Thank you very much for your constructive suggestions and questions. We will first address the major ones and then the minor ones.

Major parts.

The major question mainly concentrates on the elevation-bias part. The referees both thought that this part was weak because no statistically significant relationships between elevation and bias were found.

To improve this part, we introduced 24 topographic variables to develop a more comprehensive analysis of the bias-topography relationship since elevation as a single variable cannot totally represent the influence of topography. To obtain variables, a buffer of 0.25 °km was generated for each gauge station to match with the bilinearly interpolated satellite rainfall. Elevation, slope and aspect were then easily calculated from 30 arcs digital elevation model (DEM) within the buffer. To obtain relief data, DEM was first smoothed by a 101×101 moving window and the resultant surface represented the large-scale topographic features (Yin et al. 2008). The smoothed surface was then subtracted from original DEM to generate local relief. All topographic variables were described in Table 1.

The variables were used in Yin et al. (2008) to correct satellite monthly rainfall estimates and they found significant improvements over original satellite estimates when a regression model was used based on topographic variables. Their results implied that topographic variables may be capable of interpreting errors of satellite rainfall data. Because some variables were related, principle component analysis (PCA) was employed to reduce the redundancy in the topographic dataset and seven rotated principle components (RPCs) were determined because they explained more than 90% of the variance of the original topographic datasets. Listed in Table 2 were RPCs and original variables they represented that were useful to identify topographic factors related to satellite rainfall biases. Note that only the highest loading variables were listed.

A regression model was employed to interpret rainfall biases based on RPCs. Note that all variables were normalized before they were used in the model. It is not helpful to use TMPA to analyze the bias-topography relationship because TMPA was bias-calibrated by gauge data. In this analysis, TMPA real time (RT) that represented biases of satellite itself was used. Note that TMPA was also used for comparison.

The regression model was first run using all the seven RPCs. Then only PRCs with significant level lower than 0.01 were maintained for analysis. Results of regression models were shown in Table 3. TMPA showed the lowest correlation with R^2 less than 0.1. This result may be ascribed that bias-calibrated procedures using gauge data employed in TMPA made it less possible to explore biases of the satellite itself. Biases of CMORPH also presented low correlation with topography. Contrary to TMPA, topography can best explain biases of TMPA RT. The highest coefficient of RPC2 in the regression model implied that elevation played important roles in explaining biases because RPC2 mainly represented variability of elevation and surface roughness. PERSIANN also presented similar results. The difference is that PERSIANN required more topographic variables to interpret biases, especially aspect. This may be why we failed to develop bias-elevation relationship even if the regression was done in different climate zones.

In a summary, we decomposed 24 topographic variables into seven independent RPCs using PCA. A regression model was then employed to explain biases of satellite rainfall in the 166 stations. Biases of TMPA showed the weakest dependence on topography, which may be due to the gauge-calibrated processes that reduced biases and then weakened bias-topography relationship. The dependence of biases of CMORPH on topography is also weak. However, biases of TMPA RT and PERSIANN presented dependence on topography. Also, variability of elevation played important roles in explaining their biases.

Table 1. Topographic variables and their descriptions.

