The Cryosphere Discuss.,
doi:10.5194/tc-2016-42-RC2, 2016

The Cryosphere Discussions
Open Access
EGU

Interactive comment on "Rapid glacial retreat on the Kamchatka Peninsula during the early 21st Century" *by* Colleen M. Lynch et al.

Anonymous Referee #2

Received and published: 16 May 2016

STRENGTHS:

Positively 1 - A huge amount of work behind the paper

Positively 2 - A good review of associated publications, including Russian authors

WEAKNESSES:

- The paper is too long. The text contains lots of unnecessary naturally clear details and numbers which hinder its perception. Most numbers should be removed and put in the tables.

- The authors don't seem to take into account the uniqueness of Kamchatka region as an area where Holocene volcanism exists along with glaciation and can not help affecting it. The accomplished analysis is of a "standard" (formal) type, the same as for

Printer-friendly version

Discussion paper

non-volcanic regions.

However, along with tephra of recent eruptions (mentioned in the paper) many glaciers in Kamchatka (or their tongues) which motion is permanently destroying the friable slopes of Holocene volcanoes appear to be buried under a thick layer of deposits and continue flowing with it.

At the same time they are nothing to do with rock glaciers having usually a snow-covered accumulation zone and a high flow velocity. In other words, they keep all glacial features but have a thick cover of deposits on themselves which exceeds obviously 5 cm, the threshold used in the paper for digitizing of glacial margins, which seems to be totally invalid for glacial mapping in Kamchatka. As a result the margins of most glaciers where the described effect is observed were digitized incorrectly and should be reconsidered by the authors.

This conclusion is substantially based on the provided image of Tolbachik Volcano (Figure 2) where none of the glacial margins (neither conducted with semi-automated nor digitized manually) show the real extent of glaciers in the area (accepted and used by other authors, including USSR Glacier Inventory which data is used for comparison in the paper).

This is a serious drawback which apparently can affect the results of the accomplished statistical analysis and the paper's conclusions in general.

Now the conclusion that volcanic activity has no evident effect on glacier fluctuations seems to be very questionable and should be reconsidered using a new dataset with redigitized glacial margins.

- Some glaciers appeared to increase their size. No possible explanations are presented.

SMALLER REMARKS:

Kamchatka Peninsula is of particular interest because investigation of its recent glacial

history has been limited (c.f., Khromova et al., 2014; Earl and Gardner, 2016)

No overview or references to the glacial studies which were carried out.

Mass-balance and paleoglaciological campaigns in Koryto glacier (Kronotskiy Peninsula); ice core boring of the crater glacier (Ushkovsky volcano); remote-sensing studies etc.

The peninsula has been shaped by both volcanic and glacial forces (Braitseva et al., 1995, 1997; Ponomareva et al., 2007, 2013; Barr and Clark, 2012 a,b)

There are also folded mountains in Kamchatka by the way.

Subsequent estimates of the total number and surface area of glaciers on the peninsula tend to differ. For example, Muravyev (1999) reports 448 glaciers, with a total area of $\sim$ 906 km2, while Solomina et al. (2007) report 446 glaciers, with a total area of $\sim$ 900 km2.

But you have to know that for a half of the glaciation area peninsula (Sredinny Range) data were provided from (Vinogradov, 1968) as new qualitative cartographic and satellite materials appeared on this area only in 21 centuries. At the same time for regions of an active volcanism the results leaning on the last decades of researches and for them for passed half a century any are given glacial retreating (especially "Rapid . . .") wasn't observed. Moreover, some glaciers in Klyuchevsky and Avacha groups of volcanoes continued the approach since last century, and, just, at the expense of the languages blocked by a moraine unaccounted by authors.

According to the latest published data on fluctuations of glaciers on the Kamchatka peninsula with use of aero-photo, good permission of space images, cartographic materials, and using of GPS receivers in field researches, really, some parts of modern glaciation retreating are observed. The truth this situation is peculiar mainly for glaciers of nonvolcanic areas. Glaciers on volcanoes generally are in a steady state, or tend to growth.

