Supplementary Materials for

Microphysical, macrophysical and radiative responses of subtropical marine clouds to aerosol injections

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S1 Time series

In the main manuscript, we mainly show averages over three-time intervals (Day 1, Night and Day 2). This Supplementary Material shows time series through the entirety of the runs to give readers an overview of how they evolve with time. For the budgets of q_t, s_l, N_a and CRE (Figure S3-7), comparison between sum of the budgets (black) and model output (red) indicates the extent to which the calculated budgets close.

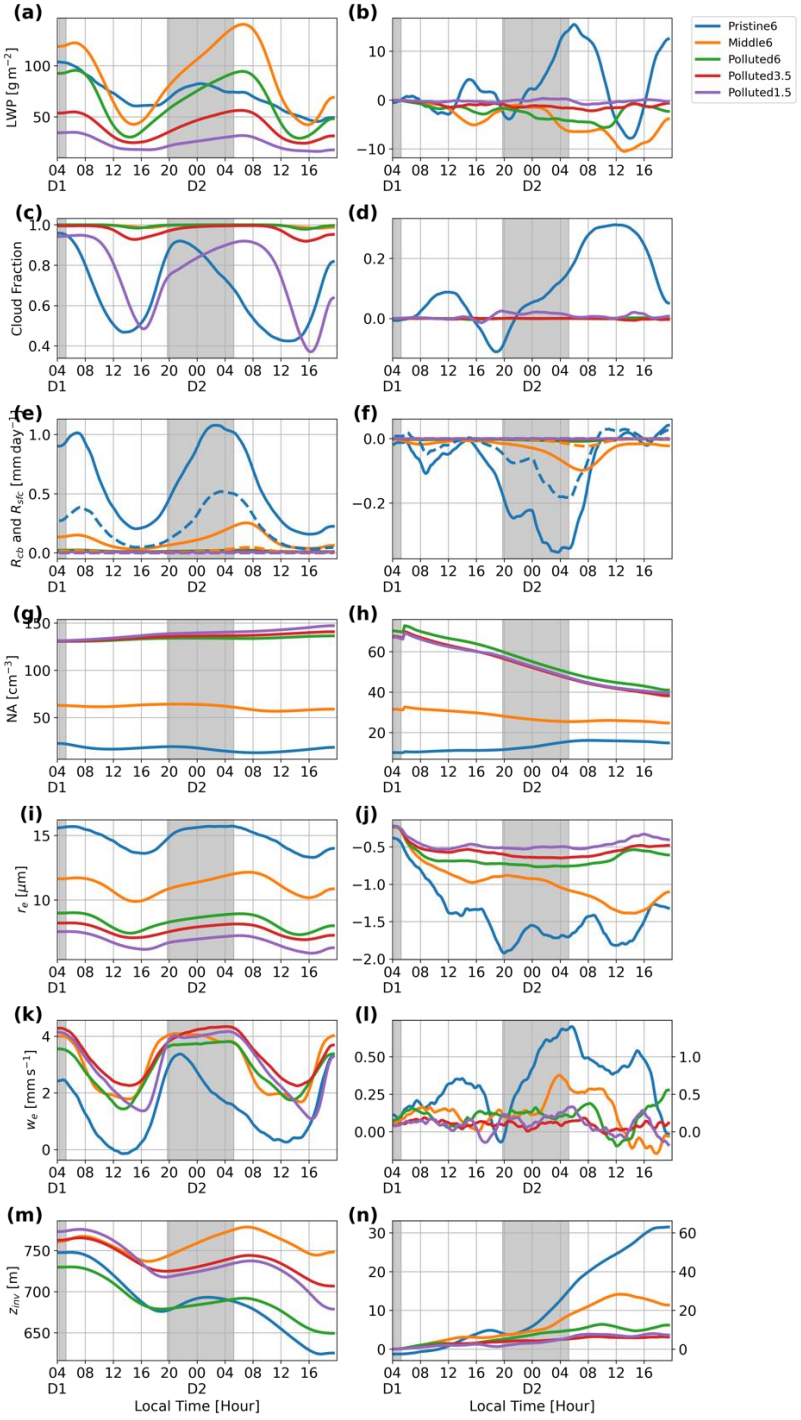

Figure S1: The time series of variables for all cases given in Table 2 and 3 in the main manuscript: (a,b) in-cloud LWP, (c,d) cloud fraction, (e,f) cloud-base (solid) and surface (dashed) rain rate, (g,h) accumulation-mode total aerosol number concentration, (i,j) effective radius, (k,l) entrainment rate, (m,n) inversion height. The first column represents the variable in the Ctrl runs, while the second the difference between the Ship and Ctrl runs. In (l) and (n), the difference in Pristine (blue) is much larger than the other cases, and so a twofold larger y-scale on the right y-axis is used.

