



Supplement of

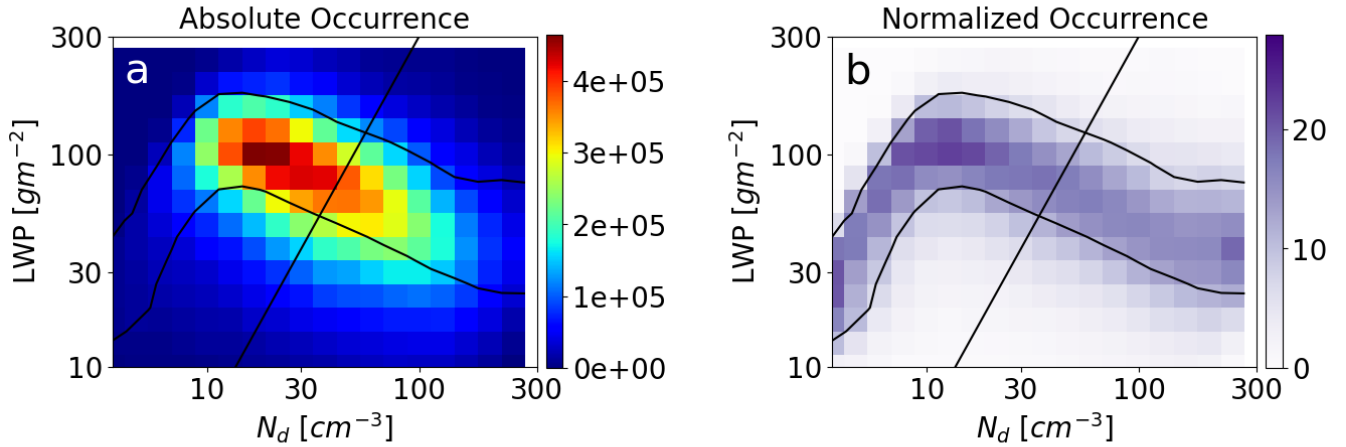
Co-variability drives the inverted-V sensitivity between liquid water path and droplet concentrations

Tom Goren et al.