Printer-friendly version

Discussion paper

For example:

– about glaciers of Koryaksky volcano – volcanic region (Manevich, Samoilenko, 2012): “Now there are seven glaciers with total area 8,36 km2. Three of them advance, two are in stationary state and one degrades;

– glaciation of Sredinny Range (Muraviev, Nosenko, 2013): . . . in the northern part of the Middle (Sredinny) Range from 1950s to 2002 – diminished by 16.6%;

– glaciation of the not-volcanic regions (Muraviev, 2013): Glaciers on the Kronotsky Peninsula (Eastern Kamchatka) and the Alney-Chashakondzha massif (Sredinny Range) shrink. Since 1950 to 2013 area of Kronotsky glaciers reduced by 18.8 km2, or by 22.9% (for glaciers with areas larger 0.5 km2). Area of the Alney-Chashakondzha glaciers reduced for the period since 1950 to 2010 by 11.6 km2, or by 19.2%, that is comparable to similar characteristics of glacier systems of Altai, Tien Shan, and Caucasus, and this contraction correlates with changes of basic climatic variations, i.e. rising of summer air temperature and decreasing of solid precipitation.

– the glaciers of Avachinskaya volcano group (Manevich et al., 2015): “The present-day glaciation of the Avachinskaya group was analyzed using data obtained during field works of 2007-2010. Twenty seven glaciers were founded the volcanic slopes with their total area of 24.04±3.6 km2. ... Comparison of recent data with aerial photographs of 1974 has allowed estimating changes of the glacier front positions and to reconstruct the glacier dynamics for the last 40 years. Eighteen glaciers have been found to be in the stationary state, seven glaciers advance, and two glaciers degrade.”

– (Golub, Rassokhina, 2015): 1. Kropotkin’s glacier (Eastern Kamchatka) since the end of the 1970th years of the XX century by 2014 (45 years) receded in the central part of the front in a place of its bifurcation on two tongues on 290 m, the left - on 390 m, the right - on 280 m. The area of a glacier was reduced by 34%; speed of retreating of Kropotkin glacier is increased, since 2003, that is caused by growth of summer air temperatures; thus, from 1976 to 2014 the area of glacier decreased from 0,85 sq.km

to 0,29 sq.km, or for 34%, from which ∼2/3 of receding fall on the first 1.5 decades of 21 centuries.

As far as I know, the russian glaciologists prepare publications on new inventory of glaciers of Klyuchevskaya group of volcanoes, etc., where the stable condition of glaciers of volcanic areas of the peninsula and retreating of glaciers non-volcanic areas similar to a velocity of retreating of other mountains glaciation of Eurasia are recorded.

OTHER REMARKS:

Glacier size (area, perimeter, length and relief) . . .

What is relief is totally unclear? There is no reference to the parameter is the part describing which glacial parameters were used in the statistical analysis.

For each glacier identified in the inventory in 2000, maximum, minimum and median altitude and mean surface slope were calculated from the SRTM DEM, and generalised glacier aspect was estimated from a line connecting the glacier's maximum and minimum altitudes. The mean annual receipt of solar radiation at the surface of each glacier was calculated using the Solar Radiation tool in ArcGIS (algorithms developed by Fu and Rich, 2002), and glacier length was estimated along inferred flowlines.

Glaciers range in length from 170 m to 9930 m, while ranging in altitude from 273 m to 4407 m (a.s.l.), with a mean altitudinal range of 419 m, and a mean surface slope of 16.9°. Rounded numbers should be provided.

GENERAL SUGGESTIONS:

1. The paper is to be shortened getting rid of unnecessary details describing the apparent parts of methodology. More stress should be put to the interpretation of the analysis results. Probably different glacial areas of peninsula can also be analyzed against each other.

2. The statistical analysis should be done once again using the redigitized glacial

Printer-friendly version

Discussion paper

margins, delineating the glacial parts covered by debris.

3. The conclusions should be tested with the new redigitized dataset.

Considering the inevitable errors in such studies these two sources rather support than contradict other. The setting off is inappropriate here (Fig. 1).

REFERENCES:

Manevich T.M., Samoilenko S.B. Glaciers of the Koryak volcano // Ice and Snow. No.3 (119). 2012. 25-30 (Summary in English).

Muraviev A.Ya. Nosenko G.A. Glaciation change in the northern part of the Middle Range on the Kamchatka Peninsula in the second half of XX century // Ice and Snow. No.2 (122). 2013. 5-11 (Summary in English).

