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Interactive comment on "Effect of Polyoxymethylene (POM-H Delrin) offgassing within Pandora head sensor on direct sun and multi-axis formaldehyde column measurements in 2016–2019" *by* Elena Spinei et al.

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We thank Anonymous Referee 2 for the comments and recommendations. Our responses to the referee comments are in italics font.

0.0.1   General comments:

The manuscript provides a detailed timelines and descriptions for multiple events such as Pandora sensor head design changes; laboratory testing for POM and non-POM units; and case-studies for real-life deployments/colocations. I found myself flipping back and fourth through the manuscript, I therefore think that the manuscript will be improved by inclusion of a master table summarizing the types of tests, dates, intercomparison campaigns, identification numbers of units, modifications to the units, etc. This table can be placed at the end of Section 1.

We have added Table 1 (see the supplement) that summarizes the Pandora instrument information and how they contributed to this study. We also added the following sentence at the end of Section 1: "Table 1 lists the Pandora instruments description and contribution to this study.". We did not add the actual field campaigns that each pandora participated in to make sure we do not give a wrong impression that only these instruments are impacted.

Can authors develop a correction factor that can be applied for direct sun HCHO data collected during 2016-2019 to correct for HCHO production, so the dataset can be utilized by the scientific community? For example, recommending temperature ranges during which data would be usable, and showing examples of intercomparison with in-situ techniques (if available) or with satellite data showing a reasonable agreement.

We have performed detailed evaluation of Pandora head sensor heat transfer and estimation of HCHO production amplitude. We are preparing a separate manuscript: Spinei et al. 2020 (in preparation). We added the following reference to point 5 of the conclusions: " Considering that Pandora head sensors have almost identical design from material, shape and thermodynamics point of view

data between 2016 and 2019 can be corrected based on (a) meteorological data (temperature and wind) to estimate internal head sensor temperature and (b) on ΔS measurements to estimate $HCHO$ production amplitude (Spinei et al. 2020 in preparation)"

0.0.2   Specific comments:

Lines 10-14: define cold and warm temperature ranges. Remove quotation marks from "cold"

We added the temperature information: Measurements in winter, during colder ($< 10^oC$) days in general and at high solar zenith angles ($> 75^o$) were minimally impacted. Measurements during hot days ($> 28^oC$)

Figure 1: define light blue, gray and green lines

We added the following information to the figure caption: (green: box with a median mixing layer height (MLH), grey: box with a measured MLH; light blue: box+exponential profile with a median MLH, and black: box+exponential profile with a measured MLH,

Lines 91-98: add explanation for which spectra are used for direct sun and multi-axis DOAS retrievals.

We have made the following modification: DOAS implementation of multi-axis retrieval is significantly less sensitive to instrumental changes. This is due to the fact that single scan sky scattered solar spectra are analyzed using a zenith

C3

reference spectrum taken within maximum 10-15 minutes from the scan measurements. Direct sun spectra, on the other hand, are analyzed using a single reference spectrum that was potentially taken months apart from the rest of the spectra.

Figure 2: add ambient temperature to the figure

added

Line 160: add a coma before 118

added

Line 161: add a coma before and 148

added

Line 171: remove quotation marks from, "mimicking"

removed

Line 314: remove bold face from contribution

removed

Lines 404-405: The statement "Pandora HCHO measurements derived from direct sun observations between 2016 and 2019 cannot be used in the current form. Results presented here most likely are representative of other instruments build between 2016 and 2019" is very drastic. Authors should consider adding recommendations on possible corrective approaches, so the data could be utilized by scientific community.

C4

We are preparing a publication to describe such corrections. We added: "Considering that Pandora head sensors have almost identical design from material, shape and thermodynamics point of view measurements between 2016 and 2019 can be corrected based on (a) meteorological observations (temperature and wind) to estimate internal head sensor temperature and (b) on ΔS measurements to estimate HCHO production amplitude (Spinei et al. 2020 in preparation)

C5