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Interactive comment on "Rainfall and weather conditions inducing intense landslide activity in northern Spain (Deba, Guipúzcoa)" *by* Victoria Rivas et al.

Victoria Rivas et al.

jaime.bonachea@unican.es

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Dear referee #1:

Thank you very much for your comments.

We understand there is somehow a confusion between our proposition and your interpretation. We probably have not been able to state the goal of the work and explain the landslide data sufficiently.

We are aware of the current approaches to obtain accurate thresholds, but that is not our main target, precisely due to the limitations of our data for that purpose. Although

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we provide a very complete inventory of landslides, covering a long period, we only know the precise date of 6 rainfall episodes (responsible of multiple landslides simultaneously). On the other hand, even if we have a wide network of gauges, rainfall data are daily. Therefore, our objective is not to obtain a conventional threshold comparable to those obtained in specific works on this subject, but to show the conditions in which most of the landslides are triggered in the area. In this sense, the six precipitation episodes produced the 50% of the total landslides. The results show that, contrary to what has been published so far, the rainfall associated with this type of events in northern Spain (mild marine west-coast climate) is characterized by high rainfall intensity and linked to convective conditions, typical of autumn and summer, showing a behaviour more characteristic of the Mediterranean area. Certainly, there are other slope movements triggered by different meteorological situations, but at least half of the landslides in the study area have occurred under the conditions described. The arguments that support this conclusion are the analysis of the weather conditions and seasonality responsible of most landslides, and a set of 3 rainfall indicators (cumulative, antecedent and intensity) which show that the six episodes of rain are among the most outstanding of the last 60 years. The I-D function is just another indicator, one among others, useful with caution, for comparison purposes. In this regard, we consider that we should modify the introduction to reinforce the exposed approach.

Response to your comments 1. You are right. We have modified table 1 specifying more clearly the types and dates of movements. In the same way, the text should be adapted to better explain landslide ocurrence.

2-3-4. You are right, there are only six major rainfall episodes but the rainfall amount is different for the 688 locations were landslides took place. Moreover, landslides occurred under diverse conditioning settings (geology, terrain geometry, etc.), that is neither homogeneous nor isotropous and therefore we computed the rainfall in each point where landslides were triggered. In any case, again it is not our purpose to obtain a conventional threshold but an approximate/rough value showing the conditions for mul-

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tiple landslide occurrences in this area, that is, critical values responsible of numerous and simultaneous slope failures at a local scale.

We have not intended that the I-D value obtained be considered for a warning system but that we only refer to a possible subsequent application after a more robust evaluation (lines 281-284).

For all of the above, in our approach it is not appropriate to take the statistical analyses further.

5. We agree the duration should be measured in days (as represented in figure 3). Figure 4 has been expressed in hours for comparison purposes only, to highlight the differences with other standard or local (obtained using similar data, such as the figures published for the Pyrenees and Asturias) functions.

Regarding figure 2, we have adapted the colour scale to better visualize the spatial pattern of each episode, difficult using a common scale. There is no objection to changing it.

We think we can revise the manuscript, reinforcing the goal and improving the explanation on landslide occurrence.

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Table 1. Periods of landslide occurrence. Characteristics of the images used for the inventory of landslides.

Type	Flight date	Scale/ Resolution	Colour/BW	No. landslides identified	Landslide occurrence
Ortophoto	21/June-30/June, 2015	25 cm	Colour	3	Almost no activity
Ortophoto	16/July-03/October, 2014	25 cm	Colour	3	Almost no activity
Ortophoto	30/July-04/September, 2013	25 cm	Colour	8	Undetermined date
Ortophoto	23/July-08/August, 2012	25 cm	Colour	18	November 2011
Ortophoto	19/June-25/June, 2011	25 cm	Colour	1	Almost no activity
Ortophoto	04/June-01/July, 2010	25 cm	Colour	9	Undetermined date
Ortophoto	23/April-29/May, 2009	25 cm	Colour	5	Undetermined date
Ortophoto	27/July-06/October, 2008	25 cm	Colour	6	Undetermined date
Ortophoto	17/March-06/September, 2007	50 cm	Colour	0	Almost no activity
Ortophoto	17/July-14/November, 2006	25 cm	Colour	9	Undetermined date
Ortophoto	02/June/-15/July, 2005	50 cm	Colour	0	Almost no activity
Ortophoto	15/July-28/September, 2004	25 cm	Colour	4	Almost no activity
Ortophoto	10/September-29/September, 2002	25 cm	Colour	23	August 2002
Ortophoto	1/September-30/September, 2001	1 m	Colour	8	Almost no activity
Aerial Photo	3-4 April, 1997	1/18000	Colour	223	Undetermined date
Aerial Photo	April-August, 1993	1/15000	Colour	95	October 1992
Aerial Photo	March, 1991	1/18000	Colour	133	July 1988
Aerial Photo	June-September, 1985	1/15000	BW	141	August 1983
Aerial Photo	May-June, 1983	1/18000	BW	104	Undetermined date
Aerial Photo	No Data, 1970	1/15000	BW	109	Undetermined date
Aerial Photo	January, 1954	1/12000	BW	278	October 1953

1

Fig. 1.

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