Reviewer 2:

We are greateful to the reviewer for his/her comments and valuable advice. We have addressed all raised points in a revised version of the manuscript. In the following, we give a point-by-point reply to the points raised (in bold), with changes to the manuscript in italics:

I read through the manuscript several times with great interests. The authors have done a thorough job by documenting changes in palsas and peat plateau in northern Norway. The work will be very valuable for palsas and permafrost studies in the Arctic. I do have some concerns and suggestions about the current version of the manuscript.

Major concerns:

1). Potential error analysis: There are several places in the work which could produce substantial errors. First, the 10 m diameter threshold. By ignoring all palsas less than 10 m in diameter could produce potentially significant errors. The authors have four in-situ sites, they should their in-situ data to evaluate how much error it may bring out. Second, the authors just use one same person to delineate the boundaries of palsas for each study site. Yes, it will be very consistent but not necessarily the lowerest in errors. To digitize any data and information from paperwork into computer, it usually requires two persons to do the same work separately, then use a program to check each other. If both agree, pass, if not, go back and check the original paper version to reduce the human error to the minimum. If it did by the same one person as stated in this study, the potential error is unknown. The authors should seriously consider the issue.

The 10 m threshold was only used in the mapping of the palsa distribution at 250m scale, not in the delineation process for the four study areas, for which also palsas with diameter of less than 10m were mapped. We have clarified this in the revised verison of the manuscript.

In the revised version, we have also addressed the potential error of using the 10 m threshold in the distribution mapping process by using, as proposed by the referee, the data from our four study sites. This is now included in section 3. We find the difference (by comparison of using and not using a 10 m threshold) in number of grid-cells to be 8 % and the estimated difference in the total area of palsas for the four study sites to be 0.16 %, the latter of which is negligible in the context of our study. In the revised evrsion, we write:

"To determine the uncertainty induced by the 10 m threshold in the 250 m scale mapping (see above), we once again investigate the four main study areas and their surroundings (c. 140 km2). By mapping at best possible resolution, palsas with smaller diameter can be detected which facilitates estimating the number

of 250 m grid-cells excluded due to the mapping threshold. We find that the number of grid-cells with presence of palsas is 8.6 % higher when including palsas and palsa remnants with diameters less than 10 m. However, the total area covered by palsas/peat plateaus increases by only 0.16 % due to the limited area of these palsas. We therefore conclude that our mapping can provide a robust estimate for the total area covered by palsas/peat plateaus, although isolated small palsas occur regulary in grid cells flagged as free of palsas/peat plateaus."

To address the uncertainty by only using one person to delineate the boundaries of palsas and peat plateaus, one of the authors has re-mapped about 50 % of the area of palsas/peat plateaus at mire 1 in Karlebotn for the 2008 image. Comparison of the total area gives a difference in 8 % in the mapped total area between the two persons, which is substantial, but signifantly smaller than the changes in extent over time. The process is described in Sect. 3:

"To ensure a consistent interpretation of the extent of palsas on the aerial images, the same person delineated the palsas for each individual study area. To estimate the accuracy of the manual and thus to a certain extent subjective delineation process, parts of the Karlebotn study area (~ 0.24-0.26 km2) were independently mapped (using the images from 2005) by two persons. This comparison yielded a difference of 8 % in the total area which can be considered a rough estimate for the mapping accuracy."

In Sect. 4.2 (Results) we write:

"We note that the reduction in areal extent is significantly larger than the estimated accuracy of the manual delineation process (8 % of the total mapped area, Sect. 3)."

2). The authors should provide more in-situ information, such as at a specific site or a specific palsa, what is happened and/or happening? If palsas disappeared, peat materials are still there. And also geomorphologically, what it looks like when palsa is gone. I believe that not all of them become thermokarst ponds or lakes.

We have added a paragraph to Section 5.3 and a new figure showing an aerial image form a peat plateau near *Suossjavri* with block erosion and pond formation clearly visible. In the revised version, we write:
"Fig. 13 shows an aerial image of a peat plateau near Suossjavri highly affected by block erosion, as common for palsas and peat plateaus in this area. At the actively degrading margins, the mire vegetation is not yet established and a water-filled depression forms, indicating that the retreat of the margin occurs at higher velocity than the regrowing of the mire vegetation. However, the water bodies become overgrown and many of them eventually disappear which is evident from both the aerial images and field observations. The proximity between the standing water and the ice-rich core of the peat plateaus and palsas most likely contributes to thermal undercutting and eventually block erosion at the margins

(Kurylyk et al., 2016), but a variety of factors, such as the height of the palsa and the ground ice content can be expected to play a role for this process.

