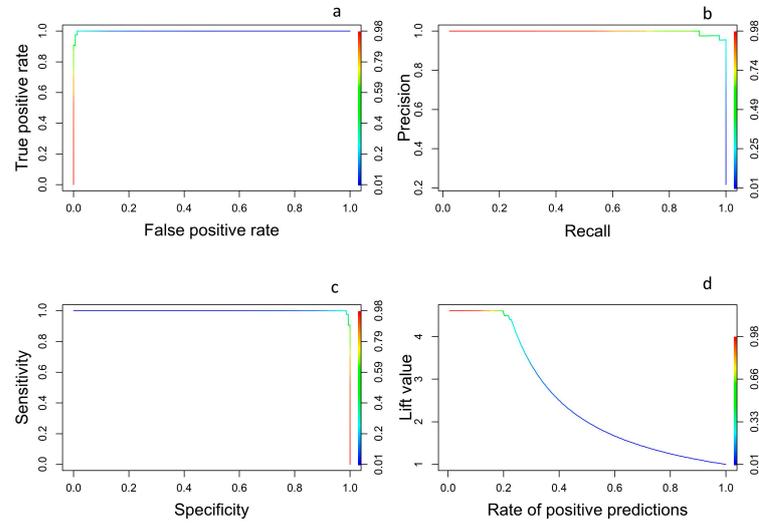


**Table S1.** The forward method (Likelihood Ratio) binary Logistic regressions of daily soil seepage events in the summer pasture of alpine meadow (Rain-fre: rainfall frequency; SWC: soil water content; Rain: rainfall amount).

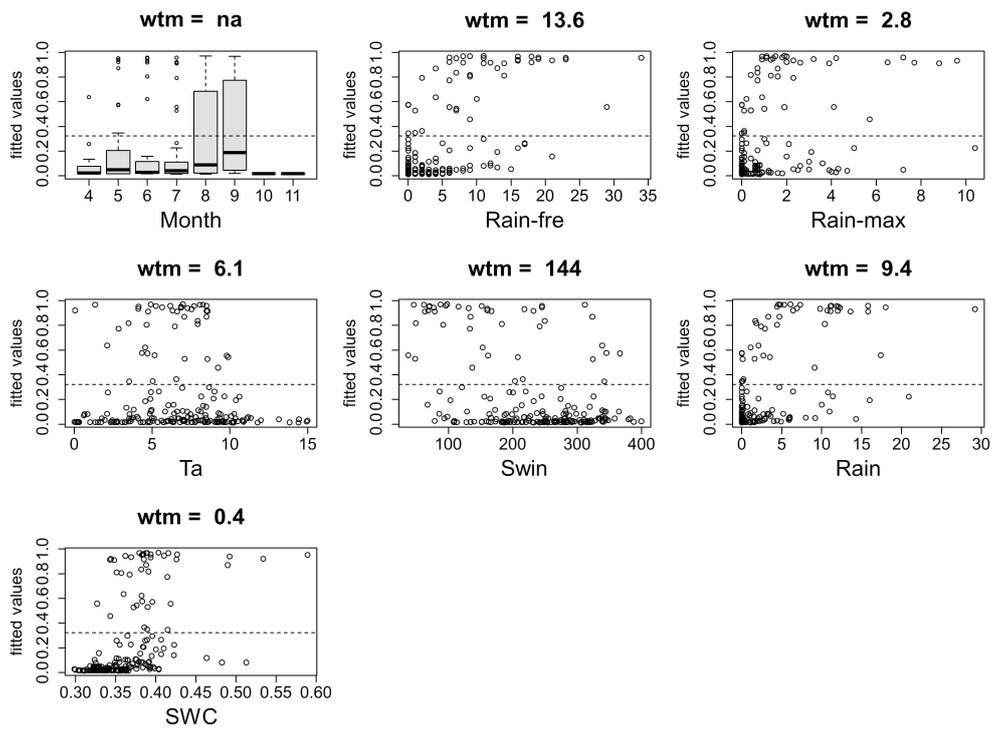
Model*	Variable	Coefficients	Sig.	Nagelkerke R <sup>2</sup>	Percentage correct	
					No Seepage	Seepage
I	Rain-fre	0.22	0.00	0.37	94.2%	37.2%
II	Rain-fre	0.22	0.00	0.50	94.2%	46.5%
	SWC	24.24	0.00			
III*	Rain	0.25	0.00	0.30	94.8%	39.5%

Note: the model could be described as  $\text{Log}(P/(1-P)) = ax + b$ , where P is the probability of soil seepage, a is regression coefficient, b is the regression intercept,  $\text{log}(P/(1-P))$  is the logarithm of the odds ( $P/(1-P)$ ).

