

Interactive comment on “Uncertainties in climate change projections and regional downscaling: implications for water resources management” by W. Buytaert et al.

Anonymous Referee #1

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Summary

The paper evaluates the value of high resolution RCM data for the Andes region compared to GCM data. With the delta method change factors are applied to the observed climate data to obtain climate data for the future period 2070-2099. In a first analysis this method is applied to an ensemble of IPCC-AR4 GCMs and performance is evaluated by the agreement amongst the ensemble of models on absolute quantities and projected changes. For precipitation there is a larger inter-model uncertainty over the Andes.

In a second analysis the performance for the RCM PRECIS is compared to the per-

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formance of its driving RCM HadAM3p. Model derived mean precipitation fields are compared with the CRU climatology. Results show that the RCM data provide an increased spatial variability. However, over the Andes region biases for PRECIS are comparable to, or large than, biases for HadAM3p.

In a last analysis runoff is calculated from the climate model data, the largest source of uncertainty in the future projections originate from the climate model ensemble. The full range of projected changes bracket the current hydrological conditions, not giving an indication on direction of change. The author concludes that from the current climate projections one can only retrieve that the uncertainty is large and water management should focus on robust and adaptive strategies to be able to cope with the full range of projections.

General comments

The paper is clearly written and the relevance of the study is extensively stated. Although the performance of RCMs has been evaluated before, even for larger ensembles of RCMs, the uniqueness of the Andes region and its complex orography is more challenging. Furthermore only a few studies on this topic exist for South-America. Therefore this study is of relevance to HESS.

The following points still need to be addressed:

1. PRECIS and HadAM3p precipitation is compared with the CRU climatology. As stated in the paper, the quality of the CRU climatology might be less for complex mountainous regions like the Andes. The authors generated precipitation fields from time series of rain gauges in the area to apply the Delta method to. Why isn't the PRECIS precipitation validated against these precipitation fields obtained from local rain gauges. Although much effort has been made to create the best possible climatology with the CRU climatology, the focus was not specifically on the Andes and the authors might be able to derive a better local precipitation climatology themselves. It would be interesting to see the results of this comparison.

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2. This point is related to point one. To my opinion figure 5 does not show any outstanding behavior for the PRECIS model. Especially over the east side of the Andes biases are worse than for HadAM3p, as the author also states in the paper. Are these biases the same when comparing with the from rain gauges data derived precipitation fields?

3. The first sentence of section 4.3 is too positive about the PRECIS performance, especially because the focus of this study is on the Andes.

4. Line 9, 10 and 11 on page 1834 state that: “the largest share of uncertainty in future projections results indeed from the climate model ensemble, highlighting the importance of improved downscaling.” I don not agree with the author on this statement. To my opinion, keeping in mind the large bias and spread in precipitation between the different GCMs, uncertainty from the climate model ensemble could better be reduced by improving the GCMs or applying some form of bias-correction to the precipitation data of GCMs. I have the same objections against line 16 and 17 on page 1837 “results suggest that the resolution at which PRECIS was implemented is insufficient”. Please adjust or provide a more extended / better motivation.

Minor comments:

1: page 1823, line 10-11: “Due to the limitations in the understanding of local climate processes GCMs are typically run on grid cells with a size of several kilometers.” Is this true? I think it is even harder to implement the knowledge we have with the low resolution of GCMs.

2: page 1823, line 18: sentence incorrect “are also are”.

3: page 1823, line 20: “ban” should be can.

4: page 1828, line 6: “This model is” which model, PRECIS or HadAM3p?

5: page 1830, line 16 and line 18: It is not clear whether the thresholds in these sentences refer to the same threshold.

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