Predicting groundwater arsenic contamination in shallow aquifers of south Louisiana, USA

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Groundwater arsenic (As) contamination has been recognized as the largest natural mass poisoning in human history, with more than 140 million people worldwide exposed. The Mississippi River delta has broadly similar geology and sedimentary depositional environments to the large deltas in South and Southeast Asia, the most severely affected regions in the world, and therefore, may also be vulnerable to groundwater As contamination. Logistic regression has been extensively used in environmental assessment and investigation, particularly in predicting the probability of groundwater As contamination. In this study, which is based on surface parameters (i.e., hydrology, soil properties, geology, and sedimentary depositional environments), logistic regression is used to develop a predictive model to assess the probability of As contamination in shallow groundwater of south Louisiana. The model is developed and calibrated using 3286 aggregated and binary-coded As concentration measurements from Bangladesh and verified using 78 binary-coded As measurements from south Louisiana. The model's predictions are in good agreement with the known spatial distribution of groundwater As contamination in Bangladesh, and also indicate high risk of As contamination in shallow groundwater from Holocene sediments in south Louisiana. Furthermore, 79.5% of the existing shallow groundwater As measurements in the study region are correctly predicted by the model, indicating good performance of the model in predicting groundwater As contamination in shallow aquifers of south Louisiana. Future investigation is planned to test the veracity of the model predictions for larger areas of southern Louisiana by targeted shallow groundwater sampling and analysis.