We are very grateful to the reviewer for reading the manuscript extremely carefully and forwarding the valuable suggestions for improvement. Point-by-point responses to the reviewers' comments are listed below.

1. General comments

Reviewer's comment: However, the results, conclusions, and discussion presented in the current manuscript are not clear, concise, and well structured.

Authors' response: Thank you very much for the suggestion.
As you suggested, the results, conclusions, and discussion will be reorganized in the final manuscript.

2. Specific Comments

Reviewer's comment 1: Assemble projection based on multi-GCMs has been widely used for regional future climate change scenarios, which is referred as the mainstream and popular method in the downscaling technique. However, only one GCM MRI-CGCM3 was selected in this study, based on the conclusions from Yuan et al. (2013) indicating a better performance in simulating diurnal rainfall over subtropical China, which is not enough for performance evaluation of multi-GCMs from CMIP5 in the specific Poyang Lake basin.

Authors' response: Thank you very much for the suggestion.
The research is mainly aimed to propose a spatiotemporal distributed downscaling method which could be applied to every single-GCM model. The MRI-CGCM3 is a study case to examine the model performance or availability of STDDM, as well as Poyang Lake which is taken as a study area. The validation is operated in several aspects. For the historical data, simulations from the GCM-downscaled result by STDDM and observations from meteorological stations were compared (Section 4.1). For the future data, we compared the future period (2081-2100) with the baseline period (1998-2017). The intra-annual and inner-annual variability were analyzed. The precipitation changes were also explained by climate warming in section 4.4. The explanation suggests the downscaling method is reasonable and STTDM could be applied in the basin-scale region based on a GCM successfully. The examination on a test GCM is necessary before STDDM could be used in other GCMs or multi-GCMs. In Section 5 (Conclusion), we will propose a prospect to apply STDDM in multi-GCMs in the future work.
Indeed assemble projection is a mean stream. The model ensemble has a better model performance than the single-model assessed by R (correlation coefficient) and RMSE (Root-Mean-Square Error). However, the model ensemble is burdened with a smaller standard deviation (SD) than the single-models and observations (Fig 1). Except for R and RMSE, SD is also an important model evaluation index. The small SD value means small fluctuation, which demonstrates the fluctuation signal of original models (the signal-models) is not kept completely after being assembled. The SD of multi-GCMs is usually smaller than original models (Fig 1). The monthly and daily variation are weakened in model ensembles. The ensemble can hardly analyze the seasonal or daily extreme event change

exactly, taking the extreme dry (or wet) months and the max daily precipitation for example. In the study, we analyze the seasonal variations, as well as the change of extreme event intensities and frequencies. Using multi-GCMs can hardly reflect the application accuracy of STDDM precisely, in extreme climate analysis based on monthly and daily data. So a single-model should be selected to test the performance of STDDM.

A specific single-model could be used to analyze the seasonal change exactly, especially the extreme climate event change. As MRI-CGCM3 has the best spatial resolution among the CMIP5 GCMs, and a better performance in simulating diurnal rainfall over subtropical China, we took MRI-CGCM3 as a test case to apply in the Poyang Lake Basin and examine whether the STDDM can be used to produce reasonable monthly and daily data, especially the extreme climate change.

The title *Variations of future precipitations in Poyang Lake Watershed under global warming using a spatiotemporally distributed downscaling model* might confuse you. So it will be revised as *Precipitation projection using a spatiotemporal distributed method: a case study in Poyang Lake Basin based on MRI-CGCM3*. And the content will be revised corresponding to the revised title.

In summary, using multi-GCMs instead of MRI-CGCM3 in the study could be reconsidered.

