Reply to Referee #1 interactive comment

We would like to thank Referee #1 for the constructive comments.

I only have one comment for one issue which I think the authors should consider. In the study I did not find any particular discussion related to the type of vegetation characterizing the AmeriFlux sites and its effect on the result. I think that vegetation type can be relatively important as for example grass roots are shallower with respect to tree and shrub roots and thus can exert potential different effects both on the coupling strength between the soil moisture profile (surface vs. root zone) and on the transpiration flux itself also considering that transpiration is the dominant pathway for the total evapotranspiration and is estimated to account for two-thirds of global land ET based on flux tower measurements (Schlesinger and Jasechko,2014). Based on that the authors should provide at least a discussion on the potential effects of the vegetation type on the presented results.

Thank you for the comments. In order to minimize the effect of different root depths from different vegetation types on NMI(θ_S, fPET) and NMI(θ_V, fPET), we used exponential filter to extrapolate θ to a unified 40 cm bottom layer depth and find that the overall fPET information contained in θ_S is slightly higher than that of θ_V. However, the difference between NMI(θ_S, fPET) and NMI(θ_V, fPET) diminishes when using different methods for calculating θ_V using AmeriFlux observations.

The revised manuscript will contain significant new discussion regarding the role of vegetation on key results. In particular, Fig. 4 has been newly expanded to better isolate the impact of vegetation type and the role of vegetation types is now directly addressed via new text appearing in Section 3.3 of the revised manuscript.

Furthermore, we showed the result of NMI(θ_S, fPET)/NMI(θ_V, fPET) ratio as a function of vegetation type in Fig. A1. The conclusion that the overall fPET information contained in θ_S is slightly higher than that of θ_V does not vary with vegetation types, although NMI(θ_S, fPET) is much higher than NMI(θ_V, fPET) in open shrubland and woody savannas.

For the rest comments annotated in the manuscript:

1. P6 Line 141. *Ac* and *As* not defined

We've made the following revision in Section 2.2 to clearly defined *Ac* and *As*:

"Based on V_{max}, photosynthesis rates per unit LAI including carboxylase-limited (Rubisco limited, denoted by A_C) type and export-limited (for C3 plants, denoted by A_S) type are calculated respectively."

2. P9 Line 211-215. Maybe a statement to point to section 3.1 is necessary here.

As suggested, we've added a statement to directly point to results starting from Section 3.1:

"Therefore the comparison of NMI(θ_S, fPET) and NMI(θ_V, fPET) is conducted using NMI(θ_S, fPET)/NMI (θ_V, fPET) ration throughout this paper."

3. P9 Line 222. Is it for Case I?

Yes, the "vertically-integrated (0–40 cm) soil moisture" is estimated from Case I. We've also clarified this in Section 3.1:

"…i.e., the relative magnitude of fPET information contained in surface soil moisture and vertically-integrated (0–40 cm) soil moisture estimated from Case I…"

4. P14 Line 287. Even though the sample size is small it would be nice to have also similar plots and the plots above for different vegetation type.

As suggested, we've revised Fig. 4 so that samples are plotted separately according to their vegetation types. With varying magnitudes, the overall overestimation of GLEAM is observed across different vegetation types.

5. P14 Line 291-294. This trend is not really evident. I see an evident increasing ratio only when AI approaches to zero. Maybe a statistical significance of this trend should analyzed.

As suggested, we've added a statistical significance of this trend. Indeed, the increasing trend of NMI(θ_S, fPET)/NMI(θ_V, fPET) ratio is more evident for CLSM and AmeriFlux, with moderate goodness of fit (0.28 and 0.13 respectively). We've also clarified this in Section 3.4:

"With increasing AI, there is a decreasing trend in surface and vertically integrated θ/ET coupling within all three simulations, with high goodness of fit above 0.5 (figure not shown). However, the NMI(θ_S, fPET) / NMI(θ_V, fPET) ratio is evidently increasing only for CLSM and AmeriFlux when AI approaches 0 [-], with moderate goodness of fit (0.28 and 0.13 respectively)."

6. P15 Line 315. This can also depend upon the vegetation type as grass and trees are characterized by different root depths. They can exert a different effects on the coupling between soil moisture and evapotranspiration.

Thank you for the comments. This concern of different root depths impact is addressed by applying different methods to retrieve vertically integrated θ as we stated in Section 2.1. The entire analysis is based on default case I that exponentially filter θ to a unified 40 cm bottom layer depth and find that the overall fPET information contained in θ_S is slightly higher than that of θ_V. However, the difference between NMI(θ_S, fPET) and NMI(θ_V, fPET) is less obvious when using different methods for calculating θ_V using AmeriFlux observations.

In addition, we showed the result of NMI(θ_S, fPET)/NMI(θ_V, fPET) ratio as a function of vegetation type in Fig. A1. The conclusion that the overall fPET information contained in θ_S is slightly higher than that of θ_V does not vary with vegetation types, although NMI(θ_S, fPET) is obviously higher than NMI(θ_V, fPET) in open shrubland and woody savannas.