

Future Geomorphology of the 'Oigo-suribachi' at Tottori Coastal Sand Dune Inferred from Wind Tunnel Experiments

Yoshinori Kodama[1]; Naoto Tabuchi[1]; Ai Ishikawa[1]

[1] Regional Sciences, Tottori Univ.

The 'Oigo-suribachi' at Tottori Coastal Sand Dune, southwest Japan has a unique geomorphology: it surrounds a base rock hill in the form of an amphitheater with an avalanche sand slope, with a depth of 25m. The Oigo-suribachi is a part of the third row of transverse dunes. In the last c.a.10 years, due to death from diseases, pine trees on the hill were cutdown. This caused the height of the hilltop to become lower than the crest-line of the Oigo-suribachi. We conducted wind tunnel experiments to examine the effect of lowering the hill to maintain the shape of the Oigo-suribachi.

The wind tunnel had dimensions of 24.61m long, 1.0m deep and 0.6m wide, with a maximum wind velocity of 11m/sec. The bed material consists of a fine sand 20cm thick. The initial conditions of all experiments were a model transverse dune, 8cm high and 1m long with steep lee side slope (32 deg) and gentle stoss side one (4.6 deg). A triangle shape pole concrete block (bases 95cm², 20cm height) placed on the leeward side of this transverse dune replicated the central hill. 34 experimental runs were conducted with the concrete block at varying heights and at a constant wind velocity (c.a. 8m/sec) condition. Each run lasted for 10-30 minutes. A video camera recorded the modifications of the transverse dune.

Two types of geomorphology developed in the wind tunnel. First case was a protruded concrete block, and the second case was a cave-in compared to the initial transverse dune height. In the former case, a perfect miniature of the Oigo-suribachi formed in 30 minutes: surrounding the concrete block as an amphitheater with avalanche sand slope, where slope failure occurred frequently and repeatedly. Fallen sand particles went around the concrete block and traveled downstream. We think that the protruded concrete block acts as an obstacle to the wind and forms a horseshoe vortex around it. In the cave-in case, the transverse dune kept moving forward to bury the concrete block, and after 30 minutes, no miniature amphitheater appeared. The relationship between the size of the amphitheater and the length of the protruding concrete block illustrates that from 1cm to 7cm, the longer the protrusion, the larger the amphitheater formed. However, the size of the amphitheater remained constant in cases of more than 7 cm protrusion.

These wind tunnel experiments show that the Oibo-suribachi will disappear in the future, if the height of the hilltop is kept lower than the crest-line of the Oigo-suribachi. That is, the crest line of the Oigo-suribachi will advance to bury the hill.