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Hydrology and Earth System Sciences Discussions

Interactive comment on "A study of the climate change impacts on fluvial flood propagation in the Vietnamese Mekong Delta" *by* V. P. Dang Tri et al.

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We would like to thank the reviewer for taking time in reading and suggesting modification to the paper. We found all comments very useful to improve our paper.

Answers to the raised comments are as follows: **General comments** *The manuscript by Dang Trie et al. wants to analyze possible effects of climate changes on Vietnamese Mekong Delta flood dynamics. In detail this study focuses upon likely effects of the combination of different components: sea level rise, changes of Mekong discharge regime in a specific upstream cross-section (Kratie) and future development of the Upper Mekong Basin. I really appreciated the authors' choice to address these important issues, but I personally suggest a major revision of this manuscript before it can be*

accepted for the publication. To the questions already raised by Anonymous Referee 1, I would like to add some critical points that need to be clarified. Here below I will provide an itemized description of my comments.

Authors' answer: We would like to thank the reviewer for taking time and evaluating the topic of the paper. We find all the comments of the reviewer useful. We are following the suggested changes so that the manuscript is improved in readability and clarity.

Please find our answers to all raised comments bellow. They are addressed one by one as they are in the interactive discussion.

Comment 1 *In the description of the study area, the authors highlight that the Mekong River has a highly complex hydraulic nature and in the abstract it is stated that this paper aims to demonstrate the particular complexity of the flood dynamics. If I understood well (line 6 at page 7240) the ISIS model, that is applied for this study, is a 1-D hydrodynamic model and it describes the Vietnamese Mekong Delta making use of 5502 nodes. Moreover, to the best of my knowledge, the Vietnamese Delta is highly regulated and the anthropogenic influence is heavy (Dung et al, 2011). I think that the number of nodes chosen for the flood model is quite low if one wants to meet the aim of representing the complexity of the such an area. Dung et al (2011), for instance, studied the same area making use of a different 1-D flood model with more than 25000 computational nodes. Comparing the hydraulic network modeled by the two studies (Fig. 5 in Dang Tri et al. and Fig. 1 in Dung et al. (2011)) it is possible to see a good agreement in the representation of the eastern side of the network, that one which comprises the largest branches of the delta, while it is not the case for the rest of the hydraulic network and particularly it is not the case for the smaller rivers and channels network. The southern side of the "Coastal Area", the "Ca Mau Peninsula" and also the northern side of the Vietnamese Delta are depicted in the manuscript by*

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Dang Trie et al. with much less detail. Furthermore I think that there is a high degree of subjectivity adopting a hydrodynamic model with a low number of nodes as most depends on the way that the different cross-sections are connected one another. On the other hand I understand that it is probably not so easy to have access to more data than those already adopted in the presented study. Can the authors please explain the rationale behind their choice? And, can they please give more details regarding also the trade-off between assuming a limited number of nodes and giving a satisfactory representation of the complex dynamics of the Delta? Did they try to use a more complex model, a model that uses more nodes?

Authors' answer: We would like to mention that the 5520 nodes that we are referring to, in the description of the model are not the computational nodes. These are the nodes that are describing the model, in terms of cross-sections and description of detailing of links between canals and main river reaches. The number of computational nodes is different than the nodes describing the model. The Mekong Delta computational nodes are located approximately at a computational space of 500m, one from each other, on a 8619 km of channels of the VMD. Looking at the comments of both reviewers, we do acknowledge that the description of the 1D model in the manuscript needs to be better addressed, and we will make the clear distinction between what are the nodes which describe physical characteristics of the model, and the computational parameters, such as computational nodes, time step of computation, simulation time, boundary conditions, etc.

Comment 2 *At page 7235 line 2 the authors make distinction between the upstream and downstream section of the Vietnamese Delta, and this same distinction is reflected in the figures as well (Fig 5 and Fig 6 for instance). I probably missed it, but I did not find any explanation for the reason why the authors made such a separation and, to me, it was difficult to follow the line of reasoning of the manuscript. Do the flood simulations in the downstream section (see paragraph 3.1.3) consider also the*

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tidal/future sea rise effect, while the representation of the upstream section doesn't? What are the different conditions that force the model in these two configurations? Can the authors add some clarifications? And, if the authors will maintain this difference, it will be better to specify it in the figure captions as well; for instance Fig 5 refers to the upstream section, while caption of Fig 6 will state that it is depicting the simulation results for downstream section, and so on for all the other figures.

