Legend

Reviewers' comments

Authors' responses

Direct quotes from the revised manuscript

Reply to Reviewers' comments (Reviewer#2)

Reviewer #2: This paper provides a useful dataset of estimated daily recharge per unit specific yield (RpSy) across 485 well locations in the US derived using the water table fluctuation method on daily groundwater table time series. Overall the paper seems to be a useful contribution, but I suggest that the following aspects are further considered before publication:

Response: We would like to thank the reviewer for their positive feedback and for recognizing the value of our dataset. We have carefully considered the suggestions made by the reviewer, and incorporated them to the best of our ability.

Reviewer #2: To understand interannual variations in recharge (Fig. 5) would it be useful to not just consider a timeseries plot, but also make scatter plots of drivers (PPpt, or Ppt-ET) and responses (recharge). This may help to better understand and quantify their linkages.

Response: We would like to thank the reviewer for their insightful suggestion regarding the analysis of interannual variations in recharge. Following the reviewer's suggestion, we have added the scatter plots in the supplementary information to illustrate the relationship between key drivers (e.g., Ppt or Ppt-ET) and RpSy, in addition to the timeseries plot. These new visualizations help to clarify and quantify the linkages between drivers and responses. Thank you for helping us improve the clarity of our analysis. We included in the supplementary file,

A plot of the normRpSy and normPpt in Figures 5a and S7a show that the inter-annual variation of normRpSy is much larger than precipitation fractions. This points to the ratio of recharge to precipitation being generally much higher in wetter years than in drier years. In contrast, the inter-annual variation of normRpSy is relatively muted with respect to (Ppt-ET), highlighting that the ratio of recharge to (Ppt-ET) is relatively smaller in wetter years than in drier years (Figures 5b and S7b). **[Page: 8, Line: 229-134]**

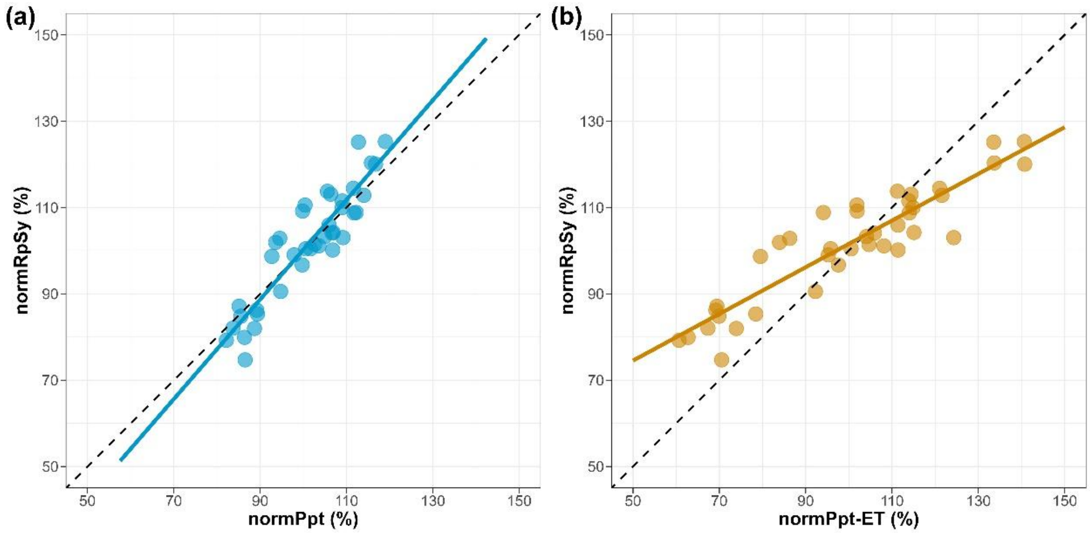

Figure S7: Scatter plot showing the variation between (a) normalized annual recharge (normRpSy) and precipitation (normPpt) shown using blue dots; (b) normalized annual recharge (normRpSy) and Ppt-ET (normPpt-ET) shown using orange dots.

Reviewer #2: In figure 4, panel a and d look completely identical but should be different. Check if an presentation error is made here.

