

## ***Interactive comment on “Groundwater level changes on Jeju Island associated with the Kumamoto and Gyeongju earthquakes” by Soo-Hyoung Lee et al.***

### **Anonymous Referee #1**

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This manuscript discussed the coseismic water level changes following several earthquakes. The authors want to explain the different response amplitudes following the same magnitude earthquakes. And they attributed to the different energy attenuation in different earthquakes. The topic of coseismic water level changes is interesting, but in my view, this manuscript did not convinced me well. Overall, more details about the hydrogeology setting of the wells and more quantitative analysis are needed in order to understand better about the mechanism of the coseismic response.

I have several comments on this manuscript, the details are as followings:

(1). The author described the lithology and groundwater wells in Jeju island, but no information is provided about aquifer and the well structure of these wells. I suggest

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that a cross-section of the hydrogeology setting with location of these wells would be insightful.

(2). Equation 1, the authors use the moving average method to filter the relative low-frequency ocean tide. However, in my understanding, the ocean tide has different frequencies (ranges from low to high frequencies). What's more, I think if you want to filter the low frequency signals, why don't you use the high-pass filtering? I am doubting about the result by moving average method in filtering the low frequency data. The ocean tide can be calculated and removed by several existed programs such as Spotl, Baytap.

(3). The authors argued that the groundwater level caused by M5.4 foreshock was less than the M5.4 foreshock, and attributed this difference to the effects of M7.0 mainshock. Although the aftershock has lower amplitude than the foreshock, there are three wells have coseismic water level response following aftershock, but only two wells show response following the foreshock. The authors may need to explain this phenomenon.

(4). Page 4, "35". What's four geological columns at the SG1, SY1, HD1 and PP well, and what's the leaky confined aquifer model refer to? The authors should provide much more details about them. There are seven wells in the study, why the author only use the four well's response data to show the relation between hydraulic conductivity and water level response.

(5). The author said  $X_t$  is the raw groundwater level corrected for atmospheric pressure, but they didn't show what method was used in the correction.

(6). In Discussion section, the author argued that the larger response following Gyeongju earthquake than foreshock and after shock (M5.4) is caused by the extension of the Yangsan fault. However, from the Figure 1, I cannot see any parts of the Yangsan fault across the Jeju Island. Thus I think it is not justified to say that the energy of the Yangsan earthquake may have been effectively transmitted along the fault plane. The authors need to provide addition evidence to support their speculation. In fact, this

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phenomenon is more likely caused by the hydraulic properties changes after the M7.0 earthquake. Because large earthquake will lead to the changes of aquifer properties and even the disruption of aquifer system (Brodsky, 2003; Wang et al., 2004; Elkhoury et al., 2006; Manga et al., 2012; Xue et al., 2013; Wang et al., 2016), the aquifer properties might have changed after the M7.0 earthquake, thus the different aquifer properties in the Kmmamoto M5.4 and Gyeongju M5.4 lead to the different amplitudes of water level changes. Quantitative calculation of the aquifer properties is need in order to further discuss the mechanism.

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