

Interactive comment on “Urbanization dramatically altered the water balances of a paddy field dominated basin in Southern China” by L. Hao et al.

L. Hao et al.

gesun@ncsu.edu

Received and published: 22 April 2015

Response to Review #1 by Hao et al.

Comments:

Manuscript review for hess-2015-12: “Urbanization Dramatically Altered the Water Balances of a Paddy Field Dominated Basin in Southern China” by Hao et al. The authors analyzed hydrologic responses to urbanization in a paddy dominated basin in southern China. The essence of those similar topics should reside in attribution analyses related to “what’s the most important impact factor and how to quantify its impact”.

C1210

Similar discussions in general extensively exist in literature already, and most of them rely on detailed observations or modeling approaches. I believe the methodology in attribution used in this study could be substantially improved, which would also enable their results to be more persuasive (see specific comments below). I would suggest a major revision of this manuscript before possible consideration in the publication of HESS.

Response: Based on the Reviewer’s suggestion, we have added a standard attribution study that intended to separate the individual contribution of climate change and variability or landuse/land cover change from the total observed changes (increase) in streamflow. We used two types of models, Climate Elasticity Model, and Rainfall-Runoff Model, to examine the sensitivity of streamflow changes in response to P and PET (CEM), and P (RRM). We found that P explained about 15% of the increase of streamflow while the 85% of streamflow increase was attributed to LULC. These additional attribution analyses were consistent with earlier findings using the mass balance method and further confirmed that the observed increase in streamflow during the past recent decade was most likely due to urbanization, a major factor influencing the hydrological changes in the study basin.

New analysis was added in Section 2.4 Line 194-225, and Section 3.5 Line 280-290.

Specific comments: 1) Line 18 of abstract, the expression of “water-dominated to a human-dominated landscape” is not accurate, paddy field is also “human dominated” to some extent, please modify.

Response: we modified the sentence as: “. . .an artificial wetland-dominated landscape to an urban land use- dominated one . . .”.

2) Necessary details of statistic methods and corresponding results (for instance, sen’s slope, DHR) should be provided. Response: we added the statistic methods and results. See line 166-175.

C1211

3) How reliable is the “Baseflow index program” in your case? The uncertainty will definitely jeopardize your results regarding to the changes of baseflow, please clarify.

Response: the method we used was standard baseflow separation method and was widely used in the literature. We added Figure 5 to provide more details about how to determine N.

We found the results on the significant increase in baseflow are consistent with other water table data from a several wells. We have added groundwater data to support our hypothesis (Figure 10). Thus, we believe our analysis results are reliable.

4) section 3.3, “our results showed that N. . . .”, please rephrase this paragraph which does not make evident sense to me. Response: We added a few sentences to better describe the uses of N number. See line 185-192.

5) section 3.3, “the increase in baseflow or low flow. . . as a result of groundwater management”. Section 4.2, “the large reduction in ET from paddy fields might overwhelmed. . .”. What do you think is the main factor that leads to the increasing trend of baseflow in your basin? I believe the authors need to elaborate their attribution analyses.

Response: Many factors may result in an increase in baseflow in an urban setting, such as an increase in groundwater recharge due to a reduction in ET, leaking from drinking water supply systems, reduction of groundwater pumping, or an increase in rainfall. In the study basin, we think it is more logical to attribute the baseflow increase to an increase in groundwater recharge due to reduction in ET as a result of paddy rice conversion to urban use. The detected rise of baseflow was consistent with water table data (Fig 10) that show a significant rising trend.

6) section 4.1, “a decrease in ET is normally. . .”. please explain.

Response: Thanks for pointing out the mistake. There was a typo in this sentence. Now the sentence reads as ‘A decrease in ET is normally caused by a decrease in P

C1212

and/or PET (Sun et al., 2005; Sun et al., 2011a, 2011b).

7) please check the basic usage of scientific terms in hydrology, such as , streamflow / runoff, and their units.

Response: Done. We used a consistent unit for streamflow (mm). We made sure that we used streamflow as a standard term to represent discharge at the watershed outlet demoted as Q.

8) what’s the temporal coverage of streamflow observation? I suggest tend analyses of all variables (e.g. streamflow, precipitation, ET, PET, baseflow, etc) should be framed within an overlapped time window.

Response: We have acquired streamflow data from the two hydrological monitoring stations. The annual data cover from 1986 to 2013. However, daily data for the ‘rainy season’ (May –Oct) are available only from 2002 to 2013. MODIS ET data are from 2000-2013. After we found a ‘break point’ for annual streamflow change around 2002, we focused our attribution study in two periods, the baseline 1986-2002, and second period 2003-2013 that experienced the most dramatic urbanization.

9) please swap the presenting orders of table 1 and table 2. Response: Done.

10) Fig 3 could be dropped off, since it is less relevant to the topic. Response: we would like to retain this Figure to show the increase in Temp. We add trend analysis for the recent period 1990-2013 to show the acceleration of warming and thus evaporative potnetial.

11) Words / expression should be revisited for the whole manuscript, to name a few: Line 10, P8, “are control”; Line 4, P16, “practices”, etc. Response: Corrected. We have one native English speaker review the entire manuscript for grammars.