Response: We appreciate the reviewer's note regarding Figure 4. Upon review, it was found that we inadvertently made a mistake during the production of the combined figure, by pasting identical figures in panels 4a and 4c. We are grateful to the reviewer for pointing this out, and we have since corrected the figure accordingly.

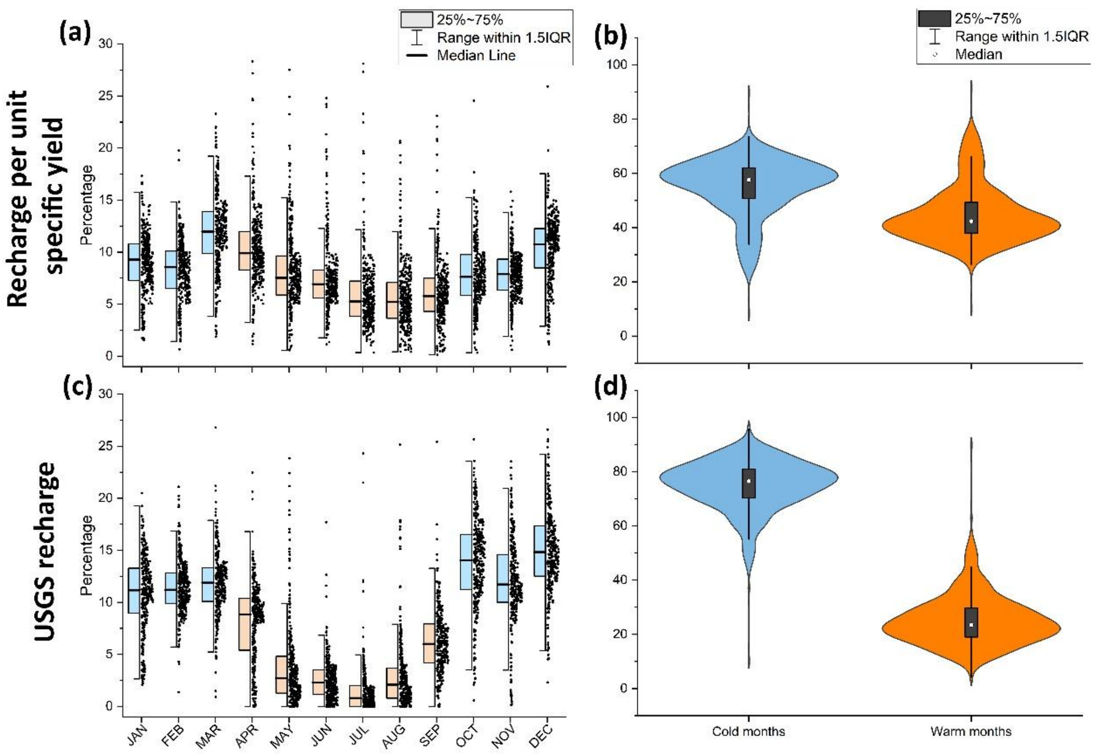

Figure 4: Fraction of recharge in different months and seasons (i.e., Cold seasons (Oct to Mar), Warm-season (Apr to Sept)) relative to the total recharge(/equivalents) for RpSy (top, a and b) and USGS (bottom, c, and d) recharge products. In this plot, USGS recharge data for the grids with RpSy estimates are used. IQR indicates the interquartile range.

Reviewer #2: the quality of all figures rather limited. For example, Figure 1: make the timeseries somewhat more readable (using a highjer resolution figure output and a slight change of line styles may help here. Please check all figure to potentially up the standard.

Response: We appreciate the feedback on figure quality. We have enhanced Figure 1 by enhancing the resolution and adjusting line styles to improve readability. Additionally, we have reviewed and made similar improvements across all figures (Figure 2, Figure 3, Figure 5, Figure 6) to meet higher standards.

