Issue No.	Referee # 1's comments	Responses
	The manuscript is proposing a methodology to accelerate flood modelling. The VRSS aggregates the depression into parameters of modelling and mass balance is used to distribute water volume within the surface runoff network. The overflow from selected sinks are therefore used as the inflow for 2D MIKE FLOOD modelling.	Many thanks for the comments and questions. We put a brief description in order to establish the basis for a joint understanding and further discussions. In the sub-model approach, the 1D surface network model is used to consume the large-scale inputs (e.g. distributed rainfall and DEM) on the full basin 2D domain. This is achieved by the VRSS and the 1D static solver. The VRSS prioritises the important sinks thus simplifying the topology of the 1D surface network without neglecting the volume losses, which therefore ensures the correct spilling volumes as well as spilling configurations. The 1D static solver distributes the water volume in the 1D surface network based on the mass balance. The search algorithm is implemented for optimal upstream tracing and identifies the relevant 1D overland flows only. The selected 1D overland flows (streams) are used to identify the catchments (i.e. sub-impact-zones) relevant to interested flooding targets (i.e. buildings). Here, identified catchments configure sub-model domains whilst sub-setting (simplifying) the DEMs, 2D rainfalls and urban topologies, that allows for the fast operating detailed 2D re-simulations on the relevant (necessary) domain only.
1	There is no that time variable used in the VRSS calculation. How much time for the rainfall to reach the sinks, and how long will the flow take from one sink to another are unclear	The impact of time-variable towards the results of the sink spilling configurations dependent on the VRSS and 1D static solver is considered insignificant. The specific purpose of the 1D surface network model is to consume large-scale high-resolution information, as well as to deliver a preliminary simulation result (i.e. spillover/ non-spillover) only, such that an overview of the full-basin sink spilling configuration could be yield for more detailed 2D simulations. Based on such a specified modelling purpose defined along with the low level of expected details, the dynamic processes in the runoffs (rainfall-to-sink/ sink-to-sink) will not affect the sink spilling configuration. As such, we deliberately disregard

		the time-variable for pursuing time-reductions of the 1D simulation other than enabling 1D dynamic flows. In the authors' option, it is not considered as a worthwhile trade-off between improved accuracies and the increased computational efforts when the dynamic wave is used to describe dynamics in the VRSS as well as 1D surface network modelling. Instead, we think that the reflection of such runoff dynamics in 2D models at the local scale is considered reasonable and computationally efficient from a holistic view (Lines 649-654).
2	The sub-model is eliminating the areas of out of interest and only run the 2D model in the small sub-catchment within a large basin. The same exercise has been used in extensive previous work. There novelty of the approach is unclear	To the authors' knowledge, no research literature that presents the sub-model approach in the context of the urban flood modelling has been identified. Besides, some methods used for cutting domain from the large basin domain (e.g. cut-off based on municipality border, cut-off elevation cells greater than a certain threshold, making a buffer based some certain spatial distance or using ArcGIS watershed tool) have been discussed at Lines 619-627. As pointed out at Lines 621-623, these methods lack a holistic view, thus resulting in imprecise predictions in the boundary areas from various extents. Moreover, the determination of the threshold values for those cut-off methods tend to be subjective. At some points, the modellers would not know whether more or fewer errors will be introduced due to the added or reduced the domains. However, the sub-model approach will delineate a precise modelling domain and boundary automatically for users. In addition, the advantages of using the sub-model approach is outlined below: • As suggested at Lines 634-645, the sub-model approach is achieved in a GIS automation procedure. This allows for a fast-and-handy sub-model generation process, especially in the case that thousands of sub-models are needed (e.g. Lines 635-639). Here, users only need to specify the targeted buildings, distributed rainfalls and basin-DEM, where the modelling domain and boundaries of the sub-model will be customised precisely. Most likely, the same task would turn out to be incapable when

