Reply to Anonymous Referee #1

This paper presents the results of numerical experiments to investigate the impact of sea level rise induced by climate change on the extent and severity of the inundation caused by tropical cyclone (TC) storm surges in coastal Bangladesh. As the authors correctly point out, the approach used is a quite simple one and does not take into account relevant aspects such as possible future modifications in TC tracks and intensity and morphological changes. Nevertheless, the manuscript is an original contribution to the issue of climate change-induced hazards and the results of the study provide interesting suggestions for mitigation measures to be taken by policy makers and can encourage further research about this topic. The manuscript is quite well organized and written, even though the presentation of the results is somewhat confusing in some parts and should be revised and made clearer. In my opinion, the paper can be accepted for publication after the following comments are addressed.

We appreciate the comments from referee and would like to thank for evaluations and feedback which helped to improve the manuscript.

General comment #1: *The description of results in Sections 3.2-3.4 can be sometimes confusing and has to be improved. The authors in some cases comment about absolute values of inundated areas extent in km2 or storm surge height, in other cases provide information about percent variations of simulated values with respect to present time and percentages related to the same quantities appear even inconsistent (see, e.g. lines 363 and 372). This is particularly the case of Section 3.4, where the discussion about Figure 7 is hard to follow. Lines 310-314 seem to repeat what stated in lines 295-301 but numbers are slightly different. The caption of Figure 7 itself is wrong, because each of the four plots shows the comparison of present time water level with both the considered future scenarios. Also, the higher percent variation in storm surge height at Charchanga station obtained for TC Aila with respect to Sidr is not intuitive and the authors should provide some interpretation attempt. In conclusion, my suggestion is to thoroughly revise this sections and to add one or more tables (e.g. one for inundation extent and another one for storm surge height) containing both the absolute values and the percent variations with respect to the present time scenario.*

Thank you for pointing out these problems. In the revised manuscript, we've updated it by adding both the absolute values and percent variations in the write up to make it easier to follow. Three separate tables were also added both for inundated area and storm surge level and their percent change to identify the differences easily.

In section 3.4, corrections were made in calculated values of storm surge level in following lines:

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%.

A new table with all the calculations was also added in the manuscript.

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 these mistakes in the updated manuscript.

We've also corrected the calculation error in line 363 [revised line 364] and 372 [revised line 373]. In line 363 [revised line 364], it should be 28.3% - 53% as shown in newly added Table 5. In line 372 [revised line 373], it was incorrectly written as 38% and 48%. It should be 31% and 53%, based on the calculation shown in Table 5. In the revised version, it was corrected. Also, in line 374 [revised line 374], the percentage values were corrected and it should be 28.3% and 46.5% instead of 25% and 34%.

Caption of Figure 7 was also updated based on the suggestion.

An additional paragraph and a new Figure (Figure 8) was added based on the comment of reviewer #2 to represent the relation between SLR and the additional increase of storm surge level. Following underlined paragraph was added at the end of section 3.4 [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 daypresent-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 a 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 a 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's are still differences found between them. This 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.

Following are the four tables that were added in the updated manuscript for section 3.3 and section 3.4, updated Figure 7 and newly added Figure 8

