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Marine aerosol distributions from shipborne observations over the South China Sea: diurnal variation characteristics and their controlling factors

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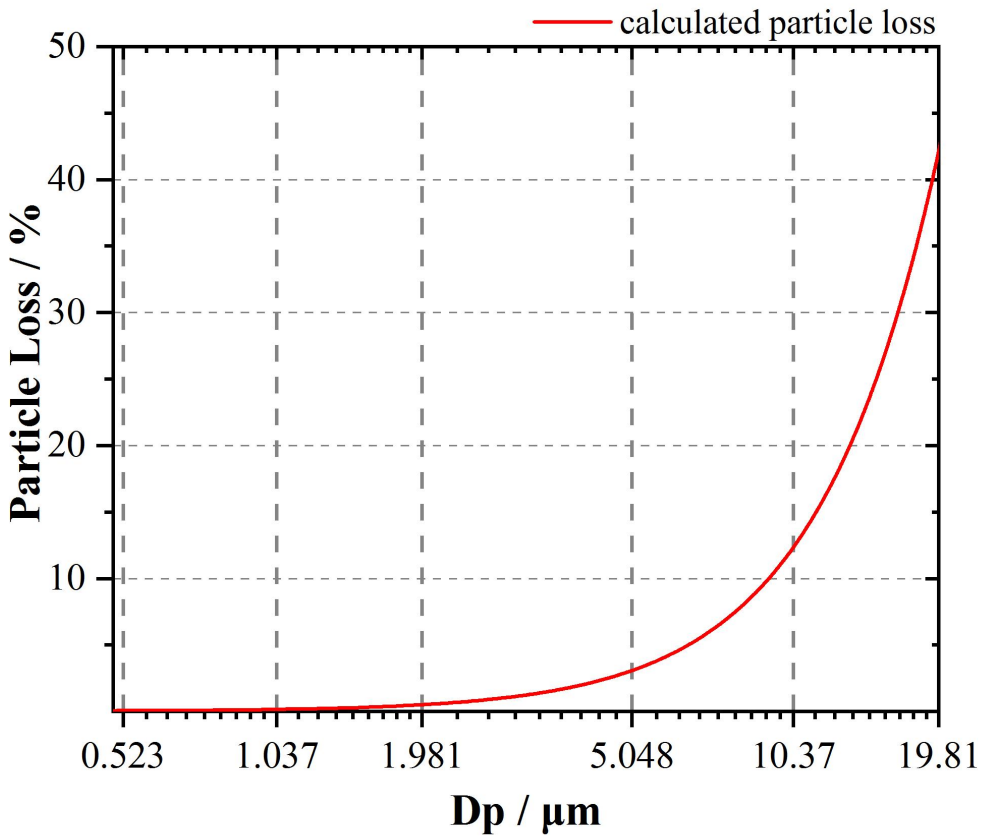

Fig. S1 The calculated particle losses for the Model 3321 APS spectrometer in this cruise.

S1. The field inter-comparison experiment description

To verify the APS measurements, we performed a field inter-comparison experiment from 2 October to 17 October 2025 at a decommissioned wharf in Zhuhai, Guangdong Province, China (22°12′ N, 113°37′ E). This site is remote from industrial emissions and roads, with an unobstructed 180° view of the northern SCS, to ensure marine aerosol measurements are achievable. Three instruments were deployed side-by-side in an open environment with 10 cm long tubes. These tubes were fixed to the railing at 30° to the horizontal and faced the sea surface (to simulate the previous observation scenario and minimize terrestrial interference). The three instruments comprised: a Model 3321 APS spectrometer (TSI Incorporated, USA), which measures 0.5–20 μm; a Portable Optical Particle Spectrometer (POPS, Handix Scientific, USA), which measures 0.115–3.37 μm; and a Model 11-D Portable Aerosol Spectrometer (GRIMM, Germany), which measures 0.25–30 μm. The aerosol data resolution was set to 10 min in this inter-comparison experiment.

