Reply to reviewer comment RC1:

We thank the reviewer for his/her efforts to evaluate the quality and potential impact of our manuscript. We have read the comments carefully and reply to each comment individually below. The original reviewer comments are marked in blue.

1. English language must be significantly improved before the manuscript can be considered for acceptance. For example, one sentence in the abstract contains multiple grammatical mistakes: “This communication present a simple statistical seasonal forecast model able to predict the salinity intrusion up to 9 months ahead with high skill.” The authors are requested to properly take care of the English writing throughout the whole manuscript.

Thanks for pointing this out. The language will be double-checked in the revised version.

2. Use of in-situ measurements of soil intrusion is considered in the forecast model, while it is rather time-consuming and cost-ineffective. Would the authors comment on the use of remotely-sensed salinity intrusion (e.g. https://doi.org/10.1186/s40645-019-0311-0) in the forecast model?

In-situ measurements were used, because surface water salinity is measured operationally by the hydro-meteorological service at various locations in the Mekong Delta. The hydro-meteorological service is also responsible for the official forecast of the salinity intrusion in the Mekong Delta. The data is thus readily available at the responsible agency, and therefore it is straight-forward to use this data set for our prediction model. However, it would be of course useful to get additional data based on remote sensing platforms, because remote sensing could provide a better overview on the spatial dimension of the salinity intrusion. If remote sensing can deliver reliable measurements of surface water salinity, I would certainly support the use of it. However, we cannot judge whether this is possible or not, as this is not our field of expertise. The cited paper covers the determination of soil salinity, which is not the target of our forecast, but rather the outcome of saline water used for irrigation.

3. The description about the salinity intrusion is rather comprehensive in the current version of the manuscript. It can be significantly shortened. In contrast, how the proposed forecast model is formulated and works are much less described and thus must be properly enhanced.

We think that the comprehensive description of the salinity intrusion in the Delta and their negative consequences is required to illustrate the necessity of a reliable seasonal forecast and to motivate the research presented in the manuscript. However, we agree that the method could be described in more detail, even though all applied methods are rather standard. In order to stay within the limits of a brief communication, we propose to provide more details in a supplement. We would ask the editor to give a statement about this suggestion. If a supplement is not favoured, we would shorten the motivation part and provide an additional paragraph about the methodological details.

4. Figure 1 shows the land use over the Mekong Delta, while it presents the 2010 status. How is the land use over the Mekong Delta changing with time? How does the evolving land use influence on the proposed forecast model?

The land use in the Mekong Delta is changing quite dynamically as a consequence of economic, political and environmental pressures. In the coastal regions the salinity intrusion is one of the main drivers of land use change. If sufficient amounts fresh irrigation water are not available, farmers and the provincial administration adapt to this situation by e.g. growing more saline tolerant crops, or by changing the farming systems. If the latter aspect this is supported by governmental incentives, as e.g. in Soc Trang province, where the replacement of paddy rice crops by saline or brackish shrimp production was officially supported, significant changes in land use can occur in a short time. The map in figure 1 is thus mainly for illustrative purpose, showing the different land use in the coastal regions compared to more upstream areas, and to highlight which main land use types are mainly affected by salinity intrusion. In this context it is noteworthy that the differences in land use in the Mekong delta are mainly governed by salinity intrusion and different inundation dynamics.

However, changing land use in the coastal region does not influence the forecast model. The salinity intrusion is dominated by the interplay of tidal forces and river discharge during the low flow season (see e.g. Dang et al., 2019). Both factors are not influenced by land use in the coastal region. The dry season discharge can be altered by storage of flood water during the flood season in high-dike compartments in the upper parts of the Vietnamese Mekong Delta and its release during the early stages of the dry season, but only to a very limited extent (Thanh et al., 2020; Triet et al., 2017). Therefor even the hypothetical conversion of all flood compartments into areas protected by high dikes (i.e. a large scale land use change in the upper part of the Vietnamese part of the delta) would hardly impact on the salinity intrusion and thus the applicability of the proposed model.

