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Detailed documentation of dynamic changes in water depth and surface velocity during large flood at steep mountain stream

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Understanding discharge capacity of the channel and changes in hydraulic property during large storms are essential for the flash flood prediction, however, those information are limited for the steep mountain channels because of complex nature of steep channels and lack of measured data. Thus, we aimed to obtain detailed water level and surface velocity data during large flood at steep mountain channel and document how complex channel morphology could affect water flows during large storms. We installed water level and surface velocity sensors at cascade and 10m downstream pool cross section of the cascade-pool channel at Aono Research Forest of the Arboricultural Research Institute of The University of Tokyo Forests, in Japan and measured for 1-minutes interval. We could obtain data for storm with total precipitation of 288 mm falling in 59 hours with maximum rainfall intensity of 25 mm/hr on relatively wet condition. During this storm, relative water depth increased from 0.35 to 1.57m and surface velocity increased from 0.35 to 4.15m/s. As expected, changes in water depth, surface velocity and velocity profiles were complex and even different between adjacent cascade and pool cross section. Changes in flow characteristics occurred fist at the cascade when discharge increased to some point, water was suddenly stagnated locally at the foot of the cascade. From this moment, water level increased remarkably but surface velocity and velocity profile stayed almost constant at the cascade cross section. Then, at the downstream pool, when most of rocks were submerged at the mean depth of 0.7m, surface velocity suddenly started to increase remarkably and velocity profile changed, as they might develop negative flow in the lower portion of the profile, but water level did not increase as much. When rainfall diminished, first, surface velocity markedly declined and velocity profile went back to original state at the pool, then submerged flows at the bottom of the cascade was cancelled. Those data proved the longtime hypothesis that marked change in flow characteristics would occur when steps became submerged based on field data. Presented temporally and spatially detailed flow measurements were effective to document and understand flow characteristics during large flood in steep mountain channel.