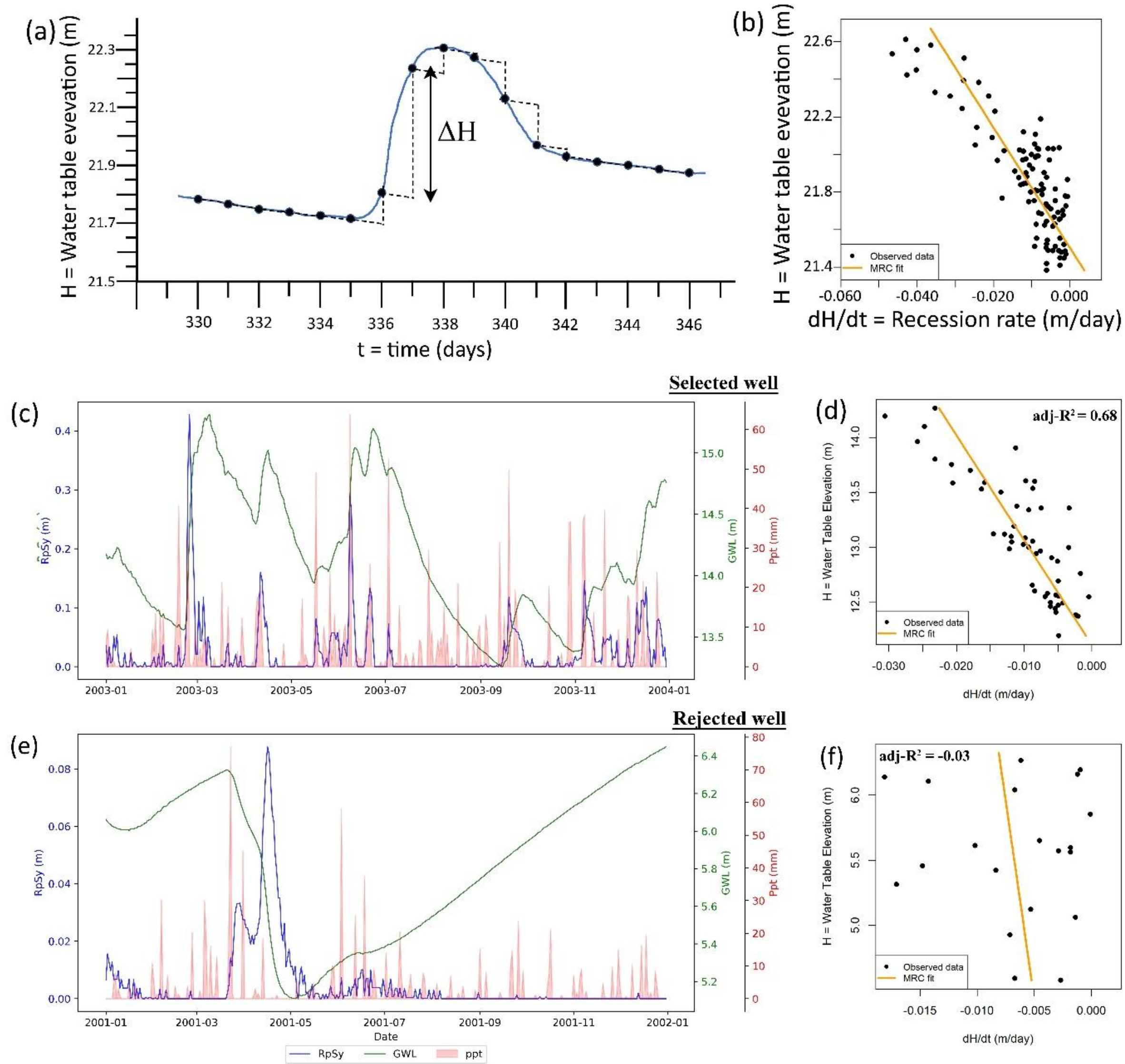

Figure 1: (a) Schematic representation of ΔH evaluation in the WTF method, which is then used to obtain daily groundwater recharge using Eqn 1, (b) a typical dH/dt vs. H plot used to derive the MRC. The hydrographs (c) and (e) show daily groundwater level (GWL), precipitation (Ppt), and estimated recharge per unit specific yield (RpSy, discussed later) for a selected and a rejected well,

respectively. Here, selection/rejection is based on representativeness of the MRC, which here is determined based on an adj-R2 value of 0.2. (d) and (f) show the dH/dt vs. H plot for the corresponding selected and rejected wells, respectively.