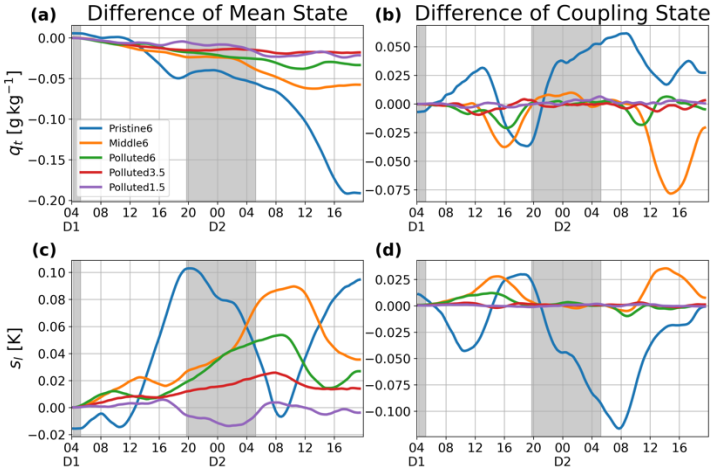

Figure S2: The time series of differences of mean and coupling states of thermodynamic variables for all cases. The left (right) column represents the difference of mean (coupling) states. The upper row represents total water mixing ratio (q_t), while the lower one moist static energy divided by specific heat capacity of dry air (s_l).

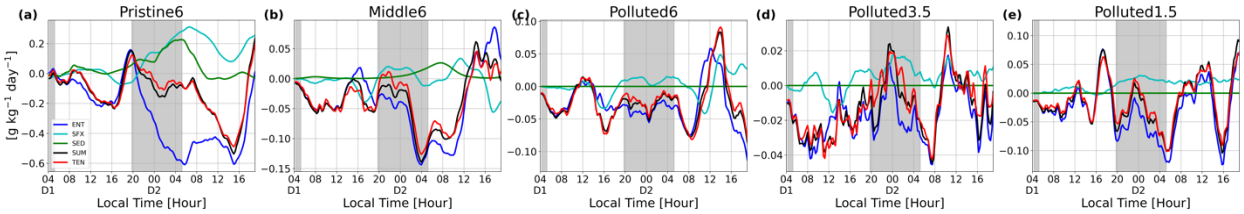

Figure S3: The time series of q_t budget terms for (a) Pristine6, (b) Middle6, (c) Polluted6, (d) Polluted3.5 and (e) Polluted1.5 throughout the run: entrainment (ENT, blue), surface flux (SFX, cyan), sedimentation (SED, green), sum of all the budgets (SUM, black) and tendency of $< q_t >$. Gray shade indicates nighttime.

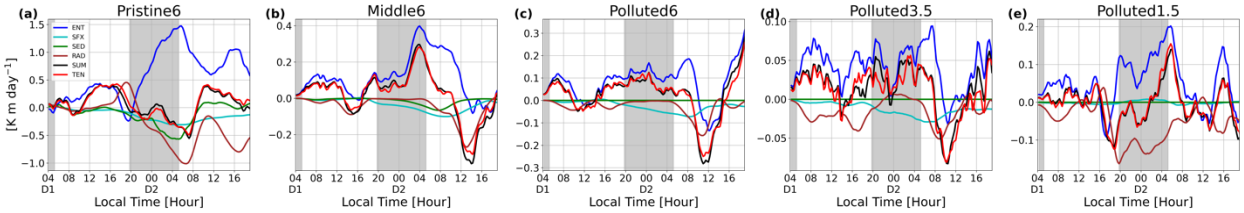

Figure S4: Same as Fig.S3, but for s_l: entrainment (ENT, blue), surface flux (SFX, cyan), sedimentation (SED, green), radiation (RAD, brown), sum of all the budgets (SUM, black) and tendency of $< s_l >$.

