Response to Comments by Reviewer 2

Comment: This paper provides a well-written and useful comparison of dry deposition from several models. The authors deal with a wealth of information in a logical and generally well-thought out way. The paper is worthy of publication after dealing with the comments made below.

Response: We would like to thank the reviewer for the overall positive assessment of our manuscript and the thoughtful and constructive comments that helped us improve several sections. In the sections below, reviewer comments are shown in regular black font, our responses to reviewer comments are shown in italicized black font, and changes incorporated into the revised manuscript to address the major comments are shown in regular blue font.

Major comments:

Comment: The term Vd is used, and many plots are provided and compared, but no mention is made of which height the values refer to. A Vd calculated at 1m can be very different to one calculated at e.g. the center of model grid boxes. Are these 1m values, or Vd from grid-center, or something else? Are the results across models really comparable?

Response: Thank you for raising this point. All models analyzed in this study calculated and reported V_d and the effective conductances either at the midpoint of the first model layer or as a first layer average. The heights of the first layer varied across models and this information has been added to Table 1. The only component of V_d directly affected by differences in layer heights or the assumption of a reference height is the aerodynamic resistance r_a. We compared the magnitudes of reported r_a, quasi-laminar sublayer resistance (r_b), and bulk surface resistance (r_c) for all models and found that r_c is typically at least a factor of 10 higher than r_a. Therefore, we expect the differences in first layer height to have only a minor effect on our comparisons of V_d and effective conductances. While we acknowledge that the differences in layer heights can introduce an additional degree of freedom when comparing the absolute magnitude of V_d across models, the general agreement of the LU-specific grid model V_d and effective conductance results with the single point model results from Clifton et al. (2023) (in which all models calculated V_d at the same reference height and used the same observed meteorology) shown in Figures 10 and S9 – S11 strongly suggests that differences in layer height are not a primary cause of model-to-model V_d differences in this study.

Modifications to the manuscript text (in addition to the extra column in Table 1):

Section 2: "WRF/CMAQ, GEM-MACH, and LOTOS-EUROS calculate and report V_d and effective conductances at the midpoint of the first model layer while values in WRF-Chem are calculated as average over the first layer following McRae et al. (1982). As shown in Table 1, the height of the first model layer varies across models and may therefore affect the comparison of V_d across models. However, only the computation of r_a has a dependency on layer height. When comparing the magnitude of the annual domain-average r_a, r_b, and r_c terms for O_3 across participating models, we find that r_c is typically at least a factor of 10 higher than r_a, suggesting that the effect of different layer heights on our comparison of V_d is relatively minor and that differences in the representation and computation of the parallel surface resistance pathways constituting r_c are the main driver of differences in V_d. In addition, the independence of the different resistances included in the computation r_c (Galmarini et al., 2021, Clifton et al., 2023) on layer height also implies that our analysis of effective conductances to quantify the split between different surface deposition pathways is likely not affected by model-to-model differences in layer heights."

Section 3.1: "Consistent with the discussion in Section 2, the model-to-model differences in V_d shown in Table 2 indeed do not appear to be caused by the different first layer thicknesses shown in Table 1. Notably, the GEM-MACH (Ops) simulation has the highest V_d while the GEM-MACH (Zhang) simulation has the lowest V_d despite both simulations having one of the thickest first layer heights. This is consistent with the notion that the surface resistance r_c (independent of first layer thickness) rather than the aerodynamic resistance r_a (dependent on first layer thickness) is generally the limiting factor controlling ozone dry deposition."

Section 3.2: "In addition, the general agreement between the grid and point model comparisons shown in Figures 10 and S9 – S11 again suggests that the differences in first layer heights between the grid models (Table 1) are not a major factor impacting the interpretation of V_d and effective conductance differences across models since reference and displacement heights had been harmonized in the point model calculations."

Comment: The term effective conductance is also used throughout, but this is not a widely-used term and is not defined here. The manuscript refers to Paulot et al 2018 and Clifton et al 2020a for definition, but Paulot does not use this term at all, and Clifton doesn't really explain the difference between conductance and effective conductance. My comment about Vd above would also apply to this conductance terminology, for the aerodynamic part at least.

