

Interactive comment on “Twin-cuvette measurement technique for investigation of dry deposition of O₃ and PAN to plant leaves under controlled humidity conditions” by S. Sun et al.

Anonymous Referee #2

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The study presents a comprehensive and precise technical description of the buildup of a high flow rate (> 20 L min⁻¹) dynamic twin-cuvette system for quantifying the trace gas exchange fluxes between plants and the atmosphere under very well controlled conditions (light, humidity and temperature). The advantage of the described and tested twin-cuvette system is to avoid wall deposition as a disturbing background effect. The system was characterized using two reactive gases (Ozone, O₃ and Peroxyacetyl nitrate, PAN) in the range of concentrations that typically can exist in the Environment (32–105 ppb and 100–350 ppt). At relative humidity (RH = 40%) a linear dependency

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of the trace gas fluxes for O₃ and PAN in relation to its ambient mixing ratio could be observed. At the given humidity of 40% the deposition of O₃ was only controlled by the leaf stomata (*Quercus ilex*). For PAN an additional resistance inhibits the uptake by the leaves. The formation of water films on the leaf surface of the plants inside the chamber could be tracked with custom built leaf wetness sensors. The authors describe the direct calculations in detail and discuss the statistical significance of the results. They demonstrate that with the twin-cuvette system influences of wall deposition can be excluded. Therefore the dual cuvette system represents a more precise method to characterize flux measurements with reactive trace gases under very well controlled laboratory conditions. The manuscript is well structured written, understandable and therefore pleasant to read. The Title is comprehensive. The abstract is adequate and compact. All tables and picture are of good quality. The references are comprehensive and up to date. Although I am not a native speaker it seems for me that the quality of English-writing overall is o.k. I recommend the publication of the manuscript with the following minor revisions.

Specific comments:

1. Page 12054, line 3. The citation Kulmala et al., 1999 is missing in the references.
2. Page 12054, line 9. The citation Altimir et al., 2006 is missing in the references. The citation Altimir et al. 2006 is additional given at page 12060, line 14.
3. Page 12059, line 1. Instead of “... per time and is defined according to Bonn et al. (2013) as:” please write “... per time and is defined according to Bonn et al. (2013) as Eq. (1):” to integrate the hint of equation 1 in the text.
4. Page 12060, line 27 and Page 12061, line 1. Instead of “The net-signals were used to calculate the electrical surface conductance G in μS .” please write “The net-signals were used to calculate the electrical surface conductance G in μS , Eq. (3).” to integrate the hint of equation 3 in the text.
5. Page 12062, line 22. Add at the end of sentence the hint to equation 4 as: “... as follows (see e.g. Teklermarim and Sparks, 2004), Eq. (4).”.
6. Page 12063, line 10. Give a hint in the text to equation 5 and write: “The deposition velocity V_d (mms⁻¹) of O₃

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and PAN was calculated following Eq. (5).” 7. Page 12063, line 16. Give a hint in the text to equation 6 and write: “The stomatal conductance of water vapor $g_{s,calc}$ (H_2O) ($mmol\ m^{-2}\ s^{-1}$), Eq. (6) was determined ...”. 8. Page 12064, line 18. Integrate a hint to equation 7 in the text: “... where VPD is given according to von Ceammerer and Farquhar (1981) as Eq. (7).” 9. Page 12064, line 1 and 2. Integrate a hint to equation 8 in the text: “The stomatal conductances of O_3 and PAN were determined following Eq. (8) from ...” 10. Page 12064, line 10. Integrate a hint to equation 9 in the text: “... and Sparks (2004) by following Eq. (9):” 11. Page 12064, line 13. Integrate a hint to equation 10 in the text: “... was calculated according to the equation scheme of Teklemariam and Sparks (2004), Eq. (10):” 12. Page 12064, line 15. The writing of (Lasik et al., 1989) is wrong; correct is (Laisk et al., 1989) as given in the references. The same writing error was found at page 12078 in line 10 and line 14. 13. Page 12065, line 4. Integrate a hint to equation 11 and 12 in the text: “...the inlet and outlet of the cuvette, Eq. (11) and Eq. (12):” 14. Page 12065, line 6. Integrate a hint to equation 13 in the text: “...defined as follows, Eq. (13): ” 15. Page 12065, line 8. Integrate a hint to equation 14 in the text: “By combination of Eqs. (11)-(13) we received Eq. (14):” 16. Page 12065, line 13. Integrate a hint to equation 15 in the text: “... difference between both cuvettes could be simplified as Eq. (15):” 17. Page 12066, line 21. Give a hint to equation 16 in the text: “...was determined in Eq. (16) by the standard ...” 18. Page 12067, line 2. Integrate a hint to equation 17 in the text: “... the Gaussian error propagation (Bevington and Robinson, 2003), Eq. (17):” 19. Page 12078, line 8 and 9. The citation Fares et al. 2010 is not given in the references. 20. Page 12080, line 24 and 25. The given citation Bevington and Robinson is from 2003 not 2002. 21. Page 12084, line 27. Citation: the name Spaks is wrong in the reference, correct is: Teklemariam, T. A. and Sparks, J.P.: Gaseous fluxes of peroxyacetyl nitrate (PAN) into plants leaves, *Plant Cell Environ.*, 27, 1149-1158, 2004. 22. Page 12085, Table 1, line 2. The citation Wang et al. (1995) is not given in the references. Table 1, line 3. The citation Van Hove et al. (1998) is not given in the references.

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