Issue No.	Referee # 2's comments	Responses
	The topic of the presented study is interesting and relevant: fast flood models to allow for real-time urban flood forecasting. However, the presented manuscript has a few aspects that would benefit if improved and clarified	Many thanks indeed for your interest and constructive comments. We provide the point-to-point responses below for potential discussions.
1	There are other types of flood models in addition to the "2D hydrodynamic" and "1D static model" models. What about "1D dynamic" models?	Agree. The idea of the sub-model approach is to adopt a multi-scale simulation strategy that illustrates the 1D/2D complementary solution maximizing their benefits while minimizing shortcomings (Line 42). Inclusion of the relevant literature on 1D dynamic models would ensure more comprehensive coverage of state-of-the-art in the 1D model part. Moreover, this would allow for an opportunity to articulate the motivations for choosing a 1D static model other than 1D dynamic models for the sub-model approach when considering the context of the urban flood modelling.
2	What is the novelty of Module 1 when compared to previously proposed methods (e.g. Maksimovic et al., 2009)? The proposed method is based on various parameters that need to be pre-defined (e.g. HRVratio = 15% and VLratio = 5%). It would be important to learn about what impact the values of these parameters may have in the final results (and if they should be different from catchment to cachment…). A sensitivity analysis would be required.	In fact, we have conducted and included the referred comparison study between the VRSS method and the method presented by Maksimovic et al., 2009 in another independent manuscript which is focusing on the subject of 1D surface network flood models only. The sensitivity of HRVratio and VLratio towards 1D surface network models has been tested on three case areas as well as three rainfalls. The results pointed out that the performance of HRVratio and VLratio are robust when configuring 1D surface networks in different case areas applied. HRVratio = 15% and VLratio = 5% yield a computationally efficient number of sinks while maintaining the volume losses at an insignificant level for 1D static simulations. Nevertheless, If we include these contents (tests) in this manuscript, we would have a few concerns for potential discussions: 1. The main subject of the sub-model approach is to reduce 2D simulation time other than 1D simulation time. Two parameters (i.e. HRVratio and VLratio) are linking more closely to 1D

		surface network model results than the final 2D model results. As such, the authors would be concerned that the introduced VRSS sensitivity test (which is more related to the discussion of 1D surface network simplicity and 1D model accuracy and efficiency) would potentially distract or dilute the main focus on the 2D simulation part. 2. Both the VRSS and the sink screening method presented by Maksimovic et al., 2009 are focusing on a question on "how to best select critical sinks for configuring a fast 1D surface network model?". This subject requires a good understanding of existing sink screening methods in existing literature and their relation to 1D surface models. It might seem ungrounded to some readers who is unfamiliar with such a topic, if we also add a sensitivity test directly without providing a complete introduction section to cover the background, motivation factors and relevant literatures. 3. The current manuscript contains immense volume including three tests (i.e. domain reduction, boundary condition and general applicability) as well as four tests attached in the Supplementary Material, which is approximately 15,000 words in total. At this point, the authors' concern is that the inclusion of an additional sensitivity test of the VRSS method from a completed manuscript would overload the current manuscript significantly. From the above considerations, we therefore only included a summary of the main advantages of the VRSS method towards Maksimovic et al., 2009 in Lines 192-204. Meanwhile, we conducted a simple comparison study (test) in the 1D surface network configuration by comparing Arc-Malstrom (that takes a maximum sink depth as the screening criteria) with the VRSS method in Supplementary Material S2. The results revealed that the VRSS method reduces the stream order of the 1D surface network significantly, thus ensuring fewer computations (iteration times) in the link-based fast-inundation algorithm. Meanwhile, we unfolded the detailed sensitivity test and in-depth

