Hoang Van Hoan et al., Int J Earth Sci Geol. 2019
http://dx.doi.org/10.18689/2642-1569.a2.004

madridge CONFERENCES

3rd International Conference on
Geology & Earth Science

April 10-11, 2019 Valencia, Spain

Salinization of Water Resources in the Mekong River Delta, Vietnam

Hoang Van Hoan[1]*, Tong Ngoc Thanh[1], Trieu Duc Huy[1], Pham Van Hung[1], Kieu Van The[1] and Le Manh Hung[2]
[1]National Center for Water Resources Planning and Investigation (NAWAPI), Vietnam
[2]University of South Carolina, USA

Water resources in the Mekong River Delta, Vietnam (MRD) are important factors that greatly influence the livelihood and economy of this region. The MRD occupies an area of 40,577 km^2 with elevations ranging from 0.3 to 0.7 m above mean sea level; hence it is projected to be significantly influenced by salt water intrusion due to climate change.

Surface salt water intrusion is a natural phenomenon that occurs annually in the MRD from December to May and peaks in late April or early May. This phenomenon has been increasing not only in frequency but also extremeness due to climate change. The salinization of groundwater resources in sediment granular aquifers has been observed in the MRD more than 100 km inland. Saline groundwater exists in all aquifers with from both paleo and modern ages. This limits access to fresh water resources for the population of the MRD.

The historic salinity intrusion in the 2015-2016 dry seasons in the MRD, which resulted from a long lasting abnormal El Nino event in the Pacific Ocean, heavily damaged the coastal provinces of the MRD. The hydrological records at the Tan Chau station (Mekong River) from 1926 to present show that the peak flow and total volume of the flood was the lowest in 2015, at approximately half of the largest flood on the record and 60% of the annual average flood. Since the 2015 flood was very weak, the flow into the MRD during the dry season was also considerably lower, at 65-70% of the annual average. With this low flow, salinity intrusion during the 2016 dry season was the worst on record. Until the end of February 2016, saline boundaries of 4 g/L intruded as far as 93 km inland in the Vam Co River, in the Tien (Mekong) River Mouth intruded 65 km inland. The salt water intrusion at Hau River Mouth and West Sea Area (Cai Lon River) was 60 km inland (Fig. 1).

This study aims to quantify the impact of the sea level rise and projected precipitation on the salinity intrusion in the MRD for the period of 2015-2050. Two projected scenarios (RCP4.5 and RCP8.5) were selected to investigate the impact of climate change. The MIKE 11 model (Hydrodynamic module and Advection - Dispersion module) was used to investigate the impact of salt water intrusion due to the sea level rise and projected precipitation. The preliminary results indicate that the MIKE 11 model was able to simulate the discharge and salinity concentration in the MRD. The results from the simulations of the scenarios revealed that salt water will intrude deeply inland in the future threatening the agricultural practices and livelihoods of the farmers in the MRD.

The distribution of fresh and saline groundwater in each aquifer in the MRD was simulated based on 3,083 results of geochemical analyses of groundwater taken from 903 geological boreholes of the National Groundwater Monitoring Network (NGWMN) and 1,734 geochemical analyses of groundwater taken from 13 provinces in addition to the NGWMN in the MRD. Additionally, the results of 3,782 vertical electrical sounding (VES) points and 341 well logs were also included in the simulation. The hydraulic heads and TDS concentrations in groundwater starting from 2016 and for the coming 25 years were simulated for the seven existing aquifers in the MRD (Fig. 2). For the coming 25 years, the water table in almost all aquifers in the MRD is expected to experience a drawdown exceeding 4 m. The modelled average delta-wide drawdown increases with depth. Large drawdown areas are located around major cities and industrial zones where the groundwater extraction is expected to be extensive. In the model, depression cones are observed in some places for all the aquifers with the groundwater levels reduced well over 20 m, even up to 40 m. The excess of the groundwater extraction rate compared to the recharge provides an estimate of the amount of groundwater depletion, while negative values occur in regions where extraction rates are sustained by groundwater recharge.

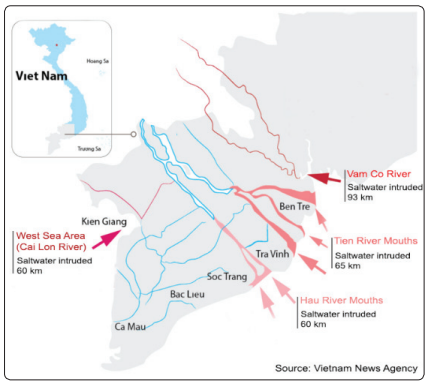

Figure 1: Sea water intruded into rivers in the dry season (February) 2016

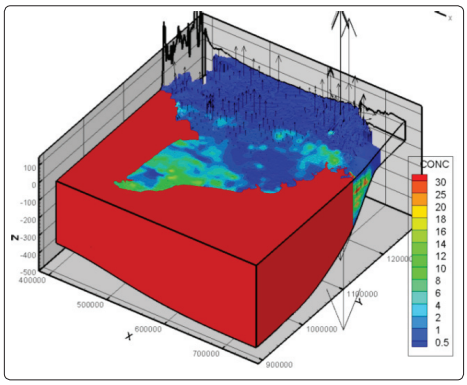

Figure 2: 3D simulation of TDS concentration of groundwater extraction starting from 2016 and for the coming 25 years

Keywords: Saltwater intrusion, Salinization, Mekong River Delta.