**Hydrology and
Earth System
Sciences
Discussions**

## *Interactive comment on* "The impact of climate change on hydrological patterns in Czech headwater catchments" *by* A. Benčoková et al.

**Anonymous Referee #3**

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General comments This paper describes the impact of climate change on the water balance of 2 small forested catchments. The paper is well structured and presented with clear figures (confer specific comments below). Though the paper does not present novel concepts and methods, it provides valuable information on Czech headwater catchments. The English of the manuscript would benefit from the help of a native speaker. There is little information on the performance and sensitivity of the hydrological Brook90 model, particularly regarding high flow events (as the 1996 event) and the impact of temperature changes as simulated by the RCM. I have some concern on the Brook90 input data, which are used to calibrate the hydrological model (see comments on the derivation of global radiation and air temperature from the meteorological station). Some statements in the Discussion section are not well supported by the presented work like the comparison of "bias-correction" and the delta-change method, or

the statement on the importance of the GCM selection compared to emission scenarios or RCMs. Generally, I would replace "predicted" by "projected" or "simulated".

Section 2.1 (Site description) Please, add here information on the meteorological station (altitude, distance to the selected catchments). Besides, I would give mean air temperature and precipitation for the meteorological station (as these are measured values) rather than for the 2 catchments (there you apply inferred values and the way how you get these values is described later in the manuscript).

I would also describe the 2 runoff stations under this section.

Average runoff at Lysina (451 mm/yr) and Pluhův Bor (276 mm/yr) differs from the corresponding values given in Table 1.

Section 2.2 (Brook90 Model) Please, replace "... to simulate most land surfaces...." by "...designed to be applicable to any land surfaces...".

Is measured runoff really an input parameter of the Brook90 Model? I would expect streamflow to be one of the output parameters.

Section 2.3 (Input data) Line 20: Please, use "...daily precipitation" instead of "precipitation depth".

You apply an average temperature lapse rate of 0.65°C/100 m, which is ok for annual mean air temperature. However, lapse rates can have a pronounced seasonal variation reflecting the more stable conditions in winter and intensified convection in the warm season. I would also expect that lapse rates are lower for minimum temperatures. Did you check this?

Global radiation cannot simply be calculated from the "length of the daylight"! You may use sunshine duration (confer Trnka et al. 2005).

What about wind speed – do you use daily mean wind speed at the meteorological station?

Section 2.5 (RCM data) A description of the RCAO model under the PRUDENCE project is given in: Räisänen, J., Hansson, U., Ullersteig, A., Döscher, R., Graham, L.P., Jones, C., Meier, H.E.M., Samuelsson, P. and Willén, U. (2003) GCM driven simulations of recent and future climate with the Rossby Centre coupled atmosphere – Baltic Sea regional climate model RCAO. SMHI Reports Meteorology and Climatology 101, pp 61.

Page 1252, lines 2-5: What do you mean with "...the model emphasizes..."? And: "...the resulting changes of meteorological variables correspond with the east-west gradient across the Czech republic" – please, specify which variables, which gradients.

Line 17: "...were downloaded from the web-page of the PRUDENCE project..." (http://prudence.dmi.dk)

Lines 22-23: Resolution of PRUDENCE grids was 0.44° (not 50X50 km). I suggest to use "scenario period" instead of "predicted period".

Sections 2.6 and 3.2 I would merge both sections under Chapter 2. The text of Section 3.2 could be shortened and replaced by Figures demonstrating the effect of the "bias-correction".

Section 2.6 You refer to 3 papers applying different methods of "bias-correction" – please, describe the method you have applied in more detail.

Section 3.1 (Model performance) I would skip Fig. 2 – the major information is already given in the text.

Sections 3.3 – 3.6 Reading these sections has left me quite confused with all the numbers, percentage changes, etc. Maybe a different arrangement of your results could help the reader to catch the major topics and results of these sections. I suggest to discuss the 2 catchments separately and to change the figures accordingly, i.e. show – separately for each catchment – percentage change of precipitation, runoff and evaporation (with the same scale for each component of the water balance). The current

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figures 5-7 show the distinct components at both catchments – this is not supported by the text, as you do not focus on the different behaviour of the 2 catchments.

Simulated daily discharge (page 1259, line 10): it would be helpful to show a cumulative frequency distribution of present day and simulated future daily discharge.

Section 4 (Discussion) I do not agree with your statement on bias-correction ("... more consistent with RCMs than ...the delta-change method"), which is based on the experiences of Lenderink et al. (2007). The authors applied a very simple form of the delta-change. A more sophisticated form of the delta-change method may cause different results (as Lenderink et al. state in their paper). Here, I would not enter the discussion on advantages and shortcomings of bias-correction and delta-change – you have only applied one form of "bias-correction".

What do you mean with the second paragraph?

Page 1262, line 26: What do you mean with the "redistribution of precipitation" - that runoff is sensitive to changes in the seasonality of precipitation?

Page 1263, line 29: (Déqué et al., 2007) instead of (Déqué, 2007)

In view of the uncertainty in the overall modelling I would refrain from giving exact percentage changes in the discussion (like 11%, 19% etc.).

Figures and Tables Figure captions of Fig. 4-7 should be altered: "Percentage change in monthly precipitation, etc. " Table 1: Considering the long-term water balance, precipitation exceeds the sum of evapotranspiration and runoff by 70 – 110 mm/yr. How do you explain this difference, is it storage, deep seep, etc? Figure 1: What does 37-47 mean? Number of Prudence grids?

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