

Interactive
Comment

Interactive comment on “Disentangling the response of forest and grassland energy exchange to heatwaves under idealized land–atmosphere coupling” by C. C. van Heerwaarden and A. J. Teuling

Anonymous Referee #1

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I do not know papers that analyse crop sensitivity to VPD, though I am sure they exist. I was trying to guess what type of grassland could possibly be completely independent of VPD, and, if anything, drought resistant crops may be the answer. However, I do know studies that show that grass is sensitive to dry conditions. For example, in addition to some of the papers the authors cited in the response to my comments, Brilli et al (2011) AFM 151:1731–1740 shows that grass in Europe reduces ET and ET/VPD as soil dries (their figure 5) and that, while not very sensitive at wide range of conditions, grasses become extremely sensitive to dry conditions at very dry soil (their figure 6).

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I think that in ECMWF and other models, because grass sensitivity to VPD is low and because very low VPD is typically co-occurring with very dry shallow soil, the models are able to parameterize their transpiration reasonably well without explicitly assigning a VPD sensitivity to grass stomata conductance. I also want to point out that model parameterization is mostly affected by the common conditions and often produces poor results in extreme conditions so just because ECMWF does it, doesn't mean it is reasonable for your case.

Second, the most problematic part in your analysis is that you ignore soil moisture, but by not describing what it was in the observations, and by using it as the empirical fitting parameter in the virtual experiment rather than a prescribed environmental forcing. By making soil moisture 50% between saturated and wilting point (and regardless to my misinterpretation for what soil moisture it translates to, though you should explain that better) you in effect remove the stomata sensitivity to soil moisture, because at that soil moisture, stomata will not be limited by soil water supply. It is therefore trivial that in such conditions the grass stomata will stay open and transpiration will be high. However it is not reasonable that shallow (affecting grass) and deep soil moisture (affecting trees) will be the same and that both will be non-limiting during an extreme heatwave with low air VPD. A much larger focus should be given to what were the conditions, try and define the range of soil moistures that could lead to such an effect and quantifying how common these conditions are

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