

Interactive comment on “World Calibration Center for SF₆ – supporting the quality system of the global atmosphere observation” by J. Lee et al.

Anonymous Referee #2

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Referee comment

1) General comments: The paper describes the inception of a new facility for quality assurance and quality control within the World Meteorological Organization (WMO)/Global Atmosphere Watch (GAW) Programme. In GAW terminology, facilities of this kind are called World Calibration Centre (WCC), regardless if they perform their own primary calibrations or are related to a scale maintained by another laboratory. Among the WCCs for long-lived greenhouse gases a WCC for SF₆ has been lacking so far. Therefore the initiative to build up a WCC-SF₆ taken by the Korea Meteorological Administration (KMA) together with the Korea Research Institute of Standards and Science (KRISS) is of great value to the GAW Programme with its global monitoring

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activities. In view of this, the paper should be of interest to the readership of the special issue of AMT.

In the Introduction the paper describes the background of the work and the expertise of the two institutions involved. The scope of the new WCC-SF₆ is briefly outlined in Section 2. In Section 3 the work is described, thereby covering a discussion of the tasks, the analytical method employed, calibration issues, the preparation of working standards by the WCC-SF₆ including an uncertainty estimate, and a comparison of the WMO/GAW scale with the existing KRISS scale for SF₆. The tasks of WCCs within the GAW Programme have been set out in the GAW Strategic Plan (published as a WMO/GAW Report). The paper lists the different tasks and outlines how the newly established WCC-SF₆ will fulfill the respective requirements.

The paper is clearly structured and the text is supported by four tables and six figures, which are appropriate for their intended purpose. However, a few aspects in the context of WMO/GAW WCCs in general and the WCC-SF₆ in particular are not covered, but should be added to the paper.

It should be clearly pointed out (preferably in the Introduction) that the WCC-SF₆, like the existing WCCs for CO₂, CH₄, and N₂O, is not intended to create an own calibration scale, but is tied to a scale maintained by a respective Central Calibration Laboratory (CCL). In this sense the name “World Calibration Centre” is somewhat misleading and thus needs clarification. Referring all GAW measurements of a certain species to the scale maintained at one single calibration laboratory only is related to the goal of optimal compatibility of measurement results, world-wide. The network compatibility goals set out by GAW for the individual species reflect the requirements of the scientific community summarized as recommendations compiled at GAW meetings (published in GAW Reports). In the case of SF₆ the compatibility goal is ± 0.02 ppt for the range 6 - 10 ppt.

While the subject of the paper is of major interest, the text has severe deficiencies with

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respect to the style of English. At present, the English is not of appropriate quality for a journal article. The authors should seek assistance by a native speaker for an overall revision. Moreover, there are a number of typos and minor errors, which should have been avoided by a more careful preparation of the manuscript.

In summary, the paper needs major revisions to improve its quality. Once these revisions addressed here have been made, it should be accepted for publication in the special issue of AMT. Specific points are listed below, followed by technical corrections.

2) Specific comments

page 7900, line 6: "... primary standards in the different laboratories around the world ...". For GAW this is not valid. According to the traceability concept of GAW, for the individual greenhouse gases there is only one primary standard, which is kept at the Central Calibration Laboratory (CCL). For the terminology see the GAW Glossary on the web.

p 7900, l 10: The requirement of specific (not "several") know-how is also relevant for the preparation of secondary standards, which generally cover the mole fraction range used for the working standards and transfer standards.

p 7900, l 13 and several other lines: "DQO": Have complete DQOs already been released by GAW? If so, please add a reference in the main text. In fact, there are recommendations for the network compatibility (see GAW Report No. 194). Please clarify.

p 7900, l 13: Write the full name of the institution, i.e. Korea Meteorological Administration, here since mentioned for the first time.

p 7900, l. 15 and p 7902, l 5: One should rather say: "After the Central Calibration Laboratory(CCL) for SF6 has been established by NOAA ESRL (USA), ..."

p 7900, l 19: As the WCCs range among the GAW Central Facilities, "facilities" should be replaced with "Central Facilities".

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p 7900, l 27 and in the main text: "a drift of 0.02 ppt". During which time period?

p 7900, l 27 and p7901, l 2: "... a working standard ... to be transferred to the GAW stations". Confusing: Is it actually one standard? Each station will need its own working standard. Or do you think at a travelling standard?

p 7901, l 5: "... nations ... emissions ..." This is a somewhat political statement and expresses a rather optimistic view. Suggestion to rephrase and explain scientific aspects.

p 7901, l 9: "... not easy to quantify their mixing ratios owing to their globally and temporally insignificant variation." Just the opposite is true. Global quantification is difficult for highly variable species, such as ozone.

p 7903, l 3: While the GAW strategic plan in general requires applying standard operating procedures, it should be pointed out here that these do not exist yet for SF6. Moreover, there is consensus within GAW that high-quality measurements involving complex systems such as GCs, require Measurement Guidelines, which leave somewhat more flexibility than strict SOPs do.

p 7903, l 11: "... globally and spatially ...". "globally" refers to a spatial distribution. Is "spatially" intended to mean "regionally" ?

p 7903, l 20: Since Fig. 1 is not mentioned in the text so far, this line might be an appropriate place to refer to Fig. 1 and explain the position of the CCL according to the GAW concept.

p 7904, l 4: "... a set of ...". Should be replaced with: "... a set of gas mixtures calibrated in the WMO SF6 mole fraction scale ..."

p 7904, l 20 till end of paragraph: "... calibrated by the primary standards provided by the KRISS ...". This statement needs more detailed explanations. Do you mean "calibrated in the scale based on the primary standards prepared by KRISS? How has the transfer of the scale to the observing sites been made? Use of transfer standards.