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

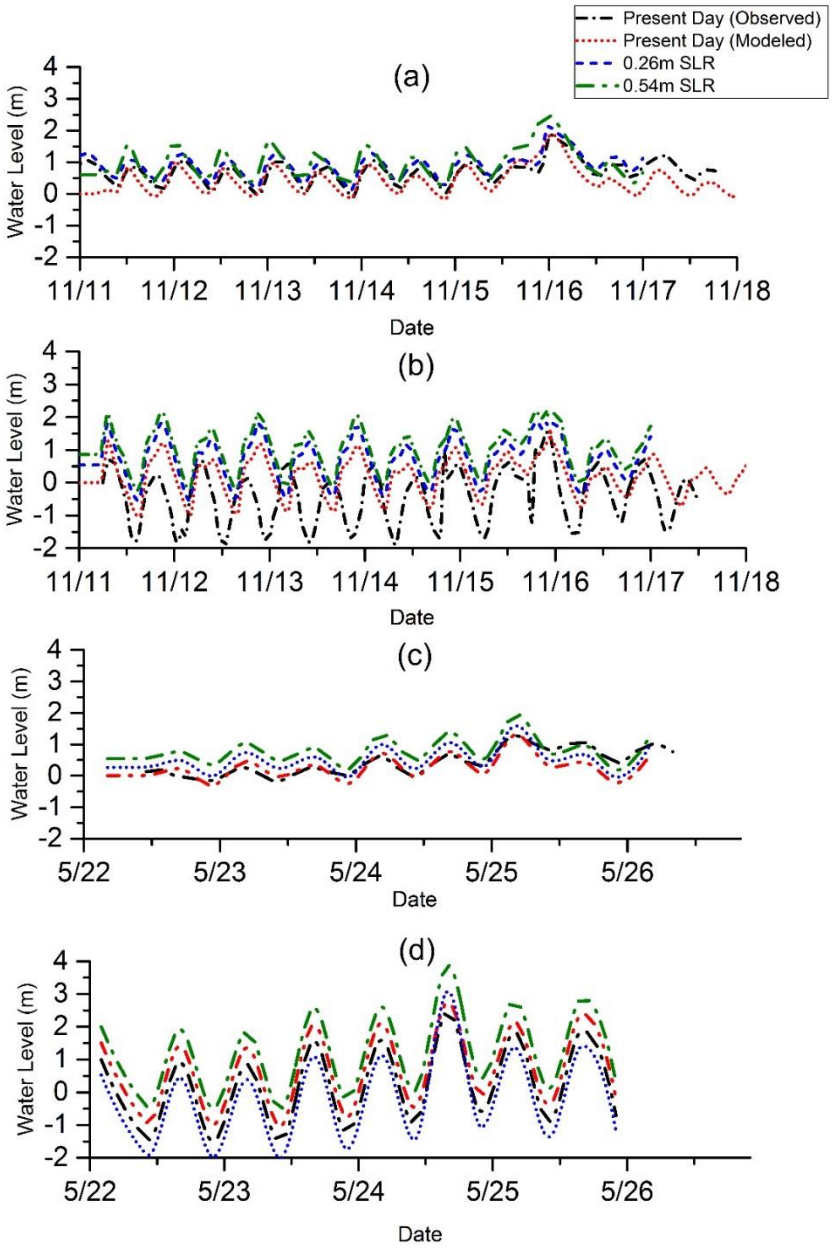

Figure 7. Comparison of storm surge water level between present day and future SLR scenarios. (a) TC Sidr at Barisal (b) TC Sidr at Charchanga (c) TC Aila at Barisal (d) TC Aila at Charchanga. The observed, modeled present-day, mid-of-21st century and end-of-21st century storm surge levels are denoted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

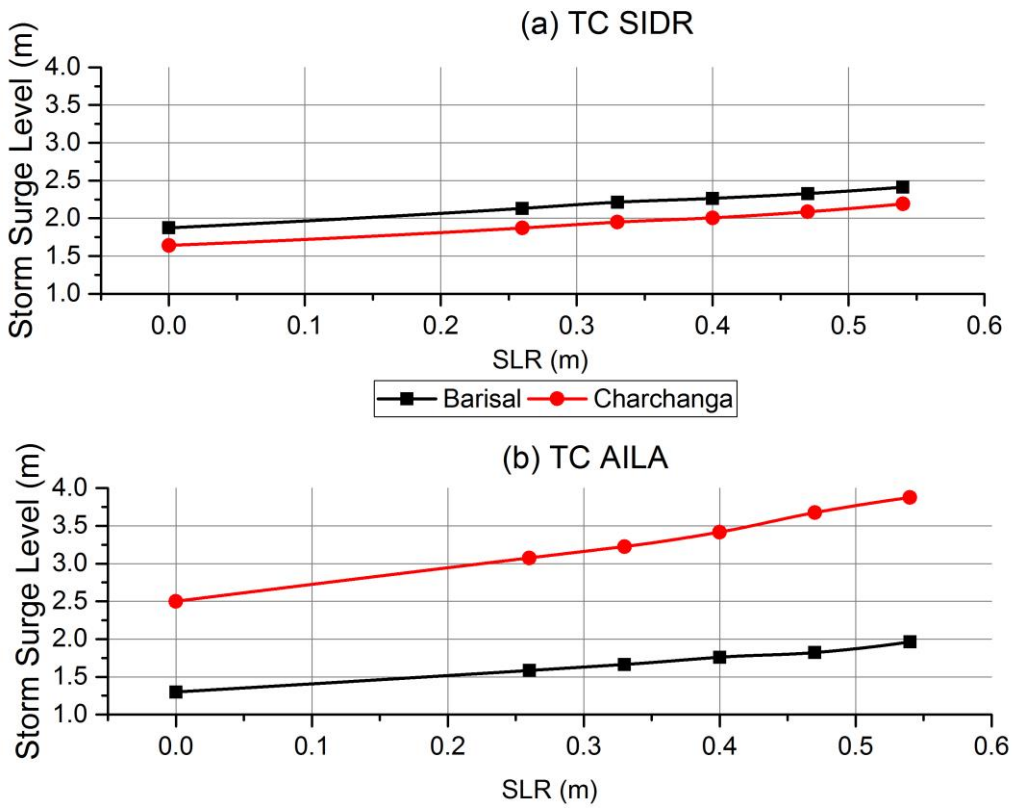

Figure 8. Relation between SLR and increase in storm surge level with respect to the present-day simulated water level for TC Sidr and TC Aila. (a) is representing the relation for TC Sidr and (b) is representing the relation for TC Aila..

