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Application of landscape evolution models in the geological disposal and its problems.

INOUE, Shin[1*], HORIO, Atsushi[1], YOSHIMURA, Miyoshi[1], HATAYA, Ryuta[2]

[1]Dia Consultants Co.,Ltd, [2]Nuclear Waste Management Organization of Japan

Prolonged topographic change is impotant issue to discuss the safety of geological disposal after closure of the site. There are two methods to predict topographic change. One is based on historical geomorphology and the other is based on computer simulation. The latter is called Landscape Evolution Models (LEMs).In this study, we aimed to apply the LEMs for geological disposal and carried out the followings; (1) development of a LEMs, (2) extraction of problems by applying the LEMs for a coastal area and provision of the solution, and (3) summarization of the merit of LEMs for safety assessment.

First, we developed theLEMs based on the Grid-based Landscape Evolution Model (GGM; Tanaka, 2011) so that the LEMs expressed uplift and subsidence, river incision, movement of sediment on slope, and sea erosion.

Second, we applied the LEMs for an actual topography and extracted the following problems.

1. Because the width of the river was fixed in the LEMs, the width of channel was overestimated in an upstream area and underestimated in a downstream area. Thus, the erosion in the upstream area was underestimated, and that in the downstream area was overestimated.
2. Because the difference of erosion resistance by sediments was not considered in the LEMs, the top of the ridge got rounded.
3. Because sedimentation in sea areas was not considered in the LEMs , the amount of sea erosion was overestimated.

Furthermore, as a problem to apply LEMs for safety assessment, the following two points were extracted.

1. Because the target area and period is too wide and long, respectively, we cannot narrow down each parameter to one value.
2. Because a depositional and erosional zone are not distinguishable in the target area, it is not necessarily led to a conservative evaluation, even if we set the parameters to increase the amount of topographic change.

These problems may be solved by a method like ensemble prediction.

LEMs calculates the amount of water in the rivers and the sediment passing through each cell per unit time. It should be an advantage of LEMs, because the method based on historical geomorphology cannot provide such data. Therefore, LEMs should be one of the important tools to lead advanced safety assessment.

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Y. Tanaka, (2011) Development of Grid-based Landscape Evolution Model (GGM): Annual Meeting of the Association of Japanese Geographers, Spring, 79: 319.

Keywords: geological disposal, landform development, Landscape Evolution Models