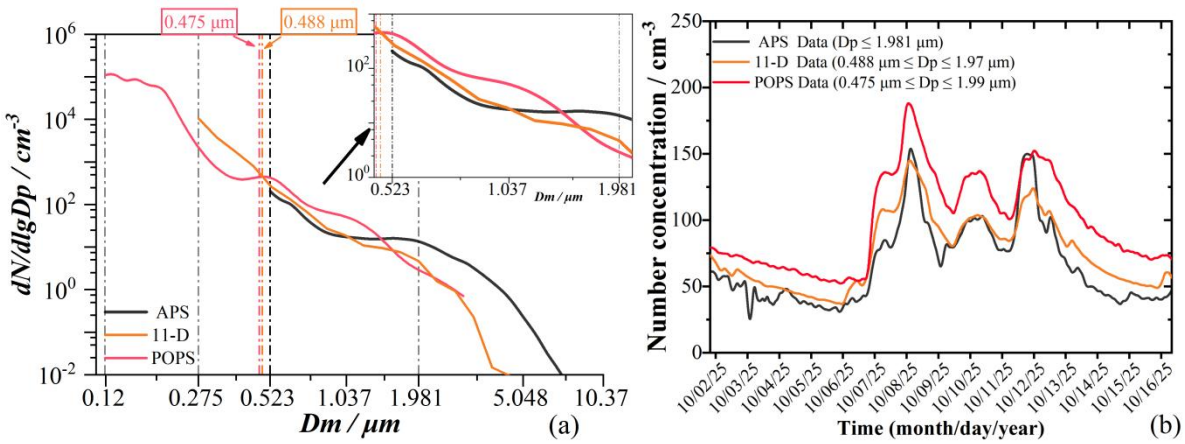

Fig. S2 (a) The NCs of average size distributions for different aerosol measurement instruments (black solid line represented the APS data, orange solid line represented the 11-D data, and red solid line represented the POPS data). (b) Trends of NCs for different aerosol measurement instruments.

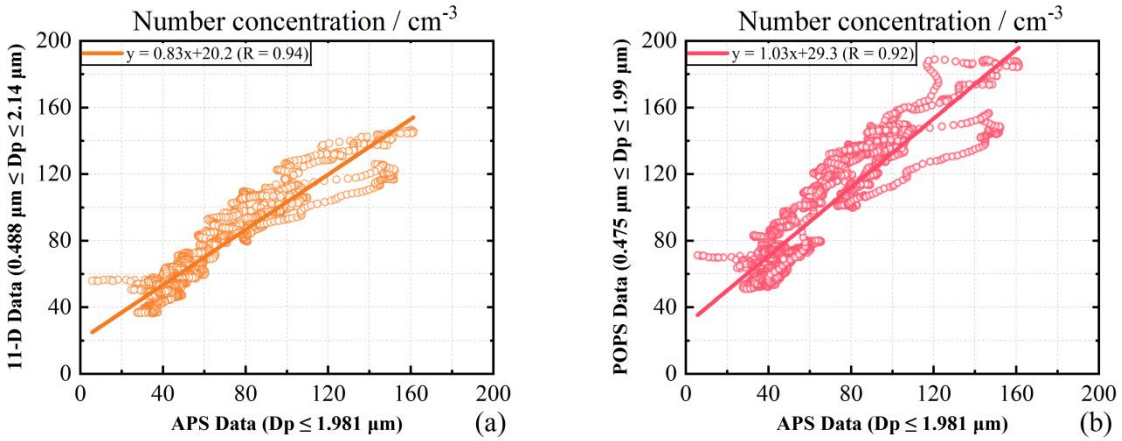

Fig. S3 The scatter plots of (a) NCs of 11-D data and APS data, (b) NCs of POPS data and APS data.

