Response to the comments of Reviewer 2

We are very much thankful to anonymous Reviewer 2 for his time to review the article and provide valuable comments. These comments are useful to improve the overall quality of the article. We will address these in the revised manuscript and accordingly our responses to each comment is given below. We marked our replies in a blue font, while original reviewer comments are presented in a black font.

Major:

RC1: I feel this paper spent a lot of efforts on "meteorological" drivers (which is good and comprehensive). However, to complete its "hydrometeorological drivers" claim in the title, some soil moisture analyses/discussions may be necessary. For example, looking at Fig. 7: it seems to me that the rapid rise of water level for the 2017 floods (different from 1998) may be due to the high antecedent soil moisture in 2017, which is resulted from the very wet spring (April) in 2017. This may have led to the rapid rise of water in 2017. By contrast, in 1998, July and August rainfall anomalies were higher but the prior spring seems to be dry (especially in the lower Brahmaputra), which leaves large room for soil storage and thus leading to much slower flood water rise. I suggest the authors to present some soil moisture analyses, which can help complete their story.

• Authors are suggested to reference a very similar analysis conducted in the US (https://journals.ametsoc.org/doi/full/10.1175/JHM-D-18-0038.1), where the researchers found the unique response of a flood was due to similar reasons as found in your study. But they also have provided more detailed analyses on antecedent soil moisture as well as flood celerity in the tributaries above the flooded location (which is also similar to this study). Authors are suggested to gather some soil moisture data (from remote sensing) to perform some analyses to improve their story-telling. Or at the very least, these important "hydro" drivers need to be carefully discussed by the paper.

Response:

AC1: According to reviewer suggestion, we are going to include a short analysis on the soil moisture using NCEP–National Center for Atmospheric research (NCAR) reanalysis volumetric soil moisture product to investigate the soil moisture condition during the flood events. Reanalysis soil moisture is model generated data where atmospheric forcing is used to simulate land surface variability processes (Lu et al., 2005). The NCEP-NCAR uses state of the art analysis for the data assimilation to produce reanalysis data (Kalnay et al., 1996). NCEP reanalysis provides soil moisture in two vertical soil layers at depths 0-10 cm and 10-200 cm. We are using soil moisture at the top layer 0-10 cm to complete the present study. To investigate the surface soil moisture condition over the basin, we calculate soil moisture anomaly before flooding event and at the starting of the event. Four dates have been selected for the two flooding events during the 2017 floods- two dates are selected before the flooding event and

two dates are selected at the starting of the flooding event. We also calculate long-term average soil moisture time series to study the evolution of the moisture in the basin during the monsoon period.

From our new analysis, we found that usually, the soil moisture starts to develop gradually with the contribution of the pre-monsoon rainfall during March to May and reach the maximum level with the start of the monsoon rainfall in the basin (see new Figure RC3a below, showing the climatology over 30 years). The average soil moisture at the topsoil layer of the basin is almost homogeneous over the basin during the monsoon period (see new Figure RC3b below, showing the climatology over 30 years). The homogenous signal in the average over 30 years suggests that this is a regular development during the south Asian monsoon. Figure RC3 c-f provides an outlook of the time series of soil moisture anomaly for the two floods events of 2017. During the first flood event in July, the soil moisture was normal both prior to the rainfall event and at the beginning of the flooding (Figure RC3c and d). Similarly, during the August event the soil moisture was normal prior to the rainfall event (Figure 1e). On the other hand, at the start of the flood event on 11 August a band of positive anomaly of soil moisture was developed in the lower part of the basin (Figure RC3f). The rapid rise of water level was recorded on 12, 13, 14 August. The high soil moisture which developed during the August flood event in the lower part of the basin was associated with the heavy rainfall event which might have contributed to the rapid rise of water level in the river. The amount of rainfall and its spatial distribution contributed to the higher soil moisture in August compared to the event July.

