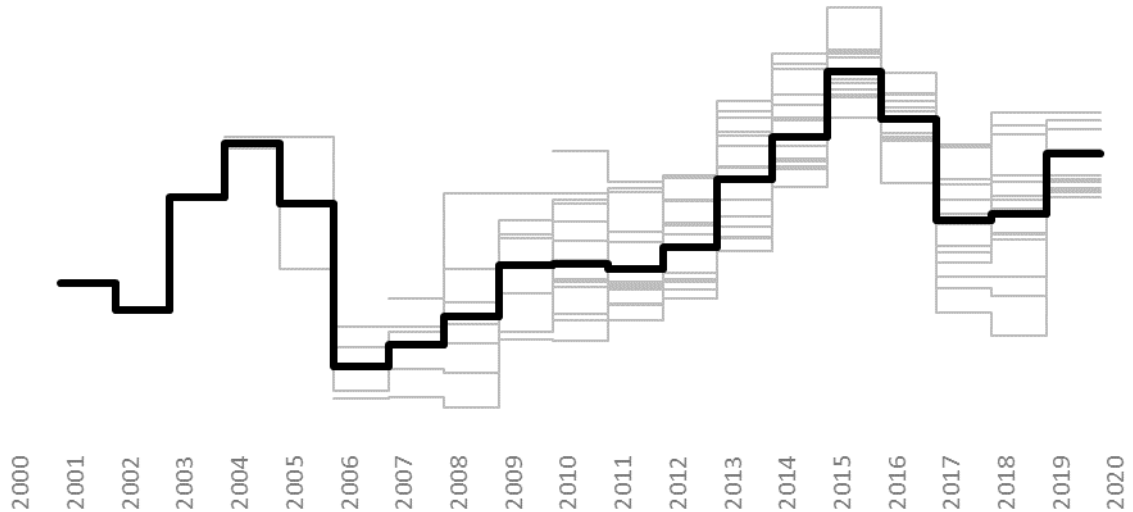# IPA Action Group Rock glacier inventories and kinematics

Rock glacier kinematics as an associated parameter of ECV Permafrost

(Comments to version 1.0)

06.02.2020

Box 0 - Preamble

No comment

Box 1 - Purpose of associating rock glacier kinematics to ECV Permafrost

Detail text: "Remote sensing data allow the producing of…"

Rock glaciers kinematics

Box 2 – Generalities

No comment

Individual time series

Box 3a – Generalities

No comment

Box 3b – Horizontal surface velocity values

"If the methodology does not allow the distinction between horizontal and vertical flow values, the horizontal value is extracted assuming that the movement develops downwards along the slope". So practically, if you take 1D along LOS InSAR series, would it mean to do a projection along slope, followed by a decomposition horiz/vert? Just wondering what it is the reason for doing so. Why not have all series (GPS or remote sensing based) projected downslope, if is what we assume to be most likely?

"be spatially representative of the landform, i.e. located within a recognized moving area": it raises the question about: if several recognized moving areas covering the same landform, which one do we focus on?

It is not appropriate to name the assumed downslope velocity as horizontal surface velocity. Downslope surface velocity may be better.

add also the possibility to provide profile information (individual points representing different moving areas)

Box 3c – Time resolution and time observation window

The time observation window should be as constant as possible in time" I would add: "and documented.

Second paragraph of 2.2.4 is difficult to understand. Should be reformulated more clearly.

"However, depending on the applied technique, this velocity value could only be obtained for a shorter time observation window than an annual one, but at an annual (or pluri-annual) frequency. The time observation window should be as constant as possible in time. The obtained velocity values are infra-annual, but the time series keeps an annual resolution."
These sentences are not clear: maybe ""also"" instead of ""only"" in the first line?

Box 3d – Required measurement uncertainty

Why 20% actually? And not 15 or 25? Something coming from experiences with the swiss series? Could maybe be explained.

The uncertainty threshold can be flexible. A 20% relative uncertainty is acceptable as long as the range of the value is within the same velocity class. For instance, a 50+/-10 cm/yr is fine if a 40 cm/yr and 60 cm/yr are categorized into the same activity level. Moreover, the consistency of the uncertaity level in a range of data being used to construct a time series is more important than the absolute magnitude of the uncertainty. For example, ten measurements with a uniform 20% uncertainty can produce a better estimation of the long-term trend rather than a series of data with uncertainties ranging between 1% and 20%.

comparing absolute uncertainty with annual rate is not advisable since this is dependent on the time interval used.

May be it is better to speak about accuracy, rather than uncertainty? A discussion on this would be helpful.

Regional index

Box 4a – Generalities

"I see a potential positive bias problem here. Sounds somehow that what we hope to find out dictates the way to design it. I don't doubt from your series that a regional pattern can be highlighted in Switzerland, but just wondering (theoretical question): could it be some regions where no similar trend is possible to draw. And in this case, what can be defined as abnormal?
Or say it in another way: in a new region where we start the whole monitoring idea, we start with 10 rock glaciers that show a similar trend and then start to discard all others that are defined as "abnormal". What if, if we would have continued to add more rock glaciers, we would have ended up have 10 other "abnormal" rock glacier having a common trend as well?"

This regional definition is unclear and I suggest that you reconsider its definition. For example indicating the minimum number of rock glaciers, and/or aerial extent.

The regional aspect is very interesting, but also challenging. I suggest to allow for regions on different scales: e.g. to analyse the entire Alps and/or different parts/regions of the Alps. And, to make it even more complicated, depending on the dominant weather situation, landforms may indicate the same behaviour with one or the other (neighbouring) region.

Box 4b – Rock glacier selection

Could maybe explain why we focus on talus-connected? I understand that it is important to consider the glacier-connected/glacier forefield-connected separately, but I could imagine that in some areas, this category is quite important. Is it clear that this category cannot be used for the same purpose? If yes, maybe just explain it.

About "abnormality" (in relation with same comment in 4a): looking at Fig.2 (upper) -> we see that the 3 blue dotted lined are different than the others, but quite similar together. Illustrate a bit what I tried to ask about in 4a: if tomorrow you discover 7 others following this, what would it tell?"
why "of concern"? WRT what? Or do you mean shall be considered?

Box 5 – Integration of RGK in the next GCOS Implementation Plan + general questions

What are the limitations? How to deal with the limitations of the technology? What standards should be used in the analysis of inSAR data? While data are freely available, it still needs operation skills and use of proper filter techniques. InSAR is not a slam dunk!

It is important that one recognizes that rock glaciers are only one element of mountain permafrost. I.e. I caution from using rock glacier kinematics as a proxi for the all permafrost conditions in mountainous regions.

Some monitoring methods were mentioned in the document, perhaps we can also add Lidar.

I did not found it in this explicitness but I guess a lot of the workshop will be about data aggregation form different measurement points or even sensors. This problem relates to my last point too do we really measure the same with different sensors?