3D geologic modelling in the subsurface of the Tokyo Lowland : methodology and application

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This study demonstrates a 3D ground model of the coast plain in the Tokyo Lowland and the adjacent upland, using borehole log data (standard penetration test for engineering works). The borehole data are about 6000, digitized for modelling. The model area ranges from X: 387,000 –407,000m and Y: 3,944,400 –3,956,500m in the UTM 54 zone, and being composed of the coast lowland and the adjacent loam upland geographically. The 3D model is expressed with both the surface model of geologic boundaries and the 3D grid with attributes of N-value, lithology and geologic unit. The grid size is 100m in width, 1m in height. The detailed methodology refers to Eto et al.(2008) and Kimura et al.(2013, 2014).
The surface model consists of a geomorphic surface based on a digital elevation model (5m mesh) and the stratigraphic basal surfaces including the Holocene sediment (Chuseki-so), the fluvial terrace deposits, and the Middle to Upper Pleistocene Shimousa (Sm) Group, in descending order. The basal horizon of the Sm Group is close to the engineering base surface (more than 50 of N-value). The 3D grid model is constructed by horizontal interpolation of borehole data on each altitude with the inverse-distance weighting method and stacking vertically. The borehole data for modelling are subdivided into each geologic unit and the model calculation is performed for every subdivided geologic units.
The distribution pattern of the N-values and lithofacies in the 3D grid model demonstrates inner physical structure and sedimentary facies of ground such as basal gravel of the Chuseki-so, meandering-channel fills, and marine mud of inner bay. In addition, the 3D grid model offers a detailed renewable geologic model to calculate the S-wave velocity structure model for evaluating the seismic amplification properties.

Keywords: 3D geologic model, voxel model, borehole data, Tokyo Lowland, ground model