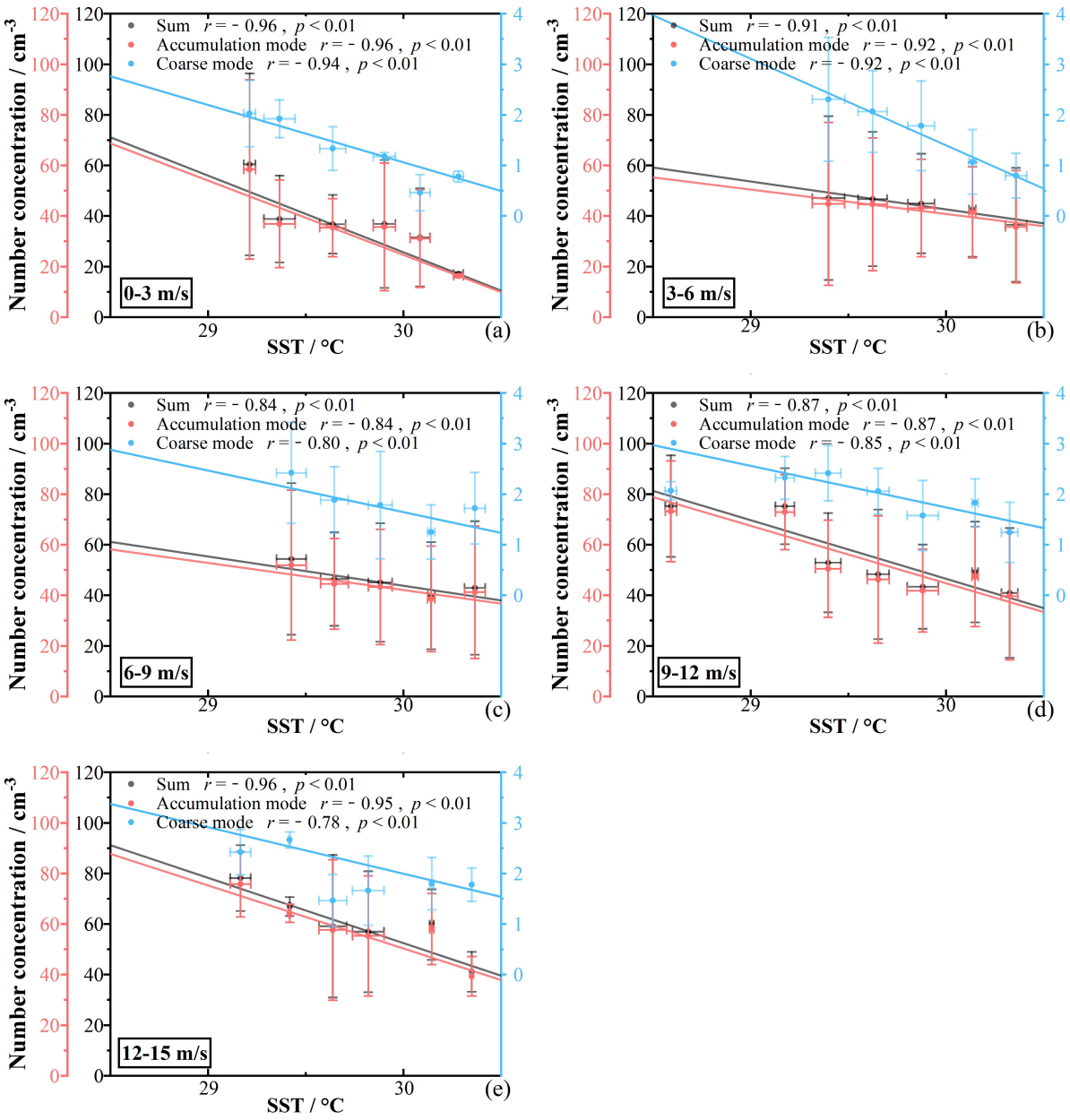

Fig. S4 The NCs versus SST in the pelagic region. The NC of all aerosol particle modes versus SST for 0–3 m s^{-1} (a), 3–6 m s^{-1} (b), 6–9 m s^{-1} (c), 9–12 m s^{-1} (d), and 12–15 m s^{-1} (e) WS intervals. The error bars represented the standard deviations. The *r* represented the Pearson correlation coefficients, and the *p* values were performed to test whether the correlations were significant.