Response: *Thank you for pointing out that including a description of the effective conductance term in the manuscript rather than relying solely on references to earlier studies is important given the central role this quantity plays in our study for comparing ozone dry deposition across the AQMEII4 models. We have added this information in the revised manuscript. We have also expanded the list of references to include the previous AQMEII4 studies Galmarini (2021) and Clifton (2023) for further information. While Paulot et al. (2018) indeed did not explicitly define effective conductances, they used these calculations in Figure 4 to break down the contribution of different surface pathways to V_d and we therefore think that a reference to that study is warranted. Clifton et al. (2020a) used the following definition "In order to probe the contribution of different deposition pathways to v_d, we examine effective conductances. Generally, a conductance is the inverse of a resistance. The effective conductance is the amount of deposition (in velocity units) occurring through a given deposition pathway. The sum of all of the effective conductances is v_d." and we therefore also retained the reference to that study. The Galmarini et al. (2021) and Clifton et al. (2023) studies provided the following information and have been added as references in the revised manuscript:*

> *Galmarini et al. (2021) – "When there are differences in resistance frameworks across models, the deposition pathways may be compared across models using a construct we will refer to here as effective conductance (Paulot et al., 2018; Clifton et al., 2020b). While generally a conductance is simply the inverse of a resistance, an effective conductance is the contribution of a given depositional pathway to the deposition velocity, expressed in the same units as the deposition velocity. The sum of the effective conductances for all deposition pathways is the deposition velocity. The effective conductances of the soil (ESOIL), lower canopy (ELCAN), cuticle (ECUT), and stomata (ESTOM) branches specifically for Wesely (1989) are given by (eqs 3 – 6)"*

> *Clifton et al. (2023) – "As explained and defined in Galmarini et al. (2021), an effective conductance [$m\,s^{-1}$] represents the portion of v_d that occurs via a single pathway. An effective conductance is distinct from an absolute conductance, which represents an individual process. (Note that a conductance is the inverse of a resistance.) The sum of the effective conductances*

across all pathways represented is v_d. In contrast, calculating v_d with absolute conductances requires considering the resistance framework. Archiving effective conductances facilitates comparison of the contribution of each pathway across dry deposition schemes with varying resistance frameworks and differing resistances to transport. Previous model comparisons examine absolute conductances and suggest that differences in pathways or processes lead to differences in v_d (Wu et al., 2018; Huang et al., 2022). Our approach with effective conductances offers a more apples-to-apples comparison across models, allowing us to definitively say whether a given pathway leads to inter-model differences in v_d"

As noted in our addition to Section 2 in response to the first major comment, the fact that the r_a term is pathway-independent and that the different r_c terms do not depend on model layer height means that the comparisons of the effective conductance (i.e. pathway) contributions across models are not likely affected by differences in first layer heights.

Modifications to the manuscript text (in addition to adding the Galmarini et al. 2021 and Clifton et al. 2023 references to the Paulot et al 2018 and Clifton et al 2020a references when introducing effective conductances at the beginning of Section 2):

Section 2: "Following the general framework introduced in Wesely et al. (1989), all models in this study except WRF/CMAQ STAGE calculate Vd as the inverse of the sum of the aerodynamic resistance r_a, the quasi-laminar sublayer resistance r_b, and the surface resistance r_c which consists of most or all of the parallel deposition pathways listed above but is implemented differently across schemes as documented in Galmarini et al. (2021). The aerodynamic resistance r_a is independent of deposition pathway in all models, and r_b is independent of deposition pathway in all models except WRF/CMAQ STAGE which computes different r_b values for stomatal and cuticular vs. soil pathways and therefore includes this term in its pathway-specific r_c calculations. As stated in Galmarini et al. (2021), "an effective conductance is the contribution of a given depositional pathway to the deposition velocity, expressed in the same units as the deposition velocity. The sum of the effective conductances for all deposition pathways is the deposition velocity." Importantly, Galmarini et al. (2021) noted that the equations used to compute the effective conductances are specific to a given dry deposition scheme and provided these equations for the different AQMEII4 modeling systems in Appendix B."

Section 2: (repeated from above): "… only the computation of r_a has a dependency on layer height … In addition, the independence of the different resistances included in the computation r_c (Galmarini et al., 2021, Clifton et al., 2023) on layer height also implies that our analysis of effective conductances to quantify the split between different surface deposition pathways is likely not affected by model-to-model differences in layer heights."

Comment: p7, paragraph starting on L173: A few factors are mentioned here for differences in O_3 deposition (e.g vehicle speeds), but some likely more important factors are not mentioned, not least that both the anthropogenic and biogenic emissions have large uncertainties in magnitude as well as location. Indeed, there is little discussion of the fact that different models produce different amounts of O_3. I think the authors should provide maps of the near-surface concentrations from the different models, and also provide references to some of the other multi-model inter-comparisons that illustrate the magnitude of model to model differences.