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Southeast Pacific



Southern Ocean

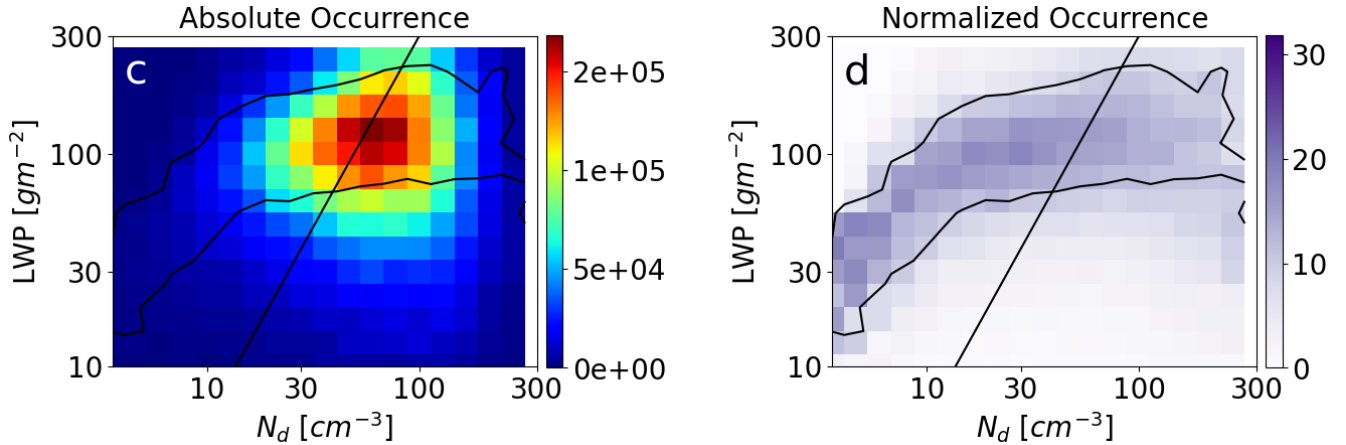


Figure S1. Joint histograms of LWP and N_d . Panels (a) and (b) are for the entire SEP region and panels (c) and (d) are for a small domain in the Southern Ocean (see Table A1 for region limits). Panels (a) and (c) display the absolute occurrence while panels (b) and (d) display the normalized occurrence relative to each N_d bin. The black curves bound the bins with at least 10% of the column-normalized observations. The diagonal line represents an effective radius of $15 \mu\text{m}$ (assuming adiabatic clouds), serving as an approximate indicator of precipitation, with precipitating clouds located to the left of the line.

