Effects of forest fire reflecting the variation of sediment discharge in mountainous catchments around Seto Inland Sea

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The forest fire, which occurs frequently around the Seto Inland Sea area, is regarded as one of the main environmental problems which disturb a forest. Especially, geomorphological issue such as the variation of sediment discharge following a disturbance of forests is considered as the problem which must be solved in terms of making the mountainous catchment devastate in connection with the soil degradation process by increase of erosion activities. So, in order to clarify the sediment yield processes following a disturbance by a forest fire in a mountainous catchment, and considering the hydrological and geomorphological processes in the headwater, we measured sediment yield at rainfall events in disturbed and secondary forest catchments in the western part of Japan.

The three catchments were under different hydrogeological conditions. The IK, TB and TY catchments were disturbed by forest fires in 2000, 1994, and 1978, respectively. In the IK catchment, although runoff response to rainfall was fastest with high peak flows, the catchment also had the highest base flow. Moreover, the annual sediment yield there was about ten times as high as in the other two catchments, and it was found that there was a the steep linear curve in the relationship between precipitation and bedload sediment yield. This is thought to be caused by overland flow generation following water repellency on the slopes, and by the accumulated sediment that forms the thick soil layer on the valley bottom. On the other hand, in the TB catchment runoff experienced high peak flows at rainfall events and low base flows, and there was a gradual linear curve in the precipitation-sediment yield relationship. This might be the result of there being a thin soil layer on the hillslope and on the valley bottom because of successive erosion after the fire. In the TY catchment, runoff had a low peak flow at rainfall events and a high base flow; and the bedload sediment yield increased exponentially with increasing precipitation. Therefore, sediment yield in the TB catchment was more than that in the TY during storm events with precipitation of less than 100 mm, whereas it was the opposite during heavier rainfalls. It indicates that as there is a thick soil layer on the slope and a thin soil layer on the valley bottom in the TY catchment following the recovering of vegetation, and that the sediment yield process predominates only during big rainfall events, only then does subsurface flow generate.