Geosci. Model Dev. Discuss., 4, C282–C284, 2011
www.geosci-model-dev-discuss.net/4/C282/2011/

Geoscientific Model Development Discussions

Interactive comment on "A pragmatic approach for the downscaling and bias correction of regional climate simulations – evaluation in hydrological modeling" *by* T. Marke et al.

Anonymous Referee #2

Received and published: 22 May 2011

This study describes a statistical method for downscaling climate model fields and presents an application to a hydrometeorological chain including emulation with a regional climate model (MM5) and a distributed hydrological model. The approach presented, while simple, is for this reason also of wide applicability. The paper is well structured, clearly written and the application presented permits to evaluate the usefulness of the method.

This said, the paper contains a few points which in my opinion require clarification and which, if addressed in the text, could possibly improve its value:

1) The method is based on the availability of a high resolution climatology for the area

of study and depends crucially on the quality of this climatology. For the case study this quality appears quite high but this may not be so for other areas. A more detailed presentation of the high-resolution climatology used would be useful, together with a short discussion of the applicability of the method when fewer observations are available (it is conceivable that for areas not well covered by observations, the applied methodology may lead to no or negative improvement in the results of the hydrometeorological chain.) In particular, figure 4 presents the downscaling function used to downscale temperature, which is rich in detail, conceivably because the PROMET preprocessor uses orographic information. It would be interesting to present also the downscaling function for precipitation (obviously the most important variable for determining the daily discharges presented in fig. 5), which, being based on observations from measurement stations will be probably less detailed.

2) The application and verification of the model presented are 'in-sample': both the observation climatology and model verification are computed on the same time period (1970-2000) and using the same measurement sites. Long-term variability in the climatology combined with the particular period used to define the climatology or insufficient spatial coverage of the measurement stations could worsen the effectiveness of the method when applied out of sample for future scenarios. Both issues could be explored for example by splitting in two the observational period or the measurement stations and using one half for defining the climatology and the other half for validation.

3) The paper actually presents two different methods: one where a multiplicative and another where an additive correction is used. The latter is used only for temperature, the former for other variables (precipitation, wind speed, humidity). It would be good to discuss more in detail which method should be chosen for a particular variable. One observation is the following: the two alternative methods correct actually different aspects of the statistics of the field on the fine grid. While an additive correction is only able to adjust the temporal mean at each gridpoint of the small-scale interpolated field, the multiplicative correction will change also its higher moments in time, in

particular variance. For variables which are positive definite and have an exponential-like distribution, like precipitation, a multiplicative correction will change both mean and variance in time. The difference will be important for the statistics of extremes in the downscaled fields and for the applicability of the method also for downscaling on small basins. There may exist also physical reasons for preferring one method to another: while for precipitation small scale variability may be introduced by multiplicative processes, small scale variability of temperature is more related to additive processes such addition of the lapse-rate correction due to orography. - Note: the paper often mentions the term 'variability': it would be better to distinguish clearly when variability (i.e. variance) in space and when variability in time is meant.

4) Other details:

- The authors verify the hydrometeorological chain for a very large basin. While the applicability of the method for smaller basins can be clearly the subject of other studies, it would be interesting to at least address this issue in the discussion.

- Please add a sentence to explain briefly the NSME score, to facilitate readers from a broader audience and make it easier to quickly follow the discussion.

- According to the description in the text, figure 5 reports daily discharges in the period 1972-2000. That would amount to 29*365 data points in the figures, while the number of points in fig 5 appear to be much less. Please clarify.

Interactive comment on Geosci. Model Dev. Discuss., 4, 45, 2011.