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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "A cross-scale study for compound flooding processes during Hurricane Florence" *by* Fei Ye et al.

Anonymous Referee #2

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Congratulations to the authors on putting together an interesting and well-written manuscript. The study seeks to understand the role of various coastal flood mechanisms occurring during Hurricane Florence (2018), such as tides, storm surge, waves, river flows and rainfall. The authors utilize a 3D hydrodynamic model (with river input from the National Water Model) to simulate the combined flooding and investigate the individual contributions of each major flood driver during Florence. In general, this is a well-written and worthwhile contribution to the field of compound flooding literature. I have some comments that I believe can improve the manuscript, and I recommend acceptance of the manuscript after the authors have considered the main points outlined below:

- The authors suggest that a 3D baroclinic model is necessary to accurately capture the

water level response. However, I suspect that utilizing such a complex model (plus the very large mesh size) would require a very large computational expense. The authors do not present results from using a more simplified approach (2D depth-averaged for example), so we don't know whether the additional complexity is actually needed to capture the water level response. The manuscript would benefit from some discussion about the trade offs between model complexity and computational burden, as well as some details about how long each simulation takes to run.

- In my experience, the NCEI CUDEM does not capture the bathymetry of coastal streams well, and tends to significantly underestimate the channel depth. Did the authors make any corrections/modifications to the raw DEM to better represent coastal streams?

- There is no mention of infiltration in this manuscript, which is an important factor controlling the pluvial flood dynamics. Did the authors completely neglect infiltration in this work? And if so, there should be some discussion/justification about why infiltration was not accounted for. Since much of the underlying soil in the NC region is sand, I expect infiltration losses would be non-negligible and neglecting infiltration could cause over-estimation of the rainfall-induced flooding.

- In addition to these comments, I have pointed out a couple issues/suggestions for the figures in the manuscript (see specific comments).

Specific Comments:

Line 106: What is meant by "bona fide" in this context? Please clarify.

Figure 3: I am a bit confused by figures 3b and 3c. The box showing the location of figure 3c indicates that 3c is north of Albermale Sound. However, when I look at Figure 3c it appears to be depicting the Cape Fear River Estuary, which is at the southern tip of NC. Please confirm/update the actual location of Fig 3c.

Table 1: The difference between the No_NWM_precip and Ocean scenario is not clear

to me. It seems they both do not include river or precip forcing?

Fig 9: It is difficult to distinguish the differences between the model runs, especially for figures 9a-d. I suggest the authors shorten the depicted time window to only show 1-2 days before landfall through 4-5 days after landfall for a-d. This will allow a reader to see more clearly the differences between the scenarios and the comparison to the observed water levels.

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