

## Quantitative Evaluation of Microtopography in the Riverside Land of the Mizunashigawa River, Japan

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This research did the quantitative assessment of how the amount of encroachment changed and microtopography change in the outside area of the new dike, which modify the land, of Mizunashi River. The origin of this river is the mount Unzen which is well known of its eruption in 1990. This area is unique because of the artificial preparation of the soil; its base-level of erosion was reset. Thus, this area cannot be discussed by the usual landform evolution, but quantitative assessment.

The result of the research showed that the effect of the change can be divided into 4 periods. There was no large-scale debris flows and erosion of the lateral had progressed with the formation of the micro watercourse network in the 7 years since the 1998. debris flows in the riverside land stabilized as the result of the terrain became stable in 2005.

There were debris flows that occurred intensively in a short period while 2005 to 2008. They were large enough to cause the outflow of the vegetation of the surface layer. As a result of these debris flows, the lateral erosion changed to the downward erosion. After those debris flows, the passage was fixed.

There was a rapid recover of the flora in 2011. This increased the stability of the outside area of the bank.

### Overview of the area

It has been more than 20 years since the Heisei eruption; however, a light rain amount of about 20 ~30mm rainfall time can cause debris flows in the Mizunashi River. To minimize the damage of the volcanic disaster, constructions for the erosion control are still continuing.

### Results and the research method

#### Calculation of bare land ratio by GIS

Putting the base-level of the erosion to the 1998, as the time lapses the ratio of the bare land decrease. For instance the bare land area was 91.62[%] in 2003, but in 2005 it became 50.32[%]. However, the ratio of the 2008 was 58.66[%] and after 2008 the ratio is repeating a micro increase and decrease.

#### Calculation of the flow path extending ratio

The calculation is about the the ratio of the flow path extending of the same waterway since 2008. The result of the calculation shows the quantitative assessment of the immobilization of the channel. This is shown by the result of the 2008, 2011 and 2013, in these three years the ratios are 1.11 and 1.10.

#### Measure of the erosional cross section and local observation

The survey date show the width of gully is 8.27[m]. This is approximately equal to the size of the width and gully erosion in the upper reaches. This date can be seen in the report of 2011 by the Unzen reconstruction office. Calculating the average erosion speed ( $v$ ) from the base level of erosion and the maximum deepening speed ( $Mv$ ) from the maximum depth of erosion, the results are  $v=4.66$ [cm/year] and  $Mv=20.6$ [cm/year]. These results show two things. First, the lateral erosion has the bigger scale than that of lower erosion. Second, the direction of the erosion changed recently from horizontal to down.

Keywords: geomorphological process, gully erosion, debris flow, GIS, Unzen Volcano