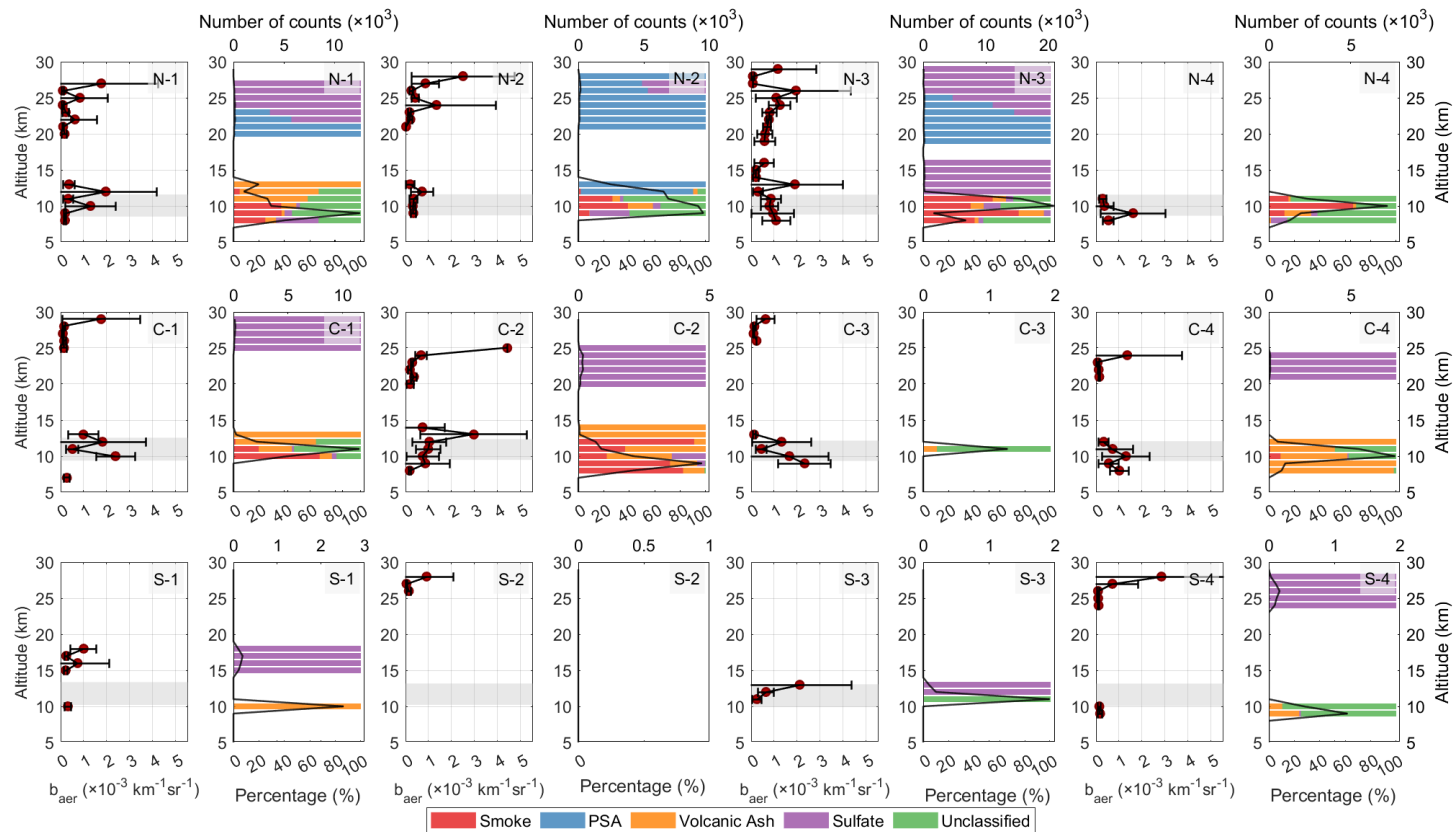
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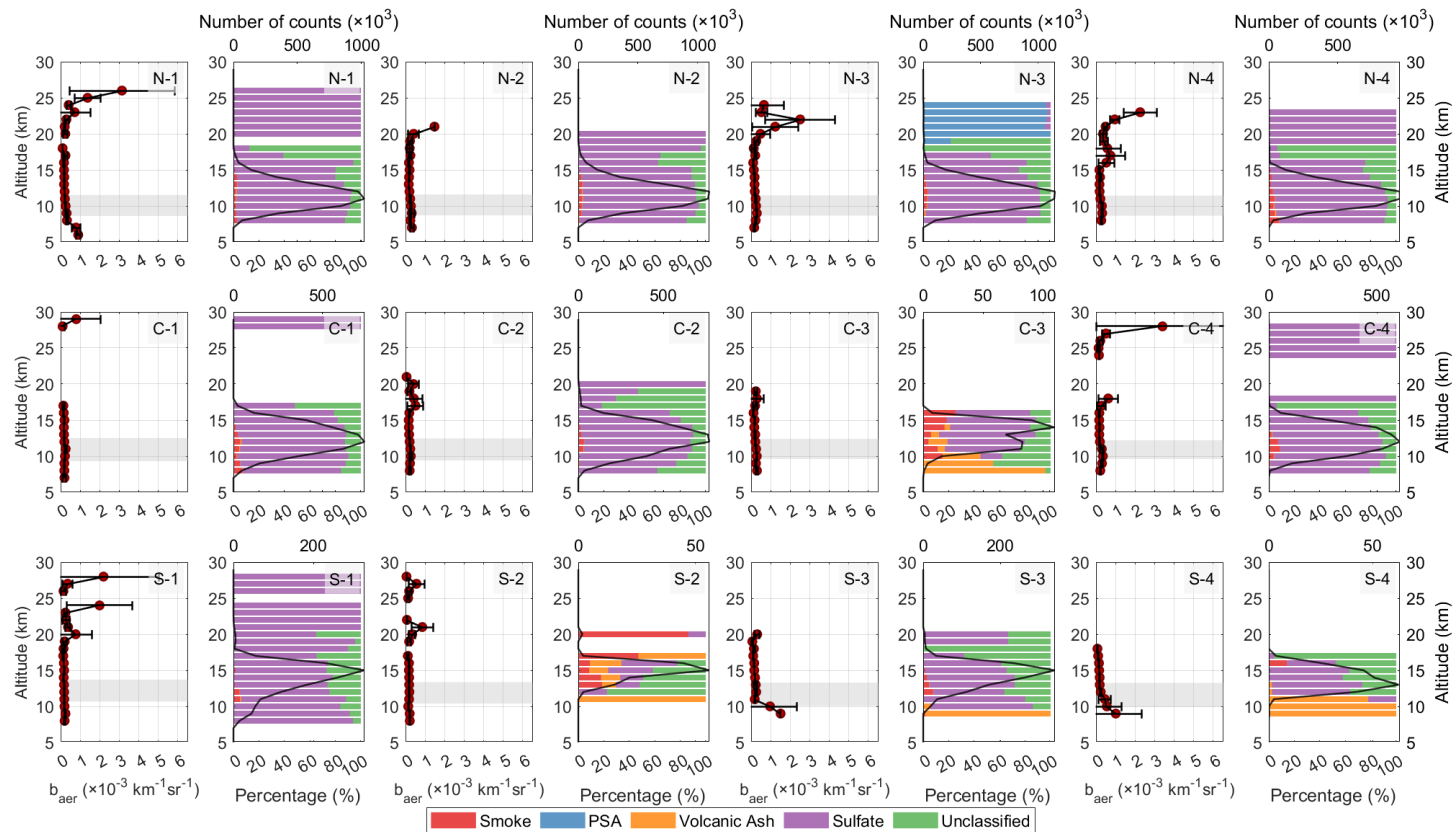
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