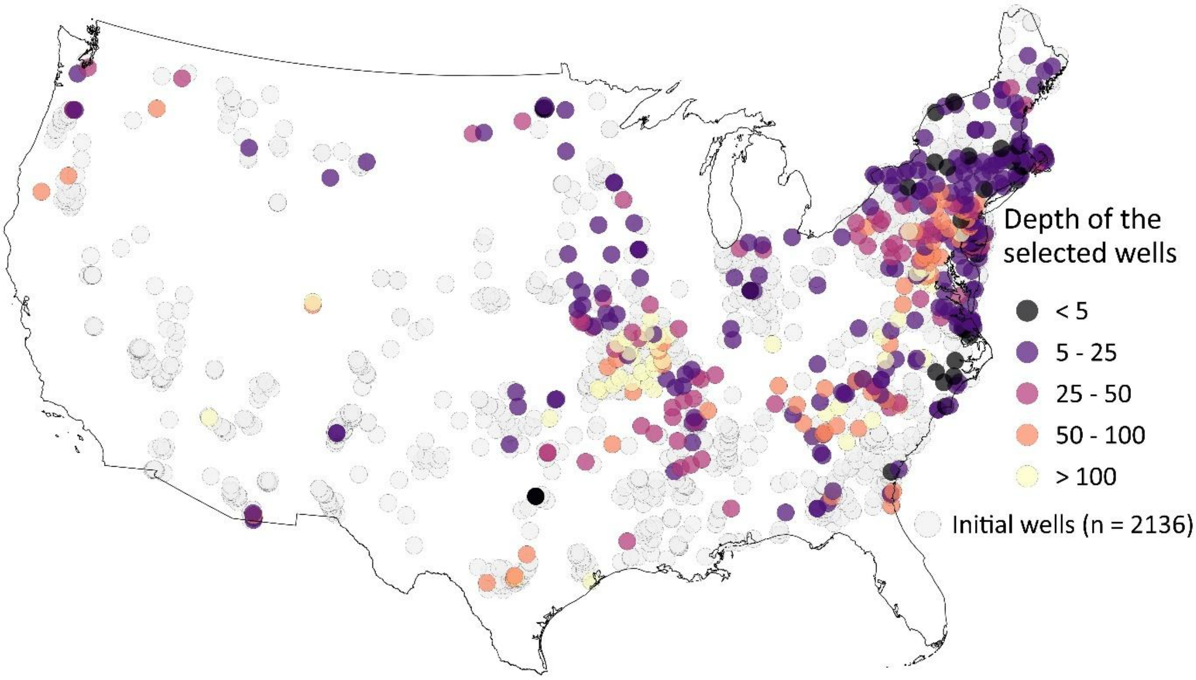

Figure 2: Location of all the available observation wells with (> 2 years) daily data and the final selected wells (shown in color) with their screen depths in meters.

