

## Three dimensional numerical simulation of saltwater intrusion in Motooka Area, Fukuoka, Japan

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The Motooka area of Fukuoka prefecture of Japan is an agricultural area located on a coastal aquifer where the groundwater is being exploited for drinking and green house agriculture. The groundwater is the main water supply for drinking and greenhouse agriculture. With the increased water demand, groundwater is being extracted at the rate of 1,200m<sup>3</sup>day. The salinity of the pumped water has been analyzed periodically and it has found that the aquifer is affected by the saltwater intrusion due to over exploitation of groundwater. The high salinity of water is not suitable for both drinking and greenhouse farming. Therefore the necessity of the understanding of saltwater intrusion phenomenon in Motooka has occurred. Due to the distributed nature of pumping well locations and non-uniform geological conditions; a three-dimensional model was needed to understand the salt-water intrusion of Motooka.

In this research a three dimensional density dependant solute transport flow model was developed to address the saltwater intrusion of Motooka. The computer code was written in FORTRAN programming language and capable of simulating transient density driven groundwater flow. The model was built by using the finite difference framework, taking into account the development of a transition zone and the variation of fluid density within it. Method of characteristics was applied to solve the advection of solute transport equation. A discretized grid system was applied to enhance the accuracy of the numerical results at the vicinity of pumping wells and to accelerate the speed of numerical calculation. The regional water table fluctuations and hourly recharge rate of the area are assigned at relevant boundaries. The model is capable of simulating both saturated and unsaturated zone flow.

The model was able to adequately represent the behavior of interface movement and up coning behavior with different pumping rates. In future this model will be further developed to address the electric conductivity fluctuations of pumped ground water in Motooka area.