Hydrol. Earth Syst. Sci. Discuss., 8, C5456–C5460, 2011
www.hydrol-earth-syst-sci-discuss.net/8/C5456/2011/

Hydrology and Earth System Sciences Discussions

Interactive comment on "The past and future changes of streamflow in Poyang Lake Basin, Southeastern China" *by* S. L. Sun et al.

Anonymous Referee #2

Received and published: 23 December 2011

Review: "The past and future changes of streamflow in Poyang Lake Basin, Southeastern China"

Hydrol. Earth Syst. Sci. Discuss, 8, 9395-9434, 2011 Doi:10.5194/hessd-8-9395-2011

The authors of "The past and future changes of streamflow in Poyang Lake Basin, Southeastern China" have developed a novel approach of building a statistical water balance model for four watersheds within the Poyang Basin. The water balance model has been calibrated utilizing observational data from weather stations within the watershed boundaries. The performance of the water balance model has been described with respect to streamflow in the basin. The authors have then characterized the contributions of climatic variables with observed changes over the past 40 years. Given

those changes and the driving climatic variables they have utilized projections of future climate to make assertions of streamflow in the 21st century.

Overall the novel approach of utilizing a statistical water balance model to attribute changes in runoff to the hydrometeorological drivers is a nice contribution to the field of climate change and hydrology. However, there are some areas which need significant considerations within the manuscript. First the language and communication can be improved significantly reducing reader uncertainty of meaning. Many aspects of attribution are based upon the analysis of linear trends from the observed period. Precipitation is known to have interannual to interdecadal cycles as does streamflow. How are these types of phenomena accounted for within the trend analysis presented. Why are linear trends presented for some hydrometeorological drivers (e.g. Table 4) but decadal variation is emphasized for streamflow (e.g. Table 3)? While there is significant amount of information provided with respect to the fitting / calibration / and validation of the water balance model for the retrospective period the analysis of climate change is not as well described and not enough information is provided to evaluate how this was accomplished and thus the discussion and conclusions drawn from that aspect of the study.

Additionally is setting up the motivation for the work presented the authors note “The influences of other climatic variables, such as radiation, wind speed, and vapor pressure, on water cycle have not been thoroughly studied. In this paper, the roles of various climatic variables in streamflow of Poyang Lake Basin, southeastern China were quantified using historical streamflow and climate data on the basis of water balance.” This reviewer feels that the work has not evaluated radiation, wind speed, nor vapor pressure impacts on the water balance. The information provided is almost exclusively focused on precipitation and evaporation. In fact later in the manuscript the authors note “Net radiation, actual vapor pressure, temperature and wind speed indirectly impact on streamflow through their roles in evaporation.” Thus only through net evpotranspiration is there any discussion of these other variables. This reviewer sug-

HESSD

8, C5456–C5460, 2011

gests the authors reevaluate motivation (which is well justified) focused on precipitation and evaporation.

Specific comments are presented below:

Suggest careful review of language. Three examples: (1) "The change of streamflow exhibited different characteristics the four watersheds exist different increasing trends during 1961 – 2000." This sentence is very difficult to interpret. (2) Introduction – "...natural variability of water resources is associated closely with climate change." Actually this is what the paper is exploring. I believe what the authors meant to say was "... natural variability of water resources is associated closely with natural climate variability." Not "change". (3) This is very confusing "As increase/decrease of temperature causes evaporation to increase/decrease, streamflow will correspondingly decreases/increases. However, when evaporation increases/decreases with decrease/increase in actual vapor pressure, streamflow will decrease/increase."

"... The global warming may even be speeded up in the future, consequently leading to an increase in both floods and droughts." -> not entirely accurate. IPCC 2007 indicated that climate change will increase probabilities of floods and droughts, but calling that "global warming" is not term of art.

Documentation needs to be improved about the climate scenarios assessed. The authors refer only to GCMs from a retrospective period and then three emissions scenarios. There is no documentation of why specific GCMs were used or selected nor how they were utilized (downscaled? bias corrected?) making it difficult to assess the quality of the methodology. The authors only refer the reader to Lawrence Livermore National Laboratory for GCM documentation. This is not sufficient as there are over a hundred runs of GCMs within the CMIP3 experiments.

In the development of the methodology the authors utilize the same variables with different meanings. "a" is used within the water balance model as well as the expression of a linear trend model. Suggest making variables unique.

HESSD

8, C5456–C5460, 2011

Equation 4- Mean water level of what? The lake? The river? Authors need to do more to express why this is appropriate. Isn't there soil moisture that stores water? Groundwater? Simple evaluation of a surface water level cannot possible account for storage.

The proposed methodologies are utilizing GCM information at what scale (2 degree) to calibrate their very fine scale expressions of water balance? Also is the bias correction implemented in Equation (9) documented within the literature? Seems like a very simplistic approach when trying to explain such a precise set of hydrologic variables. There are documented bias correction methodologies in the literature (e.g. Wood et al. 2002, 2004).

The authors have described the importance of all the hydrologic and weather phenomena that determine streamflow (including windspeed radiation etc. . .) however these variables are not coming out of GCMs. Therefore attribution statements which are expressed within equation (10) and subsequent discussion only focus on evaporation and precipitation. It is not clear how these are linked?

There is something confusing about the discussions of trends within 3.3 . Why would pan evaporation be going down as temperature increases in the ways described? Is a linear trend analysis really the right tool to evaluate these potential changes?

The discussion of the climate scenarios and associated impacts on streamflow with the largest increase being A1B followed by B1 and finally A2 appears to be more a reflection of GCM model choice a less a statement about anthropogenic forcings. At what look ahead period are these statements being made 2010 – 2050? 2050 – 2100?

I am not sure that assertions about future streamflow can be made upon the analysis provided, at least not within the information currently provided within the manuscript.

Many of the discussions and conclusions should be reevaluated after methodological questions have been resolved.

HESSD

8, C5456–C5460, 2011

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 8, 9395, 2011.

HESSD

8, C5456–C5460, 2011

Interactive Comment