A Global Sensitivity Analysis Method on Maximum Tsunami Wave Heights to Potential Seismic Source Parameters

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It is obvious that the uncertainties of the maximum tsunami wave heights in offshore area are partly from uncertainties of the potential seismic tsunami source parameters. A global sensitivity analysis method on the maximum tsunami wave heights to the potential seismic source parameters is put forward in this paper. The tsunami wave heights are calculated by COMCOT (the Cornell Multi-grid Coupled Tsunami Model), on the assumption that an earthquake with magnitude MW8.0 occurred at the northern fault segment along the Manila Trench and triggered a tsunami in the South China Sea. We select the simulated results of maximum tsunami wave heights at specific sites in offshore area to verify the validity of the method proposed in this paper.

For ranking importance order of the uncertainties of potential seismic source parameters (the earthquake's magnitude, the focal depth, the strike angle, dip angle and slip angle etc..) in generating uncertainties of the maximum tsunami wave heights, we chose Morris method to analyze the sensitivity of the maximum tsunami wave heights to the aforementioned parameters, and give several qualitative descriptions of nonlinear or linear effects of them on the maximum tsunami wave heights. We quantitatively analyze the sensitivity of the maximum tsunami wave heights to these parameters and the interaction effects among these parameters on the maximum tsunami wave heights by means of the extended FAST method afterward.

The results shows that the maximum tsunami wave heights are very sensitive to the earthquake magnitude, followed successively by the epicenter location, the strike angle and dip angle, the interactions effect between the sensitive parameters are very obvious at specific site in offshore area, and there exist differences in importance order in generating uncertainties of the maximum tsunami wave heights for same group parameters at different specific sites in offshore area. These results are helpful to deeply understand the relationship between the tsunami wave heights and the seismic tsunami source parameters.

Keywords: Global sensitivity analysis; Tsunami wave height; Potential seismic tsunami source parameter; Morris method; Extended FAST method