Application of Cross-Spectrum Analysis of the Barometric and Tidal Responses to Determinate the Hydrological Properties of Well-Aquifer system

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The main idea to monitor the water level that taps a confined aquifer as a strain meter are mainly base on water level can reflect on the small crust volumetric strain induced by tidal force. Once the coefficient of the water level change to volumetric strain caused by earth tide had derived, the well can be thought of as a calibrated strain meter. To estimate the volumetric strain efficiency of the well-aquifer system therefore been the essential work.

In this paper we follows the Rojstaczer (1988)'s method, apply the cross-spectrum method to estimate the transfer function between the water level and atmospheric pressure and water level and predicted earth tide. Because of our observation wells mostly located on alluvial layers, so we also curious about the differences of the characteristic responses with previous works.

In the preliminary results of the cross-spectral estimation between water level and atmospheric pressure shows good distribution in frequency domain. With the good quality observation data the barometric response could easily estimate and apply for determinate the fluid flow properties. In the other way, the cross-spectral estimation between water level and predicted earth tide is more complicate and didn't show clear responses. The failure of extracted tidal response from water level fluctuation could be come from problem of predicted earth tide. Ocean load may act as main disturb force to theoretical tide locally. Except that, amplitude attenuation and phase shift due to poroelastic behavior of aquifer could be significant in alluvial deposits material. Future works will focus on overcome the above difficulties of extracted tidal response from observation data. Development of cross-spectral estimation techniques could reveal the characteristic responses of well-aquifer to different sources (seismic wave, vertical atmospheric loading, and volumetric strain). And determination of the hydrological properties of well-aquifer system will help us to clarify the mechanism of hydrological anomalies associated with the earthquake.