

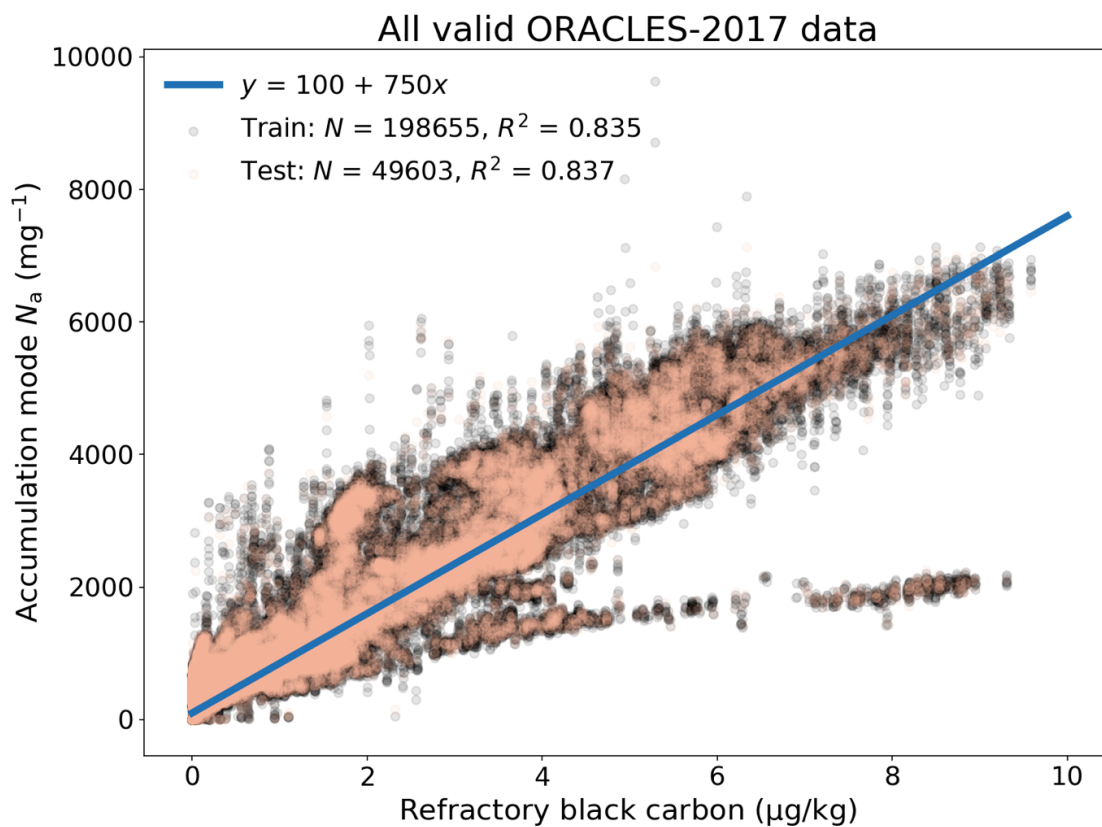


Figure S1. Fit between black carbon and aerosol number concentration based on 1 Hz ORACLES-2017 flight data. 100 mg^{-1} is assumed as the “clean” background concentration of aerosol in the absence of smoke. Randomly selected training data (198,655 s of observations) are shown in grey and testing data (49,603 s of observations) in pink with the ordinary least squares best fit line in blue.

