

Response to reviewer

Please consider addressing concerns from a reviewer, who made the following observations: "I had a chance to review the authors' changes. They've addressed my comments. My only remaining concern has to do with the results of their wind speed analysis. They found a decreasing wind trend for almost all of their hotspot/point-source sites where they report faster methane growth rate than average for the Indian subcontinent in the abstract. But they don't attribute that to emissions or wind (evidently the wind trend can explain at least part of it). So I'm just not sure what we're supposed to learn from this, but I don't have strong feelings about it. Perhaps other authors will find the analysis of methane concentrations and winds useful."

Reply: Thank you for the comment provided regarding wind speed analysis. A decreasing wind speed trend (m/s) year⁻¹ is observed over the majority of coal mine locations, thermal power plants and wetlands. In the present study, we attempted to address the XCH₄ concentrations, emissions and wind analysis. Similar attempts were also made by the Francis et al. (2023) and Chandra et al. (2017). Studies have reported CH₄ concentrations are column whereas emission processes are surface-based. An enhancement in the column CH₄ could be due to the advection by the background flow which acts as an important contributor. Also changes in boundary layer dynamics through convection process (vertical mixing) also play an important role in the column concentration.

As you kindly pointed out, we agree that negative wind trend is observed in the present study is expected to have slower winds which decreases the dispersion hence observed high CH₄ concentrations over the source locations. Also these trends are observed over the source location. Ricaud et al. (2014) studied the dispersion of the mid to upper level CH₄ levels due to the circulation with the Asian monsoon and found change in column CH₄ values.

References

Francis, D., Weston, M., Fonseca, R., Temimi, M. and Alsuwaidi, A., 2023. Trends and variability in methane concentrations over the Southeastern Arabian Peninsula. *Frontiers in Environmental Science*, 11, p.1177877.

Chandra, N., Hayashida, S., Saeki, T., & Patra, P. K. (2017). What controls the seasonal cycle of columnar methane observed by GOSAT over different regions in India?. *Atmospheric Chemistry and Physics*, 17(20), 12633-12643.

Ricaud, P., Sič, B., El Amraoui, L., Attié, J.L., Zbinden, R., Huszar, P., Szopa, S., Parmentier, J., Jaidan, N., Michou, M. and Abida, R.: Impact of the Asian monsoon anticyclone on the variability of mid-to-upper tropospheric methane above the Mediterranean Basin. *Atmos. Chem. Phys.*, 14(20), 11427-11446, <https://doi.org/10.5194/acp-14-11427-2014>, 2014.