

Comment on hess-2022-47

Anonymous Referee #2

Referee comment on "Spatiotemporal dynamics and interrelationship between soil moisture and groundwater over the Critical Zone Observatory in the Central Ganga plain, North India" by Saroj Kumar Dash and Rajiv Sinha, Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2022-47-RC2>, 2022

Based on multi-year observations of soil moisture and groundwater table at spatially distributed sites over an agriculture-driven critical zone observatory, the authors investigate the spatiotemporal dynamics of both variables, using a series of analysis methods (incl. EOF, random combination, temporal stability analysis, etc). Based on the findings of these analyses combined with stakeholders' surveys, some water management strategies were proposed. The paper is very well written, structured, and clear. Below please find some main concerns:

1. Although the analysis carried out is very convincing in terms of finding representative sites/wells for understanding the spatial mean of the CZO, it is however not clear how the human activities (irrigation/groundwater extraction) will impact such analysis. There were several places the author indicate some spatiotemporal patterns to irrigation and pre-monsoon, post-monsoon precipitations. However, this information cannot be explicitly found in the manuscript. Please the authors try to clarify this information and explain their potential impacts on their findings.
2. The satellite data SMAP was mentioned in the manuscript. However, there is no satellite SM data used in this study. This reviewer thinks this is a miss of the opportunity. It would be great to link the in-situ measurement to remote sensing data, as such, it is more operational in a sense to monitor the impact of water management strategies on soil moisture, or even groundwater storage change. It is understandable that for GW storage, the current GRACE product is too coarse. However, for SMAP soil moisture data, you do can find 1km and 3km resolution products. Also from Sentinel-1 SM, it is 1km. As such, this reviewer would encourage the author to include satellite data in their analysis.

Some minor comments as below:

- a. On page 10, line 230, this reviewer is wondering if you have the data about 'watering by farmers'?
- b. Page 10, line 234-235, this reviewer think this is only happening when the GW table is shallow, right? Please clarify and provide some more discussions on this.
- c. Line 265 'PC' should be 'EC'
- d. Line 338, it would be convenient for readers if equations were given.
- e. Line 344, these 'signals' should be marked out explicitly in Figure 9a
- f. Line 414, 'in compared to' should be 'in comparison to'