

# ***Interactive comment on “Homogenizing and Estimating the Uncertainty in NOAA’s Long Term Vertical Ozone Profile Records Measured with the Electrochemical Concentration Cell Ozonesonde” by Chance W. Sterling et al.***

**Chance W. Sterling et al.**

chance.sterling@noaa.gov

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Anonymous Referee #3 The authors would like to thank the referees for the constructive criticism of our manuscript. We have outlined our responses to the reviewers’ comments as well as the subsequent changes to the manuscript in the following response. Received and published: 1 January 2018

General comments: The authors can be congratulated for this important and comprehensive study! It is a major step in the effort for a global homogenization of the

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ozonesonde data sets. I rate the overall quality as excellent. I recommend publication after some minor revisions. Specific comments: 1. Page 5, Line 32: “RS-80 pressure sensors are known to have degraded over time.” How is this meant? Are they aging or became production worse? Please give reference. Authors’ Response: The sentence “RS-80 pressure sensors are known to have degraded over time.” has been removed from the manuscript text. This RS-80 issue is described in more detail in the next response. 2. P6L1-3: Is this part of this study? If yes, give more details. If not, give a reference. Authors Response: When Vaisala stopped manufacturing the RS80, NOAA was able to acquire and fly over 1000 inexpensive surplus RS80 radiosondes. Some of these radiosondes pressure offsets were greater than the specified uncertainty stated on the manufacturer’s datasheet. In order to determine the pressure offset we performed laboratory tests with an atmospheric chamber and a calibrated surface barometer. This is described in the text on what is now Page 6 Lines 1-5. The sentence on what is now Page 6 Line 13 has been updated and now reads, “The uncertainties of the radiosondes, while important, are beyond the scope of this analysis.” 3. P7L10-11: Don’t understand this sentence. Authors’ Response: The sentence on Page 7 Line 14 now reads, “This is in contrast to the approach of homogenizing the record to one of the ASOPOS standard ozonesonde type/solution type/pump efficiency pairing and using transfer functions to adjust for changes in the record.” 4. P7L12-14: Figure 1 doesn’t show any changes. Authors’ Response: Figure 1 has been updated to show the eras and the changes in ozonesonde type, solution type, data acquisition, and radiosonde type. 5. P14L22: How was it determined? Is it part of this study? Reference? Same questions for the values 0.98 and 0.94 at P15L2 and P15L7. Authors’ Response: The manuscript text has been updated to include the following sentence on what is now Page 13 Line 24, “The ozone sensor efficiency is determined by iteratively minimizing the percent difference in the ozonesonde and the ozone photometer for a given ozonesonde type/sensing solution pairing. Figures 4 and 5 show these differences.” 6. P15L9: Don’t understand why 0.96 is used instead of 0.94. Authors’ Response: The ozone sensor efficiency of 0.94 is believed to be due to the 6A ozonesonde type which

requires an ozone sensor efficiency of 0.96 and the 2.0% KI, No Buffer Solution which requires a 0.98 ozone sensor efficiency which totaled is approximately 0.94. A new table, Table 3, has been added that shows the ozonesonde types and sensing solutions with their corresponding ozone sensor efficiency. A new sentence was added on what is now Page 15, Line 28. "Table 3 summarizes the ozone sensor efficiencies used for all ozonesonde type and sensing solution pairings." 7. P16L6: I assume "constant" is meant instead of "linear". Authors' Response: Yes, constant was meant, not linear. Corrected in manuscript.

