Three-Dimensional Deep Structures Modeling for Geological Storage of Carbon Dioxide

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CO2 as a greenhouse gas can be stored in specific geological layer. It is necessary for carrying out CO2 storage to estimate three-dimensional distributions of reservoir and seal layers in deep part. But, almost of geological survey data are one-dimensional perpendicular data or two-dimensional horizontal data. An analysis method was developed to integrate these data for modeling three-dimensional deep structures. The method can be estimated stratigraphy and grasped reservoir and seal structures. In this research, study area is Tokyo gulf. CO2 storage can have a good effect on the Tokyo gulf because the gulf is nearby an industrial area, where has much CO2 emission. And the gulf is suitable as test case because it has many data for analysis. Lattice point of 76 x61 x80, whose unit sizes are 1 km along E-W and N-S and 50 m along the vertical direction, were set for analysis in this research area. Stratigraphies of this area are recognized Shimousa formation, central part of Kazusa formation, lower part of Kazusa formation, Miura formation and basement from surface to depth. They do not have physical values but independent parameter in this case. For this reasons, normal interpolation method can not apply to the data. Indicator conversion can solve the problem by giving value 1 to exist target layer or value 0 not to. Three-dimensional optimization principle method, which is analogous to minimize problem of mechanical potential energy, was applied every target layer dataset for existence probability distributions. This method is accurate and effective to geological data. These results compare each others, and are assumed to geological layer which has highest existence probability value. This stratigraphy modeling method can estimate objective results since it is based on geostatistics. If the critical state CO2 is injected into geological storage, suitable depth is between 800-m and 1000-m. the depth is suitable if central part of Kazusa and Shimousa formation recognized as reservoir and seal layers respectively too. Perpendicular and vertical sections show in Fig. 1. Shimousa formation distribute in east Tokyo gulf along northeast -southwest until 1000-m depth, and have a basin structure. Kazusa formation covers all of this area, and has basin structure too. This structure continues to southwest Tokyo gulf. Miura formation is tick at south Tokyo gulf, but that surface is flat relatively. Deep structure of Tokyo gulf divide into two formation, and slopes steeply to southeast and have a little basin structure at northwest of this area. This model can help to estimate a storage capacity, to simulate CO2 behavior because of its lattices.