Response: We agree that adding maps of O_3 mixing ratios simulated by each model would provide additional context for our discussion of spatial patterns in V_d and O_3 deposition fluxes and have added such maps as Figures S1 and S2. We also agree that model-to-model differences in O_3 fields due to non-harmonized inputs (biogenic emissions, meteorology) or different chemical mechanisms could also cause

O_3 deposition flux differences that cannot be attributed to V_d differences, though we also note that anthropogenic and lightning emissions as well as chemical boundary conditions were harmonized across all models.

A separate AQMEII4 paper (Kioutsioukis et al., 2025) has a more detailed assessment of model spread in surface O_3. In the revised manuscript, we added a reference to this paper to explicitly state that factors other than V_d (for example, the vehicle-induced turbulence and forest canopy parameterizations in GEM-MACH-Base and GEM-MACH-Zhang, but not in GEM-MACH-Ops) are likely driving model spread in O_3 mixing ratios and model performance. Nevertheless, comparing the spatial patterns in Figures 1-2 vs. Figures 3-4 does establish that model-to-model differences in O_3 deposition fluxes – an endpoint of interest for impact studies – are heavily influenced by model-to-model differences in V_d, which in turn establishes the motivation for the diagnostic comparison of V_d presented in subsequent Sections. The original discussion of the GEM-MACH (Ops) vs. GEM-MACH (Base) configuration differences has been removed from this section as it did not directly relate to the comparison of the spatial patterns in deposition fluxes vs. V_d.

Revised manuscript text:

Section 3.1 "Despite these generally similarities, it is important to note that models may have above-average O_3 fluxes while also having below-average O_3 V_d or that a given model may have areas with similar V_d but noticeably different dry deposition fluxes, due to the influence of factors other than V_d (e.g., the representation of regional transport and chemistry, the parameterizations for sub-grid-scale turbulence, and the location and density of precursor emission sources) on simulated O_3 mixing ratios. Maps of annual mean O_3 for each model as well as the multi-model mean and standard deviation are shown in Figures S1 – S2 and we refer to Kioutsioukis et al., (2025) for both an operational evaluation of simulated O_3 fields and analyses partitioning variability in these fields to variability in O_3 V_d and other variables such as wind speed and the height of the planetary boundary layer. Makar et al. (2025) showed that WRF-Chem (NCAR) significantly underestimated observed precipitation and Kioutsioukis et al. (2025) hypothesized that a corresponding underestimation of clouds and overestimation of radiation was the main driver for the large positive ozone bias reported for that model. The above-average O_3 mixing ratio for WRF-Chem (NCAR) shown in Figure S1 is consistent with this hypothesis and may provide at least a partial explanation for the above-average O_3 flux but below-average O_3 V_d shown for this model in Figures 1 and 3. As a second example of confounding factors when comparing spatial patterns of O_3 V_d and O_3 fluxes, the GEM-MACH (Ops) panel in Figure S1 shows generally higher O_3 mixing ratios over the Southeastern U.S. vs. parts of the Canadian boreal forest region, consistent with corresponding spatial differences in O_3 fluxes for this model despite similar O_3 V_d in these two regions. The influence of factors other than V_d in shaping spatial O_3 variability is analyzed in more detail in Kioutsioukis et al., (2025)"

Comment: p7, L177: Figures 3-4 are introduced here, but the important results shown in this Figures are not discussed at all; instead the text proceeds to comparisons between Vd and fluxes. Some relevant discussion is found later in the paper, but the reader deserves some comment here and some guidance as to where the large differences in Vd between models will be discussed.

Response: We have revised this Section to include a brief discussion of the results shown in Figures 3-4 while also explicitly noting that the role of differences in surface deposition pathways and LU distributions in causing the model-to-model differences in Vd magnitude and patterns shown in these Figures is discussed in subsequent Sections.

Revised manuscript text:

Section 3.1 "Figures 3-4 show the spatial patterns of annual mean V_d for each model and the multi-model mean and normalized standard deviation. While these maps visually confirm the results from Table 2 that GEM-MACH (Ops) has the highest mean V_d and GEM-MACH (Zhang) the lowest mean V_d over the NA domain and WRF-Chem (UPM) has the highest and LOTOS-EUROS the lowest mean V_d over the EUR domain, they also show important spatial differences. For example, both GEM-MACH (Base) and WRF-Chem (UPM) have very similar annual mean V_d when averaged over the entire domain (Table 2), but this agreement in the means masks the generally higher V_d in GEM-MACH (Base) over the Southeastern U.S. and the generally lower V_d over the Southwestern U.S. compared to WRF-Chem (UPM).The role of differences in surface deposition pathways and LU distributions in causing model-to-model differences in V_d magnitude and patterns is discussed in subsequent Sections."

