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Comment on acp-2021-40

Anonymous Referee #1

Referee comment on "Observations of aerosol–vapor pressure deficit–evaporative fraction coupling over India" by Chandan Sarangi et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-40-RC1, 2021

This manuscript addresses modeling aspects of plant atmosphere coupling and the role aerosols might play in it, with a focus on situations during the onset of the Indian summer monsoon.

This is not a mechanistic study and thus has to rely on covariances. For doing this, it makes use if three typical situations that are classified by the variations of aerosol concentrations and temperatures.

While I think this is generally a valid idea and could work, I also see a considerable amount of uncertainties and unclear definitions which reduce the validity.

First, the examples are not so well chosen. In Fig. 1, the differerence in AOD variation during the HALT period and the LAHT period is not clear. The distance between AOD minimum and AOD maximum during both periods is almost the same, just the mean trend is different (decreasing during HALT; increasing during LAHT). Why is the fourth possible scenario (LALT), not mentioned, would it support the conclusions?

Also, plants have different water strategies which particularly determines their response to vpd. Isohydric plants readily reduce stomatal aperture with increasing vpd, as it is assumed here. However, anisohydric plants tend to keep stomata open, some of them to the extent that they (nearly) become wilty, for the benefit of keeping up CO2 uptake and photosynthesis. What kind of strategy did the plants on the respective grassland use? Details about species are not given, apart from a semi-natural grassland with different C4 grasses representative for grasslands of the region. C4 grasses may be isohydric or anisohydric (e.g., Jardine, Thomas & Osborne, Ecology and Evolution, 2021), bringing the transpiration /EF reaction to vpd and the conclusions drawn in the manuscript into question. This point is my major criticism, as it can question the whole approach, si it must be considered.

The manuscript is very difficult to read. It should include a table with explanations for the more than 30 abbreviations used. These are too many for keeping all in mind and going back to the first mention is impractical.

What is more, the manuscript lacks thorough definitions. The word ‘continuum‘ is used as ‚Aerosol-plant-temperature-EF continuum‘ (l. 36), as ‚‘land-atmosphere-energy balance continuum‘ (194), and as ‘aerosol-Tair-VPD-EF continuum‘ (l. 426). A thorough definition of a continuum would be something as the soil-plant-atmosphere continuum (SPAC), an established term in plant physiology, based on the water potential as a driving, unifying factor that determines the flow of water and water vapor, independent of the physical water status (Liquid water or water vapor). Maybe something like connection is meant here, but it is really difficult to guess.