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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Reconciling the dynamic relationship between climate variables and vegetation productivity into a hydrological model to improve streamflow prediction under climate change" *by* Z. K. Tesemma et al.

Anonymous Referee #1

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General Comments: The authors have attempted to tease out the influence of vegetation adaptation to drought and future climate change in order determine the impact evapotranspiration will have on the catchment water balance. The paper lacks some of the specifics needed to determine the impact of some significant assumption made in the downscaling of GCM output. Additionally, how these downscaled datasets were then applied to VIC needs elaborating. The paper focuses on deviations from 'mean' conditions for the majority of the result reporting, however runoff processes are often triggered by precipitation events on the edge of the distributions. Without further sta-

tistical analysis it is impossible to determine how significant the modeled results are. There is no discussion on the precipitation characteristics of the region, and how these characteristics are predicted to change, which arguably might have the greatest impact on the partitioning of precipitation.

Specific Comments: Pg 10598 "statistically downscaled using the delta change method" citations would be appropriate, Chen Fowler. . .

GCM output has known difficulties with regions of high relief. How different are the 4 grid cells chosen for this study from each other? The authors aim to capture a precipitation gradient across several catchments, is this possible given the granularity of the GCM output?

Pg 10599 downscaling precipitation has several pitfalls. In particular the 'wet bias' due to the size of the gcm grid cells. When averaging 4 cells, this problem will be exaggerated. Based on equation (3) and (4) I see no methodology to solve the 'a little rain all the time' problem.

There are no descriptive statistics examining the performance of the downscaling methodology. A validation/calibration test of the ability of the downscaling methodology to accurately capture the seasonality and the magnitude of precipitation is at the foundation of this study.

Pg 10600 What method was used for the calculation of PET? The calculation of future PET was undertaken by only varying temp and precipitation patterns. Vapor pressure deficit is a critical component to evapotranspiration and in this case is kept constant. Some sensitivity analysis of this assumption would put the readers at ease that the results obtained are not just a function of the assumptions made in the paper.

Pg 10601 What was the initial condition for each of these simulations? Was there a spin up time? Where the periods examined assumed to be stationary? Pg 10601 The VIC model is a critical part of this work, but little detail of the model setup is given.

What timestep, grid resolution etc were used? What PET method, infiltration scheme?

Pg 10603 “Most of the projected seasonal precipitation simulations showed a shift towards drier climates in all seasons except summer in both emission scenarios and periods. The variability in the projected mean monthly precipitation among climate models indicates great uncertainty but all climate models clearly deviated from the baseline period 20 (1981–2010), underlining the change signal (Fig. 3).”

Based on figure 3 I don’t see a ‘drying’ trend, the models seem to be split to me. I think just reporting the mean is not enough in this case. Perhaps a box plot or the standard deviations would help examine the change (same comment for tables 3 and 4).

Figure 5: Caption doesn’t explain the ‘proportion of LAI effect’

Pg 10608 “Projections of climate-induced vegetation dynamics and their hydrological impacts are influenced by various sources of uncertainties that arise from inputs from downscaled GCM outputs.” The authors discuss in depth the differences in means, however runoff processes in semi-arid catchments are rarely triggered by ‘mean’ conditions. There is no discussion on the precipitation characteristics of the regions (intensity, duration, interstorm) and how these are predicted to change. If interstorm periods are expected to increase, this will significantly alter the hydrologic fluxes even if the mean precipitation is maintained. Vegetation response to long dry periods would be more significant that response to changes in mean conditions.

There is no discussion of existing models that use a more sophisticated vegetation module to model these effects. A review of these models would be useful to readers.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 11, 10593, 2014.