5. How the human-made disturbance impacts on the water flow from upstream to downstream along the Mekong River should be addressed. The current manuscript only concerns with the impacts of natural disturbance, i.e. climate. Unfortunately, many reservoirs have been constructed over the upstream and have significantly modified the water flow. How such a human-made disturbance factor influences the performance of the proposed forecast model should be clarified before the model can be used for the operational purpose.

We agree to the statement that man-made disturbances, particularly the ongoing and planned development of hydropower dams, have a considerable impact on the hydrological regime of the Mekong, and thus also on the salinity intrusion. The dam development causes numerous problems ranging from shifts of the hydrological regime, reduced sediment delivery and thus problems for the morphological stability of the delta, disruption of the river ecological system and negative consequences for the Mekong fishery and livelihood of many people. With regard to salinity intrusion the dam induced shift of the hydrological regime towards lower flood season discharge and higher dry season discharge, it can be stated that the dams could partly alleviate the foreseen negative impacts of the rising sea levels on salinity intrusion. This would, from our point of view, be the only potential benefit of the dam development in the Mekong basin for the Mekong delta. This benefit is, however, compromised by the reduction of sediment delivery caused by dams. This causes a deepening of the river channels in the delta, which in turn causes a higher salinity intrusion (Hackney et al., 2020; Tu et al., 2019; Jordan et al., 2019). Moreover, as this potential benefit is subject to political and economic decisions taken in the upstream countries, it is not a reliable mitigation measure for salinity intrusion in the Delta.

Due to the complex nature of this subject, we would thus refrain from discussing the particular impacts of the dam development in the manuscript. Including such a discussion would surely go beyond a brief communication, and there are numerous papers out illustrating the negative effects of hydropower development in the Mekong basin. But we would include the dam issue as a general factor in the discussion, because if the hydrological regime will substantially change due to human interference, the presented forecast models needs to be re-fitted to the new regime, and potentially the operation or actual storage volume of the dams need to be considered as co-variate in the prediction models.

References

Dang, V. H., Tran, D. D., Pham, T. B. T., Khoi, D. N., Tran, P. H., and Nguyen, N. T.: Exploring Freshwater Regimes and Impact Factors in the Coastal Estuaries of the Vietnamese Mekong Delta, Water, 11, 782, 2019.

Hackney, C. R., Darby, S. E., Parsons, D. R., Leyland, J., Best, J. L., Aalto, R., Nicholas, A. P., and Houseago, R. C.: River bank instability from unsustainable sand mining in the lower Mekong River, Nature Sustainability, 10.1038/s41893-019-0455-3, 2020.

Jordan, C., Tiede, J., Lojek, O., Visscher, J., Apel, H., Nguyen, H. Q., Quang, C. N. X., and Schlurmann, T.: Sand mining in the Mekong Delta revisited - current scales of local sediment deficits, Scientific Reports, 9, ARTN 17823, 10.1038/s41598-019-53804-z, 2019.

Thanh, V. Q., Roelvink, D., van der Wegen, M., Reyns, J., Kernkamp, H., Van Vinh, G., and Linh, V. T. P.: Flooding in the Mekong Delta: the impact of dyke systems on downstream hydrodynamics, Hydrol. Earth Syst. Sci., 24, 189-212, 10.5194/hess-24-189-2020, 2020.

Triet, N. V. K., Dung, N. V., Fujii, H., Kummu, M., Merz, B., and Apel, H.: Has dyke development in the Vietnamese Mekong Delta shifted flood hazard downstream?, Hydrol. Earth Syst. Sci., 21, 3991-4010, 10.5194/hess-21-3991-2017, 2017.

Tu, L. X., Thanh, V. Q., Reyns, J., Van, S. P., Anh, D. T., Dang, T. D., and Roelvink, D.: Sediment transport and morphodynamical modeling on the estuaries and coastal zone of the Vietnamese Mekong Delta, Continental Shelf Research, 186, 64-76, https://doi.org/10.1016/j.csr.2019.07.015, 2019.