The Cryosphere Discuss.,
doi:10.5194/tc-2016-38-SC1, 2016

The Cryosphere
Discussions
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Interactive comment on "An investigation of the thermo-mechanical features of Laohugou Glacier No. 12 in Mt. Qilian Shan, western China, using a two-dimensional first-order flow-band ice flow model" *by* Y. Wang et al.

K. Poinar

kristin.poinar@nasa.gov

Received and published: 7 March 2016

This paper combines recent field measurements taken on a polythermal glacier on the Tibetan Plateau with results from a relatively sophisticated numeric model for ice temperature and flow. The authors vary the boundary conditions and the number of terms of the heat equation used in the model and compare the model output to annual ice velocities measured by stakes and englacial temperatures measured in a deep borehole. The work concludes that (a) strain heating and (b) refreezing meltwater in the percolation zone are the major controls on englacial temperatures and, consequently,

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the velocity of this glacier.

In my opinion, the analysis and conclusions of the paper are sound and the ideas are presented clearly. Meltwater retention in firn is a topic of much current interest, especially on mountain glaciers where its effects can often influence basal temperatures. To my knowledge, thermal analyses of Himalayan glaciers are sparse, so this work would be a novel contribution for that alone.

The model appears to be state-of-the-art, and the limits of its application are discussed (omission of west branch). I think it would be beneficial to include a bit more discussion (and perhaps, but not necessarily, numeric estimation) of how inclusion of the secondary branch of the glacier would improve the results. (I think *why* it should improve the results is clear, but *how much* is not clear, and *where* is not in the expected locations.) To be clearer on my *where* point: it appears that the area of largest disagreement between measured/modeled velocities (5.3 to 7 km) occurs just upstream of the junction with the west branch (∼4500m elevation or ∼7 km). One would expect any effects of the west branch to be downstream of the junction.

This paper also appears to be the first presentation of the temperature data from the four boreholes, so a little more detail here would be appropriate. The description of the three shallow boreholes is more complete than for the deeper, and I would argue more important to the paper, borehole. For instance, how long were the sensors operational within the ice (were the temperatures able to equilibrate), and what is the error on the readings? How precise are the depths? The data in Figure 4(b) look smoother than I have usually seen from deep boreholes, leading to these questions.

My other suggestion is to improve the clarity of Figures 5, 6, and 7. Although the legends do indicate what is being plotted, they are small and encoded. This could be fixed easily by adding a title to each plot (“Varying bedrock bump wavelength”) and/or adding this to the caption.

The caption for Figure 9(d) gets measured / modeled temperatures backwards.

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I think this work is mature, interesting, and relevant, and I look forward to seeing it in published The Cryosphere.

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