		discussion in another independent manuscript to be submitted in a very near future.
3	Apparently, nothing is novel in Module II. As far as I can understand, it uses ArcGIS and Arc-Malstrom methods to generate a 1D surface channel network.	Module II used the existing Arc-Malstrøm method (Balstrøm and Crawford, 2018) to generate the 1D surface runoff network. However, instead of methods presented in each module, authors also would like to address that the main strength of the sub-model approach is proposing a methodology bundling all new/previous/enhanced methods together thus achieving an optimal combination of a 1D static model and a 2D hydrodynamic models via multi-scale simulation strategy.
4	In Module III, as the authors mention in lines 271-277, the proposed "new" method sounds as a new method implementation a method previously developed (in Arc-Malstrom).	A part of this section was re-phrased to improve clarifications in the novelty of the link-based fast-inundation algorithm as follows: 1. The main idea of the link-based fast-inundation algorithm is to establish a new data structure (configuration) based on Python environment only thus leaving off the previous ArcGIS' geometric network environment. This would allow for much more flexibility for modifying source code. 2. One of the limitations in the Arc-Malstrøm is that it needs manual operations for upstream tracing and filling-and-spilling computations. The link-based fast-inundation algorithm is programmed in the Python environment, and thus allows for the automation of the general sub-model workflow. The automation feature is essential in case that thousands of sub-models are required simultaneously (Lines 636-639). 3. The idea of Arc-Malstrøm's filling-and-spilling routine is based on an iteration which continuously identifies the next downstream sink. As stated in Balstrøm and Crawford, (2018), the limitation of the previous algorithm is that the procedure will encounter an infinite loop, if the flow loop exists in the 1D surface runoff network. This therefore requires that users eliminate the flow loop manually before enabling the computation. However, the use of the Shreve stream order has effectively avoided

		this problem, which allows for the automation of a general workflow. Based on the statement above, we consider that the link-based fast inundation algorithm is an improved version based on Arc-Malstrøm method other than a new method implementation.
5	The proposed methodology could have been tested in (a) different catchments with (b) different type of rainfall events. This would test if the proposed methodology is valid for different contexts.	In fact, the sub-model approach was tested for four catchments in order to evaluate its applicability in different contexts. In the present paper the results from the four most relevant catchments (Section 4.3) were presented covering a semi-rural catchment, suburbs, small towns and a big city in the case area; and the catchments' terrains vary from rather flat to steep slopes (Table in Fig. 14). Furthermore, the rainfall events range from 1 to 100 years (Table in Fig. 14 and Supplementary Material S5). It might be always good to test more catchments and rainfall events, but overall we feel that our selections cover a range, so we can discuss the general behaviour and applicability of our modelling approach.
7	Other comments: It is unclear what "Optimised boundary" is. Description in Section 2.5 and Figure 7b are not sufficient. This definition is very important to understand the flood model results. It is not surprising that the "Municipal domain" approach shows poorer results than the other two cases – water does not "follow" administrative boundaries…	Agree. We would try to improve the clarity in the definition of the "optimised boundary" in this section. The optimised boundary defined is based on the pre-simulation results from the 1D runoff network (1D static model). Thus, this allows for the more accurate automatically set-up of multiple outlets in terms of volumes and positions.
8	Quality of plots (and tables as figures) should be improved.	Agree. We would improve the image quality, and split figures and tables.
9	Results of flood velocity are not explained.	Discussion of flood velocity results would need to be enhanced further. Yet, in fact, Parts of the flow velocity results (errors) were first explained in the domain reduction test (Lines 535-539), when opposite flow directions were identified at Points 6, 10 and 12 due to the use of the closed boundary conditions. Thereafter, in order to resolve this

		identified issue, we proposed the optimised boundary condition, where the problematic flow velocity results for Points 6, 10 and 12 were further validated and discussed at Lines 565-568 in the boundary condition test.
	For example, in the table of Figure 14 the velocity results could be presented to evaluate the accuracy of this important flood characteristic.	Yes. We agree that it would be nice to validate the robustness of flow velocity performance in different catchments and rainfalls. But considering the detailed validation level presented in the previous two tests (domain reduction and boundary condition), we believe that - in the general application test - it would be sufficient to only use a general indictor to statistically summarise results in the form of the table for each case instead of presenting detailed flow hydrographs at points once more.
10	In abstract (line 30), the RMSE value seems to be relate to flood depth. How does flood extent and flood velocity compare?	Agree. It would be essential to highlight the performance of flood extents and flow velocities in the abstract.