Comment: p17, 3.2 and elsewhere. The large importance attached to landuse is a good feature of this and other AQMEII studies. However, differences in height, roughness length, displacement height and LAI are present even for the same land-cover. Although Fig. 10 and S6-S8 are interesting in connection with this, a table to compare values for some of the more common LU would be useful, along with some discussion of the implications.

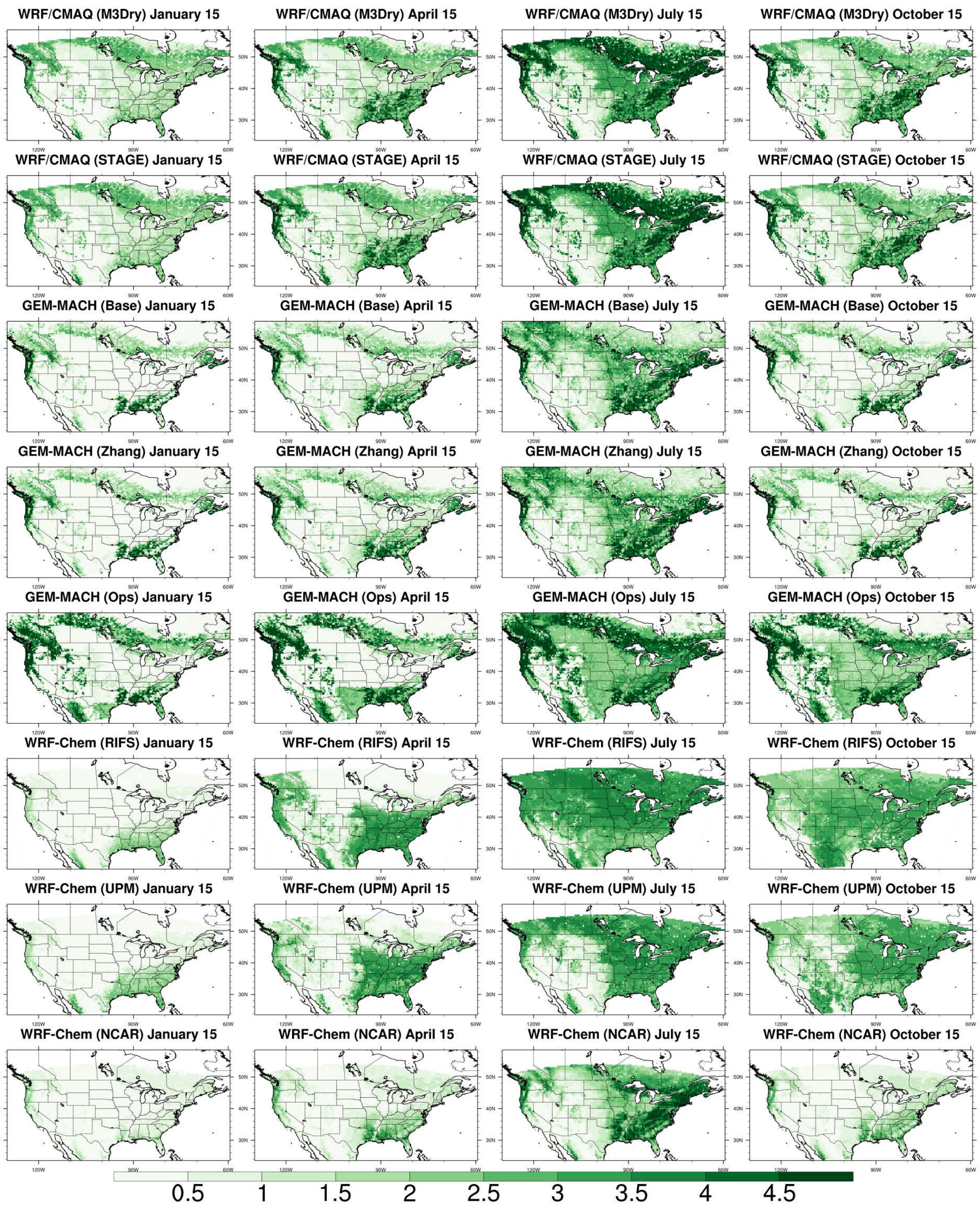
Response: *While we agree that a table comparing LAI and z0 values across models and LU types might be interesting, we would also like to note that the mechanisms through which these and other LU-dependent variables impact dry deposition in grid models is complex and includes both direct effects (e.g. LU-dependent parameter values implemented through lookup tables in the different schemes) and indirect effects (e.g. the impacts of LU on temperature and humidity in the LSM calculations which then can impact the dry deposition calculations in the CTM). Therefore, it would not be straightforward to link the information in such a table to the model-to-model differences in V_d and deposition fluxes given the complexities discussed in the following paragraphs of our response to this comment. Untangling these complexities across the different modeling systems is beyond the scope of the AQMEII4 grid model intercomparison activity, but the use of LU-specific V_d and effective conductance fields still allows us to investigate the total impacts of LU-dependent process representations and LU distributions on modeled deposition by stratifying our analyses by LU. Put differently, in our analysis presented in Section 3.2, we treat LU as a proxy for all LU-dependent processes and parameters (which vary significantly across models as summarized below), meaning that the dependence of model results on LU in this Section should be interpreted as being due to "all land-use-dependent quantities in the deposition algorithms used in AQMEII4 models."*

