



Supplement of

Brief communication: Weak control of snow avalanche deposit volumes by avalanche path morphology

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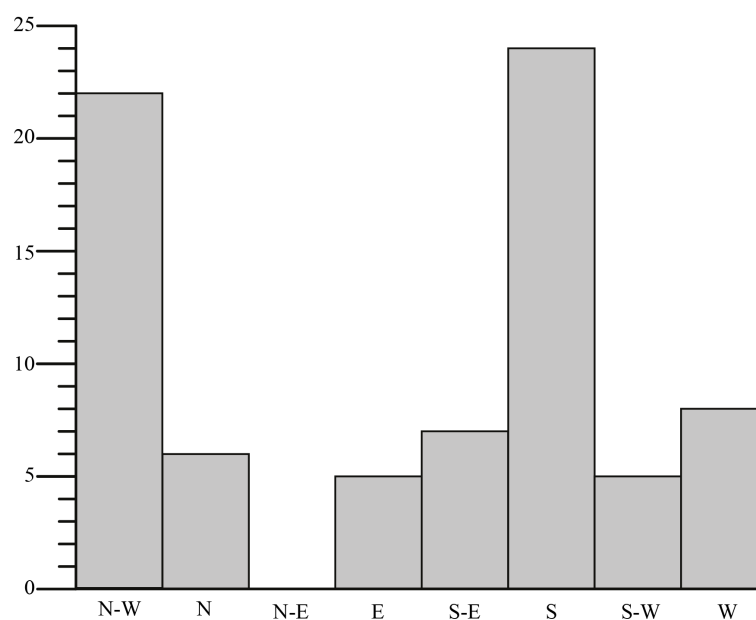
Supplements

Supplementary table 1: Descriptive statistics of quantitative morphological characteristics of avalanche paths.

| Variable | Mean | Std. deviation | Range |
|------------------------------|------|----------------|-----------|
| Length (m) | 1515 | 615 | 594-2860 |
| Minimal elevation (m a.s.l.) | 1781 | 123 | 1461-2313 |
| Maximal elevation (m a.s.l.) | 2731 | 397 | 2120-3731 |
| Mean elevation (m a.s.l.) | 2281 | 260 | 1936-2942 |
| Vertical drop (m) | 950 | 395 | 331-1887 |
| Area minimal slope (°) | 3 | 4 | 0-15 |
| Area maximal slope (°) | 82 | 81 | 39-89 |
| Area mean slope (°) | 39 | 7 | 26-49 |
| Surface area (ha) | 36 | 39 | 3-172 |

Supplementary Table 2: Pearson correlation ρ between the morphological descriptors and orientations of the set of analyzed avalanche paths. Values in bold are significant at the 0.05 level.