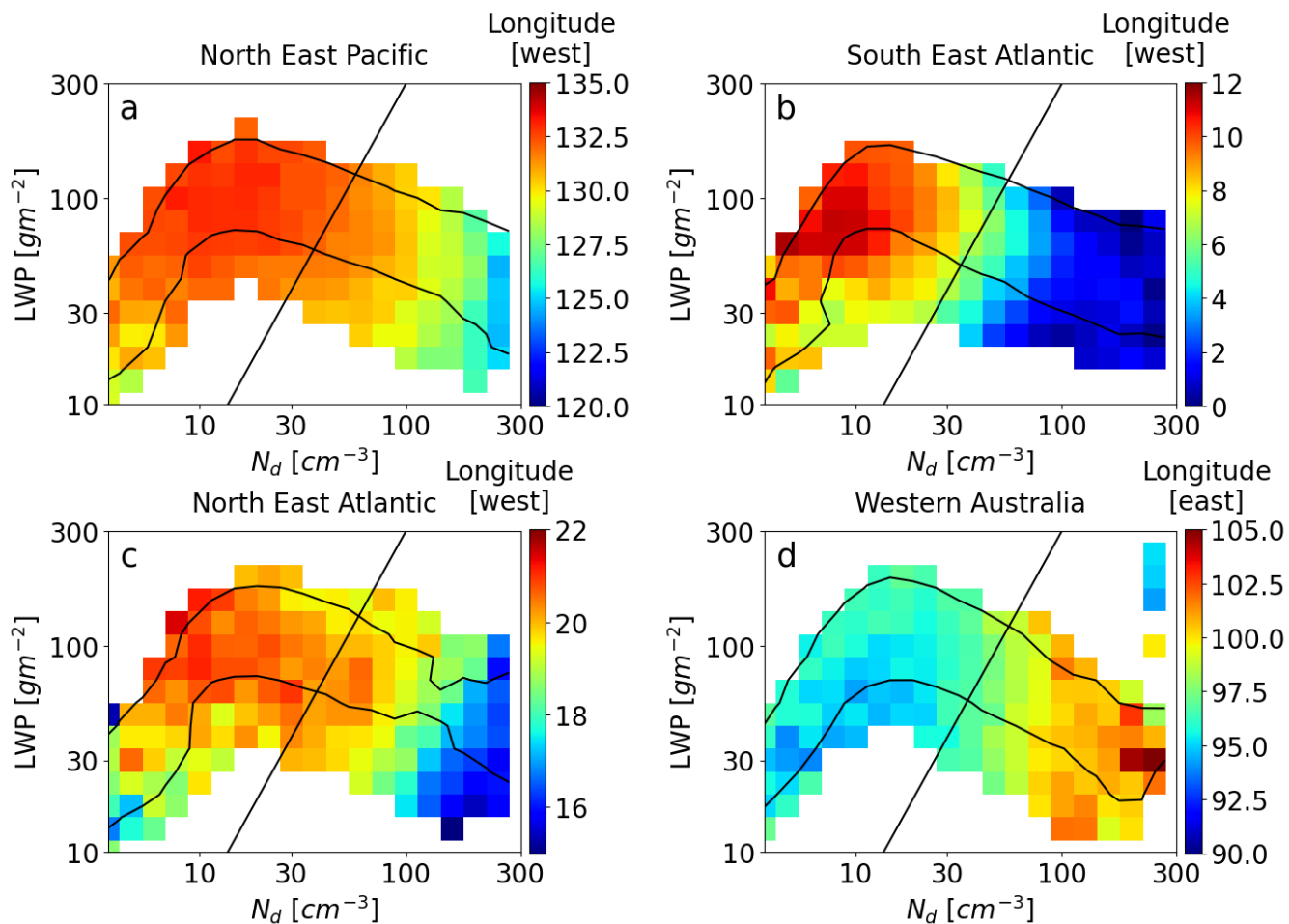


Figure S2. Bin averaged longitude in N_d -LWP space shown for four additional Sc regions. Note that for Western Australia, the longitude is longitude east, whereas for the other regions, it is longitude west. The *inverted-V* pattern emerges from the joint histograms of N_d and LWP, where each column is normalized to sum to 1. The black curves indicate the range where at least 10% of the normalized observations occur within each bin. The diagonal line represents an effective radius of $15 \mu\text{m}$ (assuming adiabatic clouds), serving as an approximate indicator of precipitation, with precipitating clouds located to the left of the line.

