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The growth-collapse simulation method of soil depth in which the effect of vegetation was taken into consideration

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The impact accompanying the transition of the watershed conditions in a forest appears under the structurally development process of a triplex in which time scales differ; geographical feature is formed by a tubercle and erosion of a mountain, the soil which supports and grows up in the root system of a vegetation repeats a collapse and a renature, the forest grows and withers. Without understanding this process, the runoff impact evaluation of watershed conditions cannot occur. We paid our attention to the collapse process in which a soil grows up again, after the soil was supported by the root of the forest, grew up and collapsed with progress of a temporal. And the development method of the longterm soil growth simulation was considered.

This method is computed for every mesh. The following routines perform the compute process of geomorphic development. First, the amount of growths of the soil stratum in the fixed period in each mesh is computed. The amount of developments of the soil depth used the equation of the following which Heimsath et al. (1999) proposed.

Soil Production(m/million year)=77×exp(-0.024×Soil Depth)

The soil depth after a fixed period is computed by applying to the initial soil depth of each mesh the value calculated by the equation. Slope stability is computed using the soil depth set up newly. It is considered by the equation that the mesh by which the safety factor was computed or less with one is that to which the collapse occurred. After setting the value of the soil depth in the mesh to 0, the altitude data after a collapse and a soil depth are re-calculated. A prolonged soil development simulation is computed by repeating the predetermined number of these processes. The simulation was computed at the place which many shallow landslides caused by heavy rainfall. The initial soil depth in the mesh which the collapse caused by the heavy rain was set to 0, and the mesh which has not collapsed was set to 1 m. And, the soil layer assumed the condition of being completely saturated by the heavy rain. In addition, the effective soil internal angle was 32 degrees, effective soil cohesion was 0.01 kPa, unit weight of the moist soil was 17.64 kN/m^3, and unit weight of water was 9.8 kN/m^3. The effect of the vegetation was included in the simulation as the cohesion.

As results of the simulation, It was confirmed that the soil layer which collapsed with progress of the temporal is recovered. Moreover, when a vegetation does not exist, the probability that a soil layer will repeat a collapse becomes high, but when a vegetation exists, a soil layer does not collapse but is recovered early.

Keywords: soil depth, geographical feature, vegetation, simulation method