Replies to comments of Reviewers #2

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Anonymous Referee #2

I have noted that the authors carefully considered my previous comments and comprehensively revised the manuscript. Nevertheless, I must say that not all of my major concerns have been fully resolved. For example, I still think that the data set is critically limited (without any red warning).

The Norwegian national landslide early warning system (LEWS) is a relatively new system operational since 2013. The analyses presented in this manuscript started in 2015 and only data for 2013-2014 were available. A large work of collection and checking of landslide information from different sources (NVE, rails and roads Authority, other databases, media) was carried out, with the aim of avoiding repetitions and providing a reliable dataset. For this reasons the study area was restricted to Vestlandet. In this area, a reliable dataset of landslides for the years 2015-2016 is still not available. Nevertheless, we checked the number of warnings issued in the last two years (2015-2016) in Vestlandet and no Red warnings were issued. The table below shows the number of warnings and the warning levels issued in Vestlandet in the period 2013-2016.

Warning levels	**yellow**	**orange**	**red**
2013	21	0	0
2014	34	5	0
2015	20	2	0
2016	21	0	0

As shown, the red level would still be missing even if we considered the period 2013-2016. According to the meaning of warning levels presented at http://www.varsom.no/en, the red level defines "an extreme situation that occurs very rarely, it requires immediate attention and may cause severe damages within a large extent of the warning area". Concluding, incorporating data from the years 2015-2016 would not change the results of the performance analysis and would not add anything significant towards the main aim of the paper, i.e. proposing an extension of the EDuMaP method for the performance evaluation of LEWSs issuing warnings over variable size zones.

And I still miss the rationale behind the assumptions of the EDuMaP method.

LEWSs may adopt a fixed or a variable spatial discretization for warnings ($\Delta A_{(k)}$).

In the first case the warning zones are univocally defined with fixed extents. For each warning zone, the warnings are issued over the whole zone according to site specific rainfall thresholds and decisional algorithms. Thus, only one level of warning can be issued in each warning zone in the minimum temporal discretization adopted for warnings (Δt). The performance analysis with the EDuMaP method is carried out separately for each warning zone. Therefore, in this case, the dij components of the duration matrix represent the time evaluation of the combination of warning levels issued and landslide events occurred in a specific warning zone in a period of analysis.

In the case of a variable spatial discretization for warnings the number and extent of the warning zones vary in time in the period of analysis (ΔT). The number of warning zones is defined by the number of warning levels issued in the minimum temporal discretization (Δt). For instance, if only two levels (e.g. green and orange) are issued in a given Δt, the area of analysis (A) would be divided into two warning zones. The extent of the warning zones is obtained grouping together all the territorial units alerted with the same level of warning. In this paper, the territorial units are defined looking at the administrative municipal boundaries. In a given Δt, the Event analysis phase is carried out for all the warning zones simultaneously. The time evaluation of the elements of the duration matrix in a given Δt (timeij) for the area of analysis (A) is carried out by weighting the spatial contribution of each warning zone in relation to the total area, as follows: timeij = Δt * TUij/A, where TUij is the extent of the territorial units alerted with a warning level i and class of landslide event j in a given Δt.

In earlier studies, the EDuMaP method has been applied to analyse the performance of regional landslide EWSs adopting a fixed spatial discretization for warnings (i.e. fixed warning zones). In contrast, the Norwegian landslide EWS employs variable size warning zones which influence, as explained, the definition of the first two phases of the EDuMaP method: identification of landslide and warning events from available databases; definition and computation of the duration matrix. In this last revised version of the manuscript, the text better explains how to define LEs and WEs and how to compute the duration matrix in case of variable size warning zones. A reorganization of sections was carried out in order to increase the comprehension of the method. Section 3 now describes the EDuMaP method and how it was adapted for variable warning zones. The definition of the area of analysis and the description of the available datasets have been moved in section 4.

Still I'm convinced that this manuscript could become a valuable contribution for NHESS. At this stage I don't have any further specific suggestions for revision.

We thank you the reviewer for his comments.