Technical corrections: 1. P4L19: Delete empty space character in front of "Changes". Authors' Response: Corrected in manuscript. 2. P4L24: Delete most empty spaces between "2" and "KI". Authors' Response: Corrected in manuscript. 3. P6L5: Explain "SkySonde" here and not later (page 7). Authors' Response: What is now Page 6, Line 7 includes the sentence, "A new data acquisition and processing software called SkySonde was developed to facilitate the implementation of the corrections associated with the data quality assessment project." And what is now Page 8, Line 4 reads, "This allows the SkySonde software to read all data files and calculate all ozone values from the raw cell current and pump temperature regardless of the data acquisition system or file format previously used." 4. P6L16+: Introduce variable symbols used in equations consistently in the text (when it is mentioned the first time). E.g. at this place: ". . . the ozone partial pressure, P\_O3, is determined . . .". An introduction is missing or too late at many other places, e.g. P9L25, P10L11,12, P12L12,13. Please use a consistent notation: ". . ., symbol, . . ." or ". . . (symbol) . . ." but not both. Authors' Response: The variable symbols have been added where it is first mentioned in the manuscript and all instances of ,symbol, were changed to (symbol). 5. P6L25: "cannot BE measured" Authors' Response: Corrected in manuscript. 6. P7L16: First occurrence of the notion n.nx buffer solution in the main text. Please give a hint that the notion is defined in table 2. Authors' Response: The following sentence has been added to the manuscript at what is now Page 7 Line 20, "This sensing solution nomenclature and recipes are shown in Table 2." 7. P7L16+: Write "buffer solution" in a consistent way with upper

or lower characters throughout the text. Authors' Response: All instances where the name of a particular solution is being discussed have been changed to upper case letters such as 1% KI, 1.0 x Buffer Solution. When discussing buffering agents or the secondary buffer reaction, buffer was changed to lower case characters. 8. P10L10+: Get the subscript depths right. Authors' Response: Corrected in manuscript. 9. P12,13 Equations 8-13: Add unit "K". Authors' Response: The sentence on what is now Page 12 Line 19 has been updated to read, "All temperatures used in calculating ozone are in Kelvin. The pump temperature ( $T_P$ ) is calculated by adding the differences between configurations and inside of the pump block ( $\Delta T_{(P,CIB)}$ ), and the difference between the inside of the pump block and the internal piston temperature ( $\Delta T_{(P,CIP)}$ ) to the raw pump temperature measured ( $T_{(P,Meas)}$ ) with Eqn. 7." 10. P12L21, P17L23: "degree" is not part of the unit Kelvin. Please delete. Authors' Response: Corrected in manuscript. 11. P13L1: Exchange "truest" by "best estimate of the". Authors' Response: Corrected in manuscript. 12. P16L14,17: Please use "i ĘZA A" instead of "microamps". Authors' Response: All instances of "microamps" has been changed to  $\mu A$  throughout manuscript. 13. P16L20: Please use "cm\*\*3" instead of "cc". Authors' Response: "cc" changed to cm3 throughout manuscript. 14. P16L22: Check place of equation number. Authors' Response: Corrected in manuscript. 15. P17L26,27,28: Add "estimated" before temperature, e.g. "estimated 1.0 K". Authors' Response: Corrected in manuscript. 16. P17L28: Add a space between "0.5" and "K". Authors' Response: Corrected in manuscript. 17. P20L8: Delete on "and". Authors' Response: Corrected in manuscript. 18. P20L9: Add ". . . average DIFFERENCES of the . . ." Authors' Response: Corrected in manuscript. 19. P20L23 & Figures S5-S8: I assume the captions for S5-S8 mentioning Dobson instead of SBUV are wrong. Authors' Response: Yes, the captions should read SBUV instead of Dobson, except for Figure S6 as the South Pole does not have SBUV data. All captions except for Figure S5 are corrected in manuscript. 20. P21L4: "Figures 11 and S7" Authors' Response: Corrected in manuscript. 21. P21L7: "(Figure 13)" instead of "(Figures 8 & 9)" Authors' Response: Corrected in manuscript. 22. Figure 1: What is the meaning of a longitude

