

Interactive comment on “Re-analysis of ground-based microwave ClO measurements from Mauna Kea, 1992 to early 2012” by B. J. Connor et al.

Anonymous Referee #4

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The authors present the 20 years trend of the ClO abundance in the stratosphere with re-analysis of the measurement of ground-based microwave spectrometre at Mauna Kea. The 20 years trend of the ClO abundance in the stratosphere is definitely important. This article can improve quantity/quality of the decreasing rate over the 20 years with the improvement of the accuracy/precision of the ClO abundance. I request revisions of the article to be good shape for ACP.

1. Introduction l4 pp30572-10 pp30573: The requirement of the re-analysis should be addressed. Please add an estimation of the uncertainty of the rate of the long-term-

C11804

trend from the old calibration method. l6-14: There are a recent reports for the diurnal variation of ClO. “Strato-mesospheric ClO observations by SMILES: error analysis and diurnal variation” T. O. Sato, H. Sagawa, D. Kreyling, T. Manabe, S. Ochiai, K. Kikuchi, P. Baron, J. Mendrok, J. Urban, D. Murtagh, M. Yasui, and Y. Kasai, Atmos. Meas. Tech., 5, 2809-2825, 2012 “Comparison of SMILES ClO profiles with other satellite and balloon-based measurements” H. Sagawa, T. O. Sato, P. Baron, E. Dupuy, N. Livesey, J. Urban, T. von Clarmann, A. de Lange, G. Wetzel, A. Kagawa, D. Murtagh, and Y. Kasai Atmos. Meas. Tech. Discuss., 6, 613-663, 2013,

There are two notable points for your paper. One, the Figure 10 in Sato et al., “Strato-mesospheric ClO observations by SMILES: error analysis and diurnal variation”, shown that ClO abundance in the night is about 7 times more than that of the day at the 0.18 hPa (about 60km) in the mesosphere. Second, this figure also shown that there is the variation during the day. For example, ClO abundance is about 200 (280) and 500 (350) pptv for 8:00 and 12:00, respectively in the mid-latitude (equator) at 4.6 hPa near the peak of ClO. The 4 hours variation is about 2.5 times and 1.25 times of ClO abundance during day for mid-latitude and equator region respectively.

ClO abundance is strongly dependent on SZA even during day.

2. Atmospheric spectra: In General: - The information of the observation and retrieval method should be described, for example, if you use same a priori profile over the 20 years or not. - Averaging kernel for day and night is helpful to understand the quantity of the calibration method. Since the day/night variation of ClO in the stratosphere and mesosphere is opposite as shown in Sato et al (2012), it is important to know how much information came from stratosphere and from mesosphere. - Baseline: Do you retrieve baseline simultaneously with ClO after the subtraction? If so, what kind of the function you used for? If not, why you did not do that? - Ozone as a baseline: Ozone is the major baseline below middle stratosphere for ClO retrieval. How did you take in account the ozone diurnal variation (day-night difference) in your calibration and retrieval calculation? - An important point is that the most of the night time ClO spectrum

C11805

information coming from the mesosphere. On the other hand, day time ClO spectrum information is coming from the stratosphere. [Day – night] means ClO stratosphere (day) – ClO mesosphere (night). I wonder what is the physical meaning of that. Please address this question.

3. ClO mixing ratio. 3.2 Secular trend I18, pp30575: 5km wide range near the peak -> need more precise/accurate description. Figure 5: I wonder the scattering of the ClO abundance might reduce if you take in account the SZA criteria. 419, pp30576: Please put the Solomon 2006 value in the Table 1 for the comparison. We want to know how you improved the value due to the re-analysis.

I15-16, pp30576: Please make clear if the highest value 2008-2009 is due to the gap cause of the failure at 2009 or not.

4. Comparison to MLS instrument As you know, ClO abundance has strong diurnal variation, as shown in the figure 3 in Sagawa et al., "Comparison of SMILES ClO profiles with other satellite and balloon-based measurements". Put the SZA (or Local time) criteria for the coincidence between MLS and MKO.

5. Summary and conclusion It is very interesting that Table 1 and 2 imply that the rate in 2004 - 2012 is slower than that of 1995 – 2004. I would like to know this interesting trend is realistic or not.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 30571, 2012.