A subglacial lake at South-Spitzbergen, Svalbard: could it be possible?

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Abstract

The melting of glaciers coming with climate change threatens the heritage of the last glaciation of Europe likely contained in subglacial lakes in Greenland and Svalbard. This aspect urges specialists to focus their studies (theoretical, numerical and on-field) on such fascinating objects.
Along this line we have approached the validation of the conjecture of the existence of a subglacial lake beneath the Amundsenisen Plateau at South-Spitzbergen, Svalbard, where Ground Penetrating Radar measurements have revealed several flat signal spots, sign of the presence of a body of water (Glowacki et al., 2008).
The whole investigation aspects and tools, mathematical modeling and numerical simulation procedure – in Figure 1, a prototypical considered physical domain -, the computational algorithm and the numerical results obtained on the real study case have been detailed and widely discussed in a trilogy of papers (Mansutti et al., 2015, 2016*a* and 2016*b*).
Measured icefield bedrock and upper surface map, several ice top surface velocity values, snow and firn layer temperature and density profiles were collected by Glowacki et al. (2008). Ice is temperate that is at melting temperature. The monitoring of the icefield thickness over the past 40 years exibited negligible average change (Nuth et al., 2010).
For the sake of confidence in the numerical simulation tool, the computational algorithm built upon these data, has been tested for sensitivity versus several physical and mathematical numerical aspects.

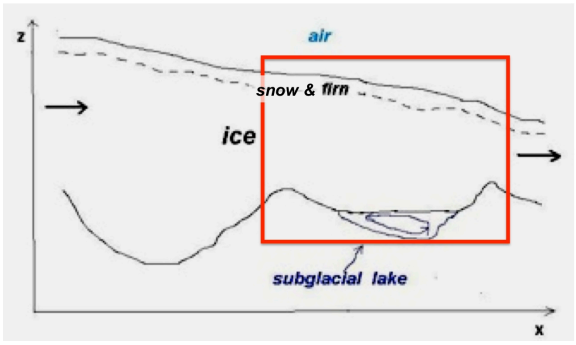

Figure 1: *Prototypical physical geometrical domain*

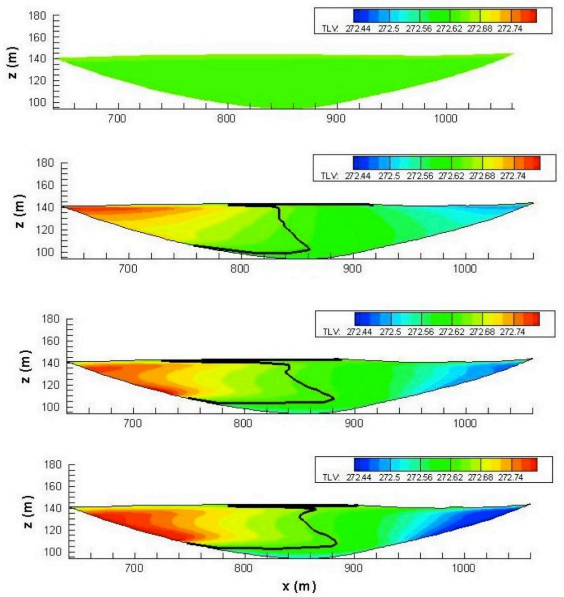

Figure 2: *Iso-temperature regions of the ice and the released water in the supposed bedrock cavity where a subglacial lake is conjectured, at increasing time shots (top to bottom) spanning 20000 days. The metastable state line is in black. The growth in time of the region occupied by water is noticeable.*

Then, due to the absence of seismic survey data, a bedrock cavity has been supposed underneath the largest flat GPR signal located around (77°170 N, 15°250 E) and the likelihood of the formation and persistence of a water basin has been checked via

numerical simulation (Figure 2).

In the proposed poster we shall summarize the main points of this investigation, that is a follow-up of the multi and interdisciplinary research activities based at the Arctic Station ‘‘Dirigibile Italia’’, coordinated by the ‘‘Dipartimento Scienze del Sistema Terra e Tecnologie per l’Ambiente’’ of the National Research Council of Italy and of the transnational project ‘SvalGlac – Sensitivity of Svalbard Glaciers to Climate Change’ funded by ESF-ERANET PolarClimate Consortium (PNRA for Italy).

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