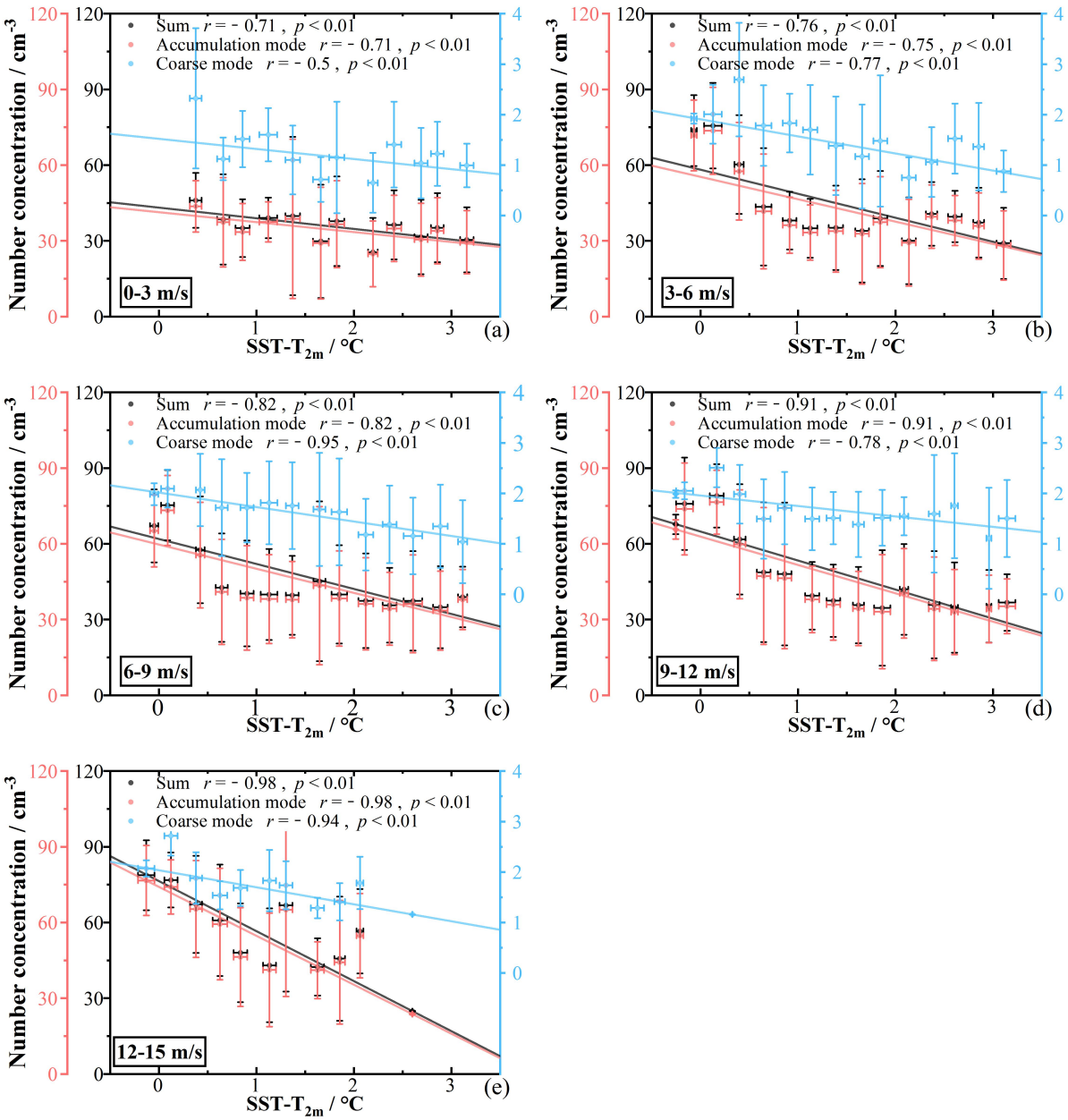

Fig. S5 The NCs versus SST-T_{2m} in the pelagic region. The NC of all aerosol particle modes versus SST-T_{2m} for 0–3 m s^{-1} (a), 3–6 m s^{-1} (b), 6–9 m s^{-1} (c), 9–12 m s^{-1} (d), and 12–15 m s^{-1} (e) WS intervals. The error bars represented the standard deviations. The *r* represented the Pearson correlation coefficients, and the *p* values were performed to test whether the correlations were significant.

