Answer to Reviewer 1

Summary and General Comments:
The authors summarize ECC ozonesonde measurements collected at the OHP station beginning in 1991, including a period of anomalously low ECC pump temperatures from January 2001 to July 2007. In the absence of any other changes, erroneously low ECC pump temperatures will cause measured ozone values to be too low. However, the authors were unable to find an explanation for the low pump temperatures, and state that no changes to the ozonesonde preparation were made during January 2001 to July 2007 to cause them.
The ECC pump temperature adjustment and subsequent recalculation of the ozone values are performed using near-coincident OHP lidar stratospheric ozone as a reference. Using the OHP ozone lidar data to adjust the pump temperature and resulting ECC ozone measurements has the unfortunate consequence of losing the independence of the ECC ozone measurements during this period.
I am not aware of similar pump temperature behaviors at any other En-Sci ozonesonde station during this period, so I strongly encourage the authors to expand discussion that rules out potential causes and seek to find an explanation for this anomalous behavior. For example, are the ECC pump motor current and ECC battery voltage recorded for this time period? Was the pump thermistor instead taped to the side of the Styrofoam box instead of the pump block during this period? Also, it was discovered a few years ago that the ozone calculation scripts in Vaisala's MW41 software had a bug that reported incorrect ECC pump temperatures, causing erroneous ECC ozone measurements. Could a software issue potentially explain this?

We would like to thank the reviewer for raising these questions, which we had also considered when looking for a possible explanation for the low ozone values recorded in 2002-2007. The metadata still available for this period does not indicate any change in 2002 regarding either the voltage of the ECC pump motor or the batteries used. Only the type of TMAX electronic interface and related software changed in 2002. This is now described in lines 69-71 of the corrected version.

A new Section 4.2 has been added to describe the changes that occurred during the 2002–2007 period (change in the TMAX interface, use of the STRATO NOAA software) and the uncertainties regarding ozonesonde preparation (position of the thermistor in the styrofoam box) :

« 4.2 Analysis of the 2002-2007 ECC homogneized temperature drop in 2002-2007

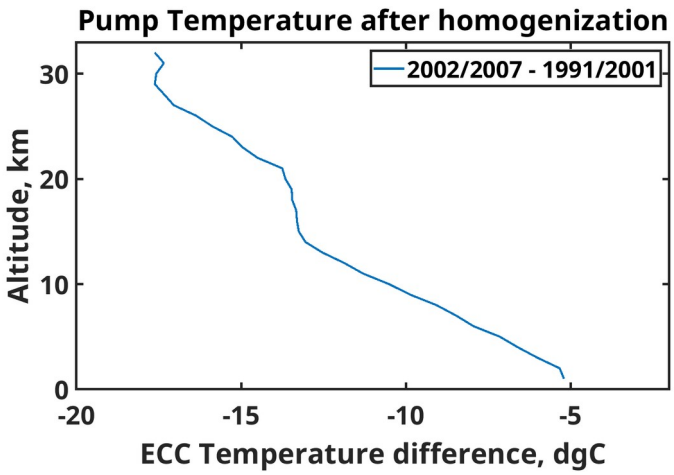
Before discussing the selected correction procedure of the ECC pump temperature, it is important to review the known changes during this time period. First, there was a change of the electronics interface between the ECC and the radiosonde in January 2002 switching from TMAX-HMOS to TMAX-C. An update of the software to read the binary files was made to handle the dataframe from the TMAX-C interface but documentation about this step has been lost. We cannot exclude a bug in the implementation of this software. The use of the TMAX-C interface was discontinued in July 2007 when MODEM radiosondes replaced the VAISALA radiosondes.

Second, we make the hypothesis that the thermistor was taped to the pump during this time period 2002-2007 in Ancellet et al. (2022) but this information has not been precisely recorded in the metadata and there is a large uncertainty about the position of the thermistor position in the styrofoam box. The pump temperature correction applied during the homogenization process performed in Ancellet et al. (2022) might not be correct.