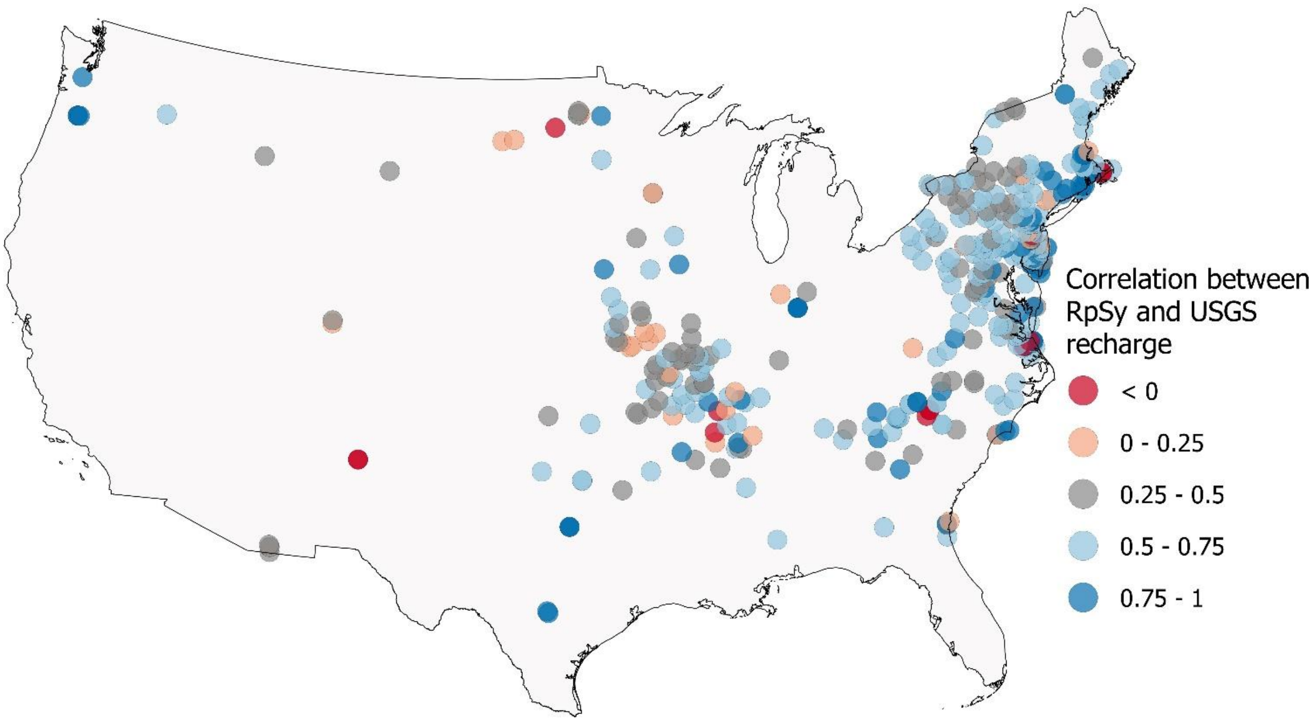

Figure 3: Spatial variation of temporal correlation between RpSy and USGS recharge.

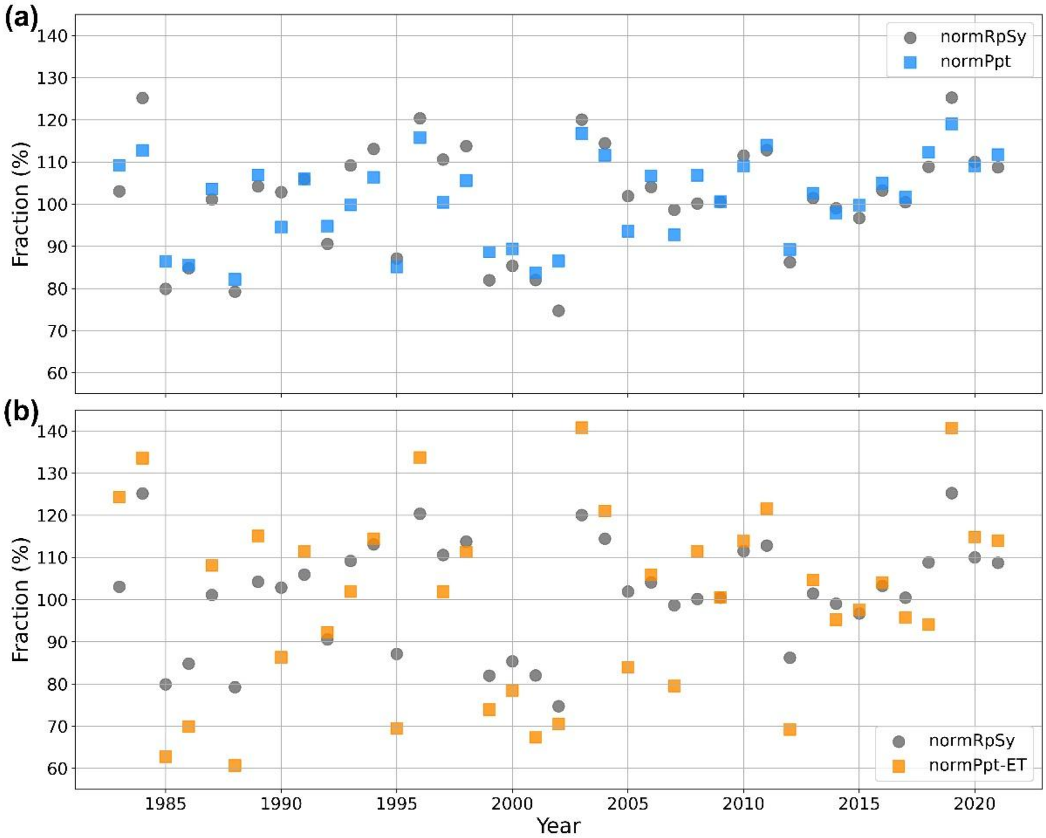

Figure 5: Inter-annual variation of normalized annual recharge (normRpSy, shown using grey solid dots), precipitation (normPpt, blue squares), and Ppt-ET (normPpt-ET, orange squares).

