

This manuscript investigates contrasting air pollution and surface temperature trends over South and East Asia using multi-satellite observations and CMIP6 simulations, and assesses how recent observed changes compare with SSP1-2.6, SSP2-4.5, and SSP3-7.0. This manuscript addresses a relevant and timely topic, but several major issues need to be resolved before it can be considered for publication. My main comments are as follows.

1. The study uses only GFDL-ESM4, MRI-ESM2-0, and UKESM1-0-LL. Please clarify whether and how these three models can be considered representative of the broader CMIP6 ensemble. Quantify the inter-model spread and discuss its implications for the multi-model mean. Which individual model best captures the observed 2008–2025 changes? How large are the model biases and differences among models? What are the main sources of uncertainty in their future projections? These questions should be addressed before the multi-model mean is used for comparison with observations.

2. Before comparing observed and simulated trends, please provide a quantitative evaluation of the three models against satellite and/or reanalysis observations over 2008–2025. This should include, where possible, mean bias, correlation coefficient, RMSE, spatial patterns, seasonal cycle, and trends for surface temperature and the pollutant species considered (CO, NO₂, SO₂, and AOD). Such validation would make the observation–model comparison much more convincing. Please also ensure that the model variables and observational variables are physically consistent and clearly defined.

3. Do all three models include the full process chain from pollutant emissions to aerosols, clouds, radiation, and surface temperature? Do they account for vegetation changes and land–atmosphere feedbacks, such as those related to NDVI, evapotranspiration, albedo, and soil moisture? How much do differences in the representation of these processes affect the observation–model comparison? Please clarify and discuss the extent to which these differences may explain discrepancies between observed and simulated surface temperature changes.

4. Air pollution affects radiation, but surface temperature is also strongly influenced by greenhouse gases and short-lived climate forcers, such as CO₂, CH₄, O₃, and black carbon. Many of these species are co-emitted with air pollutants, so their trends can

covary. Consequently, the surface temperature effect of pollutant changes may be masked or confounded by greenhouse gas forcing. The manuscript mainly presents correlations between pollutants and surface temperature and does not quantify the causal contribution of pollutant changes. Please avoid giving the impression that the observed relationships demonstrate a quantified causal effect. The discussion should explicitly address the role of greenhouse gases and co-emitted species. If possible, sensitivity experiments or attribution analyses should be added to quantify how much pollutant changes contribute to surface temperature trends.

5. The South Asian cloud fraction trend ($+4.3 \pm 2.3$ %/dec) and daytime T_{skin} trend (-0.2 ± 0.2 °C/dec) are not statistically significant, yet the abstract and conclusions emphasize “daytime cooling over South Asia.” Local significance in some grid cells does not imply significance of the regional mean. Please report regional-mean confidence intervals consistently, address the multiple-testing issue, and cross-validate the trends using alternative methods such as Theil–Sen, and Mann–Kendall. In addition, the moving block bootstrap procedure should be described more clearly, including the choice of block length and the treatment of autocorrelation.