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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Development and comparative evaluation of a stochastic analog method to downscale daily GCM precipitation" *by* S. Hwang and W. D. Graham

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——— Comment: in addition to my comments - pls explain how the time structure in daily GCM rainfall was corrected as it is claimed that dry spell lengths were corrected after applying corrections.

Response: The temporal distribution of precipitation, including wet-dry transition probabilities and wet/dry spell lengths, for the BCSA method is dictated by the dynamics of the GCM model. If no precipitation is predicted at the large GCM scale, then no precipitation will be generated for any of the fine-scale grid cells. If precipitation is predicted

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at the GCM scale, a fine resolution stochastic analog is generated which reproduces the predicted areal precipitation over the large GCM grid cell. Within the fine-scale resolution wet cells and dry cells are generated that reproduce the ensemble spatial correlation structure and the mean areal precipitation. In general, for higher mean areal precipitation more fine-resolution cells are wet than for lower mean areal precipitation. Thus although the ensemble of daily precipitation fields originally generated over the fine grid scale are produced independently from day to day, the realization selected from the ensemble depends on whether the GCM predicted a wet day over the large cell, and how much rainfall the GCM predicted. Furthermore they are generated to preserve the local (non-Gaussian) probability of being wet or dry on a daily basis. The fact that the downscaled BCSA precipitation fields reproduce the observed small-scale wet/dry spell lengths quite well indicates both that the large scale GCMs are reproducing wet/dry day sequences accurately and that the BCSA method, through the conditional selection of an appropriate realization from the ensemble, propagates this accurately to the local scale. This explanation will be added to the discussion of the revised manuscript.

——— Comment: Something is flawed in the approach - daily rainfall is NEVER normally distributed so you can't fit a normal distribution to it. they exhibit Gamma, exponential or hyper-exponential.

Response: We agree that daily rainfall is never normally distributed. Therefore the first step of the BCSA process is to perform a normal score transform (Goovaerts, 1997; Deutsch and Journel, 1998) on the empirical daily rainfall cdf estimated at each observation location (see section 3.4). The spatial correlation among the normal-score transformed data over the observation grid is then determined. This spatial correlation structure is used to generate a synthetic spatially distributed random field that matches the structure of the normal-score transformed observations. During the last step of the BCSA process the spatially-distributed synthetic random field is back-transformed into the original empirical (non-Gaussian) distribution. The procedure will be more clearly

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described in the revised manuscript.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 2141, 2013.