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Interactive comment on "Synthetic ozone deposition and stomatal uptake at flux tower sites" *by* Jason A. Ducker et al.

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Ducker et al. (2018) find that their estimates of stomatal conductance suggest that the nonstomatal fraction of ozone dry deposition ranges from 4 to 32% across years at Harvard Forest and note that this is different from what Clifton et al. (2017) find (20 to 58%) (see Ducker et al. (2018) lines 318-323). Stomatal conductance estimates are critical for inferring the nonstomatal fraction of deposition as the nonstomatal conductance is calculated as a residual of the canopy conductance (inferred from ozone eddy covariance fluxes) and the stomatal conductance. Ducker et al. (2018) attribute the difference between our estimates of the year-to-year range in the nonstomatal fraction of deposition to their re-calibration of the water vapor fluxes used in the stomatal conductance estimate. First, I ask them to clarify whether their range of the nonstomatal

fraction is indeed comparable with mine. Second, I use the authors' stomatal conductance estimates (given in their supplementary material) to show below that their estimates of the nonstomatal fraction of deposition are similar to those given by Clifton et al. (2017). I recommend that the authors clarify their discussion of my previous work based on this finding.

First, it is unclear how Ducker et al. (2018) arrive at their reported 4-32% range. When I examine their Figure 5, the figure referenced for these numbers, I can infer the 4-32% range from the error bars, which the caption says represent one standard deviation across daily estimates. If the 4-32% range represents the standard deviation across daily estimates, then these numbers are not directly comparable to mine and the text should be revised accordingly. The 20-58% given in my paper represents the range in the summertime daytime mean nonstomatal conductance across yearly values, not the spread across daily values. If Ducker et al. (2018) actually calculate the mean nonstomatal conductance for each year to obtain their range of 4-32% to compare directly with Clifton et al. (2017), then their approach needs to be more clearly documented in the manuscript.

To investigate whether the re-calibration of water vapor fluxes leads to the differences in the fractions of stomatal (or nonstomatal) deposition in Ducker et al. (2018) vs. Clifton et al. (2017), I downloaded the authors' monthly mean stomatal conductance estimates given in their supplementary material. I divided their summertime (June-September) daytime mean stomatal conductance estimates at Harvard by my own estimates of canopy conductance (9am-4pm June-September for each year). My methods for inferring canopy conductance from the ozone eddy covariance flux measurements at Harvard Forest are described in Clifton et al. (2017), and are similar to those of Ducker et al. (2018). Inferring the canopy conductance depends on estimates of the resistances to turbulence and molecular diffusion. These resistances are typically relatively small during the summer daytime compared to the total resistance to deposition calculated from the ozone eddy covariance fluxes, so there should not be substantial differences between our estimates of canopy conductance. Dividing their stomatal conductance estimate by my estimate of canopy conductance suggests that summertime mean stomatal deposition varies from ~50 to 100% of the total deposition during 1993-2000. This corresponds to nonstomatal deposition varying from ~0 to 50% of the total ozone dry deposition from year to year (see Figure 1 below). This is wider than the range presented by Ducker et al. (2018) (i.e., 4-32%). Given the uncertainties in the measurements and differences in our approaches especially with respect to inferring stomatal conductance, I think it is fair to say that this range is similar to the range in Clifton et al. (2017) of 20-58%. My analysis here suggests that re-calibrated water vapor fluxes are not the root cause of the major differences in the ranges given by Ducker et al. (2018) vs. Clifton et al. (2017). Rather, it seems more likely that the differences reflect consideration of the spread in daily variability (Ducker et al., 2018) rather than the year-to-year range (Clifton et al., 2017).

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Figure 1. Summertime nonstomatal fraction of ozone dry deposition at Harvard Forest for 1993-2000. For the nonstomatal fraction shown in black I use the Ducker et al. (2018) stomatal conductance (gs) estimate and my estimate of canopy conductance (gc) from ozone eddy covariance flux observations. I average their monthly daytime gs (from SynFlux_nofill_day.csv) across June-September. My gc estimates are for June-September 9am-4pm; the methods are described in Clifton et al. (2017) and are similar to Ducker et al. (2018). For the nonstomatal fraction shown in yellow, I use the same estimate of gc as for the black line, but I use my estimate of gs (see Clifton et al. (2017)

methods). The ranges shown here are similar, suggesting that the much lower range of the nonstomatal fraction (4-32%) reported by Ducker et al. (2018) reflects their use of daily variations to infer interannual variability.

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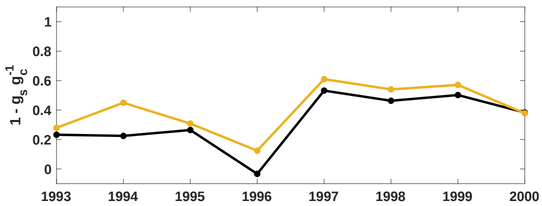

Fig. 1.