On the other hand, the interior of palsas and peat plateaus can also experience thaw subsidence resulting in thermokarst depressions and suprapermafrost taliks, as seen for peat plateaus in northern Sweden (Åkerman and Johansson, 2008, Sjöberg et al., 2015). Based on calculated thaw rates and an instant increase in air temperature of 2 °C, Sjöberg et al. (2015) estimated that it will take 175-260 years for the permafrost at their investigated peat plateaus to completely thaw. However, much more rapid degradation has been observed in the same region (Zuidhoff, 2002), which could be an indication that lateral erosion considerably increases the degradation rates. A recent study in south-central Alaska found that 85 % of the degradation of forested permafrost plateaus was due to lateral degradation along the margins (Jones et al., 2016). "

3). The authors indeed provide information about MAAT, changes in air temperature and precipitation in the study sites and the region as a whole. The authors do not provide the specific vaules for the changes in air temperature and precipitation. I hope in the revised version, this imformation will be provided. The most importanty, the authors rarely mention about snowfall and snow cover data and information. In the Arctic and Subarctic discontinuous and sporadic permafrost zones, the combination of peat layer and snow cover is often more important than air temperature in terms of permafrost presence or obsence. Changes in peat layer in a short period of time (60 years as in this study) may be very unlikely, changes in snowfall and snow cover conditions may be possible. Indeed, the authors state in the text that precipitation increased, but how much is it snowfall? What is snow cover variations? etc.

In the revised version, we provide additional information about snow cover and snow depth for the study areas. We write in Sect. 2: *"(…)while the mean annual (hydrological year) maximum snow depth (MASD, 1971-2000) ranges from less than 50 cm on Finnmarksvidda to more than 200 cm at the outer coast (seNorge, 2016). On Finnmarksvidda, the mean annual number of days with dry snow (MADDS, 1961-1990) is generally between 150 and 200 (seNorge, 2016), and the mean fraction of snow of the total precipitation (MSFr, 1961-1990) is usually less than 40 % (seNorge, 2016)."*

In Sect. 4., we write: *"MASD increased in all areas except Lakselv according to seNorge (2016) data, although it is unclear if this result is representative for palsas and peat plateaus, as snow depths on palsas/peat plateaus are generally much lower than in the surrounding wet mire due to wind redistribution, as e.g. observed in Suossjavri and Lakselv in March 2013."*

In Table 2, we have added data about maximum snow depth, days of dry snow and the mean fraction of snow for our four study areas.
In Sect. 3, we have added a short description of the snow model used by seNorge.

4). Some concepts are confusing: degradation of palsas, lateral erosion of palsas, and disappearance of palsa: By "degradation of palsas", we may understand it refers to the processes on the way or at the end; by "disappearance of palsas", it definitely refers to the end of palsas, and by "the lateral erosion of palsas", it is not clear it refers to lateral shrinking in size or materials are transported away. This may need to be clarified.

In the revised version, we have added a definition of the terms "degradation" (when it refers to palsas) and "lateral erosion", as it is used throughout the manuscript, in Sect. 1. We write: "*By "degradation", we refer to the processes (or the result of these processes) that decrease the volume of palsas and peat plateaus. With "lateral erosion", we mean the lateral decrease in size (as seen on 2D aerial imagery) of palsas and peat plateaus, where the margin of palsas or peat plateaus is transformed to wetland. Lateral erosion is often due to block erosion, but may also be a result of ground subsidence due to melting of excess ground ice at the edge, followed by submergence below the water table of the surrounding wet mire."*

5). Use the results from four sites to expand to the entire Finnmark, it is kind of skeptical. What is the total area of these four sites? What is the percentage fraction of the total area of these four sites to the whole Finnmark?

The total area of these four sites for 2010s is mentioned in Section 4.1, but we have now revised the sentence for clarity. We have also added the estimated percentage fraction of 2 % for the area of these four sites compared to the whole of Finnmark, and we also make clear that expanding the results to entuire Finnmark must be rega4rded a forst-oder approximation. In Sect. 4, we write:
"High-resolution delineation of palsas and peat plateaus in the four study areas (for the 2010s) covered in total 260 grid cells, corresponding to about 2 % of the 250 m grid cells with palsas/peat plateaus in Finnmark. The sites cover a gradient of climatic and environmental conditions across Finnmark, so that we consider the results a plausible first-order estimate, although it is unclear if the four sites are a fully representative subsample. We find a total area of 2.13 km^2 within the 260 grid cells, yielding an average areal fraction of palsas/peat plateaus of about 13 % in grid cells with presence of these features. The present-day total area of palsas and peat plateaus in Finnmark can thus be estimated to about 110 km^2 or 0.2 % of the total land area of Finnmark, with an estimated uncertainty of 10 km^2 due to the manual delineation process (Sect. 3). "

Some minor comments:

1). p.1, line 29 to p.2, line 1: The authors state "The permafrost temperature in palsas is thus relatively warm", the description is not precise, temperature iself cannot be warm or cold, it can be high or low. Permafrost can be warm or cold. Just a reminder.

Changed - the word temperature is removed.

2). p. 2, lines 19-20: same comments above.

Changed – the word warmer is replaced with higher.

3). p.4., the authors mentioned about winter and summer, please be specific, which months are referring to in terms of winter and summer, this is important in the Arctic and Subarctic sine the cold season is so long. Also, when you discuss about precipitation, what is the fraction of snowfall? when you discuss about changes in precipitation, what is the fraction of changes in snowfall? This information is very important for the potential readers to understand what is going on.

We have added the summer and winter months in brackets, which these data is based on. We calculated the fraction of snowfall of the total precipitation by using precipitation and snow data from seNorge. For other changes in the manuscript regarding snow depth and snow cover, see our answer above to your comment at major concern 3.

On behalf of the authors,

Amund F. Borge