Muravyev A.Ya. Glacier size changes in Kronotsky Peninsula and Alney-Chashakondzha Massif, Kamchatka Peninsula in the second half of XX century and the beginning of XXI century // Ice and Snow. No.2 (126). 2014. 22-28 (Summary in English).

Muraviev A.Ya., Nosenko G.A. Glaciation change in the northern part of the Middle Range on the Kamchatka Peninsula in the second half of the XX century // Ice and Snow. 2013. âĎŰ 2(122). P. 5–11 (Summary in English).

Manevich T.M., Murav'ev Ya.D., Samoilenko S.B. Glaciers of the Avachinskaya volcano group: current condition (state) // Ice and Snow. Vol.55. No.3 (119). 2015. 14-26 (Summary in English).

Golub N.V., Rassokhina L.I. The dynamics of the glaciers at Bolshoi Semyachik volcano (Eastern Kamchatka) at the beginning of the 21st century and formation of vegetation on the young moraines // Bull. Of Kamchatka regional association "Educational-Scientific Center". Earth Sciences. Vol.28, No.4. 2015. 60-71 (Abstract in English).

Interactive comment on The Cryosphere Discuss., doi:10.5194/tc-2016-42, 2016.

Printer-friendly version

Discussion paper

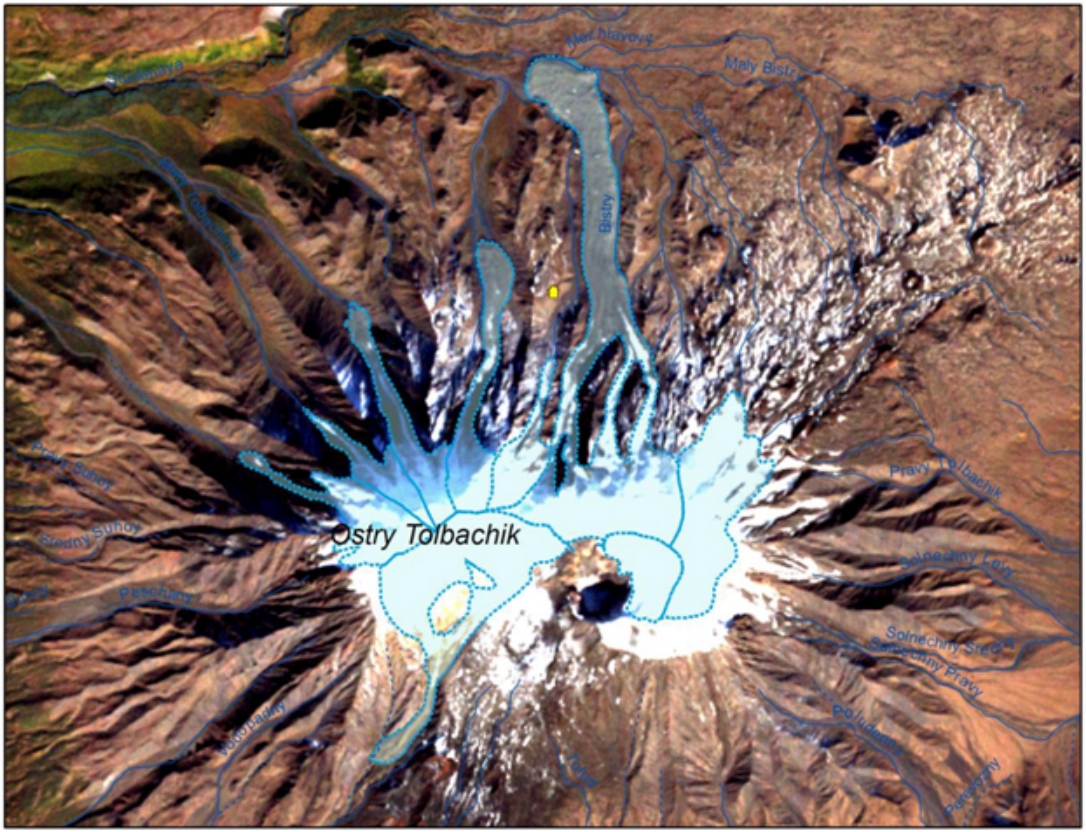

Fig. 1. The margins of the Tolbachik volcano's glaciers proved by field studies in the area

Printer-friendly version

Discussion paper