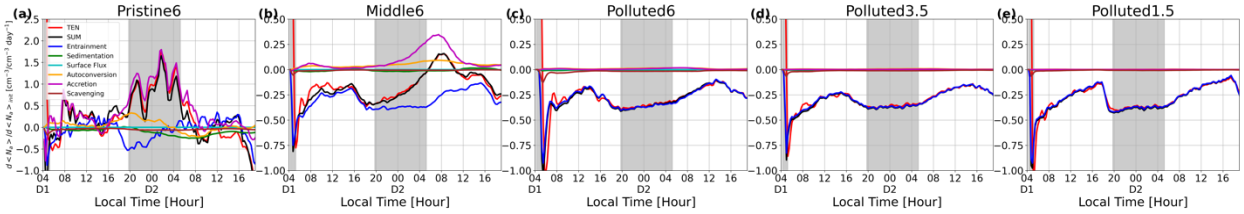

Figure S5: Same as Fig.S3, but for $\frac{d<N_a>}{d<N_a>_{init}}$: entrainment (blue), sedimentation (green), surface flux (cyan), autoconversion (orange), accretion (magenta), scavenging (brown), sum of all the terms (black) and tendency from model output (red).

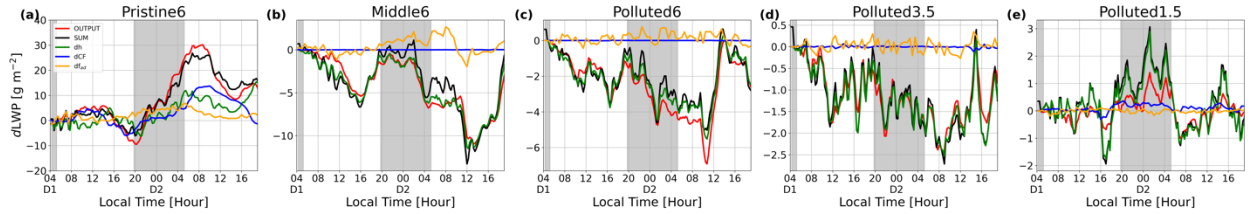

Figure S6: Same as Fig.S3, but for *d*LWP: dLWP by changes in cloud thickness (*d*h, green), cloud fraction (*d*CF, cyan) and adiabaticity (df_{ad}, black), sum of all the terms (SUM, red) and *d*LWP from model output. Details about how each term is calculated are shown in Appendix A

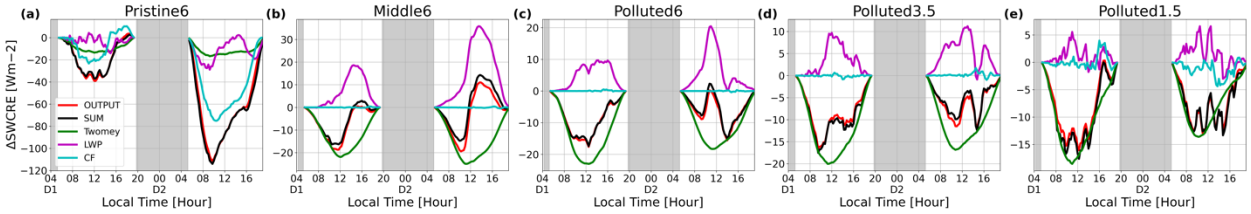

Figure S7: Same as Fig.S3, but for *dCRE*: Twomey effect (green), LWP (magenta), CF (cyan), sum of all the terms (black) and *CRE* from model output (red). Details about how each term is calculated are provided in Appendix B.