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What about the role of working standards at the observing site? Any differences between the traceability concepts of a NMI (KRISS) and GAW should be pointed out clearly. This is of major importance for the entire paper. The terminology used in this context should be in agreement with GAW (see GAW Glossary on the web).

p 7906, l 2: "A highly repeatable GC method" What does this mean? A method yielding highly repeatable results?

p 7906, l 10: "7 ml". In Fig. 2, it is 1 and 2 ml, respectively.

p 7906, starting at l 1: The KRISS scale is an issue by itself and has not directly to do with the WCC-SF6. Please clarify.

p 7909, section 4: Since a great part of this section is more a summary than conclusions, the title should be changed to "Summary and Conclusions".

p 7910, l 5 and earlier parts of the text: The authors talk about "a working standard". May one assume that more standards of this kind will be prepared to supply all GAW stations measuring SF6 ? Moreover, it should be described if the stations will get one working standard or a suite of these in order to establish the response curve of the detector?

3) Technical corrections

p. 7899, title and entire text: Since WMO is on British English, replace "Center" with "Centre", as used within WMO/Global Atmosphere Watch.

p 7901, l 11: Style: "composed" should be replaced with "supported".

p 7901, l 17: "the amount of SF6 mole fraction is reported ..." might be replaced with a shorter expression such as "the abundance of SF6 is reported ..".

p 7901, l 23: Insert "to" (and contributed to the GAW programme).

p 7901, l 26: Mixture of singular and plural. Replace "This data are" with "These data

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are".

p 7903, l 22: Confusing citation, should be replaced with: "... are described in Box 7 of the GAW Report No. 172 and ..."

p 7902, l 14: Style: "... comparison programs since the last 10 yr." should be replaced with: " comparison programmes during the last 10 yr." With reference to line 23 please note that the spelling in the paper should not be a mixture of British and American English.

p 7903, l 2: "QA" should be spelled out when mentioned for the first time: "Quality Assurance (QA) .."

p 7903, l 9: "... for their implementation ...". It is not clear to what "their" is related to.

p 7904, l 4 till end of paragraph: Issues are described in a rather confusing way. Suggestion to rephrase, for example: "Accordingly, the KMA shall possess a set of gas cylinders directly calibrated in the GAW SF6 mole fraction scale by the CCL, which ensures the shortest link possible, to distribute the scale to GAW stations by way of transfer standards, and to perform site audits. For the purpose of the linkage, in November 2010 the KMA obtained from NOAA gas cylinders in the range of 4 – 15 pmol mol⁻¹ of SF6."

p. 7904, l 9: Replace "scientific ... (SAGs)" with "WMO/GAW Scientific Advisory Groups (SAGs)"

p 7905, l 7: "... are maintained by calibration against the WMO ..." Might be shortened by saying: " are calibrated against the ..."

p 7905, l 9: Replace "Meantime" with "In the meantime"

p 7905, l 11: Typo: Replace "KWA" with "KMA".

p 7906, l 4: Replace "an Agilent" with "Agilent". Same line: What does "2 ea" mean?

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p 7906, l 7: Typo: It is plural. "Samples pass ..."

p 7906, l 11 and l 16: Typo. It should read "Porapak"

p 7906, l 20: Don't confuse the scale and gas in a cylinder (serving as standard).

p 7907, l 15: Better say: "...the analytical ability of KRISS satisfies the level recommended by WMO/GAW, ± 0.02 ppt."

p 7907, l 23: Typo: Remove "a" before "laboratories".

p 7908, l 2: Typo?: "co." in "RIX co."

p 7908, l 9: Unspecific sentence: "... air sample cylinder ... overlaid with the WMO SF6 mole fraction scale". Should be replaced with a sentence like: "... overlaid with the chromatogram of a WCC-calibrated gas".

p 7909: There are a particularly large number of problems with the style of English.

p 7910, l 3: "working cylinder" should be replaced with "working standard", the term used elsewhere in the text.

p 7910, l 23 and l 26: Non-uniform use of space around a hyphen.

p 7911, l 25: Remove the comma between "Report" and "No."

p 7912, Table 1: Suggestion to rephrase the title line, for example: "Comparison data from the GC analyzer; each area data point results from 3 successive analyses". R and S should be explained.

p 7913, Table 2: "CRMs" should be explained (spelled out).

p 7915, Table 4: The title should be more precise by saying, for example: Measurement results of comparisons between two SF6 scales.

p 7916, Fig. 1: This figure is not mentioned in the text (as already noted above). Design/colour: The text in the blue box (top left) is hard to read. Mind the contrast of

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colours. Replace "Roundrobin" with Round-robin". Caption: Replace "CCI" with "CCL".

p 7917, Fig. 2: Font size on axes: Suggestion to enlarge as shown in Fig. 4. "Heater" obviously means "ECD". Replace "PP-Q" with "Porapak-Q". Give length of the Activated alumina-F1 column. The number for the flow is different from the one given in the main text. Use uniform unit for volume (ml or cc). Caption: Replace "... column selection installed at ..." with "type of column installed in the GC". Caption: Typo, replace "minites" with "minutes"

p 7919, Fig. 4: Caption: Typo, it should read "minutes".

p 7920, Fig. 5: Replace "Calibration" with "calibration".

p 7921, Fig. 6: Caption: Typo: Replace "minites" with "minutes".

Interactive comment on Atmos. Meas. Tech. Discuss., 5, 7899, 2012.

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