

Interactive comment on “Examining regional groundwater-surface water dynamics using an integrated hydrologic model of the San Joaquin River basin” by J. M. Gilbert and R. M. Maxwell

Anonymous Referee #1

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Gilbert and Maxwell provide an interesting study on a regional hydrologic model over large parts of California from groundwater to land surface. New class of models is applied trying to close the simulated hydrologic cycle in an integrated way. This is technically very advanced. Because the model does not include human water use, the results are interpreted as pre-development. Thus, they are difficult to verify with observations. Nevertheless the authors make an attempt to check plausibility. In ensuing steps, analyses (water budgets, stream-aquifer interactions, etc.) are performed in order to extract system responses that are to a large degree basin specific but also general. It is this generality that authors should highlight more to let reader know, which results are transferable.

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The authors elaborate in detail the limitations in the comparison to observations, which have been impacted by water management practices and the lack of predevelopment gauge data as well as the influence of error prone atmospheric forcing. This is important. On the other hand, river discharge is not simulated explicitly as I understand, because no channel parameterization was used and the grid cells are 1km wide. Please discuss the potential impacts of this approximation on the comparison to available measurements in the context of infiltration and groundwater-surface interactions.

General comments

8, 1-10: Not sure if I understand. Why was snow accumulation/melt not taken into account. I was under impression that CLM-PF accounts for these processes (also section 4.3). 8, 13: Is there a reference for dry bias? 8, 32: I do not understand. Which NLDAS shortcoming exactly? 9, 6: data-drive? 9, 12: Could it also be that the model overestimates ET along river corridors, because of relatively coarse grid resolution? At 1km, river corridors can still not be resolved adequately. 10, 7-8: Seasonal variations recorded by GRACE are also influenced by anthropogenic impacts. Thus, GRACE and SJBM should not agree. 10, 20-30: Does this mean in turn that human impact cannot be determined from (GRACE) measurements since it is on the order of the error/uncertainty? 11, 12: Why is the unsaturated zone neglected? A figure might be useful. Figure 7: Plot change in storage on secondary axis. 12, 8-9: Remove, speculation. 12, 15.20: Please provide recharge estimates from other studies in the region. 13, 10-20: This is a useful analysis. What about structured heterogeneity in the aquifer. Could that also influence mountain block recharge? 16, 8-28: The interpretation of power spectra is overzealous. As authors pointed out, only one year of data are available. 16, 32: If the unsaturated zone serves as a filter between the saturated and unsaturated zone, why wasn't it included in the analysis?

The figures are of high quality. Please double check for typos.

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