

Interactive comment on “Borehole temperatures reveal details of 20th century warming at Bruce Plateau, Antarctic Peninsula” by V. Zagorodnov et al.

Anonymous Referee #1

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Principal Criteria: 1. Scientific Significance: Excellent (1) The manuscript represents a substantial contribution to scientific progress within the scope of The Cryosphere. 2. Scientific Quality: Good (2) The scientific approach and applied methods are valid. However not all the results are discussed in a balanced way. 3. Presentation Quality: Excellent (1) The scientific results and conclusions are presented in a clear, concise, and well-structured way.

Undoubtedly, the paper is within the scope of TC. It is devoted to a very interesting problem of deciphering the present-day temperature profiles from deep boreholes drilled in polar glaciers with the aim of paleoclimatic reconstructions.

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The principal concern of the referee is the validity of the basic assumption about one-dimensional (vertical) heat transfer at LARISSA Site Beta (L-B) stated in the paper in the form of the boundary problem (2). In accordance with the authors' comment, the L-B is located at a distance of about 2 km from the ice divide. But the ice divide is not a summit of an ice dome. Essential ice flow may occur both along the ice divide stream line itself and in its proximity along the glacier side slopes. Simple calculations based on the Bruce Plateau lateral scale of about 50 km, ice accumulation rates on the order of 2 m/yr, and glacier thickness of about 500 m result in predicting possible ice flow velocities as high as 100 m/yr. In such conditions the negative temperature anomaly may be, at least partly, caused by the cold ice advection from the colder high-latitude and high-altitude regions upstream from the L-B site. A detailed surface elevation map along AP in the L-B area might be very helpful in this case to decide what an ice flow pattern actually exists around L-B, what a stream line passes through this site and in what direction. Note that the GOMEZ-area surface temperature is about 3 deg C lower than the temperature at L-B. Another 2-D effect that can interfere with the paleoclimatic reconstructions is the variable elevation of the bedrock relief along the L-B stream line. An example of possible uncertainties that could be met in such situations is presented in the study by Salamatin et al. "Ice flow line modeling and ice core data interpretation: Vostok Station (East Antarctica)", in Physics of Ice Core Records II (Ed. T.Hondoh), Low Temperature Science, Suppl. Issue, 2009, vol.68, p.167-194. In this paper the past temperature cooling was reduced almost by two times in comparison with the earlier publication by Salamatin (2000) which did not take into account the lateral advection. A minor editorial correction is needed to put the right dimensions of the specific heat capacity in Eq.(4) and thermal conductivity in Eq.(5), i.e J/(kg K) and W/(m K), respectively.

To referee's opinion, the paper can definitely be recommended for publication with additional discussion focused on the above mentioned questions.