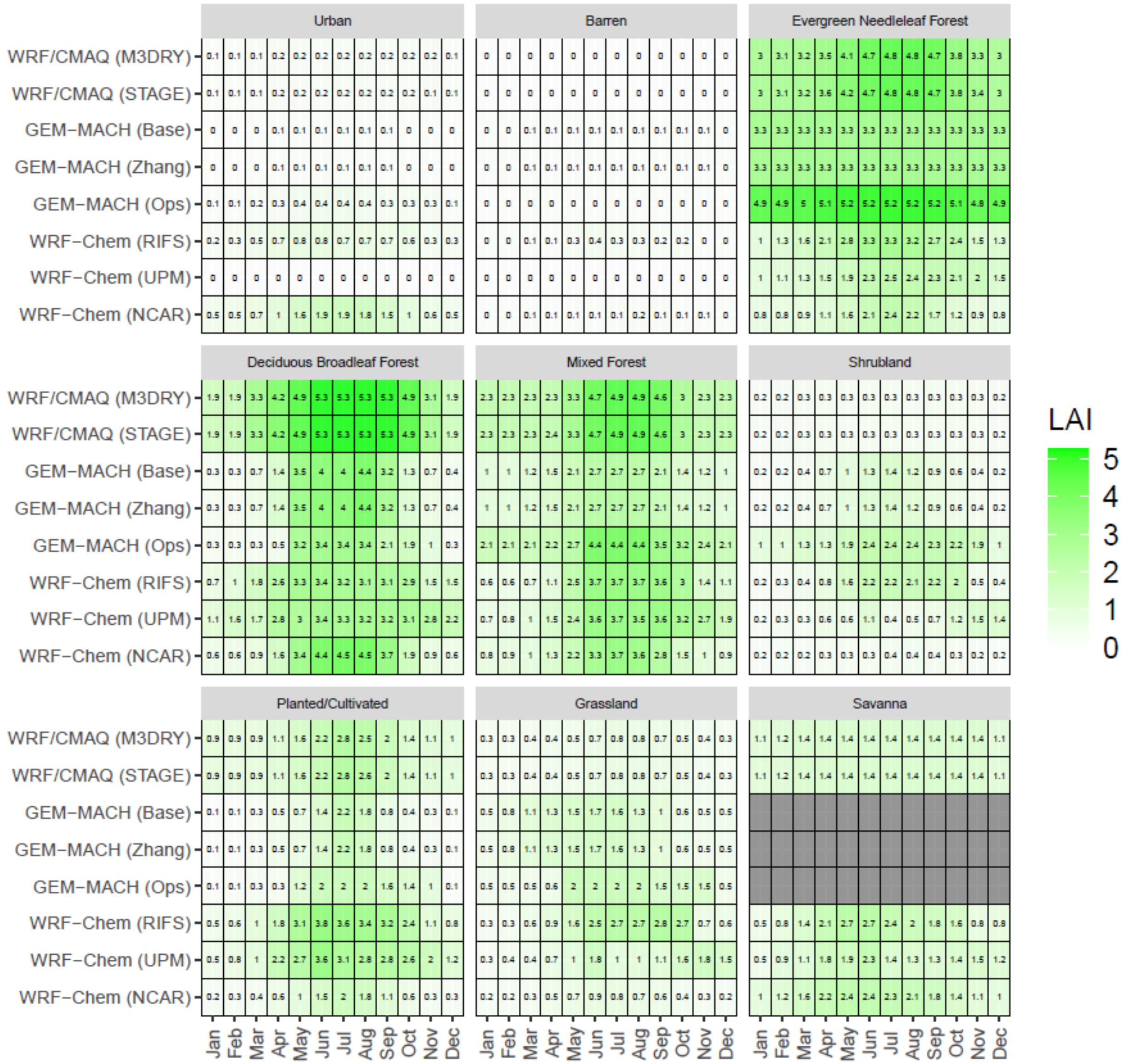
The direct LU dependency for r_a arises from z0 which affects the calculations of friction velocity and Monin-Obukhov length. The direct dependency of r_b on LU also arises from z0 and (for CMAQ STAGE) LAI. However, as noted in our response to the first major comment above, in general the r_c term is the limiting factor of ozone deposition (since r_c for O_3 rarely drops to the level of r_a or r_b, the r_c term controls O_3 V_d). Therefore, the dependence of r_c on LU in the different schemes is the most important aspect of how LU impacts V_d. Sections 3.1, 3.4, 3.5, 3.6, 3.7 in Clifton et al. (2023) provide a documentation of the r_c formulations for the different schemes while Tables S5, S9, and S11 – S13 of that study list site-specific parameter values used in these formulations (a number of which are based on LU classification in the schemes' grid model implementation). Specifically, for the six dry deposition scheme grid model implementations analyzed in the current study, Clifton et al. (2023) provide detailed documentation of their r_c calculations as follows:

