

# Supplement 1 to: Spatial consistency and bias in avalanche forecasts - a case study in the European Alps

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This supplement provides additional results on danger level 3-*Considerable*.

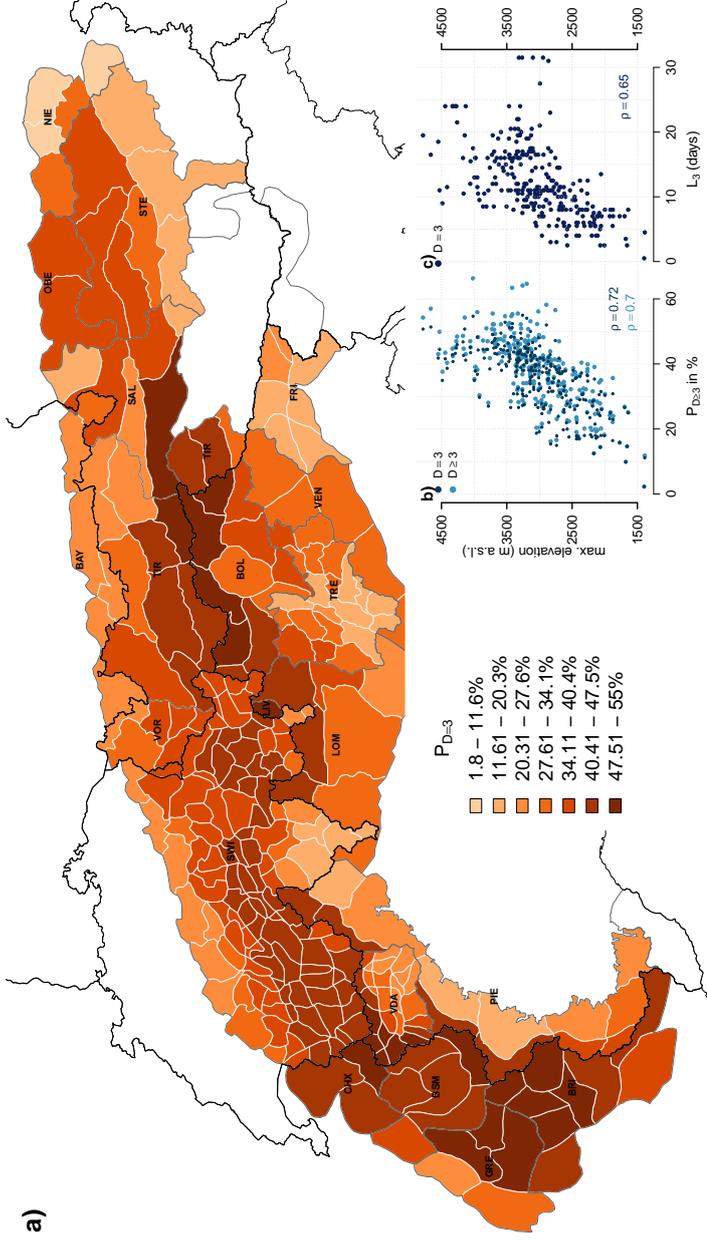
## 1 Critical avalanche conditions $D=3$

The proportion of days with a critical avalanche situation, corresponding to a forecast danger level 3-*Considerable* ( $P_{D=3}$ ), is

$$P_{D=3} = \frac{N(D=3)}{N} \quad (1)$$

- 5 The median  $P_{D=3}$  was 38% ( $D_{\text{morning}}$ , IQR: 29-43%) and 44% ( $D_{\text{max}}$ , IQR: 34 - 50%). Although large variations exist across the Alps, visual inspection of the map shown in Fig. 1a shows only moderate discrepancies across forecast center boundaries. Differences in  $P_{D=3}$  may be explained largely with the maximum elevation of a warning region: a strong and highly significant correlation was observed ( $\rho > 0.7$ ,  $p < 0.001$ ), regardless whether this was explored for  $D_{\text{morning}}$  (Fig. 1b) or  $D_{\text{max}}$ . In contrast, a very weak, though significant negative correlation was observed between  $P_{D=3}$  and the size of the warning regions (sign  
10 negative,  $|\rho| > 0.16$ ,  $p < 0.01$ ).

The median length of the longest period with consecutive forecasts with  $D = 3$  per winter ( $L_{D=3}$ ) was 11 days ( $D_{\text{morning}}$ , IQR 8-16 days) and 12 days ( $D_{\text{max}}$ , IQR 8.5-16.5 days).  $L_{D=3}$  correlates strongly with elevation ( $\rho > 0.62$ ,  $p < 0.001$ , Figure 1c) and correlates negatively with the size of the warning region ( $|\rho| < 0.25$ ,  $p < 0.001$ ). The 10% of the regions with the longest continuous periods with  $D=3$  lie mostly in Switzerland (SWI), Tirol (TIR) and Valle d'Aosta (VDA). Furthermore, the six  
15 regions with the highest  $L_{D=3}$  values ( $L_{D=3} > 27$ ) are those immediately surrounding the Swiss forecast center in Davos. Despite  $P_{D=3}$  values being similar in France to some regions in Switzerland, values for  $L_{D=3}$  tend to be lower as these periods are more frequently interrupted by one or several days with  $D \geq 4$  in France.



**Figure 1.** a) Map showing the proportion of days with a forecast danger level 3 ( $P_{D=3}$  shown for  $D_{\text{morning}}$ ). The color shading of the individual warming regions (white borders) corresponds to the proportion of forecast days with  $D = 3$ . Forecast centers are labeled according to Table 2 in the main manuscript and are marked with dark grey polygon borders. National borders are highlighted with black lines. To visualize the (at least partially) overlapping forecast regions in the Italian region of Lombardia, LIV is superposed onto parts of LOM. The inset scatterplots show the relationship between (b) the proportion of forecasts with  $D=3$  (or  $D \geq 3$ ) and (c) the median length of the longest continuous period with  $D=3$ .