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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Reconstructing the natural hydrology of the San Francisco Bay-Delta watershed" *by* P. Fox et al.

P. Fox et al.

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The authors appreciate the excellent review comments from the Referees. Our responses to each comment are shown below.

Responses to Referee #3 Comments

Comment 1. P3855, L22_23: The authors mentioned the effect of land use and forest management changes on the rim inflows. This effect is not considered in this study as explained in P3856, L3_6. If the water use in the Valley Floor is not the reason for the Delta outflow decline, then the rim inflows change might be the possible cause, assuming no significant changes in precipitation in the last 100 years. So it would be interesting to see the difference in rim inflows under "natural" condition and current

condition.

Response: The analysis suggests that Delta outflows under natural conditions were approximately equal to current Delta outflows, when controlled for climate. Therefore, Delta outflows have not declined, at least not to the extent suggested by previous research. The authors agree that changes in historical land use in the upper watersheds have impacted stream flows. However, these land use changes, which include changes in forest management, are much less dramatic than the clearance of natural vegetation from the valley floor. Consideration of how upper watershed land use changes have affected stream flows is important to understanding natural flows, but it is outside the scope of the present study.

Comment 2. A validation on the evapotranspiration estimation based on vegetation distribution would be helpful. The authors may compare the estimation results with the observed evapotranspiration in some other locations with similar vegetation distribution to see if they agree with each other.

Response: Validation of the evapotranspiration estimates can be found in Howes et al. (2015). In that work, the authors based evapotranspiration estimates on vegetation coefficients (Kv's) developed from actual evapotranspiration measurements for those vegetation types. The actual evapotranspiration was estimated using monthly Kv's and monthly grass reference evapotranspiration (locally measured). In the cases where vegetation evapotranspiration was rainfall dependent (such as rainfed grasslands and chaparral), the actual evapotranspiration was developed on a daily basis using a calibrated soil water balance model. Calibration of this model was based on measured evapotranspiration for those vegetation types. Finally, Howes et al. (2015) compared the estimated evapotranspiration for wetlands and riparian habitat to measured evapotranspiration using a surface energy balance with remote sensing data showing excellent agreement. Since this work is referenced in the manuscript, we do not propose any changes.

Comment 3. P3863, L5_6: “in Cases V and VI, the mix of rainfed perennial grasslands was varied based on the volume of rim inflow to the Sacramento and San Joaquin basins.” Could the authors explain more about this relationship and how you determine the vegetation distribution in Cases V and VI based on this relationship?

Response: We propose adding the following narratives to the revised manuscript:

“Vegetation areas in Case V are identical to Case I, except grassland areas not classified as vernal pools are assumed to be a mix of rainfed and perennial grasslands that vary from year to year based on the annual runoff volume as measured by the Eight River Index (CDWR 2013). Grassland areas are assumed to be perennial in the wettest year, rainfed in the driest year, and for all other years, the mix is assumed to vary linearly with annual runoff volume between the wettest year and the driest year.” “Vegetation areas in Case VI are identical to Case I, except vernal pools are assumed to be a mix of rainfed and perennial grassland. Aggregate grasslands are assumed to be perennial in the wettest year, rainfed in the driest year, and for all other years, the mix is assumed to vary linearly with annual runoff volume between the wettest year and the driest year.”

Comment 4. Could the authors discuss the results in Table 5?

Response: Results of the sensitivity analysis are summarized in Table 5. The discussion of results currently in the manuscript will be expanded.

Comment 5. P3867, L16_19: This statement is a little bit confusing, especially the part: “the unimpaired outflow calculation assumes that water use upstream of the Delta is limited to only Valley Floor precipitation.”

Response: Manuscript language will be revised to more clearly describe CDWR’s unimpaired flow calculation.

Comment 6. The abstract is a little bit too long.

Response: The abstract will be modified to reduce its overall word count.

Comment 7. The term ETo is defined as potential evapotranspiration (P3857, L20) and as grass reference evapotranspiration (P3858, L5). Maybe choose one.

Response: We will replace potential evapotranspiration with grass reference evapotranspiration in the manuscript.

Comment 8. P3861, L1: change “sensitively analysis” to “sensitivity analysis”; change “uncertainity” to “uncertainty”.

Response: The typographical errors identified by the reviewer will be corrected.

Comment 9. P3865, L24: the current water use level should be 31.9 billion m3/yr, as mentioned in P3865, L13.

Response: The typographical error identified by the reviewer will be corrected, i.e. 26.0 billion m3/yr will be changed to 31.9 billion m3/yr.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 12, 3847, 2015.