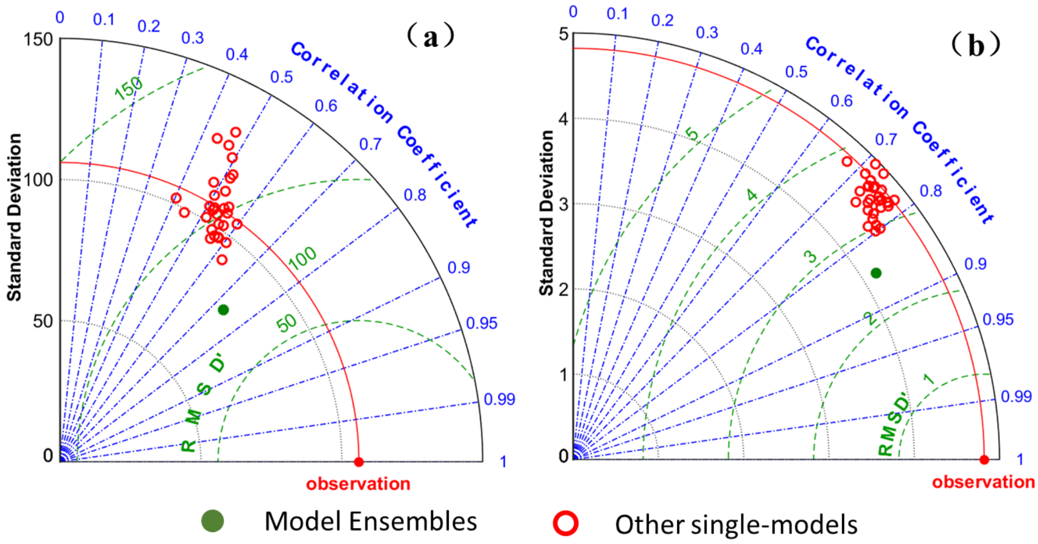

Figure 1. The Taylor figures (Taylor et al.,2001) of model evaluation. Following Taylor et al. (2001), the radial distance from the origin denotes the standard deviation of each data set (the primary observations are shown as a red line) and the angular distance from the horizontal denotes the correlation coefficient r between each model data set and the primary observations. The centered RMS error (RMSE') is indicated by the distance to the intersection of the green dashed line and the horizontal axis with units and magnitude indicated by the radial axis. The model ensemble is constructed by a genetic algorithm. The genetic algorithm is used to calculate the best weigh for each single-model, assuming RMSE' as the cost function. The model ensemble is the weighted sum of each single-model. The other single-models include ACCESS1-0, ACCESS1-3, BCC-CSM1-1-m, BCC-CSM1-1, BNU-ESM, CanESM2, CCSM4, CMCC-CMS, CMCC-CM, CNRM-CM5, FGOALS-g2, GISS-E2-H-CC, GISS-E2-H, GISS-E2-R-CC, GISS-E2-R, HadGEM2-AO, HadGEM2-CC, HadGEM2-ES, inmcm4, IPSL-CM5A-LR, IPSL-CM5A-MR, IPSL-CM5B-LR, MIROC-ESM-CHEM, MIROC-ESM, MIROC5, MPI-ESM-LR, MPI-ESM-MR, MRI-CGCM3 and NorESM1-M. The model description can be obtained from *https://pcmdi.llnl.gov/mips/cmip5/availability.html*.

The references:

Taylor K E. Summarizing multiple aspects of model performance in a single diagram [J]. Journal of Geophysical Research: Atmospheres, 2001, 106(D7): 7183-7192.

Reviewer's comment 2: In order to detect the sensitivity of precipitation change under global climate warming, different RCP scenarios should be selected to do comparative analysis. However, only RCP 8.5 was selected to generate future climate change scenarios in the current manuscript, which is insufficient to obtain a scientific and convinced projection for the study area.

Authors' response: Thank you very much for the suggestion.

The future data includes simulations of the Representative Concentration Pathways (RCPs) of 8.5, 6.0, 4.5 and 2.6. Compared to the other RCPs, temperature increases the most in the RCP8.5 scenario, which corresponds to a highest greenhouse gas emission, leading to a radiative forcing of 8.5 W/m2 and temperature increase of 7.14 °C at the end of 21st century.

