26-34 - Booth No. 55: RECONSTRUCTING PEAK DISCHARGE VARIABILITY OF THE JUNE 2022 FLOOD IN NORTHERN YELLOWSTONE NATIONAL PARK

Thursday, 16 May 2024

9:00 AM - 5:30 PM

Grand Ballroom (Davenport Grand Hotel)

Booth No. 55

Abstract

In June 2022, a rain-on-snow (ROS) event occurred as the result of an atmospheric river delivering 2.5-10 cm of rain to the melting snowpack in and around Yellowstone National Park (YNP). The ROS event led to extreme flooding in northern YNP and caused extensive bank erosion, overbank deposition, and damage to infrastructure including roads and campgrounds. The degree of flooding and amount of erosion varied dramatically across northern YNP. To better understand the causes of spatial variability of flooding and erosion, we used cm-scale RTK GPS to survey flood stage indicators and channel dimensions. We typically surveyed 7 to 12 cross sections and the thalweg for each reach. A variety of stage indicators were identified including mud lines, debris lines, wash lines, and debris snags. We then used HEC-RAS to estimate peak discharge during the flood event. We estimated discharge on rivers draining the Beartooth Range (Rose Creek, Amphitheater Creek, Pebble Creek, Soda Butte Creek, Buffalo Creek, Cache Creek, and Slough Creek), the Washburn Range (Tower Creek, Lost Creek, and Blacktail Deer Creek), and the Gallatin Range (Gardner River and Gallatin River). We also determined basin area using StreamStats and calculated Riley's Terrain Ruggedness Index from DEMs in ArcGIS. Drainage basin sizes for the surveyed reaches range from 2 km2 to 746 km2.

Nearly all of the basins are categorized as moderately rugged, however, the basins draining the Beartooths are more rugged than those draining the Gallatin and Washburn Ranges. We found that, per drainage basin area, peak discharge was greatest in the Beartooth Range relative to the Gallatin and Washburn Ranges despite similar rain and snowmelt. The basins draining the Beartooth Range are characterized by extensive exposures of low porosity volcaniclastic bedrock and steep, glacially-sculpted drainages, which can generate significant overland flow, contributing to high peak discharge. In contrast, the Gallatin Range is composed of highly fractured sedimentary rocks and a thick cover of colluvium which facilitates a higher infiltration rate than the Beartooth Range, decreasing flood potential and resulting in lower peak discharge and less erosion.

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