Seismic response analysis for the whole city with the ASI-Gauss code to estimate a city level damage

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Many wooden houses in coastal area collapsed and became debris due to large tsunamis which occurred after the 2011 off the Pacific coast of Tohoku earthquake. As the consequence of the collapse, its wooden debris greatly increased human and economic losses. In addition, restoration and reconstruction after these huge disaster delayed to remove a large amount of debris including house members. It is now pointed out that the risk of huge earthquake and tsunamis in the Nankai Trough region will be happen, and the disaster level may be almost the same or larger than the 2011 off the Pacific coast of Tohoku earthquake. Therefore, it is very important not only estimating the tunami run-up phenomenon in advance but also risk manegement such as evaluating the total amount and spread of debris, securing rescue routes, and temporary rubble storage sites. In this study, we aimed at the preliminary evaluation of the total amount of debris, the scattering behaviors, and distribution generated in the entire city after tsunami run-up using fluid structure coupled analysis.

As a first step, wooden house collapse simulation in a city during a predicted earthquake is conducted with the ASI-Gauss code[1], which is one of the large deformation FEM code with the Timoshenko beam element. Then, the ASI-Gauss code is enhanced in order to simulate whole city models. The number of wooden houses in a city level model is very large, and detailed finite element modelling for each building is almost impossible. Therefore, each wooden house is simply modelled using beam elements in the ASI-Gausse code, and the strength of structural members are calibrated equivallently with the Building Standard Law dependent on its construction year. The whole city model has been modelled automatilally from data of the Geographic Information System, which includes the locations of buildings, their shapes, age and number of floors.

References

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