Supplement for

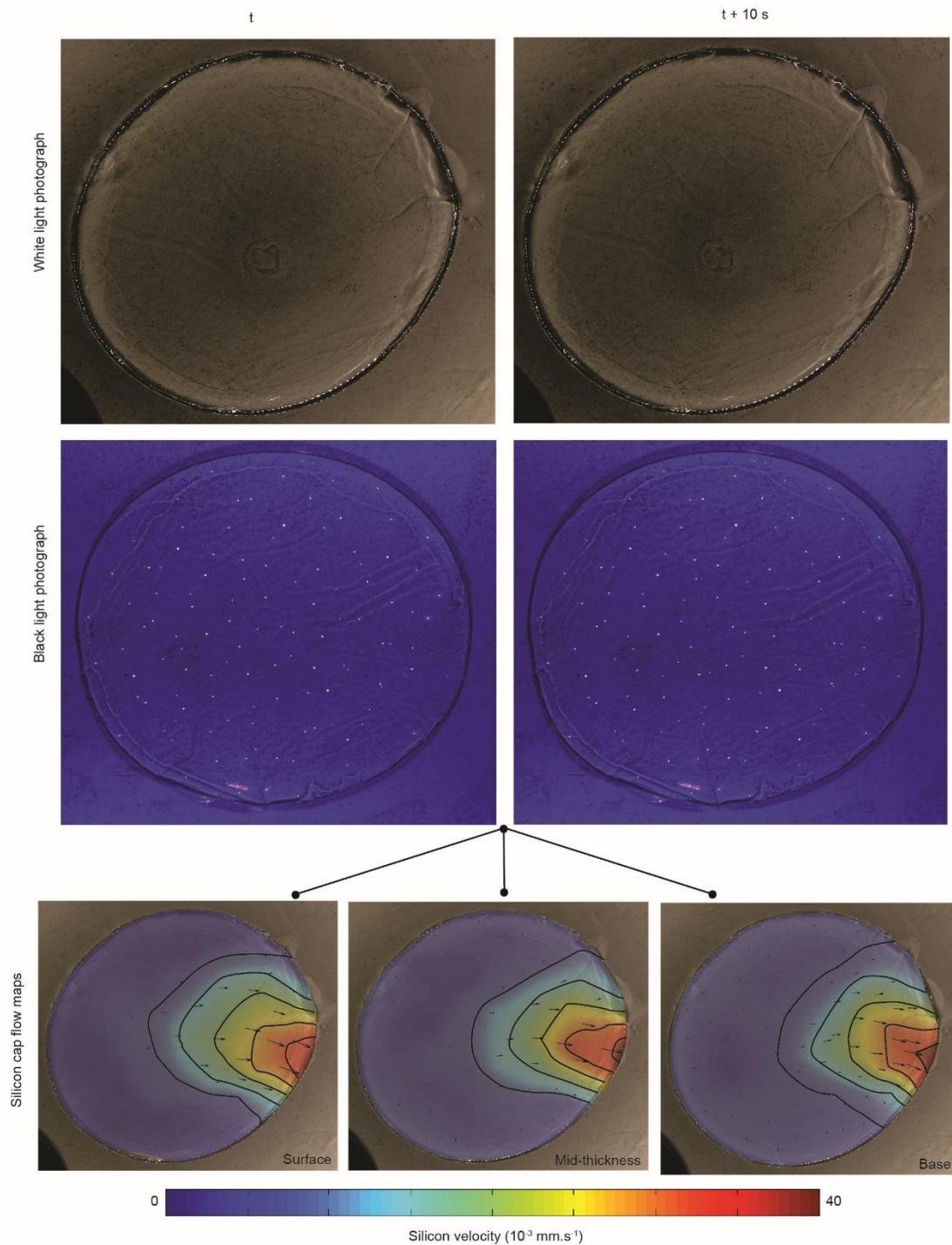
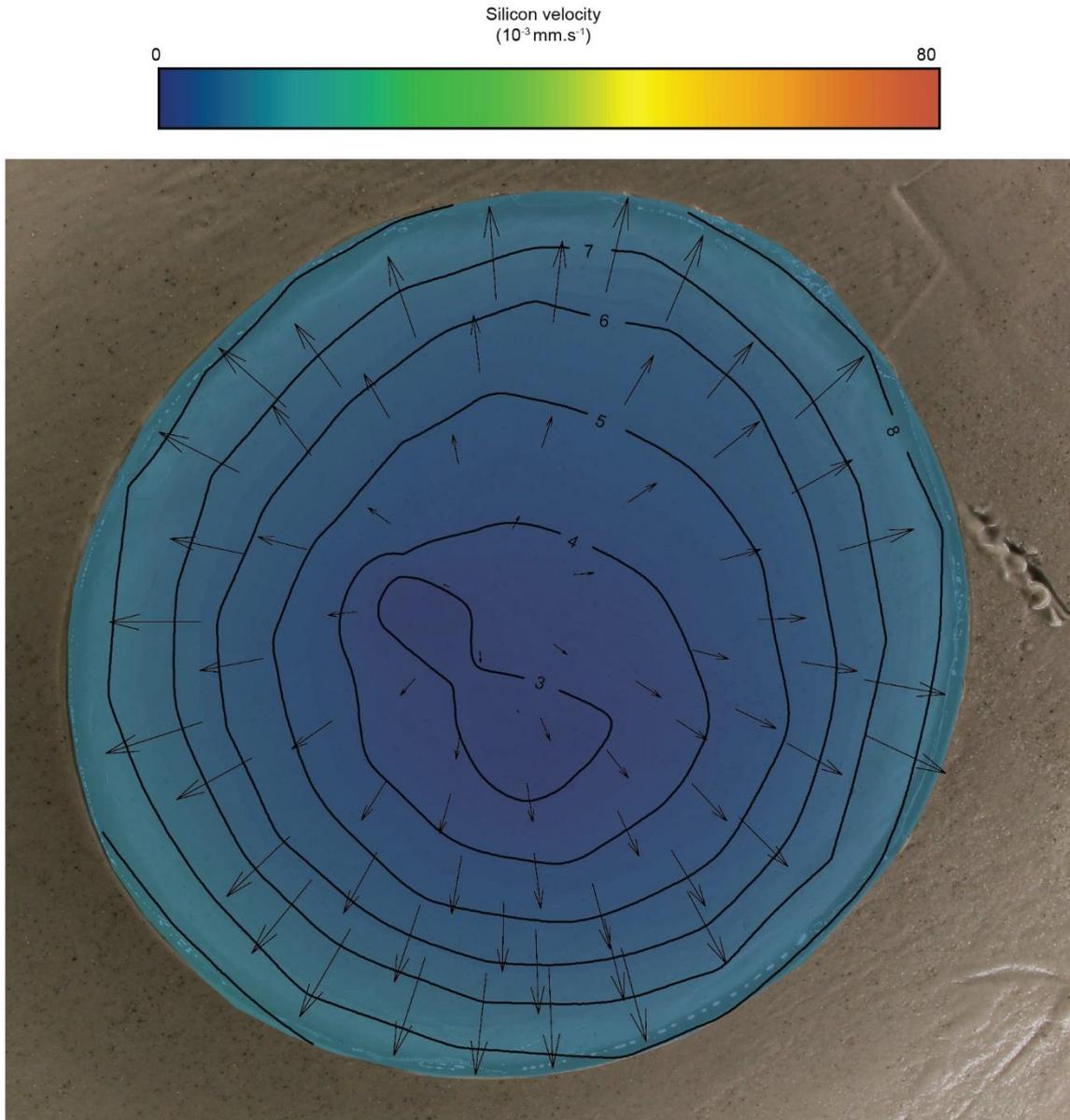
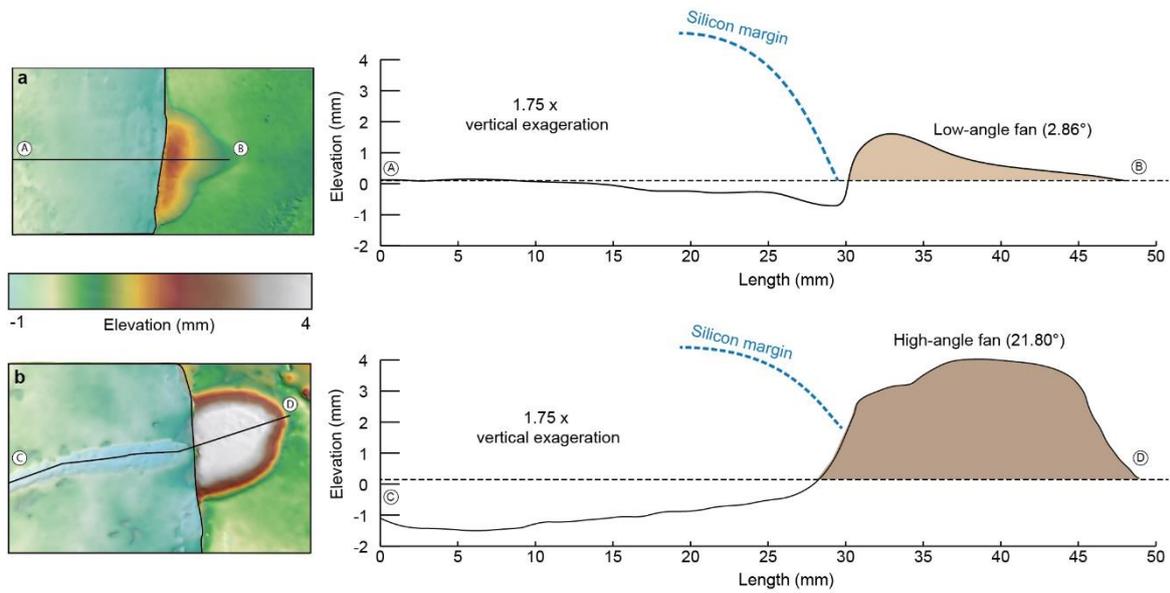