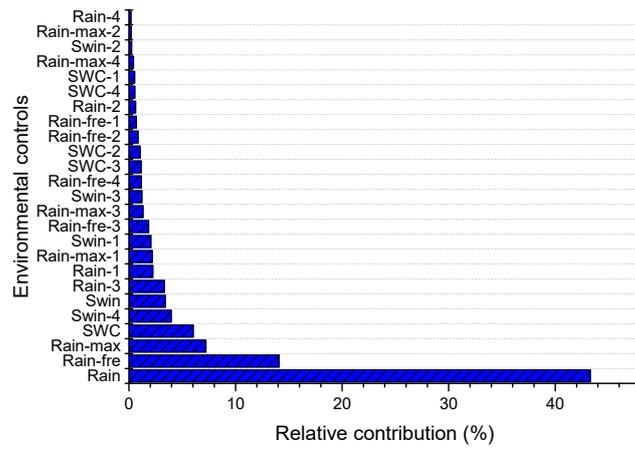
\*: The variable of Rain (rainfall amount) was forced and Rain-fre (rainfall frequency) was excluded into the model.



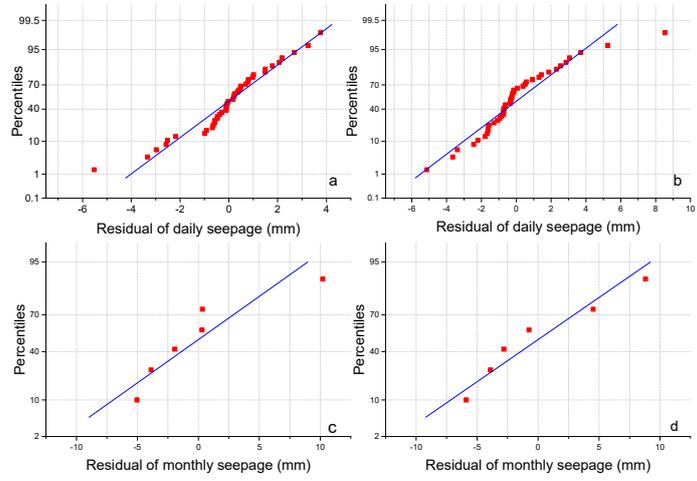
**Figure S1** The receiver operating characteristic curve (a), Precision/recall (b), Sensitivity/specificity (c) and Lift charts (d) from the boosted regression trees results. The plot was created by the “ROCR” package (Sing T, Sander O, Beerenwinkel N, Lengauer T. ROCR: visualizing classifier performance in R. *Bioinformatics* 2005, 21(20): 3940-3941) in R 4.0.2.



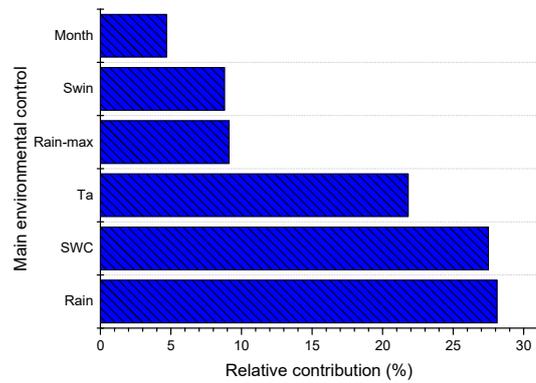
**Figure S2.** The fitted daily soil seepage probability in relation to each of the predictors used in the model (Month is categorical variable for the month period of soil seepage events, Rain-fre is daily rainfall frequency, Rain-max is the maximum half-hour rainfall amount, Ta is air temperature, Swin is solar radiation, Rain is rainfall amount, and SWC is soil water content).



**Figure S3.** The relative contribution on daily soil seepage from boosted regression trees model (mean total deviance = 7.11, mean residual deviance = 0.35. Abbreviations: Rain: rainfall amount; Rain-fre: rainfall frequency; SWC: soil water content; Swin: solar radiation; the suffix number -4, -3, -2, -1 is the 4-day, 3-day, 2-day, and 1-day before seepage events (i.e., Swin-4 is solar radiation of four days before soil seepage event)).



**Figure S4.** The percentiles of residual from linear (a, b and d) and logarithmic regression analysis on daily seepage (a and b) and monthly (c and d) seepage amount.



**Figure S5.** The relative contribution of main environmental controls (rainfall frequency was excluded) on daily soil seepage probability from boosted regression trees model (mean total deviance = 1.05, mean residual deviance = 0.51. abbreviations: Month is categorical variable for the month period of soil seepage events, Swin is solar radiation, Rain is the rainfall amount, Rain.max is the maximum half-hour rainfall amount, Ta is the air temperature, SWC is the soil water content).