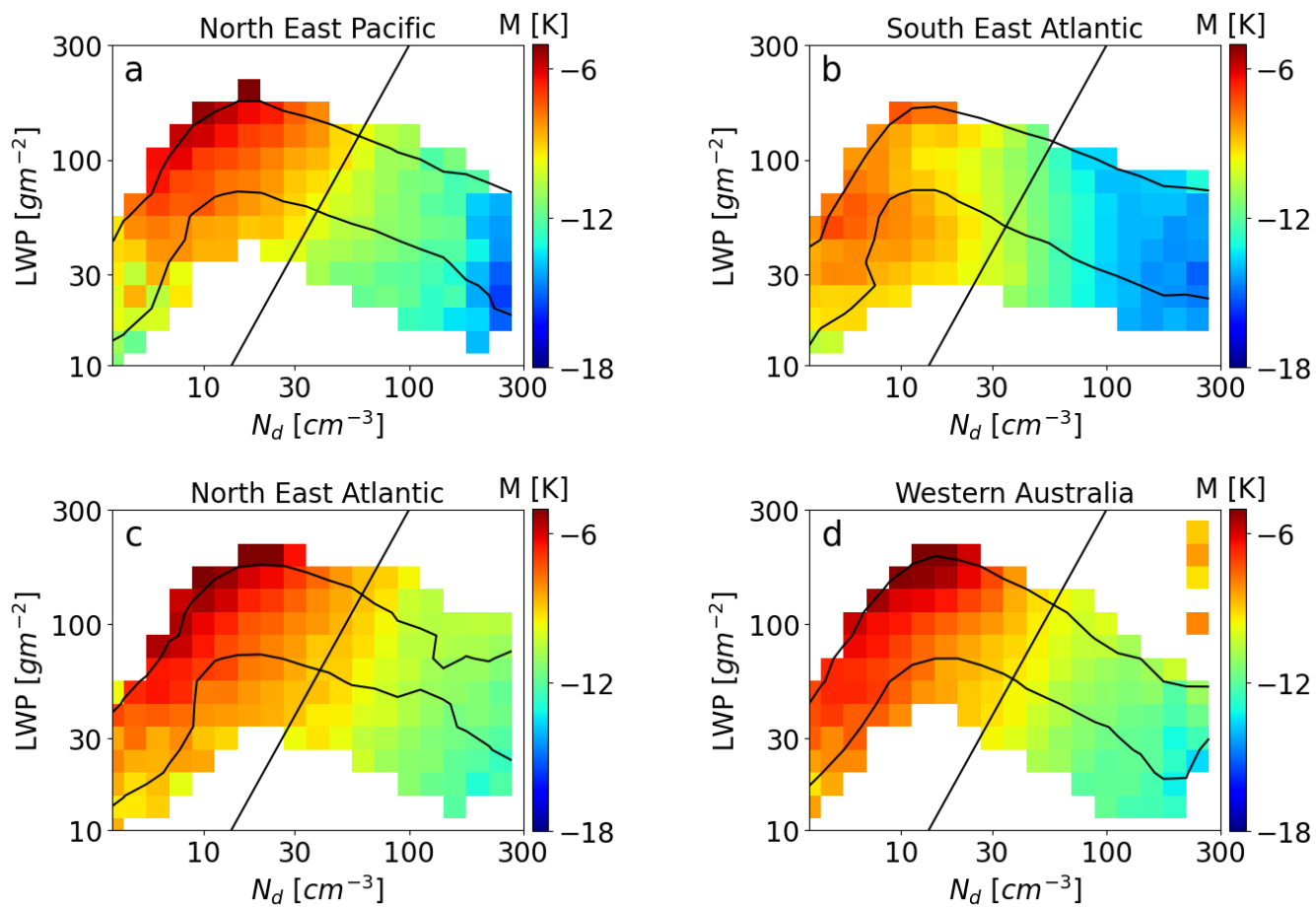


Figure S3. Same as S2 but for M . A more negative M indicates a shallower MBL, while a less negative M indicates a deeper MBL.

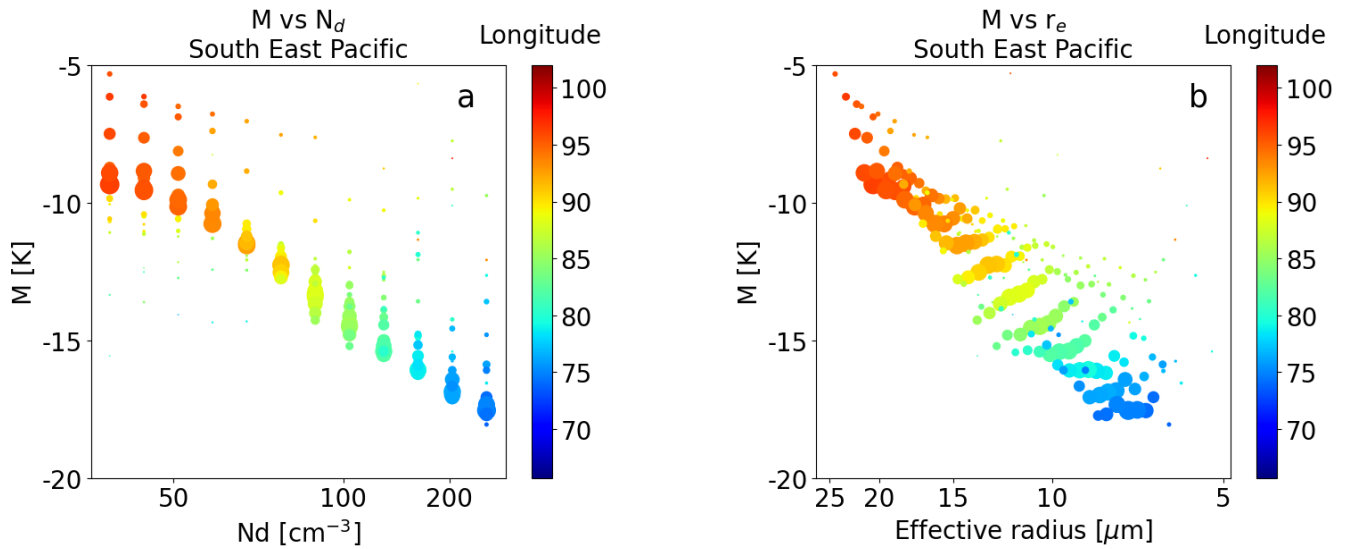


Figure S4. Relationships derived from the LWP- N_d joint histogram bins of the SEP. (a) M , a proxy for the MBL depth, against N_d . A more negative M indicates a shallower MBL, while a less negative M indicates a deeper MBL. Note the robust relationship between M and longitude (in color) with N_d . (b) r_e versus M . The increase in r_e with M as derived from the climatology, can be interpreted as representing temporal cloud vertical development. The color represents the mean longitude of each bin, and the size of the circles represents the relative number of scenes in each N_d bin.

