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Large contribution of organics to condensational growth and formation of cloud condensation nuclei (CCN) in the remote marine boundary layer

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S1. Classification of air mass origins

The origins of the air masses arriving at the ENA site are classified based on the air mass back-trajectories. Here 10-day back-trajectories are simulated using the HYSPLIT 4 model (Stein et al., 2015) every hour starting from 500 m above the ground level, with the input of NCEP Global Data Assimilation System (GDAS) meteorological data. The back-trajectories are then classified into four categories using the following approach. First, all air masses that had passed over the North America (130° ~ 60° W, 35° ~ 62° N) or northern Europe (-10° W ~ 30° E, 35° ~ 62° N) are classified as "Continental origins". Second, air masses that passed over the Arctic regions (latitude higher than 62° N) are then denoted as "the Arctic". Third, among the remaining air masses, those passed over subtropical oceans (latitude lower than 35° N) at times 6 - 150 h prior are classified as "Subtropical origins". Last, all other air masses are considered as "mid-latitude Atlantic". The dominant air mass origin during a given growth event is designated as the air mass category of that event.

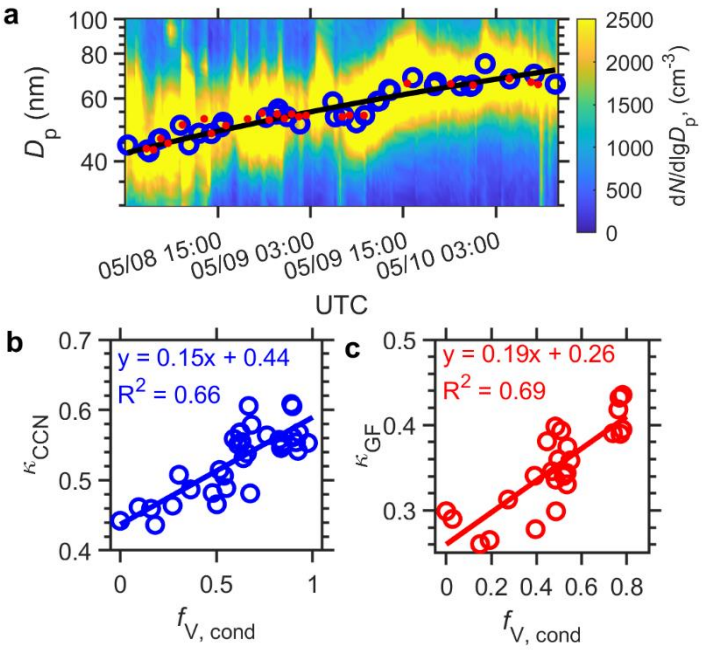
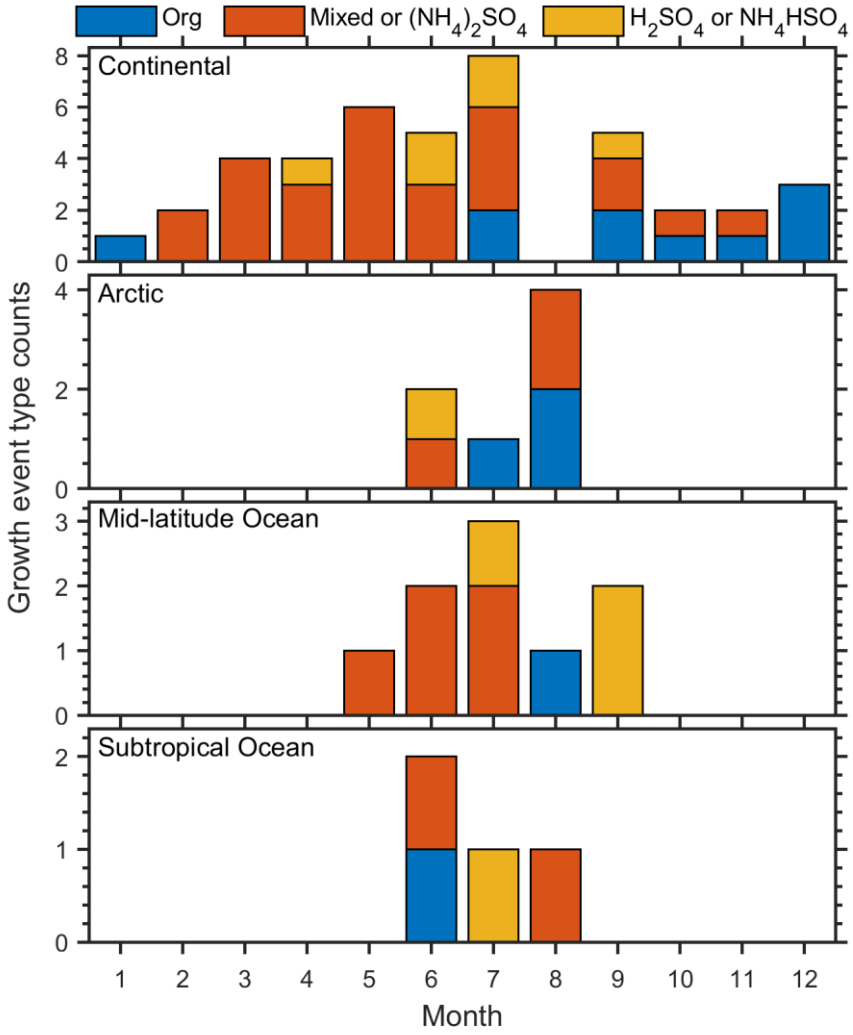


