

Supporting Information (SI) for
Quantifying background PM_{2.5} concentrations in Hainan Province,
China through model simulations constrained by multi-source
observations

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This supporting information includes:

S1. Supplementary Text

S2. Supplementary Figs. S1 to S5

S1. Supplementary Text

S1.1 Detailed description of sector-specific atmospheric pollutant emissions in

Hainan Province

Figure S2 presents sector-specific atmospheric pollutant emissions in Hainan Province for 2019. Sectors related to combustion and industrial processes dominated emissions of air pollutants, except NH₃. Residential combustion emerged as the largest contributor to PM_{2.5} (43.9%) and a moderate source of VOCs (21.5%), whereas other industries accounted for 52.2% of SO₂, 37.8% of VOCs, and non-negligible shares of NO_x (24.0%) and PM_{2.5} (23.4%). The on-road vehicle sector dominated NO_x emissions (51.2%), followed by solvent sources contributing 19.3% to VOCs emissions. Notably, agricultural activities constituted the predominant NH₃ source (87.6%). Biomass burning exhibited minimal impacts (<5%) across all pollutant categories.

S2. Supplementary Figs. S1-S5

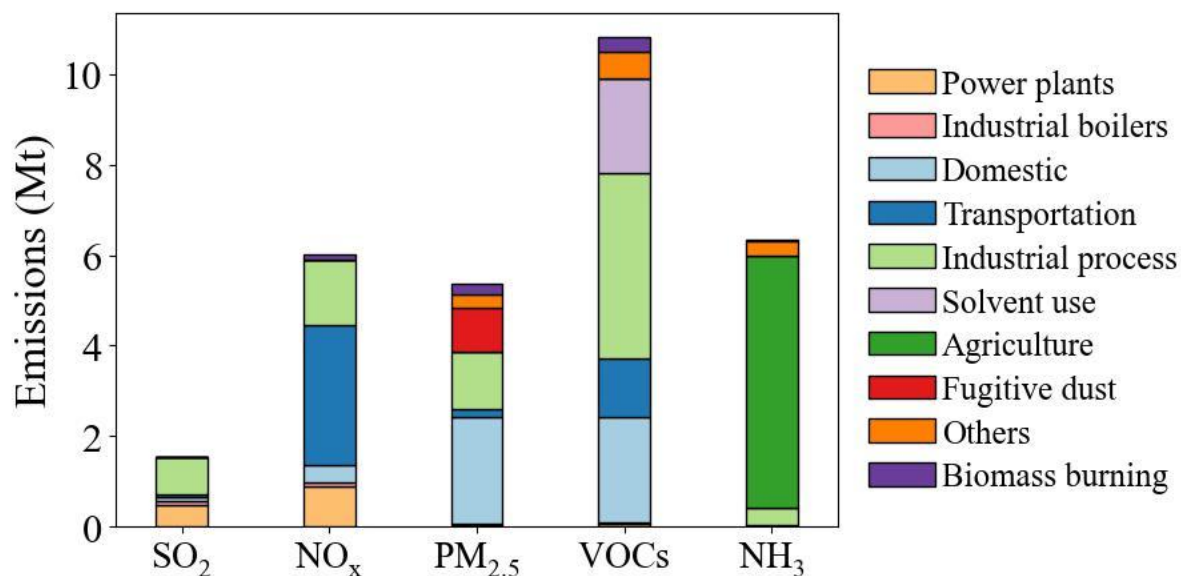


Fig. S1 Sectoral contributions to air pollutants emissions in Hainan province, 2019.