		using manual operations. Furthermore, as stated in Lines 636-639, this automation feature would pave the way to the parallelisation of many sub-models in the computer cluster environment. • This sub-model approach accounts for the full basin spatial variations of rainfall when generating the sub-model, which results in more effective domain reductions. As suggested in Lines 643-645, such a feature would promote more potentials in time reductions when combining with high-resolution weather radar rainfall data as the result of more precise spatial variations. • The sub-model approach requires users to define specified targets (e.g. critical buildings or roads). In contrast a general modelling approach "as realistic as possible" or "cover every detail as much as possible", this method would in turn force the users to rethink about the question "what is really needed for this specific modelling task", thus eliminating the irrelevant representation process of overland flow components in the way of formulating a simplified su-model. As such, an even faster simulation of sub-model approach could be achieved at the first place by sharpening the modelling focus or prioritising some critical targets. (Lines 632-634) • The 1D static model enables a fast-and-simple inundation overview at full-basin scale, where the spatial variations of hydrological factors (e.g. rainfall, infiltration, evaporation and groundwater) can be estimated as subtracted volumes from each sink in a spatially distributed manner. Here, the significance regards the heterogeneities of these different variables will be fully understood by having an intuitive view of the extracted subset inputs within the sub-domain. For example, as shown in the first column of Fig. S5 in Supplementary Material, the rainfall heterogeneity in sub-model A and B is more significant than sub-model C and D, which illustrates that rainfall inputs in

		sub-model C and D can be further simplified into uniform rainfall inputs.
3	The flood maps in Figure 10 show the water accumulating along modelling boundaries, indicates the modelling boundaries do not reflect the catchment boundary correctly. The comparison between Figure 10c and 10d shows that there are significant flooding in the north area that is modelled in sub-model and not modelled in municipality model. How are the modelling results compared in Table 2 when the information is missing in one model?	As suggested in Lines 621-623, our argument is that "it is difficult for modelers to identify precise catchment modelling boundary without having pre-simulation under a holistic basin view." For one thing, the water accumulations along the southeastern boundary of flood maps in Figure 10c indicate errors of the boundary conditions when taking the municipality border as the modelling boundary. For another, it motivates the use of the sub-model approach to automatically identify the precise modelling domains and boundaries by accounting for the full basin complications in term of rainfalls, DEM and building topology. The sub-model approach considers those flooding information as irrelevant information instead of missing information. In the sub-model approach, the north area has been modelled by using the 1D static surface runoff model in the Phase I. The reason for excluding those areas from 2D simulation (Phase II) is that the areas are irrelevant to the inundation process of the specific targets defined by users, such that the results of those areas in 2D is not needed. Again, we think a fast simulation process can be achieved by deliberately ignoring representation processes deemed unnecessary based on the specified purpose. In accordance with the statement above, the 2D flood information of the north area in Fig. 10 is considered irrelevant according to the specific modelling task. The cut-off of these redundancy modelling areas is due to the efforts of using the sub-model approach. Thus, time reductions compared to using full-basin modelling is considered reasonable. Instead of including every buildings in the basin area, the specifying the targeting buildings will push modeler to rethink their modelling priorities, and thus significant time reduction can be yield at the first place (Lines 631-634).
4	The comparison in Table 3 is misleading. The sub-model and municipality model only	Whereas the full-basin model produces information for 27m cells, only information on

	produce the information in 263k and 148k cells, respectively, while the full-basin model produced information for 27m cells. If the performance is normalised by cell number, the full basin model actually performance much fast per cell. The authors must present that all models are using the same input condition, and same or similar modelling domain.	263k cells, in this case, is useful according to the need of modelers. To remove those unnecessary computational cells will help to improve the computing speed. Also, we assume that modelers would more focus on the total computational time other than computational time per cell. As suggested at Lines 358-368, the same inputs (i.e. rainfall and DEM) have been used for comparing full-basin model, sub-model and municipality model. Also, the second row of Table 3 shows that the same DEM with the same extent (column and rows) have been used for three approaches to ensure the same start point of the comparison. The third row of Table 3 shows full-basin model did not perform domain reduction, while the sub-model and municipality model perform domain reduction in two different ways for comparisons. The sub-model used the 1D static model to process the full-basin domain as well as the full-basin distributed rainfalls before entailing more detailed 2D simulations at necessary domains, and thus it actually uses the domain and rainfall as the same as the full-basin model.