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of 169 (East of West?) at a latitude of -90. Please add East and North units. Authors' Response: Figure 1 has been updated. The latitude and longitude now include East and North units. 23. F1: Good place to mark the different eras graphically. Authors' Response: Figure 1 has been updated to show the eras. 24. F2: Explain large bars at the end of histograms (A) and (B). Authors' Response: The following sentence has been added at what is now Page 9 Line 12 to explain the large bars at the end of the histograms (A) and (B). "In Figure 2 Panels A and B, the large number of backgrounds greater than the scale of the histograms are attributed to erroneous measurements attributed to the degraded ozone destruct filters." 25. F3: Use lower case characters. Authors' Response: Figure 3 has been updated and now reads "Boulder with dry air", "Fiji with dry air", and "Trinidad Head with dry air". 26. Table 3: Add units for second column. Authors' Response: Table has been updated and the second column now includes the units ( $\mu\text{A}$ ). A new table was added, so Table 3 is now Table 4. 27. F9-12: It would be nice to have the eras mark as in later figures.' Authors' Response: Figures 9-12 have been updated to include the era marks. 28. F13-15: The relation layer to panel character is somewhat hidden. Please repeat in the caption. Authors' Response: To make the relationship between the panels, layers, and processing more clear, the captions in Figures 13-15 have been changed and now reads "Percent difference in column ozone between the merged SBUV ozone data and the ozonesonde data at Boulder, CO. Panels E and F show Layers 1-8 (Surface - 25.45 hPa), Panels C and D show Layer 9 (25.45 - 16.06 hPa), and Panels A and B show Layer 10 (10.13 - 16.06 hPa). Panels A, C, and E show before and Panels B, D and F show after applying the ozone sensor efficiency." 29. F13-15, FS1-8: Explain colour code. Authors' Response: The different colors in the plot represent different ozonesonde types. This is shown in the legend and is consistent with all of the comparison plots.

The authors would again like to thank the reviewers for doing a thorough job of reviewing the manuscript. It improved the paper a great deal. A few other grammatical and formatting errors that did not change the meaning or intention of the text were found and corrected during the process of responding to the reviews.

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Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2017-397, 2017.

**AMTD**

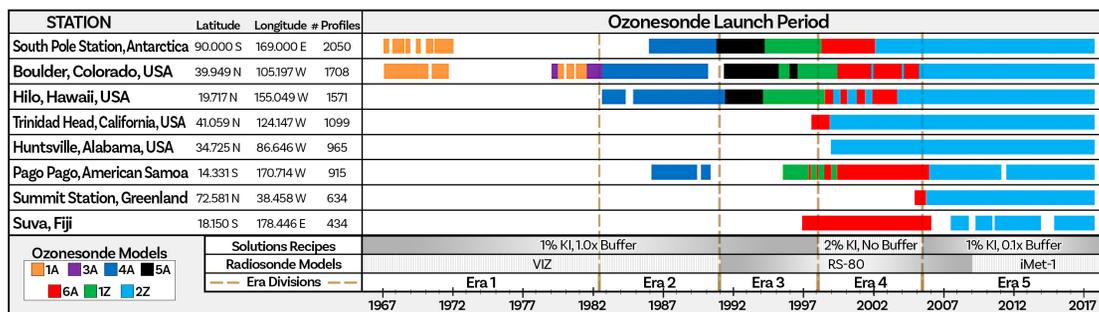
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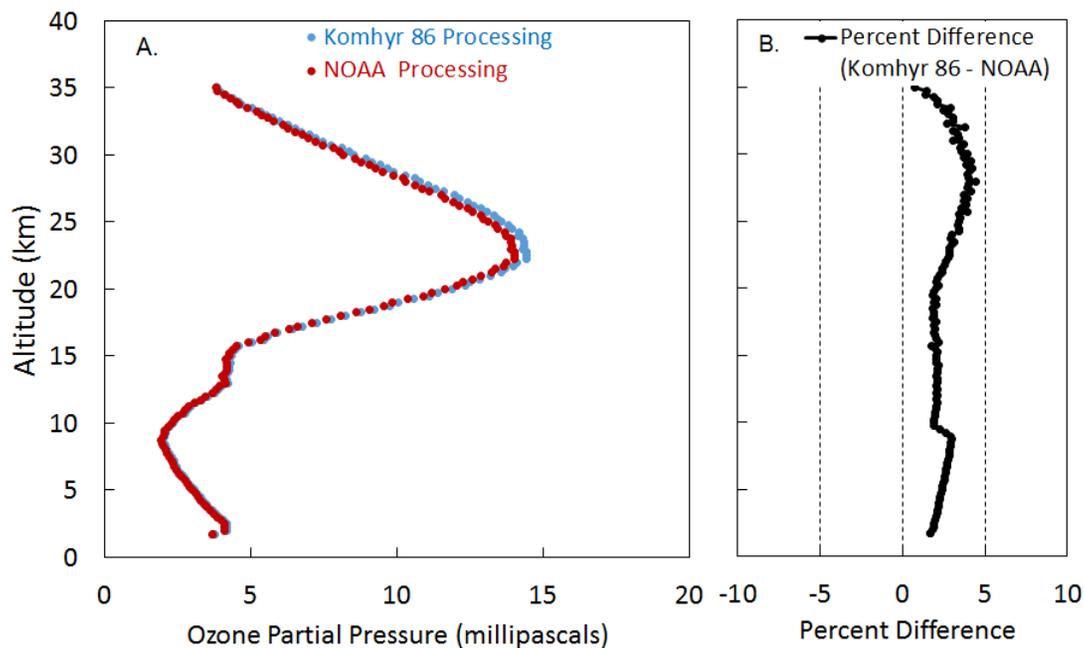