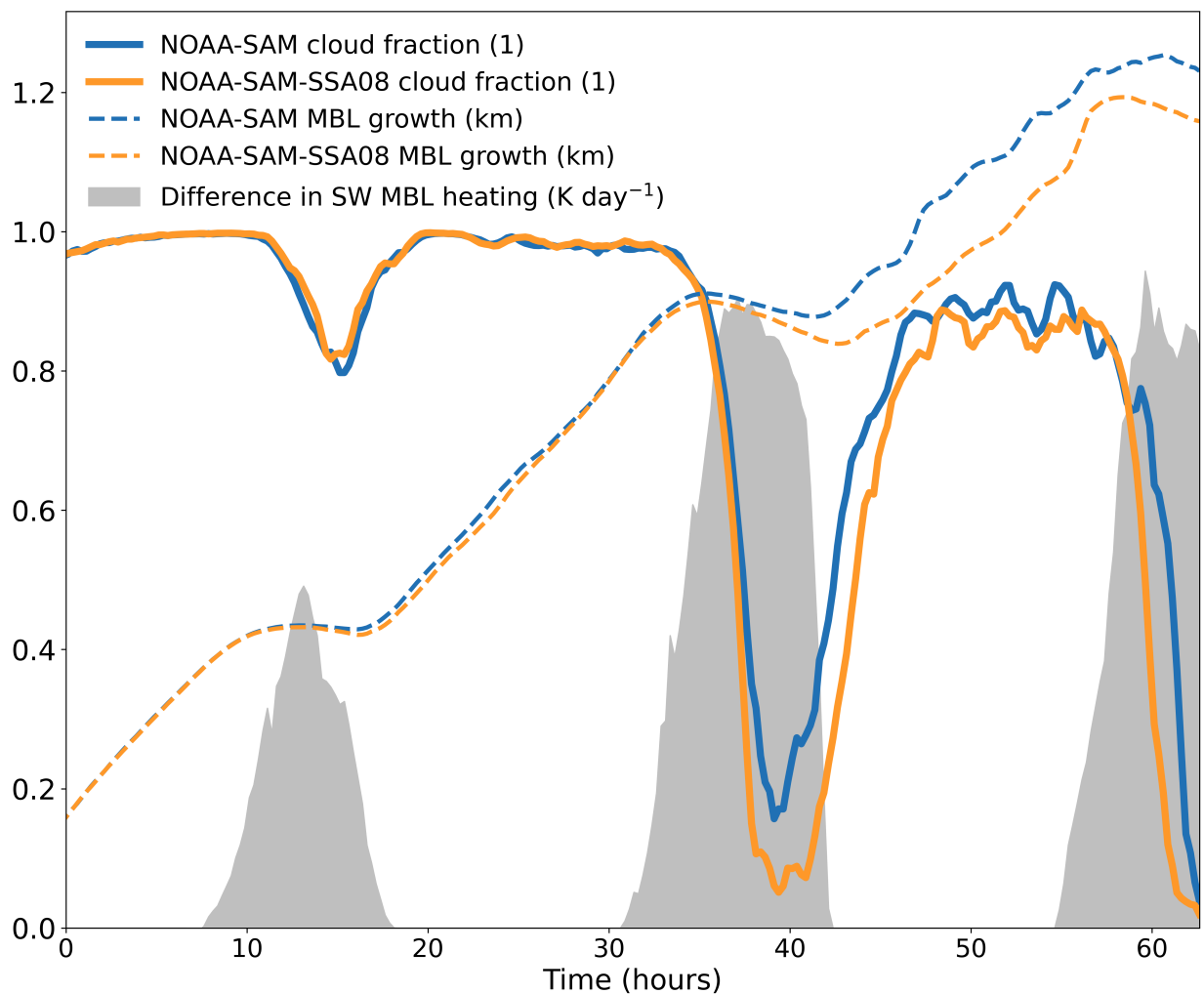


Figure S2. Effect of enhanced absorption on cloud and boundary layer evolution in NOAA-SAM. Cloud fraction and growth in the MBL are shown as solid and dashed lines, respectively, for NOAA-SAM ($\omega_0 = 0.85$; blue) and NOAA-SAM-SSA08 ($\omega_0 = 0.8$; orange). The enhancement of MBL-average shortwave heating rate is shown in gray shading.