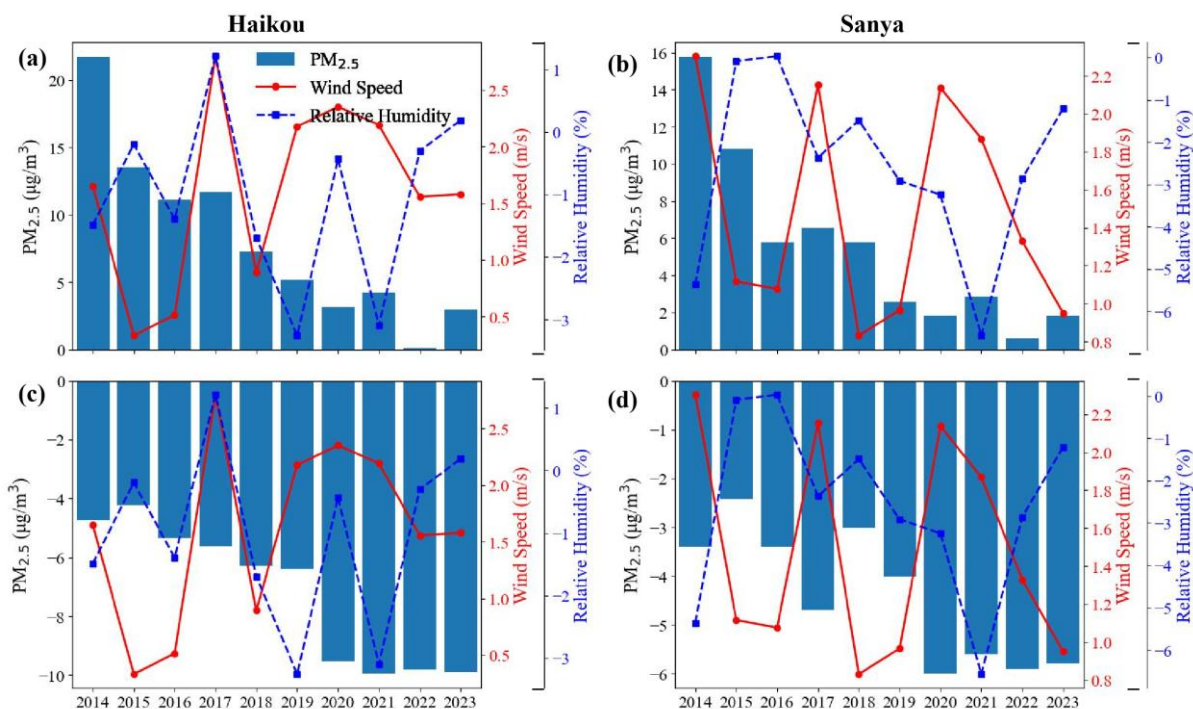


Fig. S2 Comparative analysis of the anomalies of PM_{2.5} concentrations and meteorological conditions in heavy pollution months (a, b) and clean months (c, d) in Haikou and Sanya from 2014 to 2023

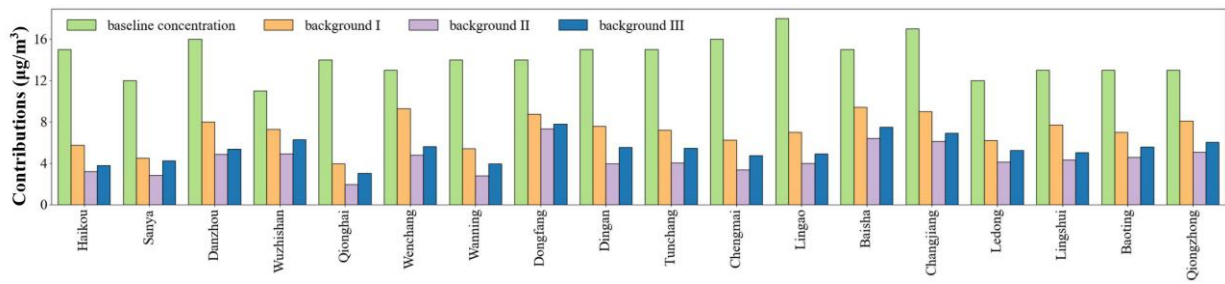


Fig. S3 Comparison of baseline PM_{2.5} concentrations with PM_{2.5} background values based on three calculation methods for all cities and counties in Hainan.

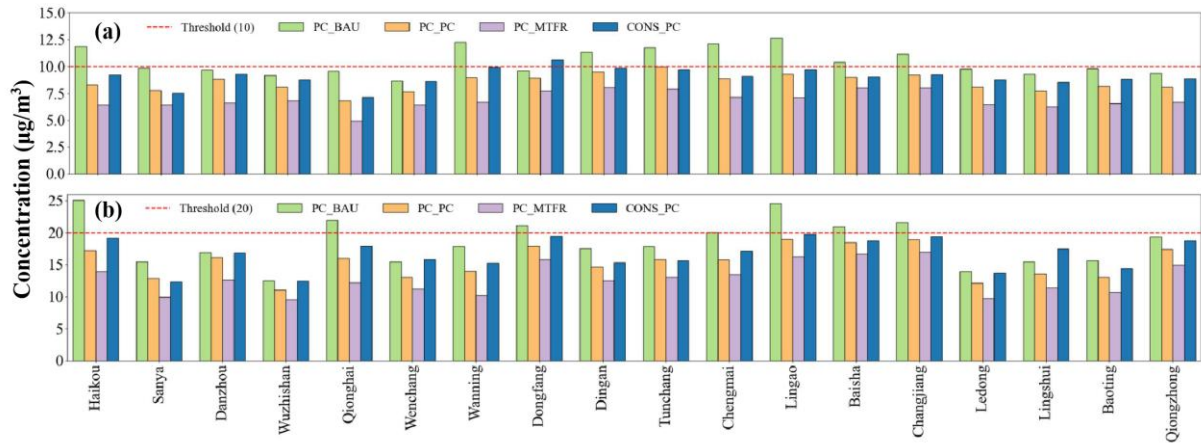


Fig. S4 Comparison of (a) annual mean and (b) annual 95th percentile of daily average concentration of PM_{2.5} with threshold values in proposed new AAQS across four further scenarios for 18 cities in Hainan Province.