Variable	Description
MEAN_slp	Mean slope angle inside 0.25 °buffers
MEAN_hshd	Mean lighting condition inside 0.25 °buffers, as represented by relative solar radiation with solar azimuth at 180 °(south) and alt of 55 °
MIN_dem	Minimum elev inside 0.25 °buffers
MAX_dem	Maximum elev inside 0.25 °buffers
RANGE_dem	Range of elev values inside 0.25 °buffers
MEAN_dem	Mean elev inside 0.25 °buffers
STD_dem	Std dev of elev inside 0.25 °buffers
SUM_dem	Sum of all elev values inside 0.25 °buffers
MEDIAN_dem	Median elev inside 0.25 °buffers
MIN_relief	Minimum relative relief inside 0.25 °buffers, based on a 0.5 °search radius
MAX_relief	Maximum relative relief inside 0.25 °buffers, based on a 0.5 °search radius
MEAN_relief	Mean relative relief inside 0.25 °buffers, based on a 0.5 °search radius
STD_relief	Std dev of relative relief inside 0.25 °buffers
Flat_asp	Proportion of flat terrain inside 0.25 °buffers, where slope aspect is coded as 0
North_asp	Proportion of area with north-facing slopes inside 0.25 °buffers
Northeast_asp	Proportion of area with northeast-facing slopes inside 0.25 °buffers
East_asp	Proportion of area with east-facing slopes inside 0.25 °buffers
Southeast_asp	Proportion of area with southeast-facing slopes inside 0.25 °buffers
South_asp	Proportion of area with south-facing slopes inside 0.25 °buffers
Southwest_asp	Proportion of area with southwest-facing slopes inside 0.25 °buffers
West_asp	Proportion of area with west-facing slopes inside 0.25 °buffers
Northwest_asp	Proportion of area with northwest-facing slopes inside 0.25 °buffers

Table 2. Topographic variables represented by each RPC. Note that only variables with the most negative or the most positive loading values are listed. The values are in the bracket.

	RPC1	RPC 2	RPC3	RPC 4	RPC 5	RPC 6	RPC 7
Variables	MEAN_slp (0.924)	MIN_dem (0.988)	Northeast_asp (-0.772)	North_asp (-0.714)	West_asp (0.814)	Flat_asp (0.714)	MEAN_relief (0.959)
	MEAN_hshd (-0.700)	MAX_dem (0.876)	South_asp (0.858)	East_asp (0.835)	Northwest_asp (0.744)	Southwest_asp (0.630)	
	RANGE_dem (0.964)	MEAN_dem (0.976)		Southeast_asp (0.726)			
	STD_dem (0.957)	SUM_dem (0.981)					
	MIN_relief (-0.837)	MEDIAN_dem (0.976)					

MAX_relief
(0.852)
STD_relief
(0.959)

Table 3. Regression model results of each satellite rainfall dataset. Note that the model was developed based on data from all 166 stations. All variables in the model are independent and statistically significant at level 0.05.

Satellite rainfall data	R^2	Regression model
PERSIANN	0.50	Bias = -0.174 - 0.146 RPC1 + 0.756 RPC2 - 0.169 RPC3 - 0.235 RPC4 - 0.196 RPC6 + 0.366 RPC7
CMORPH	0.12	Bias = -0.313 - 0.133 RPC3 + 0.233 RPC7
TMPA RT	0.60	Bias = 1.940 + 0.593 RPC1 + 1.445 RPC2 + 0.302 RPC7
TMPA	0.08	Bias = -0.112 + 0.111 RPC1 - 0.095 RPC2

Minor Parts.

Referee1.

Page 9505, line 6-7: rewrite the sentence to incorporate the 1998 flood impacts with the sentence before.

Replies: We have integrated the two sentences as follows. Wang et al. (2003) found that the evolution and eastward motion of convective cloud systems over TP played important roles in the development and strengthening of rainstorms in the Yangtze River in 1998, which produced severe floods that killed thousands of people and destroyed about seven million houses.

Page 9506, line 3-4: Combine these two sentence together, i.e. "Though high-resolution products have bias, the accuracies need to be evaluated."

Replies: We rewrote them as follows. Although high-resolution precipitation products provide a strong basis for studying the hydrologic processes in large mountainous areas, the accuracies need to be validated.

Page 9508, line 13: desert and forests are land cover not microclimates.

Replies: We could not understand this question. Could you please be more specific? Thank you so much.

Page 9512, line 14: "correlations and biases" of what? Please specify this.

Replies: We rewrote the sentence as follows. Spatial patterns of correlations and biases of the three products are illustrated in Figs. 5-6.

Page 9512, line 20: has difficulties in addressing.

Replies: We have followed your suggestion.

Page 9514, sect 3.4: Please refer to the “General comments” for the specific comments.
Replies: The replies are given in the major part.