#Reviewer 2

This work developed a new approach for hourly CO2 emission mapping at high resolution from on-road traffics for 20 cities in France, Germany, and the Netherlands in 2023, with the FCD data created from GPS information, the traffic volume data based on machine leaning models, and speed- and vehicle type-specific emission factors. The new CO2 emissions from on-road transportation were validated and the spatial and temporal variation characteristics were presented and discussed. The manuscript is generally well written. There are some comments which are required to be addressed before it can be accepted.

Author's response: We thank the reviewer for the detailed comments. Point-by-point response is followed, and the added text are highlighted in the annotated PDF provided as an attachment.

1. Pay attention to the blank before the bracket particularly in the Introduction Section.

Revised.

2. Line 13, point out the CO_2 emission from on-road traffic or transportation.

Revised.

L12: In this study, we developed new hourly on-road CO_2 emission maps with a 100 × 100 m resolution for 20 major cities in France, Germany, and the Netherlands in 2023.

3. Line 44-55, the details of this paragraph are not so necessary. Simplify the sentences and link them more to the major contents of this study.

This paragraph aims to describe the carbon emission reduction actions in cities, then propose the importance of high-resolution emission maps in the next paragraph. As suggested, we simplified it.

L44 – L52: Emission reduction targets are being translated into concrete actions at the city level. For instance, the transport sector is responsible for approximately 20% of Paris' local greenhouse gas emissions (Albarus et al., 2025), and Paris plans to reduce its direct emissions by 50% by 2030 and 100% by 2050, compared to 2004. Paris has set itself the target of phasing out diesel-powered mobility by 2024 and petrol-powered mobility by 2030, aligning with the EU-wide ban on the sale of internal combustion engine vehicles by 2035. Amsterdam aims to achieve zero-emission transport by 2030, phasing out all fossil-fuel vehicles within city limits (Amsterdam, 2024). The city is rapidly expanding its electric vehicle infrastructure, as all newly registered vehicles are required to have zero-emission engines in 2025 (CINEA, 2025). Similarly, to achieve climate neutrality in 2050, Berlin will require a long-term reduction in CO_2 emissions in the transport sector to around 1.17 million tonnes of CO_2 per year, a reduction of around 77 % compared with 1990 emissions (diBEK, 2025).

4. Line 121, The title of Figure 1 is not correct.

Revised as: Figure 1: Workflow of this study.

5. Line 165, in Table 2, for the road-specific traffic count data, are they daily or hourly? Only hourly traffic volume can be used to produce hourly emissions.

The road-specific traffic count data is hourly. Revised as “Daily mean derived from hourly averages” to make it clearer.

6. Line 195-196, why use monthly average instead of hourly or daily average meteorological data to calculate the emission factors?

This is because COPERT only supports monthly meteorological data as input.

7. Line 206-207, clarify the potential uncertainty caused by using a standard EF_{CO2}, instead of a measured EF_{CO2} from literature.

We extend the discussion part.

L560 – L565 : Moreover, COPERT characterizes vehicle technologies primarily by vehicle category and Euro emission standard and does not explicitly parameterize changes in emission performance associated with vehicle ageing. As a result, city-specific fleet age structures and local real-world driving conditions may lead to deviations from the standard emission factors used in the model, especially where detailed fleet data are unavailable to further refine the parameterization. Access to locally measured emission factors from in situ studies or the literature would help reduce this source of uncertainty and improve the accuracy of the emission estimates.

8. Line 345-346, this sentence is repeated.

Deleted L345 – 346.

9. Line 389-390, Is there any difference in the emission factors used for calculations which could cause the discrepancies?

Differences in emission factors across models can indeed contribute to discrepancies, especially when external inventories rely on different EF frameworks or updated calibrations. In this study we apply a consistent COPERT-based EF set across all cities, so the discrepancies highlighted here mainly stem from uncertainties in traffic activity (GPS-derived volumes) rather than EF differences within our calculations. We discuss the activity data uncertainty in more detail in our response to Reviewer 3.