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# Morpho-Sedimentary Impacts By The Late-Pleistocene – Holocene Jökulhlaups In The Þjórsá-Tungnaá Fluvio-Glacial System

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In Iceland, jökulhlaups correspond to glacial outburst floods that are generally related to sublagial volcanic and hydrothermal activities. They affect the main fluvial outwash plains around the ice caps. They result of the sudden outflow of a large volume of melt water with variable sediment charges drained from a (sub)glacial or an ice-dammed marginal lake that feeds short (hours to days) cataclysmic floods with peak discharges (103 to 107 m3.s-1), up to 10-100 times the magnitude of classical hydrometeorological fluvial floods. Despite their short duration, and because of large peak discharges, they have important erosive and sediment transport capacities. Consequently, repeated events have a strong morpho-sedimentary impact on the inundated areas.
The connected watersheds of the Þjórsá and Tungnaá rivers (200 km long; ∼5000 km2, South Island), west of Vatnajökull, correspond to the largest periglacial fluvial system in Iceland. It has drained numerous jökulhlaup floods during the Late Pleistocene deglaciation and the Holocene during periods of increase of the volcanic activity and heat flow. Jökulhlaups were emitted from at least two outlets along the western edge of Vatnajökull that fed the Kaldakvísl and Tungnaá rivers. The subglacial depressions (calderas) of the Bárðarbunga-Hamarinn volcanic system are favorable to the storage of large volumes of water that can feed major jökulhlaups.
The Þjórsá-Tungnaá jökulhlaup system can be subdivided into three parts: (1) the source located at the outlets of the subglacial hydraulic network, (2) a proximal transit zone along which erosional processes are dominant (erosively incised rocky substratum – scablands, abraded scoria cones, scour structures, residual buttes of the sedimentary cover) with minor lateral slackwater deposits, flood overflow ponded lakes, and hydraulic dunes along constrictions of the fluvial network, and (3) a distal depositional zone that corresponds to the coastal sandur, the area of main sedimentation before possible floods entrance into the sea as hyperpycnal plumes. Erosion and sedimentation along the system are controlled by the geometry of the fluvial network. Main erosional processes occur along steep slopes and constrictions, and in areas of fluvial channels confluences. These erosional and depositional structures were mapped along the system and summarized on a DEM.
Preliminary 2D and 3D hydraulic simple modeling of the floods has been conducted for the Kaldakvísl-Þjórsá jökulhlaup sub-system with an outlet located in the present-day lake Hágöngulón area. The modeling is based on the solutions of Saint-Venant equations obtained by both eulerian (VF2D; IRSTEA) and lagrangian (TELLUS, CSIRO) approaches. Results provide theoretical velocity fields and flood heights along the flooded area. The preliminary results of this modeling were compared to the location of the field structures along the system, and significant correlations between the structures into the field and the velocity fields have been identified.
In conclusion, a large jökulhlaup system is mainly erosive, with limited sedimentation located on its edges and on the coastal plain. Works in progress on the Þjórsá-Tungnaá jökulhlaup system deal with the stratigraphy of past large-scale outburst events, their modeling and the estimate of their recurrence. These are some of the main objectives of the JOKER project submitted to the French Research Agency.