Reply to comments on' Expected changes in future temperature extremes and their elevation dependency over the Yellow River source region' by Hu et al.

Response to anonymous referee #1

We would like to thank the reviewer (#1) for his careful reading and constructive comments which certainly improve the quality of this manuscript. Below we provide a point-by-point response to the specific issues raised.

Comment #1: In the section of "study area", more references should be cited.

Answer #1: Thanks for pointing this out. We will add more references to provide more information about the study area.

Comment #2: For the data set, the period of observed station data, re-analysis data, and GCMs have been extended to 2000, why authors just used data for the period of 1961-1990. Longer data series should be added in order to improve the simulation. For the future period, people concerns more about the climate change before the mid-21st century in comparison of the end of 21st century. Authors should add more analyses on the period of 2046-2065.

Answer #2: We agree that in comparison to the period 1961-1990 the longer time series (i.e.1961-2000) could improve the simulation. Unfortunately temperature data from three gauging stations are completely or partly missing after 1990. Thus the period 1961-1990 was chosen as baseline period in order to seek more spatial coverage. Also, the period 1961-1990 has been widely chosen as baseline period in the literature, which makes our study consistent with and comparable to other similar studies. According to the reviewer's suggestion the analyses of the period 2046-2065 will be added in the revised manuscript.

Comment #3: Many studies have showed that ERA-40 has a better performance than NCEP/NCAR in the Tibetan Plateau, why authors didn't use this kind of data?

Answer #3: We agree that the ERA40 may have a better performance than the NCEP/NCAR Reanalysis data set in the Tibetan Plateau. However, we choose this product mainly because of its free and easy accessibility. Also, the NCEP/NCAR data set has been widely applied in the literature including Xu et al. (2009), Hu et al. (2012) and Wang et al. (2012), which makes our study consistent with and comparable to other similar studies in the region.

Comment #4: GCMs have different regional adaptability. Authors should explain how they choose those two GCMs.

Answer #4: Those two GCMs were selected on the basis of (i) their relatively reasonable performances in simulating the twentieth-century surface air temperature over China (Zhou and Yu, 2006; Wang et al., 2013) and the South Asian Summer Monsoon over the historical period (Fan et al., 2010) and (ii) their wide use in previous climate change studies conducted. These explanations will be added in the revised manuscript.

Comment #5: It plays a central role to select the suitable predictors in the process of downscaling. Authors should present more details on the procedure of selecting the predictors.

Many studies have showed that geopotential height is a key factor in downscaling the climatic elements, nevertheless, authors don't use this variable, which could affect the simulation. Authors should make a further explanation.

Answer #5: As is stated in the manuscript, the predictors were selected taking into following considerations: (i) the monsoon climate generation mechanism in the study region, (ii) the correlation analysis between predictand and predictors and (iii) recommendation from similar studies in the neighbouring areas. These points will be further detailed in the revised manuscript.

We agree that geopotential height is a key factor in downscaling the climatic elements. Unfortunately the geopotential height data are not available for these two GCMs in the Program for Climate Model Diagnosis and Intercomparison (PCMDI) website.

Comment #6: The elevation of the study area is higher than 700 hpa. In the manuscript, authors select the climate variables of 700, 850 and 1 000 hpa. Such kind of factors has meaning in the Yellow River source region?

Answer #6: As is stated in the manuscript, the use of predictors directly overlying the target study is likely to fail to capture the strongest correlations between predictor and predictand, as this domain may be geographically smaller in extent than the circulation domains of the predictors. The temperature over the study region is mainly affected by the heat energy difference between land and sea, which brings cold, dry air from the northwest in winter and warm, moist air from the Bay of Bengal and the western Pacific Ocean in summer where the elevation is much lower than the study region. Thus, it is reasonable that the use of the climate variables at 700, 850 and 1000 hpa level as the predictors for downscaling temperature over the study region.

Comment #7: In the section of 4.1, authors calculate the indices by averaging 100 simulation samples. However, the main purpose of 100 realization set in SDSM is to maintain the stabilization of simulation series. Therefore, the averaging method seems not suitable;

Answer #7: The purpose of generating ensembles of time series in the SDSM is to reflect model uncertainty (Wilby and Dawson, 2012) and to insure that the model converges toward its true mean response (Chen et al., 2012). Due to the stochastic nature of the SDSM, a single realization could have resulted in a biased estimation (Chen et al., 2012). We compute the indices as the average of the indices calculated from each realization assuming it is sufficient enough to capture the stochastic nature and to reflect the uncertainty of the SDSM. This method was also used by Hundecha and Bárdossy (2008), Chen et al. (2012), Liu et al. (2012) and Hu et al. (2012).

Comment #8: Authors should prove the ability of the SDSM in the study area by comparing the simulated and observed series in terms of explanation variance and bias at the daily scale or monthly scale, as it may average the bias just comparing the difference among the indices calculated at the seasonal scale;

Answer #8: Thanks for this good suggestion. In the revised manuscript the model performance will be evaluated on a monthly basis instead of on a seasonal basis.

Comment #9: In Fig. 2 and Fig. 3, it says that there are 14 stations in the titles of the figures, but there are only 13 stations in the text, authors should confirm this.

Answer #9: Thanks for pointing this out. These were typing errors in the captions of Figures 2 and 3, and will be corrected as 13 stations in the revised manuscript.

Again, we would like to thank the reviewer for the helpful comments.

Reference

Chen, J., Brissette, F. P., and Leconte, R.: Uncertainty of downscaling method in Quantifying the impact of climate change on hydrology. J. Hydro. 401: 190-202, doi: 10.1016/j.jhydro.2011.02.020, 2011.

Fan, F., Mann, M.E., Lee, S., and Evans, J. L.: Observed and modeled changes in the South Asian Summer Monsoon over the historical period, J. Climate, 23: 5193-5205, 2010.

Hundecha, Y. and Bárdossy, A.: Statistical downscaling of extremes of daily precipitation and temperature and construction of their future scenarios, Int. J. Climatol. 28: 589–610, doi: 10.1002/joc.1563, 2008.

Hu, Y., Maskey, S., and Uhlenbrook, S.: Downscaling daily precipitation over the Yellow River source region in China: a comparison of three statistical downscaling methods, Theor. Appl. Climatol., in press, doi:10.1007/s00704-012-0745-4, 2012.

Liu, W., Fu, G., Liu, C., and Charles, S. P.: A comparison of three multi-site statistical downscaling models for daily rainfall in the North China Plain, Theor. Appl. Climatol., 111: 585-600, doi:10.1007/s00704-012-0692-0, 2012.

Wilby, R. L. and Dawson, C. W.: The Statistical DownScaling Model: insights from one decade of application, Int. J. Climatol., in press, doi: 10.1002/joc.3544, 2012.

Wang, X., Zhou, W., Wang, D., and Wang C.: The impact of the summer Asian Jet Stream biases on surface air temperature in mid-eastern China in IPCC AR4 models. Int. J. Climatol. 33: 265–276, doi: 10.1002/joc.3419, 2013.

Zhou, T. J. and Yu, R.C.: Twentieth-century surface air temperature over China and the globe simulated by coupled climate models. J. Climate 19 (22): 5843–5858, 2006.