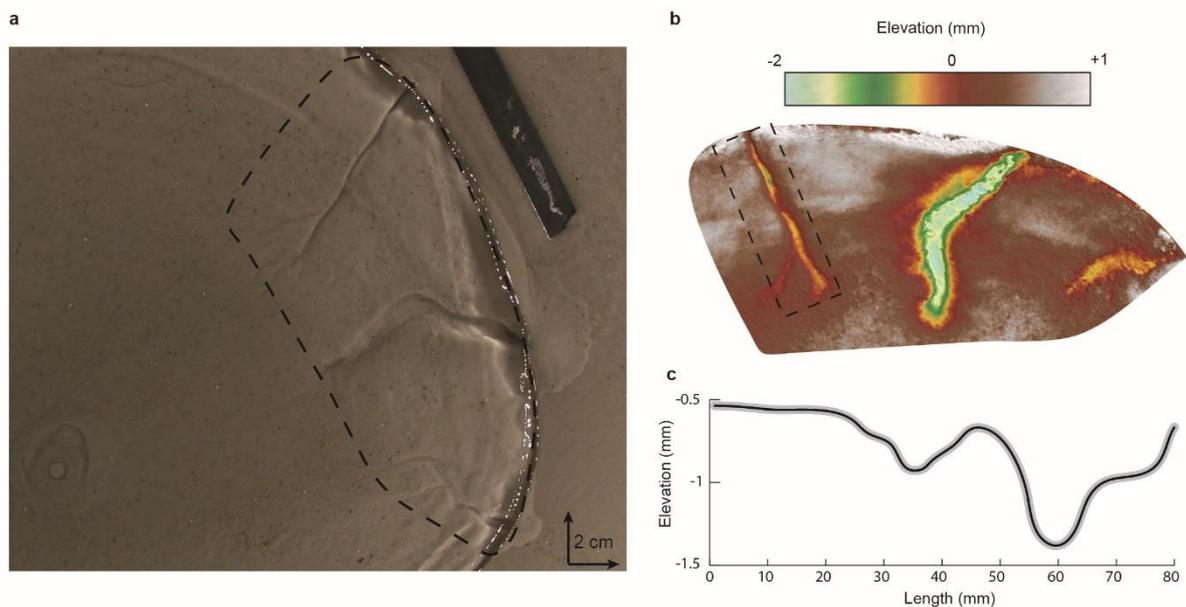
Modelled subglacial floods and tunnel valleys control the lifecycle of transitory ice streams