Reviewer #2: For the comparison of center of mass, please make more direct comparison of these datapoints than just maps. Also note that a "centroid" does not match "the date on which the cumulative value is half of the yearly total in a water year". A centroid represents the mean of a cumulative (recharge) distribution whereas the textual description would represent the date of that matches the median.

Response: For better clarity, in response to the reviewer's comment, we have edited the relevant text. Additionally, we added Fig. S9 that shows a direct comparison of centroidal dates for RpSy, Ppt, and Ppt-ET.

To assess the intra-annual variation of RpSy vis-à-vis Ppt and Ppt-ET, we evaluate the centroidal date, defined as the day of the water year corresponding to the center of mass of the daily mean time series averaged over multiple water years (a water year ranges from 1 October to 30 September). The centroidal date is calculated by first obtaining the mean cumulative daily time series of the variables (i.e., RpSy, Ppt, Ppt-ET) across all considered water years and then identifying the date on which the cumulative value is half of the water year total. We find that centroidal date for (Ppt-ET) < centroidal date of RpSy < centroidal date of Ppt (Figure 6, S9). The centroidal date of (Ppt-ET) < centroidal date of RpSy is likely due to a larger runoff ratio during the winter period. For example, for a shallow well in New Jersey, we notice centroidal date of (Ppt-ET) on 4 February, which is relatively earlier than the centroidal date of RpSy and Ppt, which are on 24 March and 5 April, respectively (Figure 6d). It is to be noted that an overestimation in ET (especially during winter) can lead to (Ppt-ET) centroidal date being earlier as well. The centroidal date of RpSy < centroidal date of Ppt is because of larger ET losses in summer. **[Page: 10, Line: 238-248].**

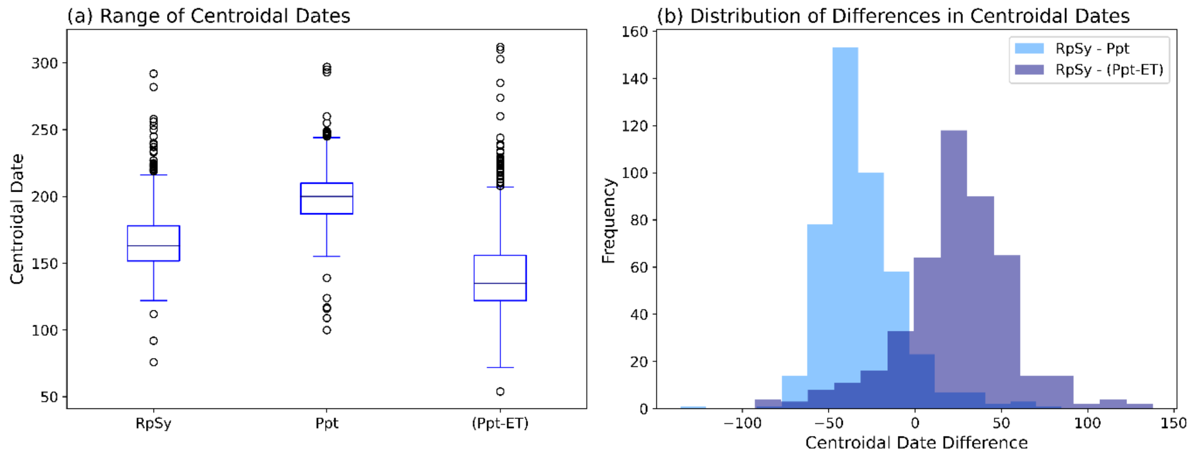

Figure S9: Variation of RpSy centroidal dates in comparison with Precipitation (Ppt) and Precipitation Minus Evapotranspiration (Ppt-ET) centroids for 485 locations. (a) the distribution of centroidal dates for RpSy, Ppt, and Ppt-ET; (b) Histogram of Centroidal Date Differences.