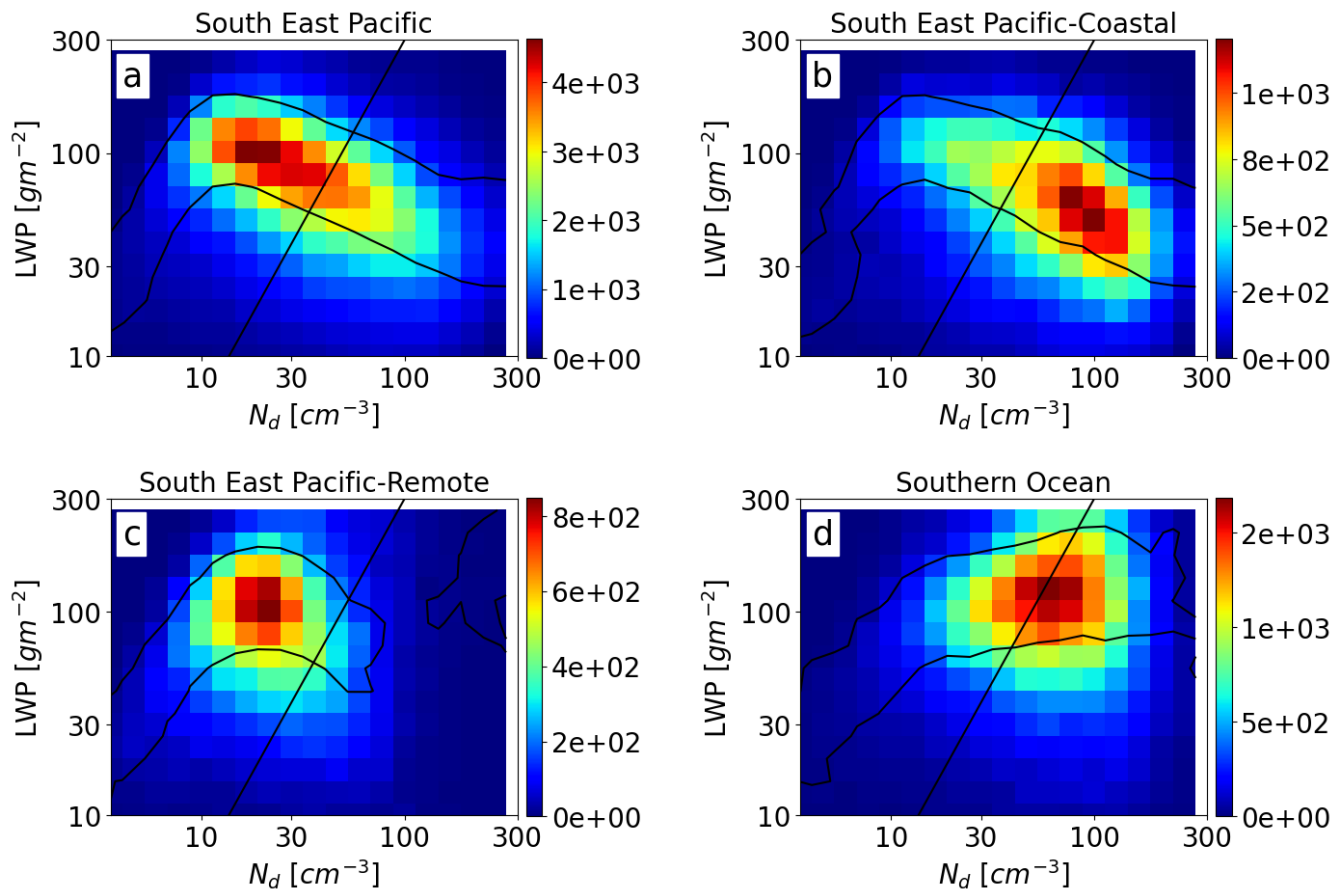


Figure S5. Joint histogram of LWP and N_d showing the absolute occurrence of scenes in each bin for different regions. It can be seen that low N_d observations in the SEP coastal region are scarce (b), whereas in the remote SEP, the opposite is true with scarce high N_d observations (c). Panel (a) is for the entire SEP domain. Also note the absence of co-variability between LWP and N_d in the Southern Ocean (d). Refer to Table 1 in the paper for the boundaries of the regions.

South East Pacific (Cloud Cover > 80%)

