Reply to Anonymous Referee #2

The paper addresses the potential influence of SLR on the flooding exposure during tropical cyclones in Bangladesh. The hydrodynamic model Delft-FLOW is used to simulate two historical storms and some future scenarios reflecting SLR of different magnitudes and uncertainties due to TC intensity and timing with respect to the tidal phase. Model results are validated against tide gauge measurements during the TC events. Further the authors investigate how inundated area and storm surge height would be changed if SLR would be present, assuming the properties of TCs remain unchanged. They conclude that even considering uncertainties of present-day TC properties the amount of flooded land would increase dramatically. The paper is well composed and clearly written. The objectives, methodology and results are sufficiently described. The discussed problematic is relevant and adds to the insight of the SLR consequences at regional scale. The approach of separating the sources of uncertainty and selecting a single trigger (here SLR) for the analysis contributes to better understanding of the potential changes in the local system.

We would like to thank the referee for the evaluation and for providing feedback which helped to improve the manuscript. Please find our responses below for general and minor comments.

However, as the authors also pointed out, there are many unconsidered conditions like changes in TCs intensity, morphology, river discharge, etc. This undermines the value of particular resultant numbers if they are considered without more generalized conclusions. For example, what would happen if the SLR of 0.4 or 0.7m occurs? Some discussion going beyond the presented two SLR case studies would be appropriate. I propose to put the results described in the Section 3.4 in relation with the SLR values and not only with the present-day inundated area/storm surge height. It would be interesting to see the direct comparison (in % or absolute values) of changes in storm surge height with respect to SLR, e.g. for TC Sidr and Charchanda it would be 0.27m increase for 0.26m SLR, which is basically a linear addition of SLR magnitude on top of the present-day surge, and 0.62m change for 0.54m of SLR, which has a considerable non-linear contribution. This could give an insight into the (non)linearity of the storm surge and SLR interactions for particular area.

Thank you for the suggestion. In section 3.4, we've made some revision in the calculated values of storm surge level and added two separate tables (Table 6 and Table 7) for both TC Sidr and TC Aila to show direct comparisons and percentage change of storm surge level under Sea Level Rise scenarios. Following are the corrected values in storm surge level:

Line 295 [Revised line 287]: 2.13 meters instead of 2.3 meters.

Line 296 [Revised line 288]: 13.7% instead of 21%.

Line 297 [Revised line 289]: 28.67% instead of 37%.

Line 298 [Revised line 290]: 2.41 m instead of 2.6 m.

Line 300 [Revised line 292]: 13.95% instead of 14% …. 1.87 meters instead of 2.24 meters……33.45% instead of 31%

Line 301 [Revised line 293]: 2.19 m instead of 2.59 m.

Line 302 [Revised line 296]: 21.93% instead of 22%..........1.299 meters instead of 1.61 meters.

Line 304 [Revised line 298]: 50.96% instead of 51%

Line 307 [Revised line 301]: 3.075 meters instead of 3.01 meters…….23% instead of 50%

Line 308 [Revised line 302]: 55% instead of 68%.

Based on the corrected calculations, we've also updated figure 7. In the initial submission, Figure 7a was mentioned as "TC Sidr at Barisal" and Figure 7b was mentioned as "TC Sidr at Charchanga". Actually, Figure 7a was representing TC Sidr at Charchanga and Figure 7b was representing TC Sidr at Barisal. We've corrected this mistake in the updated manuscript too. We've also added two additional table; one for the Tropical Cyclone tracks that were used for ensemble projections (Table 2) and one for the comparison of the change in storm surge inundated area (Table 5). Followings are the new Tables:

Table 2 List of 12 historical TC events used for ensemble projection of storm surge inundation

Name	**Date**	**Landfall**
Tropical storm 13	14-18 November, 1973	Noakhali
Cyclone 12	23-28 November, 1974	Bhola
Tropical storm 19	07-12 November, 1975	Chittagong
Tropical storm 1	22-25 May, 1985	Noakhali
Cyclone 4	21-30 November, 1988	Khulna
Cyclone 2	22-30 April, 1991	Chittagong
Cyclone 2	26 April – 30 May, 1994	Cox's Bazar
Cyclone 4	18-25 November, 1995	Cox's Bazar
Cyclone 1	13-20 May, 1997	Noakhali
Tropical storm 4	24-27 October, 2008	Barguna
Tropical storm Mahasen	10-16 May, 2013	Patuakhali
Tropical storm Roanu	18-21 May, 2016	Chittagong

Table 5. Comparison of inundated area between present day & future SLR scenarios and calculated change in percentage with respect to present day scenario.