- *For WRF/Chem Wesely, see Equations 4 – 12 and Table S5 of Clifton et al. (2023) for details on the r_c calculation and the extent of its dependence on site-specific (at the point model level) or LU-dependent (in the grid model implementation) parameter values*
- *For GEM-MACH Wesely, see Equations 34 - 44 and Table S9 of Clifton et al. (2023) for details on the r_c calculation and the extent of its dependence on site-specific (at the point model level) or LU-dependent (in the grid model implementation) parameter values. In addition, also see Tables S1, S3-S4, and S6-S8 in Makar et al. (2018) for a listing of LU-dependent values for different parameters used in this deposition scheme. Note that the terminology for the different parameters is not fully consistent across these studies, with the Clifton et al. study introducing consistent parameters names across different schemes.*
- *For GEM-MACH Zhang, see Equations 45 - 75 and Table S11 of Clifton et al. (2023) for details on the r_c calculation and the extent of its dependence on site-specific (at the point model level) or LU-dependent (in the grid model implementation) parameter values*
- *For CMAQ M3Dry, see Equations 76 - 92 and Table S12 of Clifton et al. (2023) for details on the r_c calculation and the extent of its dependence on site-specific (at the point model level) or LU-dependent (in the grid model implementation) parameter values. In addition, also see Table 6 in Hogrefe et al. (2023) for a listing of LU-dependent values for minimum and maximum LAI and vegetation fraction as well as z0.*
- *For CMAQ STAGE, see Equations 93 – 100 and Table S13 of Clifton et al. (2023) for details on the r_c calculation and the extent of its dependence on site-specific (at the point model level) or LU-dependent (in the grid model implementation) parameter values. In addition, also see Table 6 in Hogrefe et al. (2023) for a listing of LU-dependent values for minimum and maximum LAI and vegetation fraction as well as z0.*
- *LOTOS-EUROS did not participate in the Clifton et al. point model intercomparison study.*

While we could create versions of Clifton et al. (2023) Tables S5, S9, S11, S12, and S13 for the grid model implementations as a function of LU rather than site, the divergence of specific parameters used across models detailed above would not provide much utility for interpreting grid model differences. For example, as shown in Clifton et al. (2023) Sections 3.1, and 3.4 – 3.7, the complexity of the stomatal resistance formulation varies significantly across models and correspondingly has different LU dependencies in the different implementations. In addition, the tables listing site-specific parameter values in Clifton et al. (2023) represent only a portion of the LU-dependent differences in the grid model implementations since some parameters (notably LAI) were prescribed at a given site in the point model intercomparison but can diverge across models even for a given LU type in the grid model implementation for the schemes that utilize this parameter. We therefore opted to not include such Tables in the revised manuscript.

