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Estimation of sediment supply rate by freeze-thaw in a large mountainous area in Japan

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Estimation of sediment supply rate by the freeze-thaw is important for better sediment control and disaster mitigations in mountainous catchments. However, estimation method of the sediment supply rate by the freeze-thaw in the large mountainous area has not been established because of difficulty in investigating the sediment supply conditions. Thus, we conducted field observations in the Akaishi Mountains, central Japan, and established the estimation method for sediment supply rate by the freeze-thaw using remote sensing techniques. Field observations using sediment traps showed that sediment supply rate by the freeze-thaw has relationship with the number of times that the air temperature up and down zero degree. Therefore, changes in the air temperature were used as an indicator for determining spatial distribution of the sediment supply rate in this study. Distribution of the bare area in which the freeze-thaw supply large amount of sediments was investigated using satellite images (Landsat TM). Temporary changes in the snow-covered area in which changes in the ground temperature is restricted by the snow were also investigated using satellite images (Terra/MODIS). Spatial distribution of the freeze-thaw frequency in the entire Akaishi Mountains (50 x 100 km) was estimated from spatial distribution of the air temperature obtained from the elevation data (50 m mesh DEM) and the lapse rate (0.006 degree/m), spatial distribution of the bare area, and temporal changes in the snow-covered area. Our analysis revealed that spatial distribution of frequency of the freeze-thaw was not coincident with distribution of the elevation because of the snow cover. The winter mean air temperature (from October to April) was not directory related to annual average frequency of the freeze-thaw in the entire mountains. Consequently, we need to consider both snow cover and the spatial distribution of the air temperature for better estimation of the sediment supply rate by the freeze-thaw.