

## ***Interactive comment on “Anomalous frequency characteristics of groundwater levels before major earthquakes in Taiwan” by C.-H. Chen et al.***

**Anonymous Referee #3**

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1. Mainly item of the research on Hilbert-Huang Transform (HHT) apply on the long term groundwater level. There are so many complex factors been included in long-term variation (storms, water uses, weather condition) compare with short-term variation (earthquake, barometric pressures, tidal loading). The capability of groundwater levels depend on the resolution and the sampling rate. The author should clarify the data quality and provide the physical meaning of the HHT analysis.
2. The author should give the data processing flow chart with the decision criteria and data flow. There are too many individual procedure and the chosen cut-off and threshold. The readers are hard to catch up the processing.
3. The most noticeable phenomena exist in long-term groundwater level variation are  
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unusual large of the coseismic changes (the amplitudes ~several meters). The exits of the coseismic changes caused unusual signals contained inside the datum. If author like to show the effects of the pre-seismic changes should ignore the coseismic; also the earthquake characteristics are not easy to quantify the site response to the same earthquake, the site responses to the earthquakes should be included.

4. P6980 1.Introduction: the contents are unclear for the background descriptions of the observation wells. Such information is not suitable for the supplement for the explanation of well structures, observation methods, data quality etc. Redundant information such as “land subsidence” should be revised by compact writing.

5. P6981 Line 8-10, “Anomalous variations in groundwater level. . . , and these effects can be neatly removed” are not correct terms for the data processing. Also the study didn’t check the components of the each factor. How come the effects can be filtered out from the long-term records?

6. P6981 Line29-P6982 Line1 “. . . groundwater levels change when pressure in the crust near wells is modified by earthquakes” the assumption depend on the pore pressure of the crust equal to the pressure head of the wells. But the wells chosen depth in 100~300 m, such statements should be re-check.

7. P6982 2. Hilbert-Huang Transform: To deals with the groundwater variation in frequency domain, Identifying signals in the data, there are too many methodology had been carrying out. There should full with some assumptions for the model. They also raised lot of uncertainty and decreased the meaning of observation. The author should review the related HHT methods application in hydrology. It will be helpful for testify the methodology for filtering and decomposition.

8. Only the data quality and the controlled non-tectonic factors been filtering out, then the observation can be use for explanation the changes related to earthquakes. There are too many unknown from the contents. The readers would not easy to catch up the description.

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