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Atmospheric Chemistry and Physics Discussions

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

Anonymous Referee #2

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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 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

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Discussion paper

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.

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

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).

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.

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.

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