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QGIS-based Autonomous Process and Arc River Data Repository for Efficient Flood Inundation and Hazard Mapping

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Abstract

Flood inundation and hazard maps have played various crucial roles in terms of municipal hazard planning, timely flood control countermeasure operation, economic levee design, and developing flood forecasting or nowcasting systems. Given that the riparian areas prone to flood conventionally imposed special cares to justify applications of recently available flood inundation or hazard assessment numerical models on top of digital elevation models of dense spatial resolution such as LiDAR irrespective of their high costs. However, laborious and time & cost-consuming processes were required to proficiently produce inundation and hazard maps, which includes preparation of geometric and hydrologic data as input for the targeted numerical model, executing the model and post-processing, and inundation and subsequent hazard mapping. For example in Korea, field surveyed geometric dataset are provided in CAD format and should have to be manually converted into cross-sectional information compatible with HEC-RAS as a numerical model, where such dataset are not managed in centralized and standardized database. Then, flood inundation and hazard maps are generated one by one based on flood stage heights simulated from the HEC-RAS, where additional tools such as HEC-GeoRAS or manual drawing against DEM are usually applied. In order to efficiently and cost-effectively provide a series of flood inundation and hazard maps automatically with minimum practitioner involvement, this study demonstrates a set of open-source based tools that automated flood and hazard mapping processes as follows: a) parse CAD files containing geometric surveys like cross-sections and store them into server-based Arc River database approachable through website; b) retrieve geometric information using RiverML from Arc River and implicitly make them compatible with HEC-RAS input format; c) execute the HEC-RAS with some designated boundary conditions and various flood discharge; d) parse HEC-RAS output in binary format and draw flood inundation and hazard map on a given DEM through a developed add-on in QGIS using Python. We found that the proposed entire autonomous processes substantially enhanced efficiency and accuracy for flood mapping. The spatial accuracy of flood inundation and hazard map after applying above processes

were validated throughout comparison with an inundation trace map acquired from typhoon Nari, 2007, in Hancheon basin located in Jeju Island, Korea, where a series of inundation and hazard maps were comprehensively investigated to track the burst of flood in the extreme flood events.

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