Nonetheless, when considering the reviewer's comment, we created spatial maps of LAI for each of the eight simulations over the NA domain for January 15, April 15, July 15, and October 15, 2016 and tile plots of monthly mean LAI for each model organized by grid cells dominated by nine prevalent LU types. These Figures are shown below, and details on how each model generated these LAI fields are provided below these two Figures.


WRF/CMAQ (M3Dry) January 15
WRF/CMAQ (M3Dry) April 15
WRF/CMAQ (M3Dry) July 15
WRF/CMAQ (M3Dry) October 15
WRF/CMAQ (STAGE) January 15
WRF/CMAQ (STAGE) April 15
WRF/CMAQ (STAGE) July 15
WRF/CMAQ (STAGE) October 15
GEM-MACH (Base) January 15
GEM-MACH (Base) April 15
GEM-MACH (Base) July 15
GEM-MACH (Base) October 15
GEM-MACH (Zhang) January 15
GEM-MACH (Zhang) April 15
GEM-MACH (Zhang) July 15
GEM-MACH (Zhang) October 15
GEM-MACH (Ops) January 15
GEM-MACH (Ops) April 15
GEM-MACH (Ops) July 15
GEM-MACH (Ops) October 15
WRF-Chem (RIFS) January 15
WRF-Chem (RIFS) April 15
WRF-Chem (RIFS) July 15
WRF-Chem (RIFS) October 15
WRF-Chem (UPM) January 15
WRF-Chem (UPM) April 15
WRF-Chem (UPM) July 15
WRF-Chem (UPM) October 15
WRF-Chem (NCAR) January 15
WRF-Chem (NCAR) April 15
WRF-Chem (NCAR) July 15
WRF-Chem (NCAR) October 15
0.5
1
1.5
2
2.5
3
3.5
4
4.5



Both WRF/CMAQ (M3Dry) and WRF/CMAQ (STAGE) calculated LAI by interpolating between LU-dependent seasonal minimum and maximum values as a function of ground temperature. GEM-MACH (Ops) obtained LAI directly from LU-and-season-specific lookup table values, while GEM-MACH (Zhang) and GEM-MACH (Wesely) obtained grid-scale LAI from remote sensing data and then apportioned this value to specific LU types within each grid cell for the dry deposition calculations using land-use fractions and the LU-and-season-specific lookup table LAI values directly ingested by GEM-MACH (Ops). LAI in the WRF-Chem simulations was based on LU-and-month specific lookup table values and in the WRF-Chem (RIFS) and WRF-Chem (UPM) simulations was modified dynamically within the LSM following the approach described in Liu and Chen (2024, https://doi.org/10.1002/eco.2630*).*

As stated above, we ultimately decided not to include these LAI Figures in our revised manuscript because we believe the large divergence in how LAI effects are incorporated in the different models makes *it less useful to interpret V_d and effective conductance differences across models than a direct use of LU as a stratification criterion for the analysis presented in Section 3.2.*

Revised manuscript text:

Section 3.2 "Model-to-model differences in domain-average grid-aggregated V_d and pathway contributions may result not only from different process representations, but also different LU spatial distributions and/or LU-dependent parameter and variable choices. It is important to note that the impacts of LU on dry deposition calculations can be both direct (e.g. the incorporation of LU-dependent LAI in some schemes' stomatal and/or cuticular resistance formulations) and indirect and can also vary across schemes depending on the specific formulations of component resistances (Clifton et al., 2023). An example of indirect impacts of LU is the effect of LU-dependent LAI on the calculation of air temperature in the LSM and its subsequent impact on stomatal resistance even in schemes without a direct dependence of stomatal resistance on LAI. Another example is the effect of LU on the calculation of ground temperature and relative humidity in the LSM, which are then used in the formulation of cuticular resistance. Thus, examining LU specific parameters and variables (e.g., roughness length, LAI) and using them to interpret model to model differences in V_d and effective conductances is not straightforward, and untangling such direct and indirect effects across the different modeling systems is beyond the scope of the AQMEII4 grid model intercomparison activity. Instead AQMEII4 collected V_d and effective conductances for 16 standardized LU categories in addition to the grid-aggregated values analyzed above. These LU-specific fields allow us to investigate the total (both direct and indirect) impacts of LU-dependent process representations and LU distributions on modeled deposition by stratifying our analyses by LU. Put differently, in this Section we treat LU as a proxy for all LU-dependent processes and parameters, meaning that the dependence of model results on LU in this Section should be interpreted as being due to "all land-use-dependent quantities in the deposition algorithms used in AQMEII4 models."