T. Lelandais[a*], É. Ravier[a], S .Pochat[b], O. Bourgeois[b] , C.D. Clark[c], R. Mourgues[a] and P. Strzerzynski[a]

[a] Laboratoire de Planétologie et Géodynamique, UMR 6112, CNRS, Le Mans Université, Avenue Olivier Messiaen, 72085 Le Mans Cedex 9, France

[b] Laboratoire de Planétologie et Géodynamique, UMR 6112, CNRS, Université de Nantes, 2 rue de la Houssinière, BP 92208, 44322 Nantes Cedex 3, France

[c] Department of Geography, University of Sheffield, Sheffield, UK

[*] Correspondence to: *thomas.lelandais@univ-lemans.fr*

Supplement Figure 1. Post-processing of the UV markers displacement used to produce silicon flow velocity maps. Punctual UV markers (1 mm radius) are disseminated in three distinct layers: one at the base of the silicon cap (60 green markers), one at mid-thickness (60 blue markers) and 1 at the surface (60 pink markers) (cf. Extended Data Figure 1). The post-processing consists in (i) extracting the position of every marker through time and (ii) interpolating silicon flow maps for every layer.

Supplement Figure 2. Silicon surface flow map during stage 0. This map represents the silicon flow pattern when the silicon cap is only subject to gravity and viscosity forces. The silicon flows under its own weight creates a radial pattern of flow velocity direction.

Supplement Figure 3. Experimental fan morphology comparison. a, DEM (on the left) and longitudinal profile (on the right) of the substratum in the outer part of the silicon putty right after the outburst event. The longitudinal profile (A-B) cuts through a low-angle "outburst" fan. b, DEM (on the left) and longitudinal profile (on the right) of the substratum in the outer part of the silicon putty after tunnel valley development . The longitudinal profile (C-D) starts at the valley bottom and cuts through a high-angle marginal fan.

Supplement Figure 4. Digital Elevation Model (DEM) of an experimental tunnel valley and its associated longitudinal profile. a, Snapshot of the tunnel valley system. b, DEM of the tunnel valley system delineating by a dashed box in a. c, Undulating longitudinal profile of the tunnel valley bottom extracted from the DEM region in a dashed box in b.