

## Summary

This manuscript examines diurnal and seasonal O<sub>3</sub>–precursor relationships in Tucson, Arizona (2024–2025). It combines EPA AQS surface data, Pandora column and surface retrievals, with TEMPO Level 3 NO<sub>2</sub> and HCHO, and ceilometer-derived PBLH. The authors describe species variability and TEMPO–Pandora biases. They then map month by hour Spearman and Pearson correlations, test PBLH-normalized TEMPO columns as surface proxies, and apply a lagged O<sub>3</sub>–HCHO analysis.

The multi-platform dataset is valuable for a semi-arid, monsoon-influenced city that has received little study, and the manuscript is clearly organized. However, the study is currently mostly descriptive and statistical. Its main conclusions about nonlinear chemistry and regime transitions are inferred from correlation patterns rather than from model simulations or mechanism studies that could identify the underlying processes. The broader scientific advance beyond documenting these correlations for one site is also not yet clearly stated. I would encourage the authors to make the novelty and implications more explicit. In its current form, the work may be better suited to a more regionally focused or applied journal than to ACP.

## Major comments

1. **Nonlinearity diagnostic of O<sub>3</sub> sensitivity:** The  $|S| - |P|$  difference can also arise from skewed distributions or outliers, so it may not indicate chemical nonlinearity only. Supporting it with established indicators such as satellite based HCHO-to-NO<sub>2</sub> ratio (FNR) would strengthen the regime interpretation. Other indicators are O<sub>x</sub> (O<sub>3</sub> + NO<sub>2</sub>), weekday–weekend contrasts.
2. **Statistical robustness:** Please report the sample size in each month × hour bin. Please also consider a correction for multiple testing and a simple robustness check, such as comparing 2024 with 2025.
3. **Lagged correlations between O<sub>3</sub> and HCHO:** HCHO is only available in daylight, so part of the lag structure may reflect when data exist. Taking the maximum correlation across lags may also inflate the values. A null or sensitivity test would help confirm that the pattern is physical.
4. **PBLH normalization for the precursors:** The approach assumes the column is confined to a well-mixed boundary layer. That assumption is especially limiting for HCHO, which has a large free-tropospheric background. A quantitative comparison with surface observations (R, bias, RMSE) would make the conclusions more convincing.

## Minor comments

1. Time windows are defined inconsistently for evenings, 16:00–19:00 in line 219 vs. 16:00–20:00 in all other texts.
2. HO<sub>x</sub> is described as "odd-oxygen radicals".