Hydrol. Earth Syst. Sci. Discuss., 7, C930–C934, 2010
www.hydrol-earth-syst-sci-discuss.net/7/C930/2010/

Hydrology and Earth System Sciences Discussions

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

W. Buytaert et al.

w.buytaert@imperial.ac.uk

Received and published: 24 May 2010

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

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to see the results of this comparison.

We agree, and therefore during the study we did a comparison of PRECIS with other precipitation products, i.e. the worldclim interpolated climatology (Hijmans et al., 2005) and the recent TRMM 2A25 climatology (Nesbitt and Anders, 2009). Worldclim is based on field stations and is therefore very similar to CRU. However, the number of incorporated field datasets for the Andes was higher in worldclim. Also, a different interpolation algorithm was used which includes altitude as co-variable, and may improve the interpolation over mountain regions such as the Andes. TRMM is an independent, remotely sensed dataset, but its accuracy, particularly over mountain regions with a frequent occurrence of convective precipitation, is questionable. Additionally, the time periods of the model and the TRMM dataset do not match, as TRMM is only available from 1998 onwards. As Fig. 1 in this comment shows, very little difference can be observed between a PRECIS evaluation with CRU and worldclim, and there is a slightly higher difference with TRMM. We decided not to include this figure in the final paper due to the limitations of the TRMM dataset and the minor differences that we observed.

With regard to the derivation of a local precipitation climatology: this would surely be the best option, but unfortunately we do not have access to quality assessed data for the entire study region (Ecuador). They are only available at a high cost from local institutes (and often in a non-digitized format). It may be possible to derive a local climatology with publicly available data such as the Global Historical Climatology Network but these are far less abundant than the data used for worldclim, so there seems to be little point in doing so.

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?

Yes they are the same, at least when comparing to worldclim and TRMM - see re-

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sponse above and included figure 1.

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.

We will change this sentence to: “In the previous section we analyzed whether regional climate models can improve the representation of local precipitation patterns under certain conditions...”

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.

We agree that improving GCMs is worth pursuing. However, we have shown in our study that a resolution of 50 km, which is the resolution at which PRECIS has been run in this area, seem to be insufficient to capture the high spatial gradients of precipitation processes in the Andes. Hence, it is unlikely that global models can be sufficiently improved to be run at high enough a resolution in the near future to provide good predictions over the Andes.

We are more sceptical about bias correction, which is very much an ad-hoc method that may be inconsistent with the physics of climate models. It will also not resolve local gradients. Therefore, we would argue that a nested approach has more potential. This of course can only be resolved by further research, and we are happy to improve our argumentation in the paper.

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The minor comments will be addressed.

references

Hijmans, R.J., Cameron S.J., Parra, J.L., Jones, P.G., Jarvis., A. Very High Resolution Interpolated Climate Surfaces For Global Land Areas. International Journal of Climatology 25: 1965-1978, 2005.

Nesbitt, S.W., Anders, A.M., Very high resolution precipitation climatologies from the Tropical Rainfall Measuring Mission precipitation radar. Geophysical Research Letters 36: L15815, 2009.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 7, 1821, 2010.

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Interactive Comment

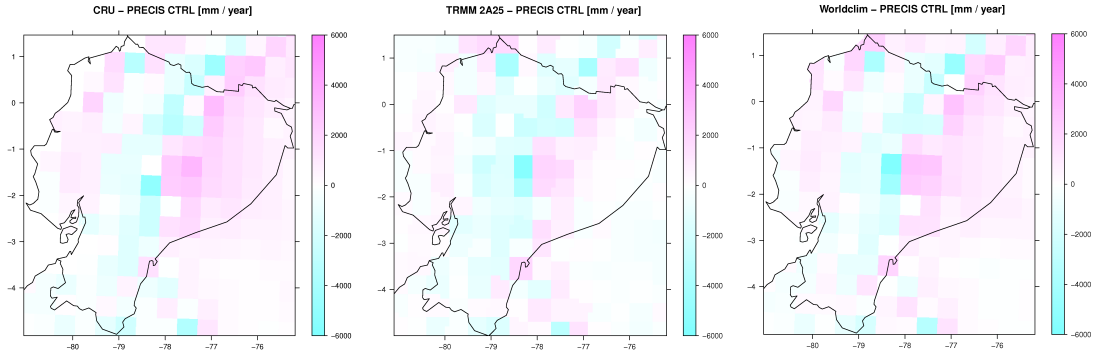

Fig. 1. Difference between simulated precipitation (PRECIS) and different observed precipitation datasets for the control period.

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