

Effects of subsurface barriers on seawater intrusion and nitrate accumulation in coastal aquifers

Qiguo Sun¹, Tianyuan Zheng¹, Xilai Zheng¹, and Marc Walther²

¹Ocean University of China

²Technische Universität Dresden

February 5, 2021

Abstract

The subsurface barrier is one of various engineering measures used to prevent seawater intrusion in coastal regions which has been widely applied. However, its two common types, the cut-off wall and the subsurface dam, are both found to cause nitrate (NO₃⁻) accumulation in landward aquifers. In this study, numerical simulations were conducted to investigate the mechanism of NO₃⁻ accumulation caused by the two types of subsurface barriers, as well as the influence of several key parameters, i.e. the infiltration NO₃⁻ concentration, the inflow DOC concentration, the barrier height and the barrier location on the performance of the subsurface barriers. The results showed that the cut-off wall generally requires a large height to ensure a satisfactory seawater prevention effectiveness, and it is more likely to cause NO₃⁻ accumulation compared to a subsurface dam. On the other hand, despite the subsurface dam may not result in the significant increase of NO₃⁻ concentration in groundwater upstream, it cannot be applied to the areas where SI has occurred due to the residual seawater problem. Moreover, the construction of a cut-off wall results in a stagnation zone appeared at the upper corner of the barrier, where accumulated NO₃⁻ significantly. With the increase of the barrier height, the stagnation zone expanded, leading to further increase of mean NO₃⁻ concentration in the landward aquifer. Since the construction of a subsurface dam will not generate such a zone, the subsurface dam generally has little impact on NO₃⁻ accumulation.

Hosted file

Manuscript.pdf available at <https://authorea.com/users/393958/articles/507451-effects-of-subsurface-barriers-on-seawater-intrusion-and-nitrate-accumulation-in-coastal-aquifers>