

Atmos. Chem. Phys. Discuss., referee comment RC2
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Comment on acp-2021-146

Anonymous Referee #2

Referee comment on "Methane (CH₄) sources in Krakow, Poland: insights from isotope analysis" by Malika Menoud et al., Atmos. Chem. Phys. Discuss.,
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New measurements of methane and its two most abundant stable isotopes, ¹³CH₄ and CH₃D, are presented from a site in Krakow, Poland. Some new measurements of source isotopic signatures are also carried out. The measurements are analysed, using a chemical transport model. It was found that the observations are strongly influenced by a mixture of sources from the nearby urban area, and fossil fuel extraction emissions from the nearby Upper Silesian Coal Basin.

The paper is well written, and the analysis of the data is thorough and sound, as far as I can see. The main weaknesses of the paper are that only a relatively short measurement record was obtained, and the site, being situated in a densely populated urban area, doesn't appear to be ideally suited to understanding regional emissions (e.g., I presume the relatively poor fit of the data and model are due, at least in part, to the proximity of unresolved sources in the model). However, the authors have done a good job of extracting as much information as possible from this dataset. I recommend the paper for publication in ACP, following some relatively minor changes.

Specific comments:

L1 – 2. I think the first two lines could be cut as they are quite general, and there would be too much to unpack in the assertion that methane emissions are a threat to the adherence to the Paris Agreement "goals".

L16: "The X(CH₄) are generally under-estimated in the model". This should be more specific. Do you mean the magnitude of the pollution events are under-estimated? (I assume so, as this is the only part that's relevant to the regional emissions covered here. We don't really care if the model gets the background component correct).

L17: "... would lead to better agreement". Need to say what the better agreement is with respect to (I.e. the data).

L29: "only 3% THOSE OF CO2..." (instead of "of the ones of")

L65: I suggest "consists of", rather than "gathers"

L93-94: "..., as described in..." (delete "the one")

L180: "This is due to a lowering of the boundary layer when the temperature decreases in the evening". This isn't technically correct. It's the temperature gradient in the lower atmosphere that leads to a lowering of the boundary layer height, rather than the temperature itself. I.e. the atmosphere tends to become more stable at night time.

L182: "emission peaks". Need to be careful with terminology here. You aren't describing "emission" peaks, but "concentration"/"mole fraction" peaks.

L216: I don't think the authors mean that pollution events are "less predictable" here. This implies that meteorological forecasting is less skilful in winter, which I don't think is the point they are trying to make.

L240 and elsewhere: I'm not actually sure what "manholes" means in this context. Perhaps this is a technical term, but, to me, a manhole is one of the many holes you see in the street that give access to the sewer system, etc. Is there a more descriptive term that can be used? If not, a line clarifying what this means would be helpful.

L347: "westerly", rather than "western" winds.

L434: I think you need to be clearer that this statement comparing the source mixture in the Netherlands and Poland only applies to these two parts of the two countries. I.e., you can't be sure (as far as I'm aware) that there are regions of the Netherlands that are more strongly influenced by fossil fuels, or vice versa.

L440: "which confirms the source attribution". It's not clear from this sentences what is being confirmed.

L444: "But the emissions within the Krakow urban area, where multiple CH₄ sources are detected at the study site, are affected in a particular way." I don't know what this sentence means. In what way are they affected?