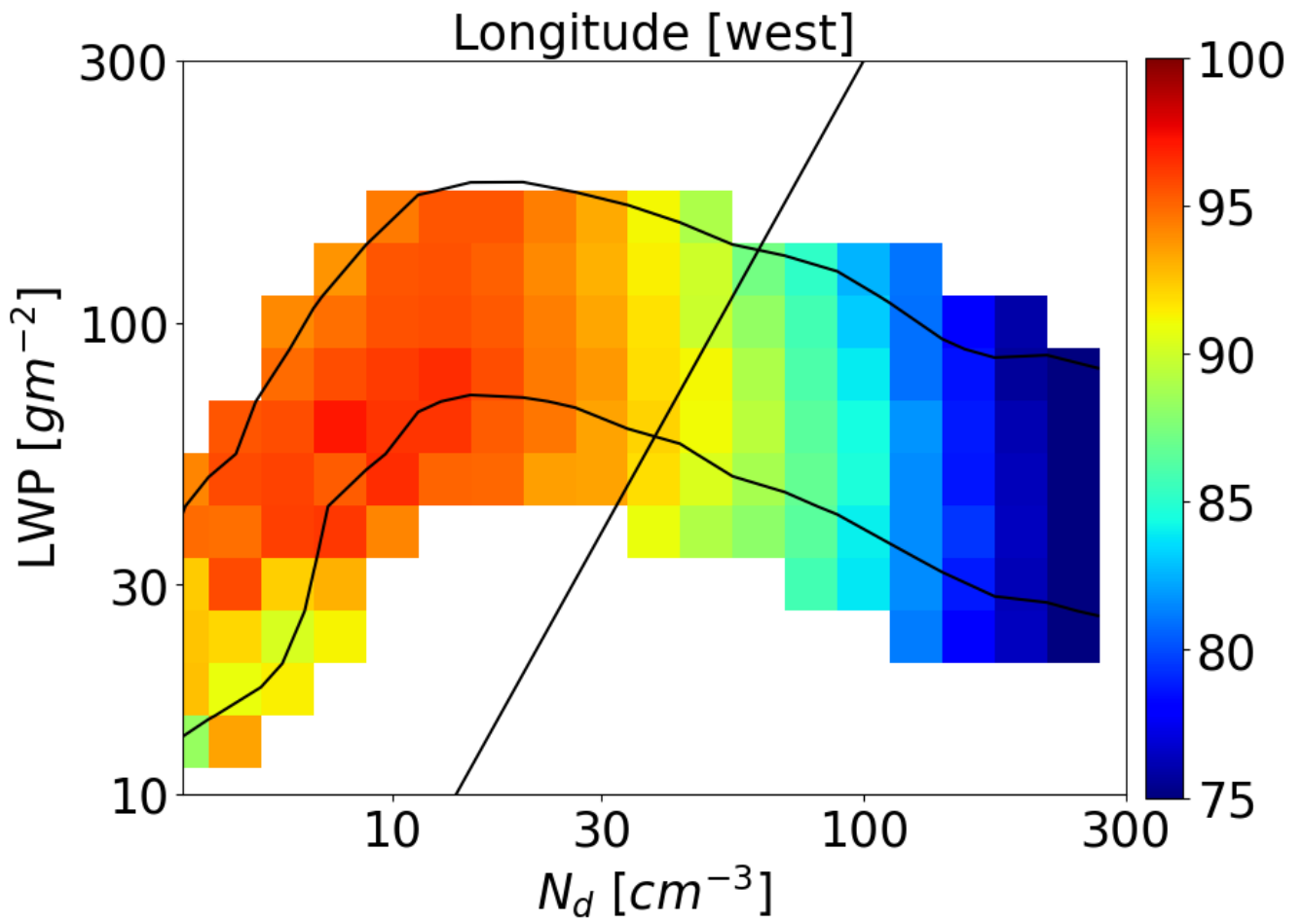


Figure S6. Same as S2 but for the SEP region and for cloud cover > 80%.

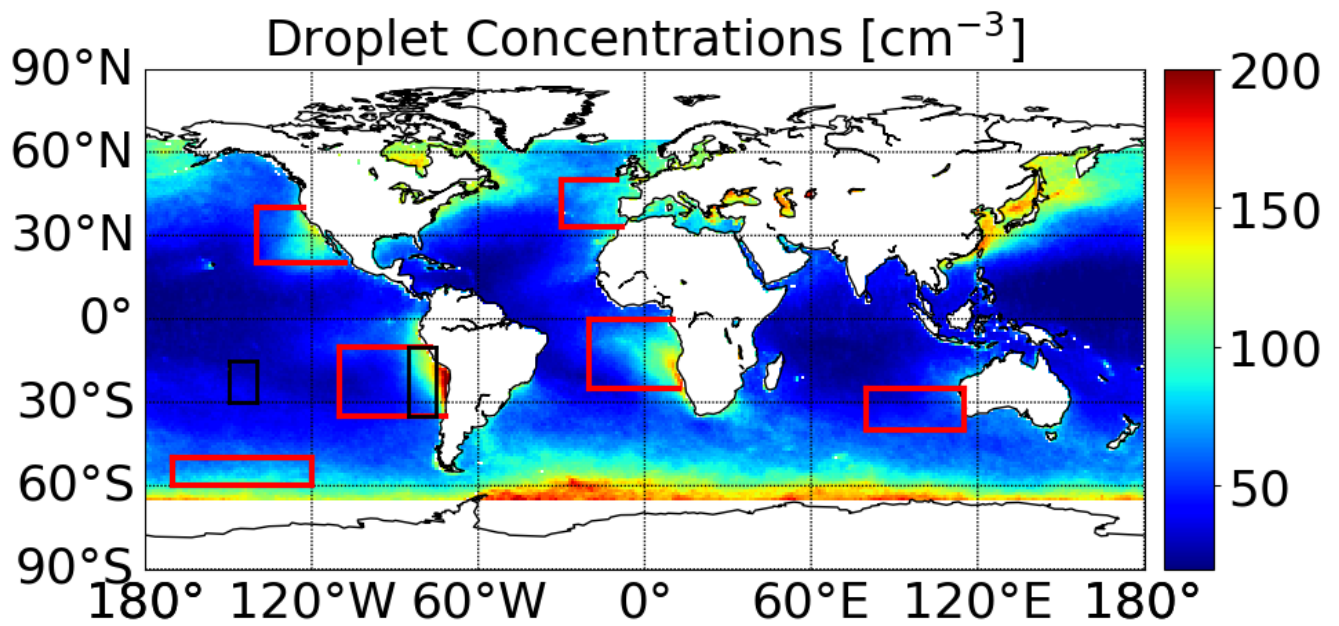


Figure S7. A map of the annual mean of N_d , showing the regions listed in Table 1. The black boxes represent SEP-Coastal and SEP-Remote.