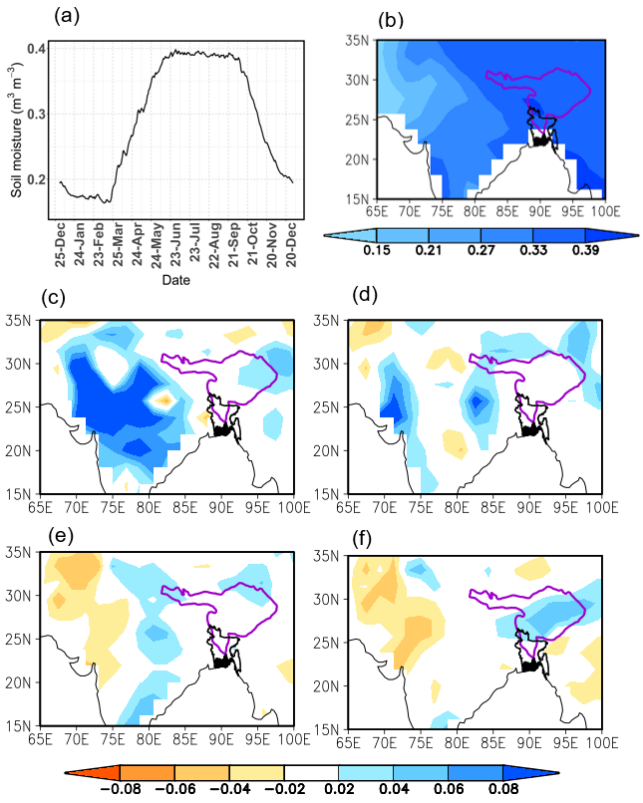

Figure RC3: (a) Development of soil moisture averaged over the basin between 1987 to 2016; (b) Spatial distribution of average daily volumetric soil-moisture (m^3m^{-3}) (0-10 cm) during monsoon period (June to September) over 1987-2016; Soil-moisture anomaly time series (c) 01 July 2017; (d) 07 July 2017; (e) 7 August; (f) 11 August 2017 (Data source: NCAR/NCEP reanalysis)

Minor comments:

Minor:

• Fig. 2: I found several arrows do not have any associated texts and were placed in wrong place maybe. Please revise the figure to make sure arrows are correctly drawn.

Response: The small arrows indicates the direction of flow. We will write in the caption that small arrows indicate the direction of flow.

• Fig. 3: why choosing the rain gauge at Syedpur but not others?

Response: We provided basin average rainfall in Figure 3 (a). To show the rainfall events captured by the rainfall gauge, we provided Figure 3(b). Moreover, the rainfall distribution shows heavy rainfall occurred lower sub-basins near international border. Syedpur is located towards the north of the country where heavy rainfall occurred during the 2017 flood event. Therefore, it has been presented as a representative gauge to capture the rainfall event.

• Fig. 4 caption: change to “over the Indian monsoon core zone (rectangular box)”;
Response: Caption has been changed

• Fig. 5 caption: missing a bracket;
Response: closing bracket is provided.

• Fig. 8: the starting point of the calculation starts from June. Is it possible to start from spring (e.g. April)? The reason is because the spring rainfall anomaly is important for understanding the antecedent basin wetness condition before flooding (recall my Major Comment earlier).
Response: The starting point of the calculation starts from June. We will include calculation from April in Figure 8.

• P1L19: change “but” to “and”; no transition needed here;
Response: Changed accordingly.

• P1L22: the sentence “Water level and river flow time series …” should be better placed in L28 before “The wavelet analysis”;
Response: Changed accordingly.

• P3L2: change “the river flow” to “the water level”
Response: In the second line we talked about the river flow, not water level.

• P3L5: change “consider” to “analyze”
Response: Changed accordingly.
• P6L9: change to “study of Zhang et al. (2017)”
Response: Changed accordingly.

• English presentation of this paper contains several repetitive phrases. For example, (1) P6L2 and P6L3; can use “it” to replace “the Daubechies wavelet function”; (2) P6L13 and P6L24: suggest authors to ask help from native speakers to improve English

presentation; here only limited examples are provided but more places need to be thoroughly revised;

Response: In the process of revision, we will look it.

• P6L32: no need to spell out “GEV” again;
Response: Changed accordingly.

• P8L1: change “shifting” to “shift”
Response: Changed accordingly.

• The English presentation of this paper can be much better simplified. For example, P8L23 can be changed to “An El Nino (La Nina) state is defined when ONI exceeds 0.5 degree C (below -0.5 degree C)”. Same apply to P7L14;

Response: Changed accordingly.

• P8L28: many of these abbreviations have been defined before, no need to define again. Please check throughout the paper, there are many such cases;
Response: Changed accordingly.

• P9L9: remove “anomalies”! It appeared again later and this use is incorrect;
Response: Changed accordingly.

• P16L9: MJO again; no need to spell out

Response: Changed accordingly.

References

Kalnay, E., Kanamitsu, M., Kistler, R., Collins, W., Deaven, D., Gandin, L., Iredell, M., Saha, S., White, G., Woollen, J., Zhu, Y., Chelliah, M., Ebisuzaki, W., Higgins, W., Janowiak, J., Mo, K. C., Ropelewski, C., Wang, J., Leetmaa, A., Reynolds, R., Jenne, R., and Joseph, D.: The NCEP/NCAR 40-Year Reanalysis Project, Bulletin of the American Meteorological Society, 77, 437-472, 10.1175/1520-0477(1996)077<0437:tnyrp>2.0.co;2, 1996.

Lu, C.-H., Kanamitsu, M., Roads, J. O., Ebisuzaki, W., Mitchell, K. E., and Lohmann, D.: Evaluation of Soil Moisture in the NCEP–NCAR and NCEP–DOE Global Reanalyses, Journal of Hydrometeorology, 6, 391-408, https://doi.org/10.1175/JHM427.1, 2005.