

## ***Interactive comment on “Groundwater fluctuations during a debris flow event in Western Norway – triggered by rain and snowmelt” by Stein Bondevik and Asgeir Sorteberg***

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### **GENERAL COMMENTS:**

The manuscript "Groundwater fluctuations during a debris flow event in Western Norway – triggered by rain and snowmelt" analyses the behaviour of the groundwater level during the occurrence of a debris flow and compares it with the behaviour during other extreme events and with the typical groundwater situation. It is considered that the research is novel because the analysis of these data is not common and the results are very important for the study of shallow landslides by allowing to know the situation of the ground before, during and after the failure. Moreover, the manuscript is well

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written and has fine and clear figures. Then are some comments that could improve understanding of the work.

### **SPECIFIC COMMENTS:**

L19-20. Saying that Storm Dagmar did not generate debris flows without giving the reason does not provide much information to the reader. I think the sentence is missing a conclusion.

L82-87. It would be useful to describe somewhere in the manuscript (perhaps here) some other important characteristic of the study area... E.g., Mean annual precipitation, climate, vegetation.

L234-237. I don't understand the relationship between this sentence and Fig. 6. On the other hand, I do not understand the arguments to infer that the peak occurred before 23 o'clock... If the intensity of the rain and the air temperature did not change, it would not be explained either because the groundwater reached the peak between 8:30 p.m. and 9:30 p.m. and then it started to decrease.

L237-238. In Fig. 8 this extrapolation is not plotted... It is important to plot it.

L269-272. Is there any hypothesis why this event did not generate landslides? There is some information throughout the manuscript that could explain the non-occurrence and it could be useful to comment on them in the same paragraph (e.g., the 2013 peak could have been greater, the distance between where the debris flow is triggered and where the groundwater is measured, artesian conditions).

### **TECHNICAL CORRECTIONS:**

L14-16. I think it should talk about precipitation and not rain, considering that until 3:00 p.m. the precipitation fell in a solid state; and only if it is possible (considering that in the Abstract each word counts) to clarify that a fraction of the melted snow came from the same event of precipitation.

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L38-39. "The mean(?) maximum rainfall intensity was 80–100 mm in 24 hours, locally up to 129 mm." Currently the sentence is contradictory to me.

L39. "Most of the landslides were debris slides and flows" is clearer. Slide is a type of movement of landslides (Hungr et al. 2014) and using it as a synonym for Landslide can be confusing. . . The comment applies to the whole text.

L41-42. In order not to use the word "slide" and not repeat "landslide" it could be said something like this: "The number of mass movements makes this one of the largest landslide events in Norway during. . ."

L44-47. Many people are unfamiliar with Jan Mayen Island. With Fig. 3 it is clearer what its position should be, but it could be clarified in the text at least that it is an island.

L92. Is it necessary to clarify the brand?

L160. I understand that it is explained below but I don't think it is convenient to describe the shape ("much sharper") and not describe the difference in amplitude. I think it is better to either describe the two characteristics at the moment or just mention that they have different characteristics and then detail them in the following sentences.

L168. Perhaps a more technical term than "the big picture" can be used... Such as "the typical/mean annual cycle".

L252-253. Do you define peak duration as the time the groundwater was less than 50 cm from the ground? I think it is important to clarify.

L261-263. It may be helpful for the reader to indicate the date May 26 in Fig. 6.

Figure 1. Snow avalanches are not landslides and it is better to use the full terms. . . Landslide instead of slide and rockfall instead of rock.

Figure 1. A minor issue in the legend: the precipitation is a continuous number. This should also be reflected in the legend. Better write: 0-30; >30-60; >60-90; . . . etc.

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Caption Figure 1. "114 debris flows and slides".

Figure 2. To respect the structure: "Photo: Jan Helge Aalbu on 16 November 2013."

Figure 4. Try to improve the sentence so as not to repeat "aerial photo". One possibility is: "Map and aerial photo from 2018 of the site near Anestølen. A. The contour interval is 100 m. B. The eastern slope is prone to. . ."

Figure 5B. It is not necessary to clarify that the rocks are solid.

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