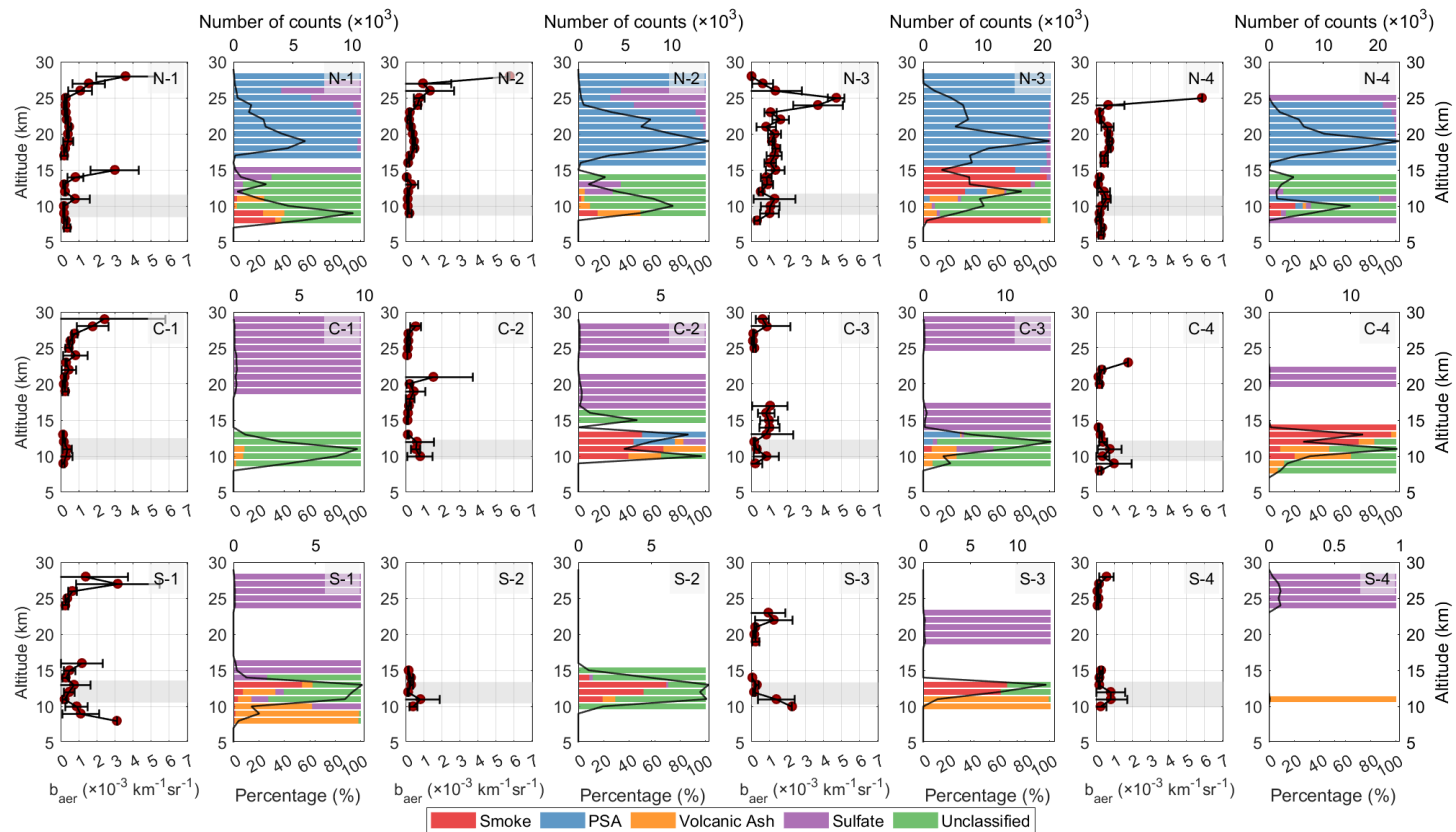
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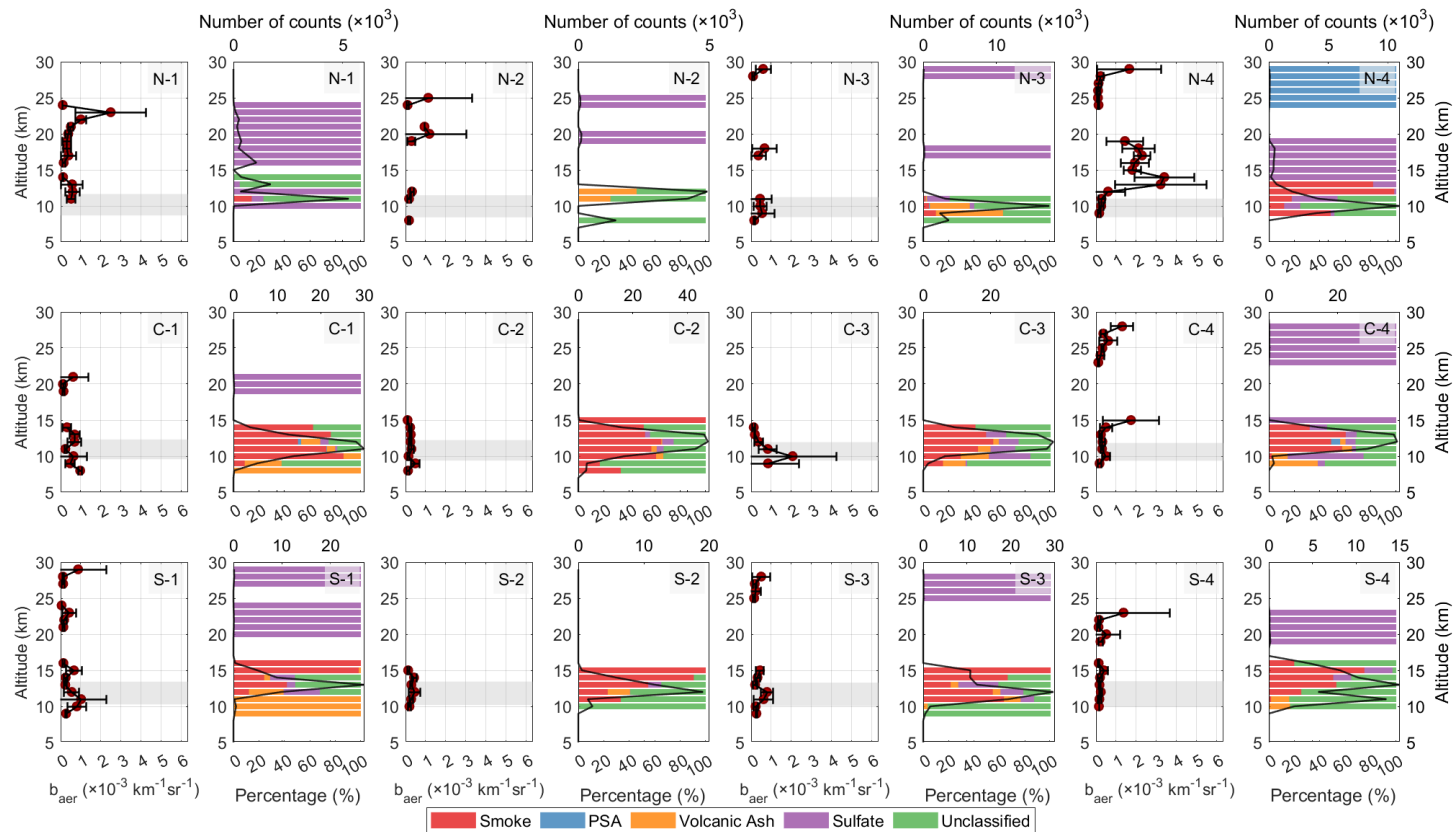