Scenario	TC Sidr		TC Aila	
	Inundated Area	**(%) change**	**Inundated Area**	**(%) change**
Present Day	1860		1208	
Mid-century	2436.6	+31	1550	+28.3
End-century	2845.8	+53	1770	+46.5

Table 6. Comparison of storm surge level between present day and future SLR scenarios for the case of TC Sidr

Scenario	Barisal		Charchanga	
	Storm surge level (m)	**% increase**	**Storm surge level (m)**	**% increase**
Present Day	1.873		1.641	
Mid-century (0.26m)	2.13	13.72	1.870	13.95
End-century (0.54m)	2.41	28.67	2.19	33.45

Table 7. Comparison of storm surge level between present day and future SLR scenarios for the case of TC Aila

Scenario	Barisal		Charchanga	
	Storm surge level (m)	**% increase**	**Storm surge level (m)**	**% increase**
Present Day	1.299		2.5	
Mid-century (0.26m)	1.584	21.93	3.075	23
End-century (0.54m)	1.961	50.96	3.875	55

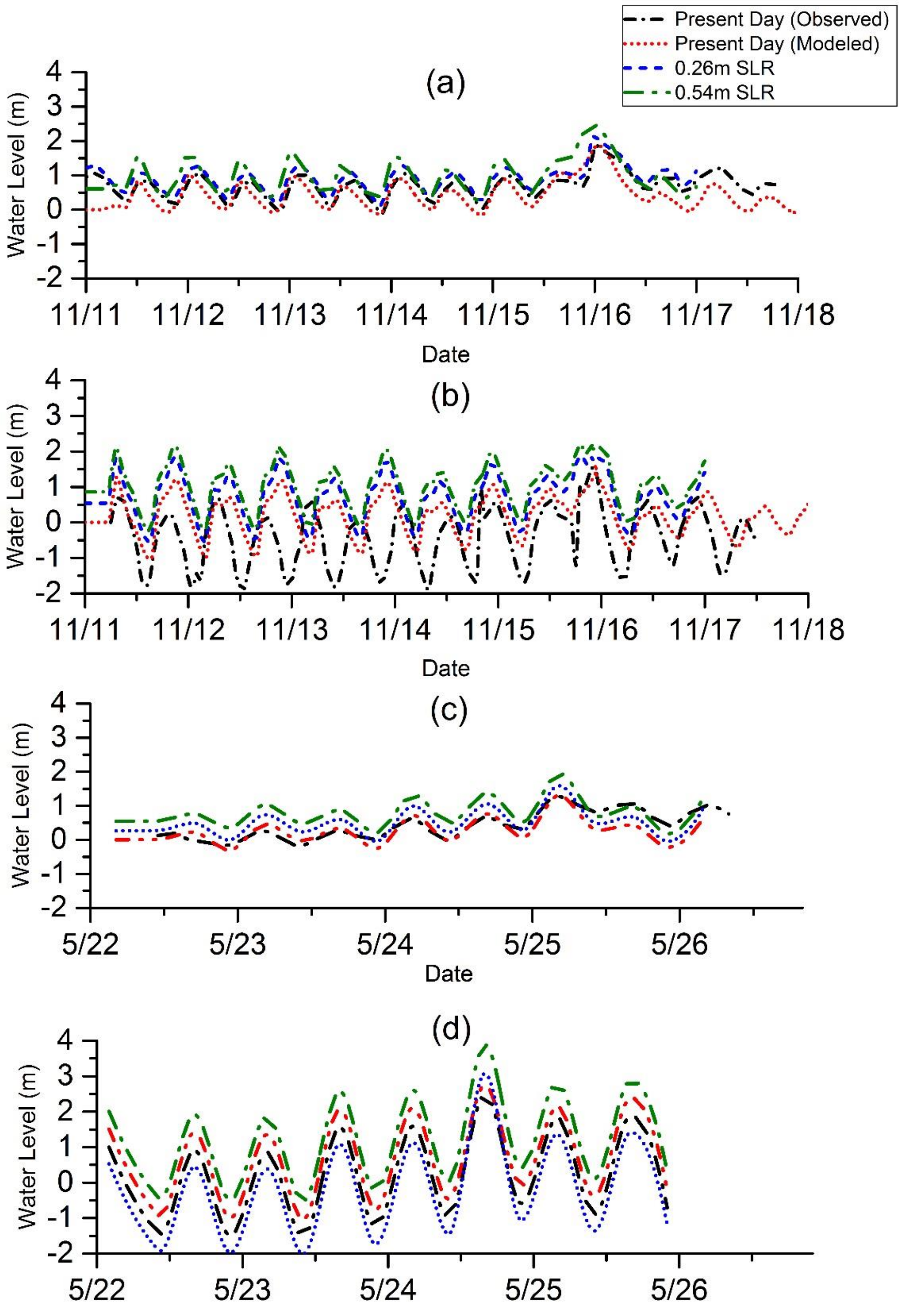

Figure 7. Comparison of storm surge water level between present day and future SLR scenarios. (a) TC Sidr at Barisal (b) TC Sidr at Charchanga (c) TC Aila at Barisal (d) TC Aila at Charchanga. The observed, modeled present-day, mid-of-21st century and end-of-21st century storm surge levels are denoted by the solid, red dashed, blue dotted, and greenred dash-dottted lines, respectively.

Regarding the relation between SLR and the additional increase of storm surge level following underlined paragraph was added at the end of section 3.4. Thank you for giving the idea to analyze this relation. [Revised line 304-314]:

"To analyze the linearity/non-linearity of storm surge level with respect to SLR, we conducted additional experiments based on 5 SLR scenarios; present-day sea level, 0.26 m of SLR, 0.33 m of SLR, 0.4 m of SLR, 0.47 m of SLR, 0.54 m of SLR, respectively. Results from these experiments are presented in the Figure 8.

For the case of TC Sidr in Barisal and Charchanga station, storm surge level increased almost linearly with respect to the addition of water due to the effect of SLR. For example, with an SLR of 0.47 m, the increase of storm surge level with respect to present day in Barisal and Charchanga stations were 0.453 m and 0.445 m, respectively (Figure 8a). On the other hand for the case of TC Aila, with an SLR of 0.26 m, the increase in storm surge level were found 0.285 m and 0.575 m respectively for the Barisal and Charchanga station (Figure 8b). Though the storm surge level is increasing almost linearly with the addition of sea water, however, there are still differences found between them, which could be influenced by the modification of ocean bathymetry to incorporate the effect of SLR. The margin of differences is higher for the Charchanga station comparing it with the Barisal station. The coarse resolution of topography near that area might be responsible for that."

