Gorner jökulhlaups: Hydraulic model explaining temporary englacial storage of water and flood delay.

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Gornergletscher is a large valley glacier located in the Swiss Alps. Gornersee, an ice marginal lake, fills every year with melt water and drains as a jökulhlaup during summer. This lake is particularly suited to study jökulhlaups as hydrographs of the outlet river exist back to 1970 and as it is easily accessible. The lake is relatively small with a volume of $1-4x10^6 \text{m}^3$ and a peak outflow of about $40\text{m}^3/\text{s}$, this is only about three times the maximal ordinary discharge.

In the years 2004, 2005 and 2006 detailed measurements were conducted during the drainage of Gornersee. This poster presents a simple hydraulic model —based on lumped elements (Clarke 1996)— and compares this with some of the field data. The lumped element model incorporates some of the features of the jökulhlaup: mainly the inclusion of ordinary discharge and the englacial storage of water. With this we:

- capture many of the observed characteristics semi-quantitatively:
- · delay between flood termination at lake and outlet.
- storage of water during the flood and subsequent release.
- · diurnal signal on lake outflow hydrograph.
- modulation of diurnal water input.

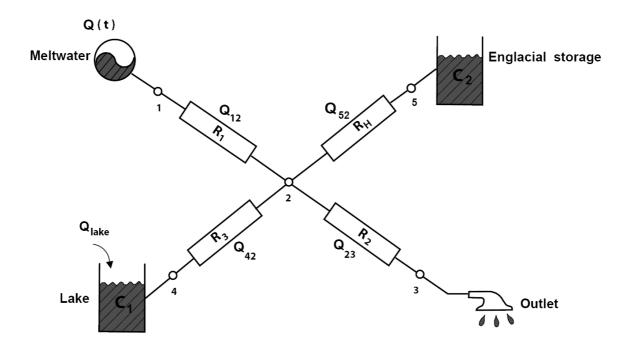


Figure 1. Lumped element model of the Gornergletscher jökulhlaup: Incorporating ordinary discharge Q(t) and englacial storage C_2 .

 $R_{1..3}$: Röthlisberger resistors, R_H : non-linear resistor, $C_{1..2}$: linear storage elements and Q(t): ideal discharge source.

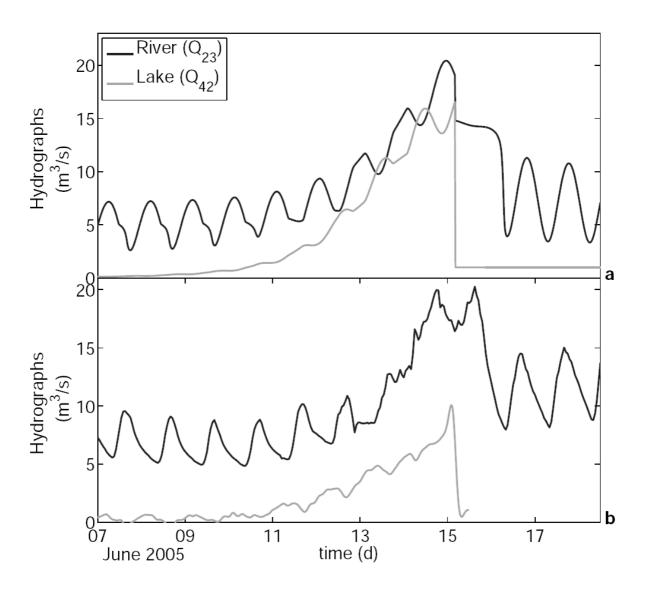


Figure 2: Comparison of model results (a) and measured data of 2005 (b). The model gives good qualitative agreement: superimposed diurnal variations on lake outflow hydrograph, delay of the end of the flood by one day and increased diurnal amplitude after the flood.

REFERENCES

Clarke, G. K. C. (1996) Lumped-element analysis of subglacial hydraulic circuits, J. Geophysical Research 101(B8): 17 547-17 559.