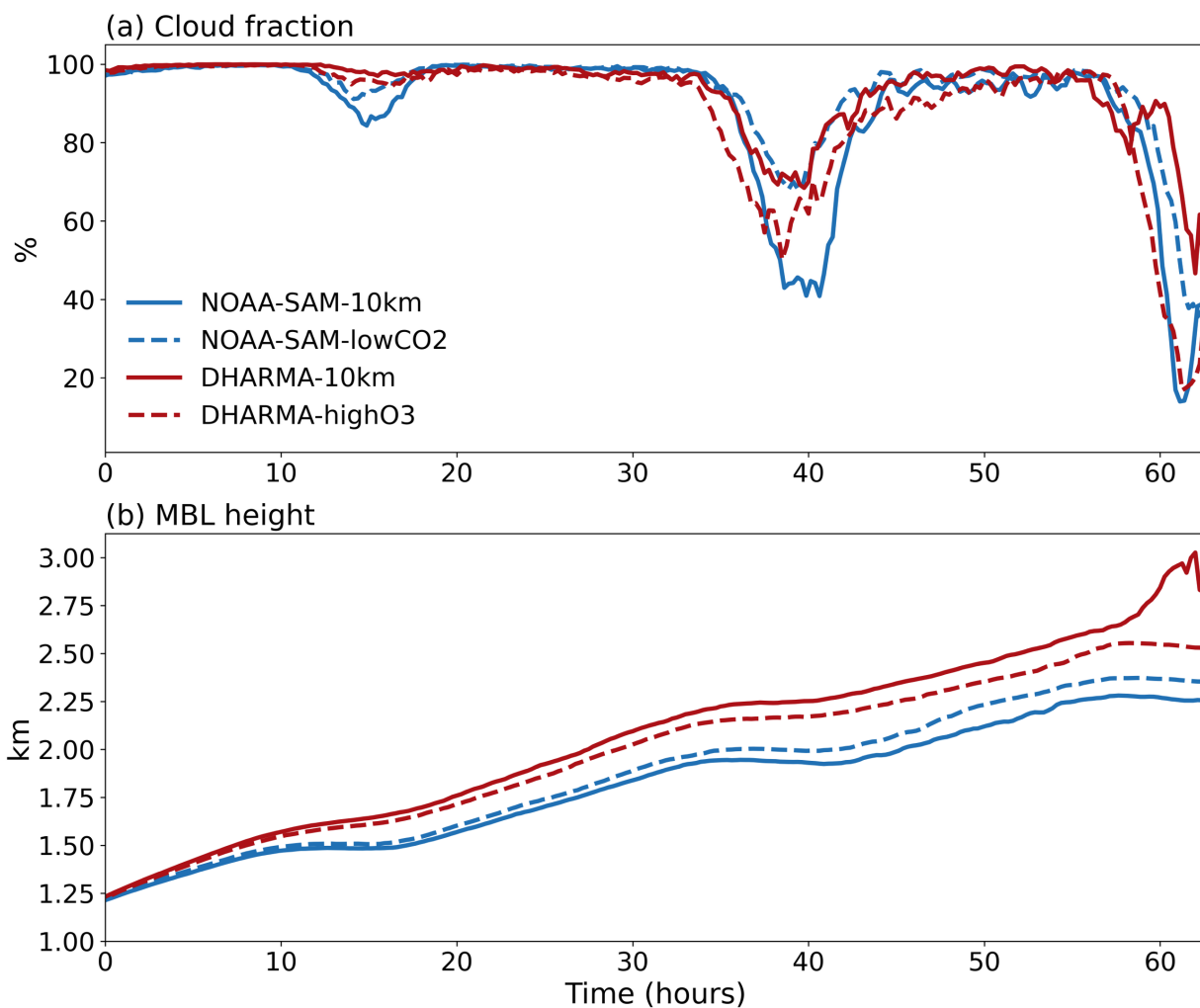


Figure S3. Effect of downwelling longwave radiation on cloud and boundary layer evolution in NOAA-SAM and DHARMA. Cloud fraction (a) and MLB height (b) are shown for NOAA-SAM (blue) and DHARMA (red) as solid (*-10km) and dashed (NOAA-SAM-lowCO2 and DHARMA-highO3) lines.