Authors' answer: We would like to thank the reviewer for pointing out that the description of the work is not described in detail. We will correct this with the revised manuscript. The work presented herein is different from previous VMD modelling studies, because it tries to address the inundation extent of the downstream area as well. The downstream inundated areas are lasting for a short time, as compared with the upstream part of the VMD (around 24 hours) however the authors considered that due to climate changes these areas will be flooded for longer time in the future. The study therefore presents both the upstream and downstream changes of the inundation pattern. The flood inundation of the downstream section do take into account both the SLR and the changes in the upstream discharge. We will also clearly reflect all the figures explanations in the text and in the figure captions.

Comment 3 *page 7233 line 16 – Are the hourly sea level measures available for a single location or for different locations?*

Authors' answer: There are several se level measurement locations available in the VMD delta. We will make it clear in the manuscript.

Comment 4 *At page 7233 line 24 it is stated that Scenario 2 considered the future development of the Upper Part of the Mekong Basin as well. Can the authors add some details in order to let the reader, who is not familiar with this area, know how is the basin expected to develop? And can they add any reference?*

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Authors' answer: Indeed in list of references, we are lacking the document Impacts of climate change and development on Mekong flow regimes: First assessment – 2009 (MRC Management Information Booklet Series No. 4, 2011). We will add the reference and specify, that according to this evaluation the expected common trends of change in flow regime due to potential upstream dam developments and the influence of climate change are: i) hydropower dams could result in a lower flow in the high-flow season and increased flow in the low-flow season; and ii) climate change could result in higher flow in both seasons.

Comment 5 *At page 7233 line 24 it is stated that Scenario 2 considered the future development of the Upper Part of the Mekong Basin as well. Can the authors add some details in order to let the reader, who is not familiar with this area, know how is the basin expected to develop? And can they add any reference?*

Authors' answer: The impacts of the upstream constructed and planned dams in the Upper Mekong Basin (in China) have not been clearly identified for the following reasons: Firstly, this analysis was not at all within the scope of this study, and, secondly, data for such evaluation was not available. The aim of this paper is to analyse the impact of sea level rise on river flood dynamics. The flooding conditions may change during dry and wet periods (reflected in discharge changes at the most upstream point of the VMD) and this was analysed in the article. The main assumption in this study is that in case of dam construction any of the VMD upstream discharge distributions will be as has been agreed in the international treaties on Mekong.

Comment 6 *At page 7237: If I understood well, figures 10 to 13 show the results of the simulations obtained referring to scenarios 1 and 2, that do not take into account the sea level rise. But few lines later, starting from line 10, the authors refer to the fact that the sea level rise would affect the coastal area. And at line 17 the authors refer to figure 14, which I understand only from line 24 of page 7240, shows the results of a simulation made considering the sea level rise and changes in the upstream*

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discharge according to scenarios 1 and 2. I think that it would be better to give a broader explanation of this transition between considering only scenarios 1 and 2 and adding the sea level rise as well.

Authors' answer: Figure 10 to 13 are results of model run No. 3 (see page 7249 of the discussion paper). In Table 1 it is mentioned that the model run no. 3a and 3b takes into account the future sea level rise (sea level from the year 2000 + 30cm). We will make it clear in the revised version of the paper.

Comment 7 *Figure 2 is too small and the same are the labels of figures 4, 16, 17 , 18, 19, 20. The legend of many figures results hardly readable.*

Authors' answer: Thank you for pointing this out to the authors We will carefully look at the figures legends and make them clearer.

Comment 8: *Sometimes the authors refer to the climate change scenarios as CC (page 7237 line 9, page 7240 for instance) some others as CLC1 and CLC2 (figure 2d). It would be better to choose between the two.*

Authors' answer: Thank you for pointing this unclarity to us. We will make the requested modifications, so that things are clearer. We will use everywhere CC.

1Comment 9. *Sometimes the authors refer to the 30th of August (legend of fig 5 for instance) and sometimes to the 31st of August (caption of figure 5, for instance); it would be better to choose between the two.*

Authors' answer: We will revise this and change the manuscript accordingly. It should be 31st August.

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Comment 10: *In figure 16 it would be better to refer to the date of the simulation always in the same way, for instance 04 July, 30 August, 23 September and 01 November.*

Authors' answer: We will revise this and change the manuscript accordingly.

Comment 11 *In the caption of figure 21 it would be better to explain the meaning of L1*$_2$*000,* $L2_2000 and so on.$

Authors' answer: *We will revise this and change the manuscript accordingly. The meanings of the captions are as follows: L1*$_2$*000 :* $Lis location(L1 can be referred back Figure, and 2000 is the year of model run.$

Authors' final remark: *All our responses to the questions raised by the reviewer will be included in the revised version of the manuscript.*

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 9, 7227, 2012.