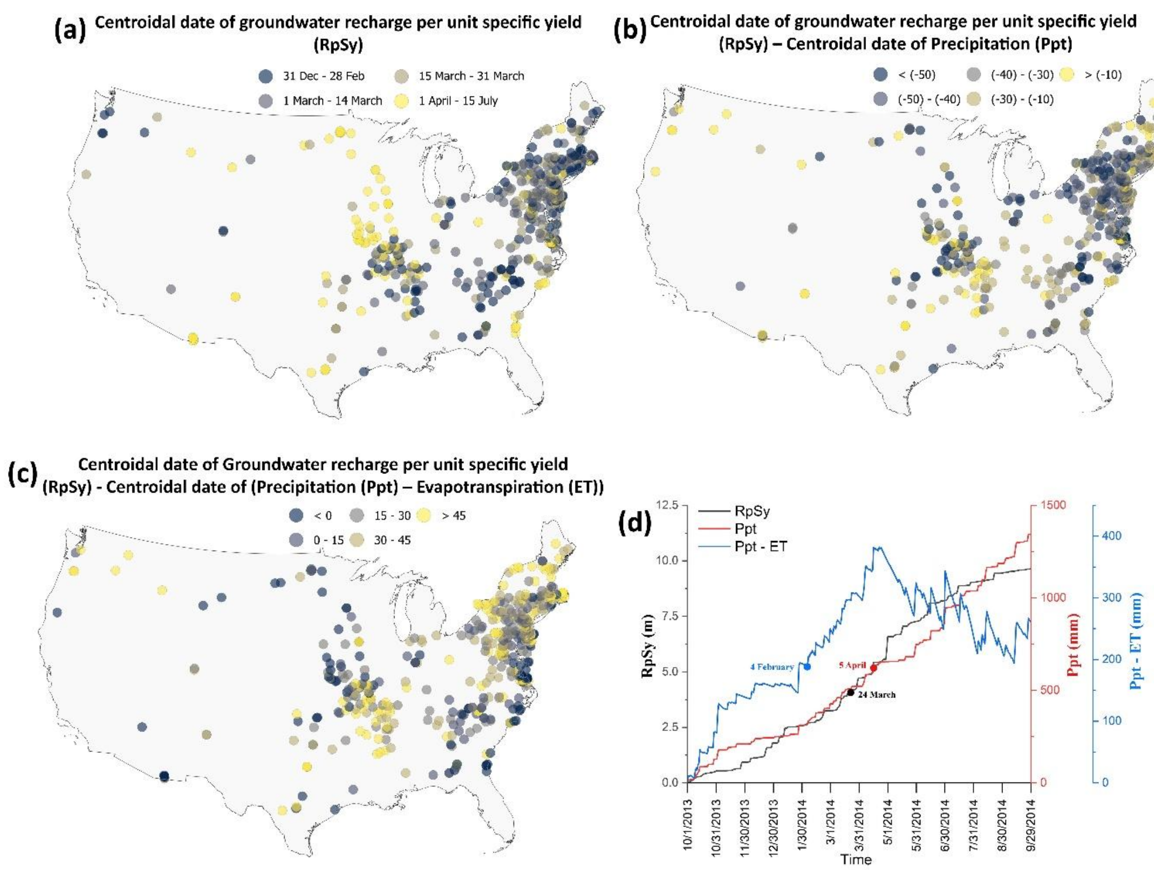

Figure 6: Centroidal date for RpSy (a). Distance between centroidal date of RpSy and Ppt (b), and (Ppt-ET) (c). A negative (positive) value indicates a later (earlier) centroidal date for the variable with respect to that of RpSy. Day 1 is the start of the water year, i.e., Oct. 1. Also shown in d is a

representative example of cumulative time series and corresponding estimated centroidal dates for a shallow well (Well ID: 400232074213201) in New Jersey.

Thank you for this valuable feedback, as it has allowed us to improve both our analysis and the clarity of our terminology in the manuscript.