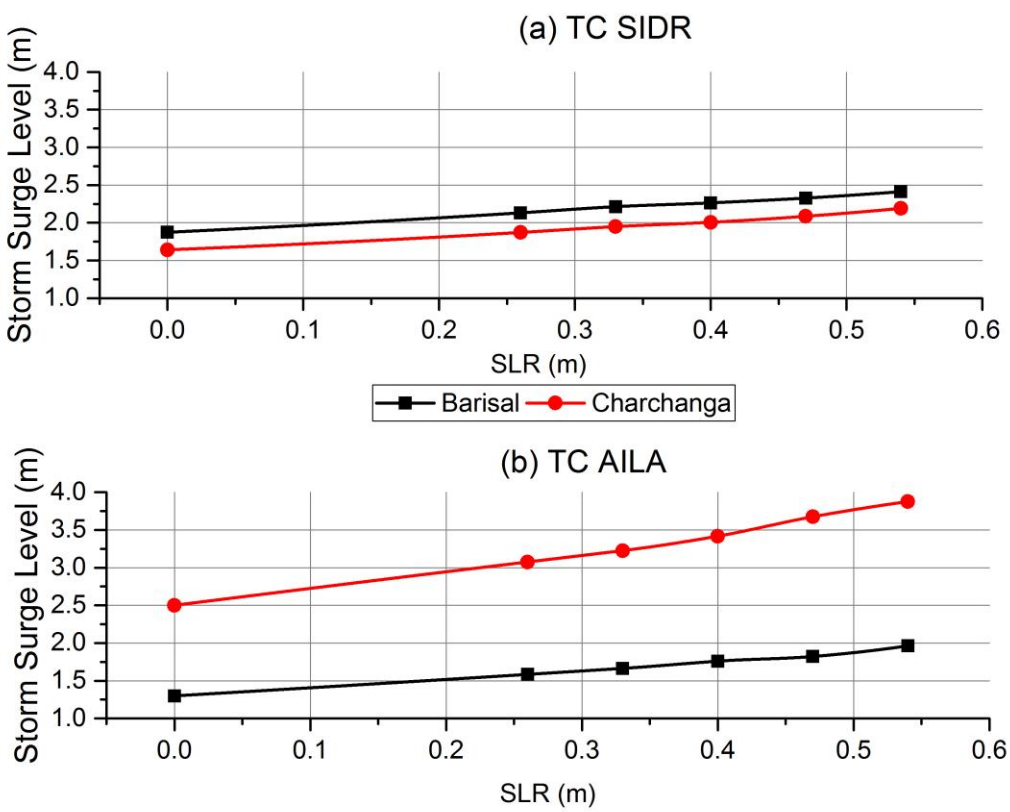

Figure 8. Relation between SLR and increase in storm surge level with respect to the present-day simulated water level for TC Sidr and TC Aila. (a) is representing the relation for TC Sidr and (b) is representing the relation for TC Aila.

It would be very helpful to include the terrain map of the model region with land elevation and land/water mask for better understanding of the present day situation and possible impacts. It could be combined with Figure 1 or not. Some names on Figure 1 would be also helpful (like main rivers, measurement location names, etc).

We've added an additional figure showing the elevation of land and river as Figure 1b in the updated manuscript. The area near the coastal zone are very flat which can be seen from the figure 1b. This make the region vulnerable to flooding easily even under normal astronomical tide conditions. We've also shown the location of Ganges, Brahmaputra and Meghna river on Figure 1a. Two separate colors were used to represent the two observational stations. Thank you for the suggestion. Following is the updated Figure 1.

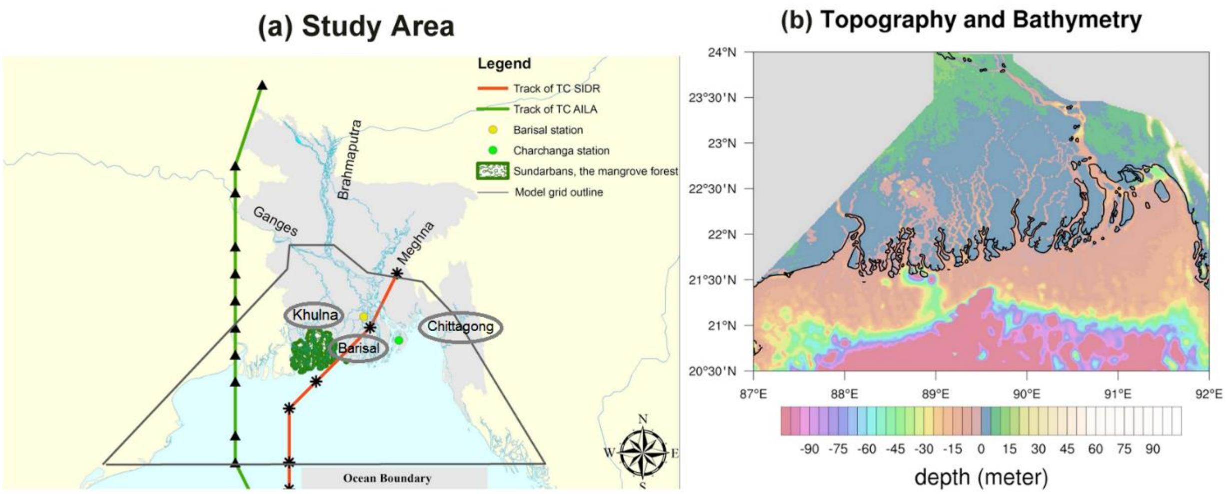

Figure 1. (a) Map of the study area for this work. The red and green lines represent the tracks of TC Sidr and TC Aila respectively. Area marked with green color indicates the Sundarban mangrove forest region. Two circles over the study area are the observation stations of Bangladesh Inland Water Transport Authority (BIWTA). The black colored outline shows the extent of model grid over the region. (b) Topography and bathymetry of the model domain. Negative depth values are representing water bodies (ocean and rivers) and positive depth values area representing land.