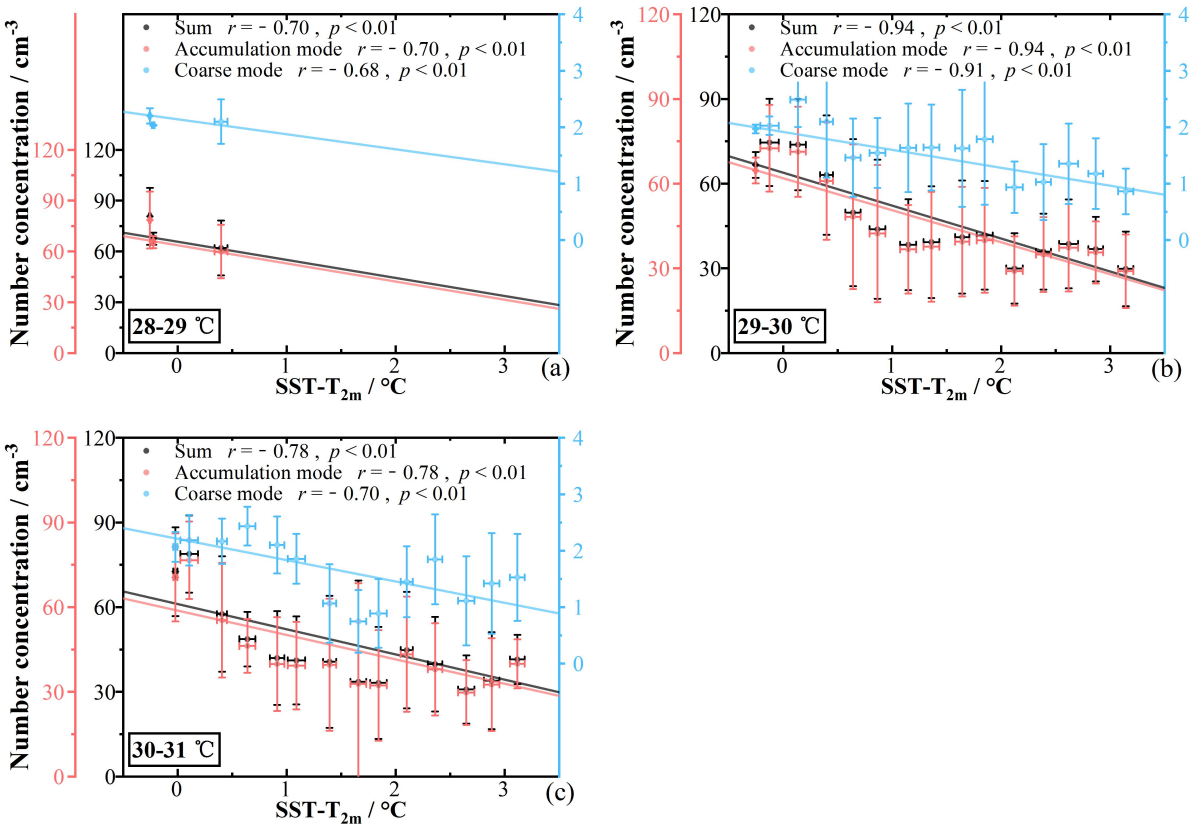

Fig. S6 The NCs versus SST-T_{2m} in the pelagic region. The NC of all aerosol particle modes versus SST-T_{2m} for 28–29 ℃ (a), 29–30 ℃ (b), and 30–31 ℃ (c) SST intervals. The error bars represented the standard deviations. The *r* represented the Pearson correlation coefficients, and the *p* values were performed to test whether the correlations were significant.