

Reply to reviewer – NHESS-422-2020

Flood and drought risk assessment for agricultural areas (Tagus Estuary, Portugal)

The reviewer's comments are in italic. Changes from the original manuscript are marked in blue.

RC1: This article is highly relevant since it handles a significant and well defined challenge in two dimensions (sea level and river flow) for a very important food production site in Portugal. The scientific contribution is the application of a simple, but consistent and complete risk method that is applicable for the managers of the water supply and irrigation system if the site, including the dikes.

I miss a more thorough discussion on how the proposed risk analysed can be used for forecasting analysis and decision support (what type of decision measures they have), when they should take decisions and how the decisions should be implemented

Following the reviewer's comment, further details about how the proposed risk assessment tool can support decision and a new table (Table 7) were added to Section 6 Discussion and conclusions (line 465):

~~“Monitoring information is crucial in supporting risk management. Timely information will allow the updating of consequence and risk criteria, and hazard scenarios, and will support mitigation and adaptation strategies definition.”~~

As directed to support decision-making, the risk assessment approach presented in this paper should be applied together with a risk treatment plan (ISO, 2009). The plan will identify appropriate measures to be taken, in particular to reduce risk when the level of risk is not acceptable or close to. For each specific site, this plan is built upon the knowledge acquired and supported by monitoring and early warning systems. Risk control measures should be identified, evaluated and their acceptance by stakeholders assessed before being applied (Simonovic, 2012). Examples of control measures to cope with water salinity and high water level risks are presented in Table 7. The responsibility for the decision-making and measures implementation will depend on the risk level. Some measures can be implemented by the risk owner and local stakeholders (e.g. farmers); others may depend on the involvement of decision makers and authorities at the national level (e.g. water, agricultural, environment and civil protection authorities). The risk level will determine when each measure should be implemented. An adaptive strategic approach (Mearns, 2010) will be adopted to better deal with uncertainty in the decision making process. Periodic monitoring and review of the risk assessment and treatment processes including the communication and consultation to all involved parts will held. This will contribute to reduce the uncertainty of the process by updating of the risk criteria and risk control measures. The improvement of the knowledge about the system, based on more data and better predictive tools, may also contribute to better characterize, quantify and reduce the uncertainty over time.

Mearns, L.O. (2010). The drama of uncertainty. *Climatic Change* 100:77–85. DOI 10.1007/s10584-010-9841-6

Table 7. Examples of risk control measures concerning water salinity and high water level risks.

Risk	Measure	Responsible for decision making / implementation	When the implementation should take place
Water salinity	Extract fresh water from alternative source	Risk owner / Risk owner and local stakeholders	When the level of risk is tolerable but tends to increase
	Reuse irrigation water	Risk owner / Risk owner and local stakeholders	When the level of risk is tolerable but tends to increase
	Adapt crops (higher salt tolerance, less water demanding, shorter growth period)	Risk owner / Risk owner and local stakeholders	When the level of risk is intolerable
	Construct reservoir	Risk owner and National authorities / Risk owner and National authorities	When the level of risk is intolerable
High water level	Implement flood monitoring and early warning systems	Risk owner and National authorities / Risk owner and National authorities	Immediately, to support risk management
	Raise dyke level	Risk owner / Risk owner	When the level of risk is tolerable but tends to increase
	Reinforce dyke	Risk owner / Risk owner and Environment and Agricultural authorities	When the level of risk is tolerable but tends to increase
	Transfer valuable goods and infrastructures to other areas	Risk owner / Risk owner	When the level of risk is tolerable but tends to increase
	Implement a water retention basin along the dyke	Risk owner and Environment and Agricultural authorities / Risk owner and Environment and Agricultural authorities	When the level of risk is intolerable
	Create new artificial wetlands	Risk owner and Environment and Agricultural authorities / Risk owner and Environment and Agricultural authorities	When the level of risk is intolerable