Minor Comments:

- p2. lines 55-56: ". . .causing deaths . . . of lives". Please reformulate ('causing deaths of people' OR 'causing loss of lives')

Corrected.

- p3. line 83: please coordinate singular/plural forms "the impact . . . are debatable"

Corrected.

- p4. lines 110-114: this passage looks like repetition of the previous one. Please remove or reformulate.

Removed.

- p5. line 143: ". . . weas . . ." typo?

Corrected.

- p5. lines 151-171: It is not quite clear from this description whether Delft3D has special module for generating wind and pressure fields from the TC track. If yes, and it "... slightly improves the original WES. . .", why the authors are still using WES and not Delft3D? If not, and wind and pressure are firstly generated by WES method and then fed to the Delft3d, then the description is misleading.

For storm surge simulations with Delft3D-FLOW, a Wind Enhance Scheme (WES) following Holland has been devised to generate tropical cyclone wind field (Delft Hydraulics, 2011). It's a built-in function in Delft3D-FLOW module. The earlier version of WES was developed by UK Met Office (Hemming et al. 1985). Later, it was further improved by Delft3D-FLOW by applying the translation speed of the cyclone center displacement as steering current and by introducing rotation of wind speed due to friction. All the version of WES is based on Holland's Wind Model (Holland, 1980). So, in this paper we used the improved version of WES (Delft Hydraulics, 2011) which is a built-in function of Delft3D-FLOW program. In the revised manuscript, we've added the citation of Delft3D-FLOW module's WES in section 2.1.3.

- p6. line 193: ". . . Storm surge. . ." -> "storm surge"

Corrected.

- p7. line 209: by tidal data the water elevation is meant? What type of instrument has been used, tide gauge?

By tidal data, we meant the water level elevation. Bangladesh Inland Water Transport Authority (BIWTA) uses auto tide gauge which provides hourly measurement of water level near the coast.

- p7. line 212: "(-ve)infinity . . ." typo?

Actually by using (-ve)infinity, we meant negative. we've changed it to 'negative' in the revised version to remove the confusion.

- p8. lines 269-272: repeated passage, please remove

Removed. Thank you for pointing that out.

- p10. lines 310-313: please review or remove the passage, it does not describe Figure 7.

Removed.

- p10. line 317: ". . . future TCs remain the same strength. . ." – either 'keep the same strength' or 'remain of the same strength'

Corrected.

- p10. line 322: "one of the methods we experimented in this study. . ." – either 'methods with which we experimented. . .' or 'methods that we tested'

Corrected.

- p10. line 327-328: ". . . the results looked much realistic. . ." -> . . . the results looked much more realistic. . .

Corrected.

- *p10. Lines 344-345: ". . .focus of the paper is to predict the future scenarios. . ." – please change 'predict' to assess/estimate/develop ". . . and comparison with. . ." -> 'and to compare with'*

Corrected.

- *p11. line 360: ". . . first floor is kept transparent. . ." – What does transparent mean in this context? Why is it relevant here?*

To reduce confusion, this has been changed to "In TC shelters, the first floor should be kept above the high surge waters."

- *Figures 3b and 7a: for the case of TC Sidr in Charchanga the timeseries of measured and modelled water levels look somewhat different and out of phase. Do the authors have an explanation for this?*

I think here you mean 3b and 7b. For the case of TC Sidr in Charchanga station (Figure 3b and Figure 7b), there's a slight shift in phase occurred during the period of November 13 to November 15. This could be due to the presence of a seiche near the gauge that interfered with the astronomical tide, and the seiche was not resolved in the model simulation, which caused the discrepancy.