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The effect of recurrent cyclonic surge events on drinking pond and near-surface groundwater salinities in coastal Bangladesh

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Salinity is a pervasive problem in the coastal low-lying area of the deltas including Bangladesh located in one of the largest delta, Ganges-Brahmaputra-Meghna delta. This delta is susceptible to episodic cyclones since it is nearly every 3 years hit by tropical cyclones in the early monsoonal season (April to June) or the early dry season (October to November). These successive cyclones associated with low-lying reclaimed lands that trigger extensive flooding and result in excess salinity in soil and surface water, which have led to low agricultural productivity. Salinity in drinking water causes negative effects on human health such as cardiovascular disease. A fully coupled surface-subsurface model was used to investigate the impact of the episodic cyclonic surges on the drinking pond and groundwater salinities in the coastal reclaimed lands of Dacope Upazila in southwest Bangladesh. We considered 5 scenarios: a cyclone hit the land in the monsoon season with remediation (clean-up the pond at (1) 7 days, (2) 3 months), a cyclone hit the land in the dry season with remediation (clean-up the pond at (3) 7 days (4) 9 months) and (5) the recurrent intervals of cyclones hit the land every 8 years. The hydrological parameters were calibrated from the fieldwork at DAB site in using in situ field observations. The results show that the episodic cyclones caused inevitable salinity to near-surface groundwater, and in pond water because of post-event delayed emptying of ponds and reversal of hydraulic head gradient. However, rapid remediation after a surge event may help avoid serious salinity in drinking water. The result of scenario 5 indicates that near-surface groundwater salinity progressively developed and move downward over time. The episodic surge events might be one of the reasons that cause shallow groundwater salinity in coastal Bangladesh. This study improves our understanding of salinization processes and how to manage drinking water ponds after a storm surge induced flooding in deltaic coastal settings.