Specific comments:

#1

Please check the correspondence between the references in the list and the citations in the text. For instance, the works by Mohal et al. (2006) and by Vatvani et al. (2002) seem to be missing in the text. Also, the reference to the Delft3D-FLOW manual is not coincident (Delft Hydraulics in the text vs. Hydraulics, D. in the reference list.

Mohal et al. (2006) was removed from the reference list since it was not cited in the main text. Vatvani et al. (2002) should be in section 2.1.3 but somehow it went missing. In the updated manuscript, it was added at the end of section 2.1.3. Along with that, we've also added the refence from Holland (1980) at the end of section 2.1.3.

Reference to the Delft3D-FLOW manual was also corrected in the reference list. Thank you for pointing out these errors.

A general revision of the whole text is needed to eliminate several typing and punctuation errors, uppercase and lowercase letter usage, and missing or unnecessary blanks.

A general revision has been carried out to eliminate typing, punctuation and grammar errors.

***#2** Line 55: replace locale with locales.*

Corrected

***#3** Line 310-314 are redundant.*

Removed.

***#4** At the end of the Introduction, a brief paragraph illustrating the structure of the manuscript should be added.*

Thank you for the suggestion. We've added the following paragraph at the end of introduction section: [Revised line 106-110]:

The structure of the paper is as follows: brief description of the Delft3D Flow model and the methodologies used to simulate future changes in storm surge and inundation, to generate ensemble projections of storm surge inundation were discussed in section 2, In section 3, validation of the model results, present day storm surge inundation scenarios, ensemble projection of storm surge inundation and future change in storm surge level were presented. Section 5 includes, discussion on model results and the uncertainties associated with the future projections. Finally, section 5 presents the concluding remarks on research findings.

***#5** In Equations (2) and (3), the term P0 is not defined.*

It's the density of water. We've corrected it in the updated version.

***#6 Line 143:** replace weas with was.*

Corrected.

***#7 Lines 145-147:** please provide some information about the native resolution of the topography and bathymetry data used.*

We've added the details on bathymetry and topography section.

In line 145, "The land elevations are specified using the data from the Center for Environmental and Geographic Information Services (CEGIS), Bangladesh" since they're based NASA's Shuttle Radar Topography Mission (SRTM) 90m resolution datasets.

Following lines were added in the 2.1.2 Model Grid and Bathymetry sections:

In this study, the land topography data were obtained from NASA's Shuttle Radar Topography Mission (SRTM) 90-m resolution datasets (Figure 1b). The ocean bathymetry wais specified using the data from the General Bathymetric Chart of the Oceans 30-arc-sec interval gridded data (BODC, 2003, Figure 1b).

#8 Line 156: the reference should be to the work by Holland (1980), I suppose.

Actually, it should be Hemming et al. (1995) instead of Hemming et al. (1980). Delft3D uses Wind Enhancement Scheme (WES) which is based on Holland's Wind Model (1980) in order to bring asymmetry by applying the translation speed of the cyclone center displacement as steering current and by introducing rotation of wind speed due to friction.

#9 In Equation (6) the term e is not defined.

It's the base of the natural logarithm (=2.71828182846) (Delft Hydraulics, 2011). We've included this information in the revised version.

#10 In Equation (8) the definition of MAE is not correct.

Corrected.

#11 Line 218-219: the BIWTA acronym has been already introduced and can be used without the full explanation.

Corrected.

#12 Line 376: replace "the probable range of inundated are" with "the most probable range of inundated area extent".

Replaced.

#13 Line 480: replace representing with represent.

Replaced.

#14 Lines 506-508: uppercase letter are unnecessary for measured and modeled water level.

Corrected.

#15 Line 556: replace showing with is showing.

Corrected.

#16 Table 2: 12 historical TC tracks are used in ensemble projection as mentioned in Sections 2.2 and 3.3.1. In my opinion, a further figure illustrating each track and/or just a table listing the main characteristics of each storm (e.g. name, intensity, day of landfall, etc) would be useful.

Thank you for the suggestion. We've included Table 2 with the information of 12 historical TC tracks that were used for ensemble projections.

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

#17 Table 3: the third row with average values of statistical indicators can be eliminated, because averaging just two values is poorly significant.

Thank you. It was eliminated.