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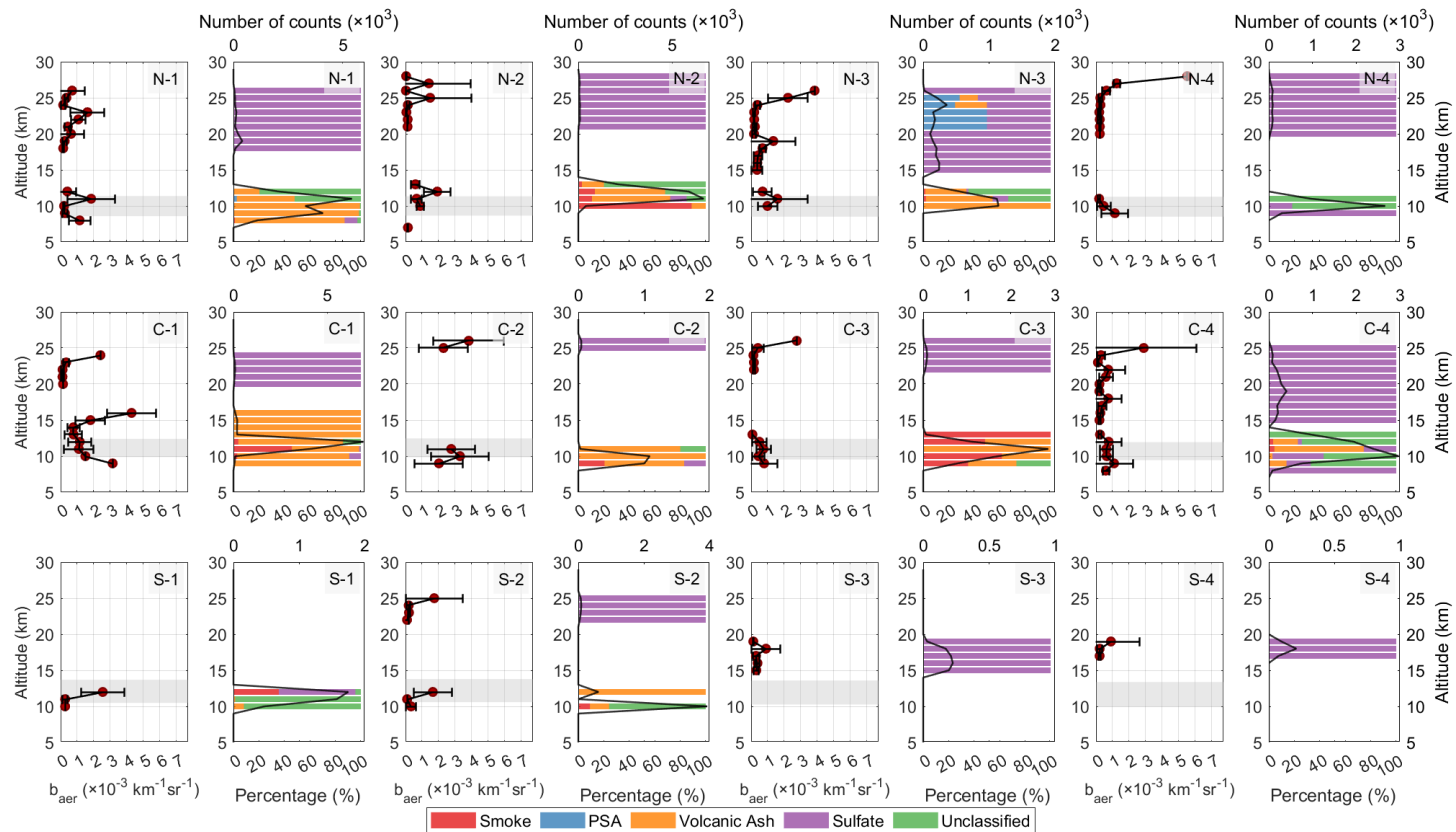
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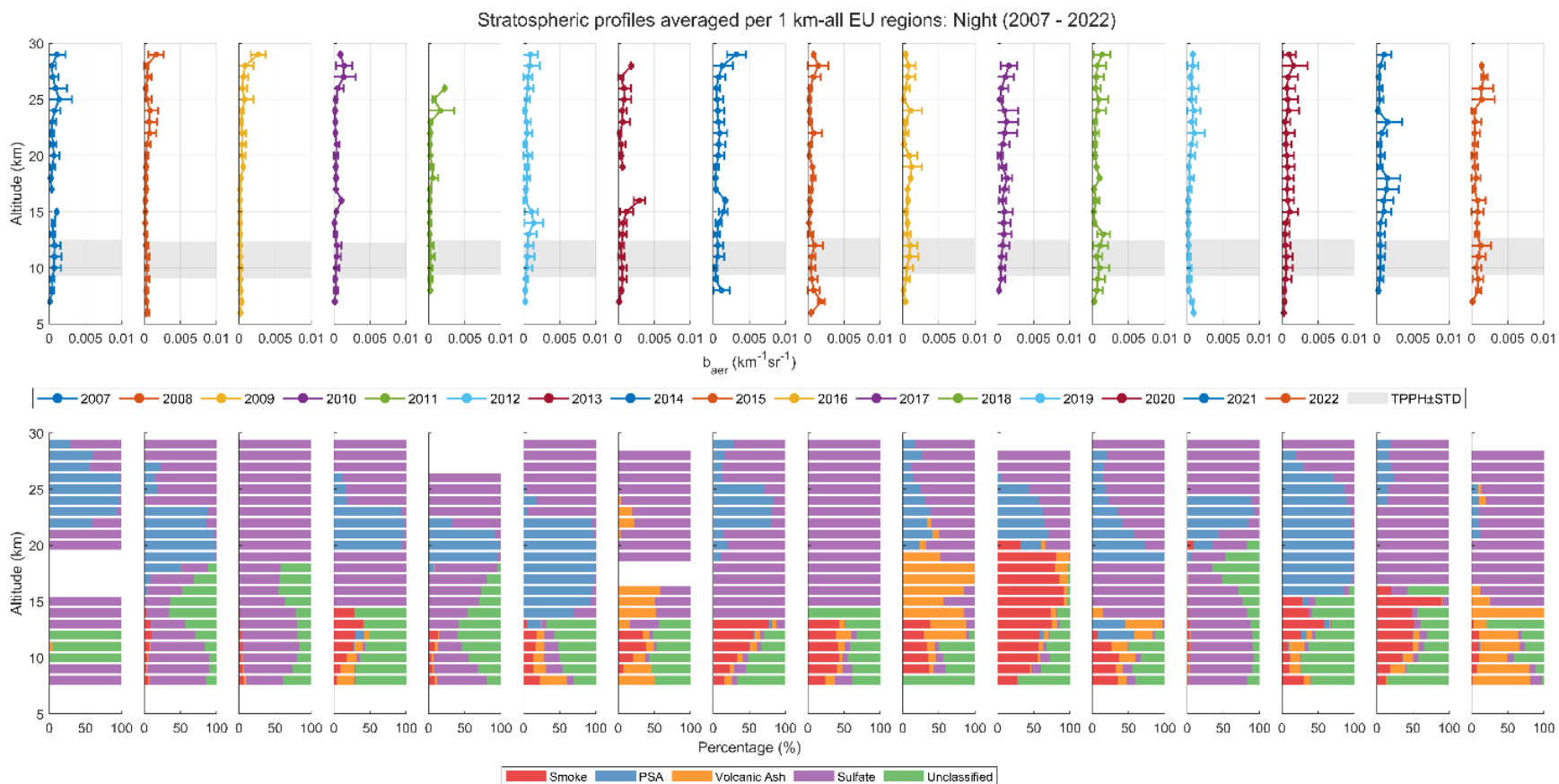
Year 2021



Year 2022



Section 2: The following figure provides a broader view of the atmospheric state by averaging the sub-regional nighttime data to represent the vertical aerosol distribution over the entire European domain.



Section 3: The following figures present the seasonal contributions for each year from 2007 to 2022, across every European sub-region. This analysis breaks down the four main stratospheric aerosol subtypes: Sulfates, Smoke, Volcanic Ash, and Polar Stratospheric Aerosols (PSA).

