Referee #1

I thank the authors for their thoughtful revisions and clarifications. The objectives, results, and conclusions are now more clearly presented, and the addition of a discussion section helps better contextualize the findings. The manuscript is substantially improved.

However, before recommending acceptance, I suggest a minor revision to improve the discussion of the method's limitations.

The current discussion of limitations remains somewhat superficial. For example, the authors mention line 496 that external factors, such as anthropogenic water use or land cover changes, could influence DRT estimates, and that uncertainties in data retrieval and processing exist. While these points are valid, they are presented quite briefly. A more reflective discussion of these limitations, including potential impacts on the linearity assumption and the overall reliability of DRT estimation, would provide a deeper understanding of the method's scope and constraints.

In particular, it would be helpful to briefly address:

• The role of unobserved hydrological fluxes, such as evapotranspiration and runoff, and how they might affect the relationship between precipitation and storage variations.

• The spatial scale mismatch: while precipitation data are aggregated to the GRACE resolution, a brief discussion of how differences in signal characteristics may still affect comparability would be useful.

• Regression behavior: The authors present a global map of β_1 values, which is informative, but further clarification is needed on how to interpret high values (e.g., >2 or >3). High β_1 values could indicate non-linearity in the precipitation-storage relationship or potential methodological issues, such as data noise or model misfit. A brief discussion on this would help assess the model's reliability and its applicability to different regions.

I am not requesting any new analysis, only a more explicit discussion of these points in the text.

Authors: We thank the reviewer for the constructive comments. In this revised version, we have substantially strengthened the limitations of the method section. We have revised the section as follows:

"While this study demonstrates the utility of DRT estimates derived from precipitation and GRACE/GRACE-FO TWSA data for evaluating global datasets, it is essential to discuss certain methodological and data-related limitations to appropriately contextualize the findings. First, we assumed a linear relationship between cdPA and dTWSA. However, this dynamic relationship may be disrupted by anthropogenic activities (e.g., groundwater extraction, dam construction, deforestation, and urbanization) as well as natural processes (e.g., evapotranspiration and runoff) which can modify the hydrological response independently of precipitation dynamics. These factors may delay the transfer of precipitation into storage components or reduce the volume ultimately contributing to storage. Second, uncertainties inherent to GRACE/GRACE-FO data processing and precipitation products, stemming from sensor characteristics or model parameterizations, may introduce noise or systematic biases

into DRT estimates and their consistency. Third, the simplified water balance framework assumes stable partitioning of precipitation into evapotranspiration and runoff. However, temporal variability in these processes, driven by factors such as temperature, vegetation dynamics, or soil moisture conditions, may weaken the cdPA and dTWSA relationship, particularly in energy-limited regions (e.g., high-evapotranspiration zones) or areas highly sensitive to runoff (e.g., snowmelt-dominated basins). Fourth, a spatial scale mismatch remains between datasets: GRACE/GRACE-FO's coarse spatial resolution smooths fine-scale TWS variability, while spatially aggregated precipitation data may obscure localized hydrometeorological events (e.g., intense convective rainfall), thereby affecting the precipitation–TWS relationship in regions characterized by complex topography or localized weather systems. Finally, the occurrence of high regression coefficients ($\beta_1 > 2$) highlights the sensitivity of storage changes to precipitation inputs and suggests the presence of unmodeled nonlinearities or time lags in the hydrological response. The high β_1 values, indicating rapid precipitation removal via runoff or evapotranspiration, may reflect limitations in the linear model's ability to capture delayed storage responses or nonlinearities in specific hydrological regimes. Despite these limitations, this study provides a valuable framework for assessing global precipitation and TWS products via the hydrological drought characteristics."