Comment: p37, concerning "Data availability", I thought it was ACP policy to avoid such "available upon request" approaches, and instead to ensure data are available through zenodo or equivalent. This is always the better approach.

Response: We have made netCDF files with the gridded annual, monthly, and monthly median diurnal AQMEII4 model fields analyzed in this manuscript available on zenodo at … The full set of gridded AQMEII4 model fields at higher temporal resolution and diagnostic outputs for additional variables collected as part of AQMEII4 constitutes very large datasets on the order of terabytes that cannot be hosted permanently online with resources available to the authors. Access to this data also requires software and documentation for their interpretation and for processing from the storage format into netCDF format. For more information and access to AQMEII4 model outputs beyond the fields analyzed in this manuscript, interested readers are encouraged to contact the AQMEII4 co-leads Stefano Galmarini (stefano.galmarini@ec.europa.eu) and Christian Hogrefe (hogrefe.christian@epa.gov).

Modification to the manuscript text

"The gridded annual, monthly, and monthly median diurnal AQMEII4 model fields analyzed in this manuscript can be obtained as netCDF files from zenodo at https://doi.org/10.5281/zenodo.15127614. Gridded AQMEII4 model fields at higher temporal resolution and diagnostic outputs for additional variables collected as part of AQMEII4 constitute very large datasets (Tb), and their access requires software and documentation for their interpretation and for processing from the storage format into netCDF format. For more information and access to AQMEII4 model outputs beyond the fields analyzed in this manuscript, contact the AQMEII4 co-leads Stefano Galmarini (stefano.galmarini@ec.europa.eu) and Christian Hogrefe (hogrefe.christian@epa.gov)"

Minor comments

Comment: The abstract should mention the number of CTMs used in this study.

Response: This information has been added in the revised manuscript.

Comment: L27 and elsewhere. O_3 should have 3 as a subscript

Response: This has been corrected in the revised manuscript.

Comment: Table 1: Be more explicit with regard to the LU scheme, preferably with references. For example, which MODIS dataset? What is DEPAC. What is AQMEII4 LU? (This one is discussed above, but a reference would be appropriate in such a summary table.)

Response: The requested information has been added to Table 1 in the revised manuscript.

Comment: Connected to this, L457 states that the LOTOS/EUROS model uses the official LU data of the European Union, but that is not called DEPAC as given in Table 1.

Response: This statement has been clarified as follows in the revised manuscript:

Modification to the manuscript text: Here it should be noted that the LOTOS/EUROS and WRF-Chem (RIFS) dry deposition calculations indirectly used the CORINE dataset developed for Europe (https://land.copernicus.eu/pan-european/corine-land-cover/, last accessed May 2, 2025) by mapping the CORINE categories to the internal DEPAC categories in LOTOS/EUROS and to the USGS24 categories in WRF-Chem (RIFS). On the other hand, the WRF-Chem (UPM) dry deposition calculations relied on the global USGS24 dataset while WRF/CMAQ relied on the global MODIS dataset augmented by additional urban categories in the greater London area and mapped these to the AQMEII4 categories as shown in Table S1.

Comment: L94 and elsewhere. Define "Europe", and use a different acronym (e.g. EUR) unless you really mean the European Union (pre or post Brexit). Actually, define North America too. All of USA + Canada, or that domain shown in Fig. 1.

Response: In the revised manuscript, we changed the abbreviation for Europe to EUR and explicitly referred to Galmarini et al. (2021) and Figures 1 – 2 for the spatial extent of the analysis domains.

Comment: p13, Fig. 5. The colors in the legend should match those of the figure.

Response: We changed the color of the hashes in the legend from black to the color used to depict the different pathways. This was also updated in all other figures using the same color and legend scheme.

Comment: p19, and elsewhere. Again, the "effective conductance" term, but what is this?

Response: Please refer to our response to the second major comment.

Comment: In SI, is "Soil" really soil, or undergrowth?

Response: When labeling a pathway as "Soil" in the maps and bar charts depicting effective conductances, this indeed refers to the pathway representing deposition to soil as defined in the Wesely (1989) framework, though the exact representation of this pathway varies across models as documented *in Galmarini et al. (2021) and Clifton et al. (2023). Deposition to undergrowth such as twigs and barks (if implemented in a given scheme) is represented by the "lower canopy" pathway, again following the original Wesely (1989) framework. See Section 3 of Galmarini et al. (2021) for additional details on how this framework was used to define the dry deposition diagnostics collected for AQMEII4.*