Review of “Comparison of formaldehyde measurements by Hantzsch, CRDS and DOAS in the SAPHIR chamber,” Glowania et al., AMT (2021)

This manuscript describes a comparison of three measurements of atmospheric formaldehyde (HCHO). The instrument were run simultaneously during a series of experiments in the SAPHIR chamber. Corrections are developed for the Hantzsch and CRDS methods to account for drifting baselines and water vapor artifacts. After these corrections, all three measurements agree to within their stated uncertainties. This paper is appropriate for publication in AMT. Suggested revisions are mostly minor.

Specific Comments

L112: There are also applications in the 10s and 100’s of ppt range, where there are different challenges.

L186 – 189: is this proprietary information? This “rod-shaped material” sounds like Hopcalite or a similar catalyst. Would this material be recommended as a zero-method for the CRDS?

L254: This implies that the DOAS is not “calibration-free” as stated in the abstract. It was calibrated against a Hantzch. Rather it doesn’t need to be continuously calibrated. Recommend clarifying language.

L263: Does this accuracy also propagate the uncertainty in the Hantzsch method used to calibrate the differential cross section? Also, does this match current recommendations by, e.g., the JPL handbook? HCHO UV cross sections changed by 8% between JPL 2011 and 2016, and these are based on Meller and Moortgat (2000).

Figure 1: A plot comparing the mixing ratios calculated using either method might be more informative.

L283: Is the timing of calibration measurements random?

L287: While this empirical correction method may work for this particular set of experiments, it does not provide a recipe that is easily generalized for other CRDS users. How rapidly does this offset change over a day? Is there a dependence on ambient or instrument temperatures? Such questions could be answered with lab experiments under controlled conditions (sampling the same concentration and systematically varying H2O or temperature), and it is somewhat surprising that such experiments were not done in this case to provide robust empirical correction algorithms.

L335: would these “time-dependent systematic errors” be less evident if the test were done at higher HCHO (well above the instrument detection limit)?

General comment: do the authors recommend implementing an automated zero system (background determination) for the CRDS? If so, how frequent should zeros be to achieve good accuracy? Should the method of zeroing retain ambient water vapor concentrations (e.g. using a catalyst) or can one get away with drierite or zero air? This is considering uses like routine monitoring for air quality.

Technical Comments

L63: maybe worth noting that this detection limit is with a data frequency of 1 Hz. Also, maybe worth also citing Cazorla et al. (2015, AMT).

L77: delete “the sensitivity is not satisfying and”