# Digital water level analysis based on well tide and air pressure effect

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In this paper, the porosity, the volume compression coefficient of solid skeleton and the volume compression coefficient of water in the aquifer are studied by using the air pressure coefficient and tide factor from Dahuichang Well, Banqiao Well, Huanghua Well, Dadianzi Well, Fengzhen Well and Sanhaodi Well in the north of North China.
The results show that there is an obvious power function relationship between porosity and volume compression coefficient of solid skeleton and that of water in aquifer.(1)In the first quadrant, the volume compression coefficient of aquifer solid skeleton increases with the increase of porosity.This is due to the fact that when the pore pressure increases, the volume of water decreases. When the external stress remains unchanged, the skeleton stress decreases, the skeleton volume increases, and the pore volume increases together.Therefore, with the decrease of skeleton stress and the increase of skeleton volume (expansion), the volume change (or rate of change) is also larger (easy to compress). The compression coefficient of skeleton volume increases with the increase of porosity.(2)When the pore pressure increases, the volume of water decreases, and the smaller the volume change (or change rate), the smaller the volume compression coefficient of water. At the same time, this process is the process of porosity increase. Therefore, the volume compression coefficient of water decreases with the increase of porosity.(3)The elastic deformation of water decreases with the increase of porosity. This is because the compression coefficient of water is smaller and smaller, and the volume change is smaller and smaller, so the water is more difficult to compress. At the same time, the solid skeleton is easy to compress and elastic deformation becomes stronger.(4)The relationship between the volume compression coefficient of the water in the aquifer and the solid skeleton satisfies the quadratic polynomial of one variable, and the volume compression coefficient of the water in the aquifer is larger than the volume compression coefficient of the solid skeleton, so the water is easier to be compressed.
In addition, combined with the step response function of water level to air pressure in convolution regression method, the results of groundwater type determination of the aquifer system of these six Wells show that there is an obvious exponential function form with e as the bottom between the lag time of water level to air pressure and the step response function of water level to air pressure in each of the six Wells. The positive and negative coefficient a before the base number e determines the underground water of the Well aquifer system Type of water. For pressure Wells, the step response function of water level to air pressure increases with the increase of lag time of water level to air pressure, while for non pressure Wells and semi pressure Wells, it is the opposite.

Keywords: Well water level, Well tide effect, Barometric response