Third, the NOAA STRATO version 8.66 has been implemented at OHP to produce level 1 files between February 2004 and June 2007 with two consequences: (i) a different processing software has been applied for the ozone retrieval without a recording of the ECC current in the level-1 files, (ii) the binary files with the ECC current have been lost. In order to include cell current in the data files, Ancellet et al. (2022) performed a reverse calculation of cell current since the necessary variables to back-calculate the cell current from the ozone partial pressure were available in the data file. We are confident that this process produced very small uncertainties in the ECC current retrieval. Use of the STRATO software has been discontinued in July 2007 when switching to the MODEM data acquisition system. »

I also wonder about the validity of a linear correction to the pump temperature.

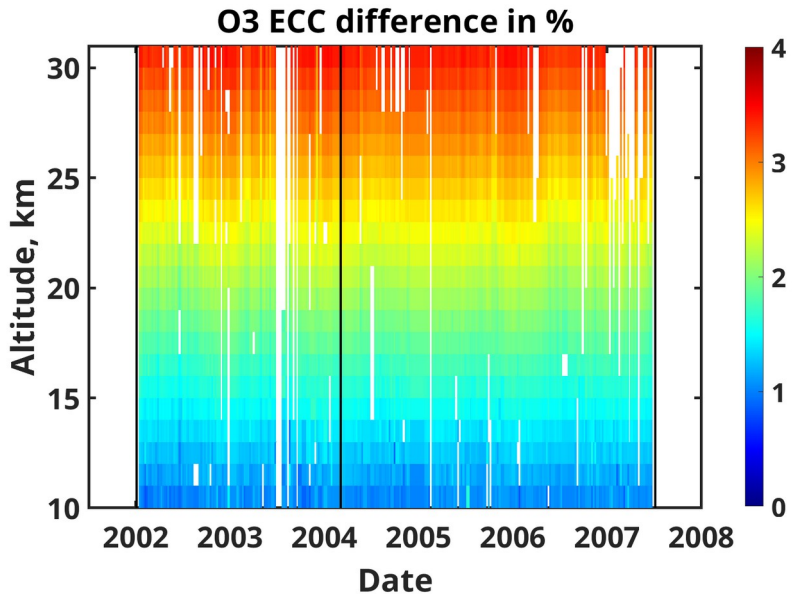
A new figure 7 now shows the vertical profile of the pump temperature difference between the period 2002-2007 and the period 1991-2001. This difference can be approximated by a linear evolution of -0.4 K/km. Lines 185-189 have been updated to discuss this figure.



Have the authors evaluated the corrected ECC ozone measurements other than in the stratosphere and total column?

We selected the 25 km level in the stratosphere where the differences of ozone vertical distribution are minimum for profiles which are not measured simultaneously. Differences in the troposphere between ECC and tropospheric ozone lidar are discussed in Ancellet 2022 where it is shown they are within the error bars of the two instruments. Therefore, they are not discussed in this paper.

We nevertheless added Fig. 10 in the paper to show that the effect of the ozone correction discussed here is less than 1.5% in the troposphere during the period 2002-2007.



Also, it is not explained how the total column is derived from the ECCs – I presume an above-burst satellite climatology is used.

We added a small discussion about the ozone normalization factor calculation in lines 57-64: « The residual ozone above the 10 hPa pressure altitude or above the balloon burst altitude are derived from the McPeters and Labow (2012) satellite monthly mean climatology at pressure smaller than 10 hPa. The normalization factor is not calculated for ballon burst altitudes lower than the 25 hPa pressure level or when the SAOZ measurement is not available. The corresponding sounding are nevertheless included in the OHP data set. This corresponds to 9.5% of the 1524 OHP soundings from 1991 to 2023. Only ozonesonde profiles with a normalization factor below 1.3 are considered here (i.e. only 3 soundings out of the 1524 excluded of the data base). The fraction of soundings with normalization factor higher than 1.2 is 1.3%. Normalization factor is always larger than 0.83 and no filtering is applied for low values of the normalization factor. »

