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The Cryosphere Discussions

Interactive comment on "Ideal climatic variables for the present-day geometry of the Gregoriev Glacier, Inner Tien Shan, Kyrgyzstan, derived from GPS data and energy-mass balance measurements" *by* K. Fujita et al.

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Idea of 'ideal climatic variables': I believe that it is important to find the climatic regime needed to maintain the current glacier geometry. Although there are many sets of climatic regimes which could also maintain the current geometry as the reviewer #2 pointed out, I emphasize that we can narrow the sets of summer mean temperature and annual precipitation down to a certain range by the dynamics-based precipitation. In addition, 'the story', which the reviewer #2 showed in his/her comment, would not be described without the 'ideal climatic regime' as reference. However, I will withdraw our

justification by consistency among the dynamics-based precipitation and the long-term precipitation because we don't perform any dynamical confirmation (e.g. response time). In order to convince the reviewers as well as readers, I make further calculation to seek sets of summer mean temperature and annual precipitation for zero mass balance over the current glacier geometry. As I showed in the previous publications, seasonal cycles affect glacier mass balance even under the same annual averages (of summer mean temperature and annual precipitation). I use 29 seasonal cycles (1979-2007, NCEP/NCAR reanalysis datasets and GPCP precipitation data). I prepare daily precipitation as:

PRcal=(PRyr/APyr)APgv

Here PRcal is daily precipitation used in the model, PRyr and APyr area daily and annual precipitation in a given year (yr), APgv is a given annual precipitation. I change annual precipitation from 50 mm to 600 mm at 50 mm interval. Under a given annual precipitation, I seek summer mean temperature at the summit of glacier by changing air temperature homogeneously at 0.1 degree C interval. I will add a figure showing the relation between annual precipitation (50 to 600 mm) and summer mean air temperature at the glacier summit (4600 m) together with the dynamics-based set (I called it 'ideal climatic variables' in the first manuscript) and the long-term averages. This figure provides how the current climatic regime is situated against the ideal regime.

Stake and GPS mass balances: Because we have not performed the GPS survey in 2005 (only at the summit AWS), we could not show the GPS-based profile for the period 2005-2006. But anyhow, I agree that geodetic mass balance can only be applied to entire glacier and not to altitudinal profile. I will remove the description about comparison of surveyed and calculated profiles, and will just describe the profile of elevation change (Fig. 4a) to obtain the specific mass balance (Table 4).

The wording with respect to correlations: We first showed correlation coefficients for the SINGLE monthly averages and then showed better multi-monthly (or annual) averages.

I will add 'single' before 'monthly'.

Description about energy mass balance model: I still don't think that more detailed descriptions are necessary though both reviewers required it. I have read many papers which described methods unclearly by citing previous works. I leave the decision, whether I have to add more details or not, up to the editor of this manuscript, J. O. Hagen. If he also requires the details, I will add it as supplement.

Vertical depletion: The AWS is situated 1.3 to 2.4 m higher than the surrounding stakes (Stake 1 to 4). Surface inclinations from the AWS toward the other stakes are so small (-0.037 degree to -0.021 degree) that the downhill effect is negligible (-0.65 to -0.37 mm with 1 m horizontal movement). I will add this explanation and revise description as the reviewer #2 commented.

Figures: I will add legends directly on the figures.

Figure caption. Annual precipitation and summer mean (JJA) temperature at the summit of Gregoriev Glacier. Line with gray hatch is climatic regimes for the zero specific mass balance. Solid circle is dynamics-based climatic regime. Open box is from the Tien Shan station.

Interactive comment on The Cryosphere Discuss., 5, 855, 2011.

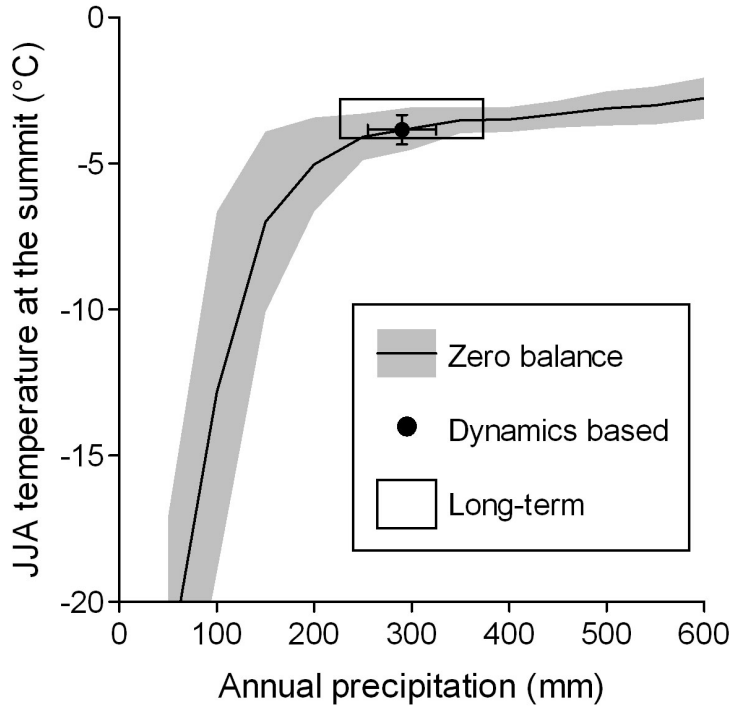

Fig. 1. Annual precipitation and summer mean (JJA) temperature at the summit of Gregoriev Glacier.