Review of "Investigating coastal backwater effects and flooding in the coastal zone using a global river transport model on an unstructured mesh" by Feng et al.

In this study, the authors explored the coastal backwater effects and flooding in the coastal zone making use of a global river transport model. Here the backwater effect was defined as an extreme phenomenon when the downstream river stage is higher than the river stage of the current channel, resulting in the negative friction slope and hence negative flow velocity. In particular, the backwater effects were mainly induced by the dynamic sea level variation, especially during the storm surge event together with the fluvial flood. Generally, the paper is well organized and written. However, there are still some major and minor concerns that should be properly addressed.

Major concerns:

1. The valid of decomposition method applied to the river mouth (i.e., 8545240 in Figure 1): It can be seen from Figure 1 that the tidal gauge with no. 8545240 is located in the upstream part of the Delaware Bay (or Delaware river delta), thus the water level fluctuation is not featured by typical tidal cycles (either semidiurnal cycle or spring-neap cycle, see also Figure 6 in the manuscript). Consequently, my major concern is that the decomposition of the total water level (TWL) into low-frequency surge (LFS) and tide is still valid in this station (i.e., 8545240), especially during the flood events when the river discharge is substantially larger than the tidal discharge since in this case the tidal signal is weak and hard to be detected.
2. The missing of realistic tide-river interaction and its associated backwater effects: As presented in Section 2.2, the global river routing model is mainly driven by runoff from a land surface model. This implies that the model did not explicitly account for the potential impacts of tide from the open sea. Thus, in principle, the adopted MOSART model intuitively neglects the tide-river interaction, which is one of the major physical mechanism leading to backwater effects in coastal zones. For the time being, the backwater effects in this study is mainly constrained by the upstream river discharge and downstream total water level, without explicitly accounting for the tide-river interaction.
3. Figures 4 and 6: In Figure 4, we observe that MOSART model significantly underestimated the extreme flood peak. Thus, my major concern is whether the two computed quantification metrics (including water depth change Δh and water volume change ΔV) for backwater effects are reliable, especially during the Hurricane Irene and Hurricane Sandy. The case is similar for the reproduction of the water level in tidal gauge of 8545240. As a result, the reliability of computed Δh and ΔV should be clarified. By the way, the current MOSART model is also driven by the total water level observed in tidal gauge with no. 8545240, i.e., as a coastal boundary condition? If so, then the comparison between observed and computed water levels presented in Figure 6 is not proper.
4. The negatively correlated relationship between river discharge Q and ΔV (or Q and total water level TWL) in the Susquehanna River has to do with the fact that the imposed total water level was derived from the tidal gauge of 8545240, which is located

in the Delaware River? Please clarify the adopted coastal boundary condition adopted in the Susquehanna River basin.

5. Since most cities are actually located in the downstream part of the adopted coastal boundary condition (e.g., 8545240 in Figure 1), the real application of flood control from this study focusing on the river basin is questionable. Further explanation is required for the implication of this contribution.

Some minor comments:

1. Section 2.1: the study domain does not belong to Methodology.
2. Lines 129-130: Please also illustrate the backwater effect in two studied regions.
3. Line 257: the definition of Kling-Gupta efficiency (KGE) is missing.
4. Lines 282 and 288: eq. 1→Eq. 1
5. Line 403: How did you compute the time series of ΔV (for the whole river basin or only in the main channel)?
6. Figure 7: What are the observations for the grey solid and dashed line? In addition, please correct the units for the ΔV and the discharge
7. Line 476: though→through