The authors should consider changing 1991-2023 to 2001-2007 in the title, since those are the only dates where the ECC measurements are adjusted.
We thank the reviewer for this suggestion. The new title is:
Correction of the Observatoire Haute Provence electrochemical concentration cell (ECC) ozonesonde long-term data record over the 2002-2007 period

Recommendation:

The paper is concise, well-written, and only requires a few minor technical corrections. However, before acceptance I strongly encourage the authors to expand the discussion on the potential origins of the anomalously low ECC pump temperatures from 2001-2007, and the validity of the linear pump temperature correction.
See hereabove the changes made to follow these two recommendations.

The conclusion has been also updated to summarize the additional analyses requested by the two reviewers in lines 232-237:

"A detailed assessment of the possible causes for the low pump temperature recording in 2002-2007 is difficult due to the limited number of written documents still available, but section 4.2 provides a discussion of the known changes, namely a possible wrong recording of the ECC temperature values in the level-0 files or/and a large uncertainty about the actual location of the thermistor in the ECC gondola. Although frozen ECC solutions in the styrofoam box could be another candidate for the ECC low ozone values in 2002-2007, the altitudinal change of the ECC current in the altitude range 20-30 km does not provide clear evidence that such an indirect effect is the main reason for the ECC ozone bias observed at OHP."

Line-by-Line and Technical Comments:

Abstract Line 4: "instruments" done

Abstract Line 5 (and main text): Clarify that this is Aura MLS at first mention done

Abstract Line 9: Not really the "pump speed trend" but the pump flowrate distribution, correct? Yes, this is correct it has been corrected

Line 62-63: "No significant sounding preparation changes occurred during the time period March 1997 and July 2007." However, I must believe there is an explanation for this pump temperature behavior that is yet to be discovered

See text modifications proposed hereabove to discuss the possible problems encountered in 2002-2007.

Line 73: Change "when" to "where" done

Figures (general): Higher resolution figures should be submitted : This will be addressed before submitting the final version.

Line 98 and 128: Be precise in whether you mean "statistically significant" or not, and how that is defined
We confirmed that the bias of the ECC ozone concentration in section 3 is significant by Wilcoxon rank sum test (Wilcoxon, 1945) when considering differences with MLS for the period January 2007–June. So line 109 has been rephrased accordingly in section 3. Measured and calculated difference of the mean pump temperature $T_{Pc} - T_P$ is significantly different ($p < 0.01$) by Wilcoxon rank sum test. So we rephrased line 164 in section 4.1 by : "Measured and calculated difference of the mean pump temperature is not large for period 3".

Line 106: I think Figure 3 shows the opposite of what this text describes. The reviewer is right. We apologize for switching the two temperature ranges in the figure description.

Lines 107-108: It is not clear to me why changing the radiosonde, interface, and batteries would cause the ECC pump temperature to change. Certainly, a change in the thermistor location would do that, if that is what you mean

Changing to MODEM radiosonde in 2007 implied change of batteries and electronic with less heating in the box. Indeed, the position of the thermistor to measure the pump temperature was also changed in 2007 but this has been accounted for in Ancellet et al.(2022). It is now

better stated in the paper that the pump temperature T_P discussed in this paper is always the homogenized pump temperature already accounting for the pump location difference. So, the additional temperature difference for the 2002-2007 period is either a bug in the temperature recorded in the level-0 file or an ECC pump temperature correction too weak in Ancellet et al. (2022).

Figure 2 caption: There are only panels a and b in this Figure The reviewer is right the caption has been corrected

Figures 3 and 5: Please use the same color scale on both of these Figures. I prefer the Figure 5 colors : This will be addressed before submitting the final version.

Table 1: I assume these are values for 25km as also indicated on Figure 4, correct? Please make that clear in the Table 1 caption Done