Natural Hazards and Earth System Sciences Discussions

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Reply on RC2_Author Comment

Diyali Chattaraj et al.

Author comment on "Integrated Multi-parametric Analytic Hierarchy Process (AHP) and Geographic Information System (GIS) based Spatial modelling for Water logging Susceptibility Mapping: A case study of English Bazar Municipality of Malda, West Bengal, India" by Diyali Chattaraj et al., Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-2020-399-AC2, 2021

- The enlargement of the study area definitely will provide better understanding about regional control of waterlogging. But our objective is confined to a micro/ward level analysis which provides vivid insights about waterlogging susceptibility at grass root level. Your valuable suggestion will be considered in future works.
- Road network plays a very important role in waterlogging especially in this municipality. The authors have considered road network as built-up, in land-use and land-cover map as well as considered in the overlay For this study area, drain network and road network run almost parallel to each other and their spatial distribution is also similar, that is why, the authors have not considered road network as a separate criterion.
- The study is solely dealing with waterlogging susceptibility mapping with the help of some parameters. Thus, to make the manuscript much simpler the words related to flood will be omitted.
- As the authors have already mentioned in AC1, all the maps presented in the paper (has been extracted with 600 dpi resolution) will be enlarged and rearranged so that all the components of map could be noticeable. A satellite view (FCC) of the study arch will be incorporated in the location map (Fig. 1).
- Figure 2 and 3 will be merged with a precise workflow of methodology as per your suggestion in the final manuscript.
- Tables generally provide a visual grouping of information and make the information more noticeable. That is why Table 1 has been included in the text. If it is not needed than it can be eliminated.
- 5 elevation zones, which have already been mentioned in the text, will be incorporated and displayed in the elevation map (Fig. 4) as well.
- The slope map has been prepared from a contour map collected from the municipality. The accuracy of that contour map is considered 5 millimeters in order to get a clear idea about the micro-topographic forms of this region. The variation of the slope map is very less as the study area belongs to flat topography having only about 13 sq. km. of areal extent. The authors have already experimented with finer class intervals and did not find any differences in the final result.
- The situation is also similar in case of flow accumulation These two maps have been included in criteria according to experts' views (hydrologists and engineers) and various literatures dealing with the waterlogging susceptibility mapping.
- In consultation with the experts to formulate the decision-making process, six parameters namely; elevation, slope, rainfall, soil, flow accumulation, land-use / land-

cover (LULC), and drain density are considered responsible for the initiation of waterlogged condition in English bazar municipality. The criteria weight (weightage scheme) has been developed accordingly as per experts' views and based on the previous literatures. If required, some more literatures will positively be reviewed for further understanding.

- Land use land cover is considered one of the most important parameters of water-logging within municipality premises. The LULC undergoes unplanned construction on the low-lying wetlands (located at the west) along with dramatic transformation of the natural and manmade sewerage system without paying any attention to the normal and storm water disposal waterways have led to drainage congestion and water-logging (Fig. 13). Further, absence of planned and adequate drainage system in the newly built-up extension (discussed later) has led the perennial problem of water-logging to be deep rooted in the urban fabrics of this municipality (less dense the drain network (Fig. 11a & b) emanates the capacity of an area to be more waterlogged (Fig. 13). You have also highlighted the importance of road network, which is included in land-use and land-cover map to determine the criteria weight. The temporal change of land-use and land-cover has not been considered in the overlay analysis. Only the land-use and land-cover of 2018 has been taken into consideration. Moreover, two time series satellite data (1990 and 2018) (Fig. 8a & b) have been used to identify and quantify (Fig. 9) the LULC change within municipality over last 30 years.
- The English Bazar municipality experiences a unique urban growth pattern. The LULC map of 2018 (Fig. 8b) shows urban infill, which has taken place in the eastern part that you have identified. If you have a look on the multi-date LULC map (Fig. 8a & b), rapid urban expansion has been developed in the western part which is attributed to huge in-migration since 1970 during the liberation war of Bangladesh. Rapid population growth, unplanned low-land filling eventually leads to number of localities to be emerged in the western part of municipality as newly built-up area (Fig. 10), which is further documented in table 4.
- As per the manuscript, result and discussion have been mentioned under different sections, but the results with the necessary discussions go simultaneously from section 4. Therefore, the section wise sub-headings can be rearranged for clear-cut understanding. Moreover, section 7 exclusively deals with several mitigating measures, suggested by the authors and stakeholders, applicable to this micro-region.
- The authors belong to English Bazar municipality, Malda town and experience the problem of drainage congestion and water-logging after every medium and heavy shower. However, some plates covering several waterlogged pockets within municipal wards, captured by the authors, will be sent as field evidence through supplement file, which may help to understand the severity.

Please also note the supplement to this comment:
https://nhess.copernicus.org/preprints/nhess-2020-399/nhess-2020-399-AC2-supplement.zip