

Interactive comment on “Sensitivity of stomatal conductance to soil moisture: implications for tropospheric ozone” by Alessandro Anav et al.

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Response to RC2:

We would like to thank the reviewer for the time taken to read and comment on this manuscript and the positive comments and opinion. Please find below our responses to the reviewer's comments.

Anonymous Referee #2

This study investigated the impact of soil moisture on model predicted O₃ dry deposition and concentration. This is a good effort in improving current approaches handling the dry deposition process in chemical transport models as well as in studies focusing on assessing O₃ impact on vegetation. By including soil moisture effect in stomatal

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uptake modeling, O₃ dry deposition would be reduced by about 10%. While such a difference is somewhat significant, it is much smaller than the known uncertainties in most dry deposition algorithms, which is typically on the order of a factor of 2. For example, Schwede et al. (2011, A.E., 45, 1337-1346) compared one American and one Canadian models used in major monitoring networks for O₃ and other gaseous species, and Flechard et al. (2011, ACP, 11, 2703-2728) compared three European and one Canadian models for nitrogen species across the NitroEurope network. Both of these two studies suggested the differences between the commonly used dry deposition models (and thus the uncertainties in most models) being as large as a factor of 2 even on long-term average basis. In this circumstance, including soil moisture in some models may not improve the O₃ prediction and may even increase the bias if the models are already biased low. This does not mean that sensitivity studies on soil moisture effects are not needed, but the existing known large bias should first be outlined, and the significance of the present study could then be elaborated. Some other specific comments are listed below.

RC2

1. Remove the introductory materials in the abstract and provide a more concise summary of the major findings.

AC2

We shortened the introductory materials in the abstract as suggested.

RC2

2. Simplify the discussion of the basic concepts (especially paragraphs 3-7 in this section), and add a brief discussion on the large uncertainties in the commonly used existing schemes (as outlined above).

AC2

We thank the reviewer for suggesting Schwede et al. (2011) and Flechard et al. (2011)

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papers; we have added a discussion on the uncertainties of existing dry deposition schemes in section 4 of the revised manuscript.

RC2

3. In Sections 3.2 and 3.3: where possible, first give a brief discussion on how well the original dry deposition scheme performed based on available literature so we would know if the revised version (by including soil moisture) would perform better or worse. This is important because the scientific community would depend on this finding to decide if additional effort is needed in generating soil moisture field and applying it in the dry deposition estimation.

AC2

The comparison of model's performances was already given in section 3.4, thus readers can already easily understand if the modified model would perform better or worse; additionally, in section 3.4 of the revised manuscript we have broadened the discussions comparing our results with former studies. Finally, in the last section we have broadened the discussion on the uncertainty of dry deposition, comparing this study with former publications.

RC2

4. In section 4, on one hand, it is stated that the dry deposition scheme is improved; and on the other hand, the bias on the model predicted O₃ concentration was increased. While it is possible that the increased bias in the predicted O₃ concentration was due to the large uncertainties in the other physical and chemical processes in the model, it is also possible that the original dry deposition scheme was already biased low. In the latter case, the scheme is improved in terms of including more processes, but not for the overall predicted dry deposition. Some clarifications are needed here.

AC2

Thanks for this suggestion, we fully agree that further clarifications are needed. For

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this reason, we have broadened this discussion in section 4 adding some clarifications and references.

Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2017-1057>, 2017.

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