**Fig. 1.** Figure 1: The eight long-term NOAA ozonesonde stations with Latitude, Longitude, # of Profiles, and launch period.

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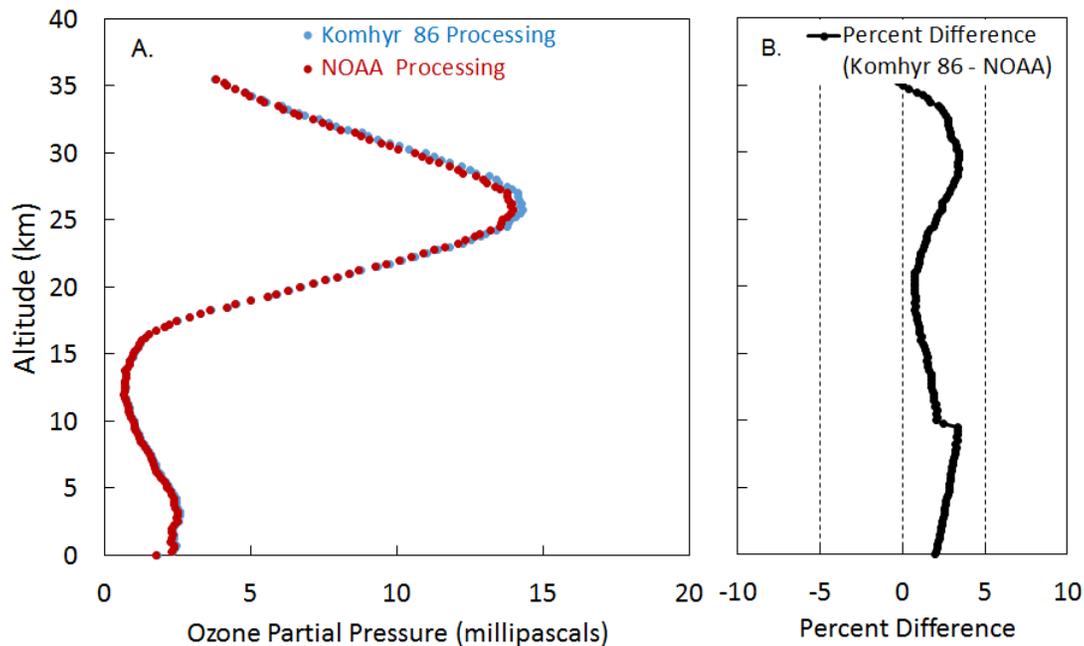
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**Fig. 2.** Figure S1: Average Boulder profile for Era 3 processed with the 1986 Komhyr processing and the NOAA ozone sensor efficiency processing techniques, Panel A. The percent difference in the two processing

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**Fig. 3.** Figure S2: Average Hilo profile for Era 3 processed with the 1986 Komhyr correction and the NOAA ozone sensor efficiency correction, Panel A. The percent difference in the two processing is shown in P

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