Figure S1. An example case of deriving $\kappa_{c,CCN}$ and $\kappa_{c,GF}$ for the same growth event. (a) Aerosol size distribution during the growth event. The blue circles and red dots represent lognormal-fitted Aitken mode diameters at the times of the SCCN and HTDMA measurements, respectively. The black line shows the growth of the Aitken mode diameter during the event. (b) A $\kappa_{c,CCN}$ value of 0.59 (i.e., the sum of slope and intercept) is derived from the linear fitting of κ_{CCN} vs. $f_{V, cond}$. This value falls in the intermediate-$\kappa_{c,CCN}$ category. (c) A $\kappa_{c,GF}$ value of 0.45 is derived from the variation of κ_{GF} following the same approach. Major condensing species of this case is determined to be $(NH_4)_2SO_4$ (see detailed discussions in section 5 of the main text).



35 **Figure S2. Monthly distribution of condensational growth event and the dominant condensing species for each type of air mass origins.**

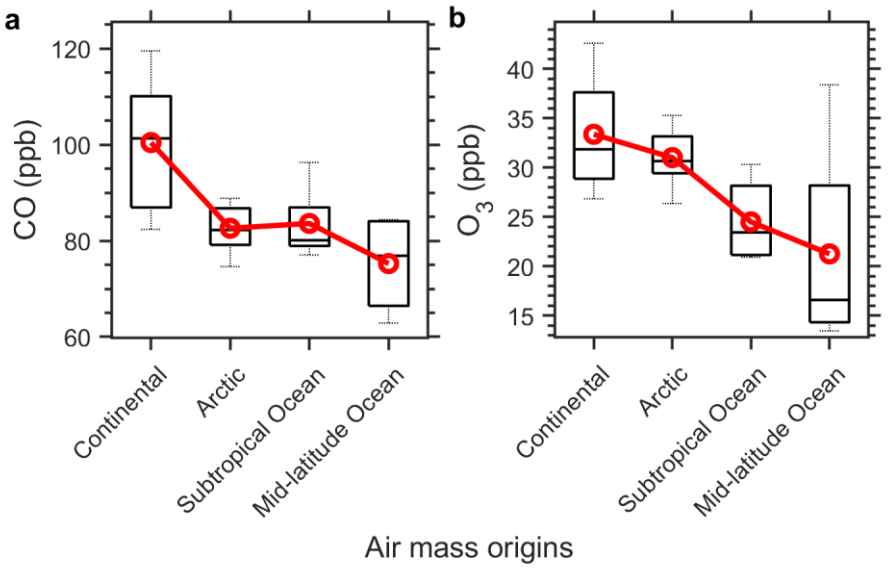


Figure S3. Trace gas mixing ratios in air masses of different origins. (a) CO and (b) O_3.

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