Characteristics of discharge and sediment load in a subarctic river basin and their response to climatic change

Kazuhisa Chikita[1]; Tomoyuki Wada[2]; Yu-ichi Narita[2]; Daisaku Kido[2]

[1] Earth and Planetary Sci., Hokkaido Univ.; [2] Earth and Planetary Sci., Hokkaido Univ

Characteristics of discharge and suspended-sediment load from a subarctic river, the Tanana River, Alaska, were examined by observations in the glacier-melt season (June to September) of 2000 to 2005. The drainage basin (area: 6.48x104 km2) of the river is occupied by the ca. 96 percent permafrost region of the diluvium to alluvium and the ca. 4 % glacier-covered region in the Alaska Range and Wrangell Mountains. The hydrographs of the Tanana River are explained by the superimposition of rainfall runoffs and baseflow from the permafrost region and glacier-melt runoffs from the glacial region. The suspended-sediment load, meanwhile, varied synchronously with the discharge, but its magnitude nonlinearly responded to the discharge. The nonlinearity of sediment load is probably due to different seasonal variations in the sediment supply from the glacial region and from the river channels. The runoff analyses by a tank model were carried out for the hydrographs of 2000 to 2005. The rainfall onto the whole drainage basin and the meltwater input into the glaciers were estimated by the Thiesen method and the positive degree-day approach (PDDA), respectively. The analytical results, reasonably reproducing the hydrographs, indicated that the glacier-melt runoffs occupy on average ca. 62 % of the total discharge. The glacier-melt runoffs occupied ca. 78 % in 2004, when the large forest fire occurred in the drainage basin. The weather condition of high temperature and non-rainfall tends to increase the contribution from the glacial regions.