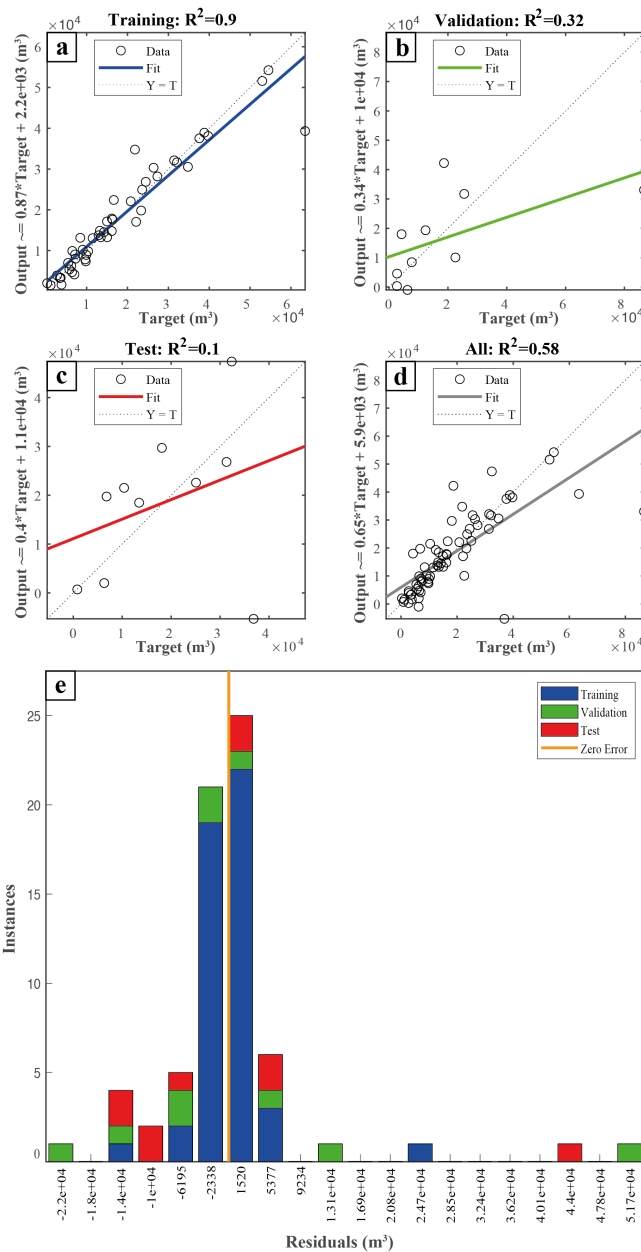
| | Min elevation | Max elevation | Mean elevation | Vertical drop | Min slope | Max slope | Mean slope | Surface area | N-W | N | N-E | E | S-E | S | S-W | W | Path frequency |
|----------------|---------------|---------------|----------------|---------------|--------------|--------------|-------------|--------------|--------------|----------|-------------|----------|--------------|----------|--------------|--------------|----------------|
| Min elevation | 1 | 0.01 | 0.26 | -0.17 | -0.09 | 0.10 | 0.14 | -0.09 | 0.25 | -0.04 | -0.03 | 0.01 | -0.19 | -0.01 | -0.03 | -0.01 | |
| Max elevation | 0.01 | 1 | 0.94 | 0.97 | -0.42 | 0.41 | 0.01 | 0.72 | -0.07 | 0.04 | 0.01 | 0.05 | 0.12 | -0.15 | -0.11 | 0.17 | |
| Mean elevation | 0.26 | 0.94 | 1 | 0.86 | -0.42 | 0.38 | 0.06 | 0.74 | -0.04 | 0.03 | -0.01 | 0.02 | 0.14 | -0.08 | -0.12 | 0.13 | |
| Vertical drop | -0.17 | 0.97 | 0.86 | 1 | -0.42 | 0.37 | -0.02 | 0.74 | -0.14 | 0.05 | 0.11 | 0.04 | 0.17 | -0.14 | -0.01 | 0.19 | |
| Min slope | -0.09 | -0.42 | -0.42 | -0.40 | 1 | -0.48 | 0.07 | -0.41 | 0.08 | 0.17 | -0.19 | -0.22 | 0.16 | -0.01 | -0.14 | -0.24 | |
| Max slope | 0.01 | 0.41 | 0.38 | 0.37 | -0.48 | 1 | 0.49 | 0.28 | 0.06 | -0.08 | 0.21 | -0.16 | -0.18 | 0.03 | 0.21 | 0.51 | |
| Mean slope | 0.14 | 0.01 | 0.06 | -0.02 | 0.07 | 0.49 | 1 | -0.19 | 0.26 | -0.03 | -0.15 | -0.22 | -0.12 | -0.03 | 0.18 | 0.34 | |
| Surface area | -0.01 | 0.72 | 0.74 | 0.74 | -0.41 | 0.28 | -0.19 | 1 | -0.22 | 0.05 | 0.10 | 0.09 | 0.10 | 0.07 | -0.11 | 0.11 | |
| N-W | 0.25 | -0.07 | -0.04 | -0.14 | 0.08 | 0.06 | 0.26 | -0.22 | 1 | -0.18 | -0.17 | -0.20 | -0.43 | -0.17 | -0.21 | 0.11 | |
| N | -0.04 | 0.04 | 0.03 | 0.05 | 0.17 | -0.07 | -0.03 | 0.05 | -0.18 | 1 | -0.07 | -0.09 | -0.20 | -0.08 | -0.10 | -0.22 | |
| N-E | | | | | | | | | | | | | | | | | |
| E | -0.03 | 0.01 | -0.01 | 0.11 | -0.19 | 0.21 | -0.15 | 0.10 | -0.17 | -0.08 | 1 | -0.08 | -0.18 | -0.07 | -0.10 | 0.31 | |
| S-E | 0.01 | 0.05 | 0.02 | 0.04 | -0.22 | -0.16 | -0.21 | 0.09 | -0.20 | -0.09 | -0.08 | 1 | -0.21 | -0.08 | -0.11 | -0.03 | |
| S | -0.19 | 0.12 | 0.14 | 0.17 | 0.16 | -0.18 | -0.12 | 0.10 | -0.43 | -0.20 | -0.18 | -0.21 | 1 | -0.18 | -0.23 | -0.27 | |
| S-W | -0.01 | -0.15 | -0.07 | -0.14 | -0.01 | 0.03 | -0.03 | 0.07 | -0.17 | -0.07 | -0.07 | -0.08 | -0.18 | 1 | -0.10 | -0.14 | |
| W | -0.03 | -0.11 | -0.12 | -0.01 | -0.14 | 0.21 | 0.18 | -0.11 | -0.21 | -0.10 | -0.10 | -0.11 | -0.23 | -0.10 | 1 | 0.34 | |
| Path frequency | -0.01 | 0.17 | 0.13 | 0.19 | -0.24 | 0.51 | 0.34 | -0.11 | 0.11 | 0.11 | 0.31 | -0.03 | -0.27 | -0.14 | 0.34 | 1 | |



Supplementary figure 1: Number of paths by orientation

Supplementary Table 3: R^2 statistics for the fitted neural network models. For each series (annual, winter and spring) and model type (3 or 8 layers) the table provides the median (50%), 80% and 97.5% percentiles over the distribution of the 100 bootstrap iterations.

| | 3 layers | | | 8 layers | | |
|--------|----------|------|-------|----------|------|-------|
| | 50% | 80% | 97,5% | 50% | 80% | 97,5% |
| Annual | 0.18 | 0.32 | 0.46 | 0.28 | 0.43 | 0.57 |
| Winter | 0.29 | 0.45 | 0.57 | 0.33 | 0.56 | 0.76 |
| Spring | 0.06 | 0.21 | 0.37 | 0.10 | 0.30 | 0.54 |



Supplementary Figure 2: Example of one (among the 100 bootstrap iterations) fitted 8-layer neural network annual model. Linear correlation between observed and predicted values for: (a) training sample, (b) validation sample, (c) test sample, (d) full sample, (e) histogram of residuals for the training, validation and test samples.