The research is to detect remarkable precipitation changes under climate warming, which should be pronounced enough to be acknowledged by us. To get the obvious precipitation changes, what we should do is to obtain the future precipitation in a high-emission scenario where the temperature increment is large enough. Compared to the other RCPs, the temperature increment in RCP8.5 scenario is the largest. So we select future simulations in the RCP8.5 scenario.

Although it is valuable to detect the sensitivity of precipitation change, the sensitivity analysis is not the purpose of the study. And there are many climate change related researches (Gourdji et al.,2013; Sillmann et al.,2013; De et al., 2014; Cai et al.,2017) only use the high-emissions scenario to investigate the impacts of climate warming. The result from RCP8.5 scenario is the most remarkable, from which we can get the obvious change and know what will happen when climate warming gets worse. The study is to investigate the remarkable change of precipitation under climate warming.

So it could be reasonable to only select RCP85 scenario in the experiment to detect the significant changes of precipitation.

The references:

De Lavergne C, Palter J B, Galbraith E D, et al. Cessation of deep convection in the open Southern Ocean under anthropogenic climate change [J]. Nature Climate Change, 2014, 4(4): 278.

Cai W, Li K, Liao H, et al. Weather conditions conducive to Beijing severe haze more frequent under climate change[J]. Nature Climate Change, 2017, 7(4): 257.

Gourdji, S. M., Sibley, A. M. & Lobell, D. B. Global crop exposure to critical high temperatures in the reproductive period: Historical trends and future projections. Environ. Res. Lett. 8, 024041 (2013).

Sillmann J, Kharin V V, Zwiers F W, et al. Climate extremes indices in the CMIP5 multi-model ensemble: Part 2. Future climate projections[J]. Journal of Geophysical Research: Atmospheres, 2013, 118(6): 2473-2493.

Reviewer's comment 3: Too many time periods are defined in the manuscript corresponding to different years, such as baseline and future periods, historical, historical extent and future, etc., which would make readers confused and difficult to understand.

Authors' response: Thank you very much for the suggestion.
Cmip5 GCMs include historical (1850-2005), historical extent (2006-2012), RCPs (2005-2100 or 2005-2300) scenarios (Friedlingstein et al., 2008). At the WGCM meeting in October 2011, there was agreement that it would be useful to extend the CMIP5 historical runs to near-present 2012, rather than ending them in 2005 (Friedlingstein et al., 2008). So another scenario (historical extension) from 2006 to 2012 was constructed to extend the historical data to 2012. In the study, we merge the historical (from 1961 to 2005), historical extent (from 2006 to 2012) and RCP85 (from 2013 to 2100) data, as merged data (1961-2100). From the merged data, simulations from 1998 to 2017 were selected as the baseline period data, and simulations from 2081 to 2100 were selected as the future period data.

The references:
Friedlingstein OB, Webb M, Gregory J. A Summary of the CMIP5 Experiment Design [J]. 2008.

Reviewer's comment 4: It will be better to add an evaluation section for the gridded meteorological data by using gauging stations observation.

Authors' response: Thank you very much for the suggestion.
The evaluation for the gridded meteorological data will be added in the manuscript.

Reviewer's comment 5: English writing is poor in the current manuscript, which needs to be polished by a native English-speaking editor. Examples of grammar errors are as follows:
Line 27: threating to → threatening
Line 37: constructed → constructs
Line 43: in the station scale → at the station scale, many similar errors in other paragraphs.
Line 45: as underlays of the local region is complex → as underlays of local region are complex
Line 57: project → projects
Line 69: Precipitation redistributions under global warming has → Precipitation redistributions under global warming have
Line 77: includes → include
Line 84: metrological → meteorological, many similar errors in other sentences. Figure 2, 1(a): observitions → observations

Authors' response: Thank you very much for the language editing.
The manuscript is under language-editing. The writing errors will be revised in the manuscript.