Snow melt triggering of shallow landslides under climate change.

The case study of Tartano valley, Italian Alps

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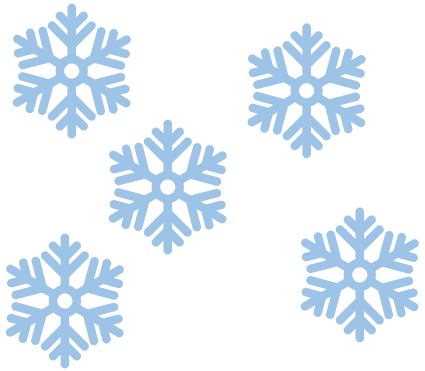
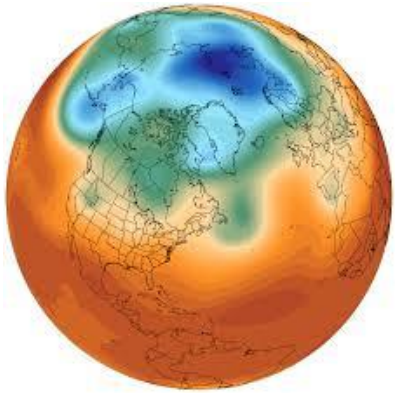
Presentation outline





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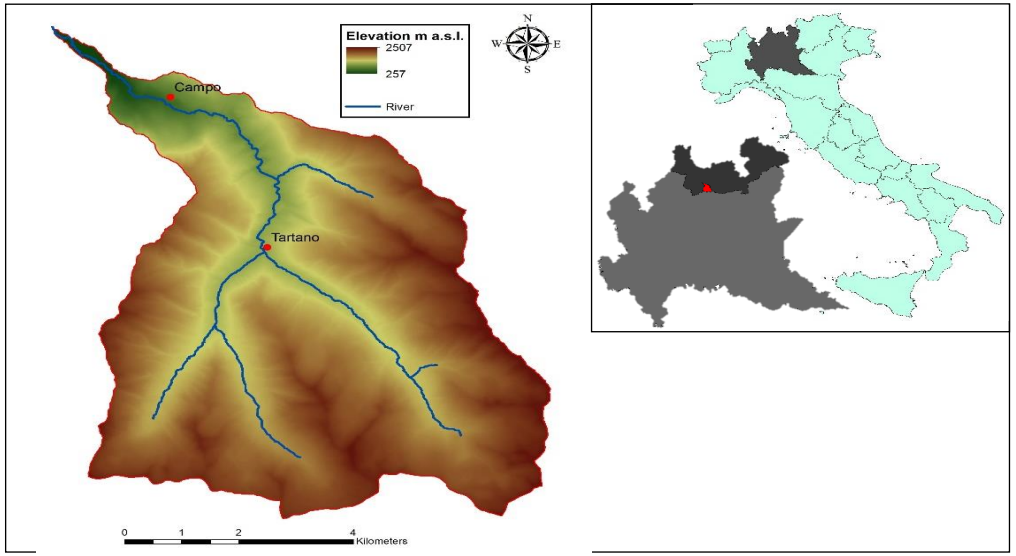
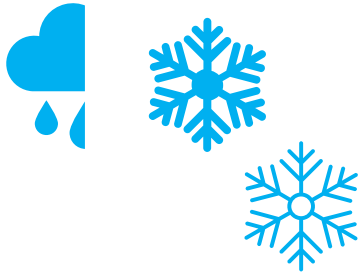


The effects of snow

WINTER



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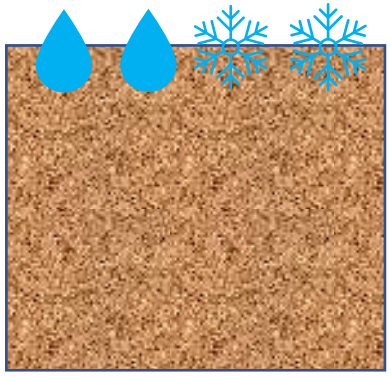
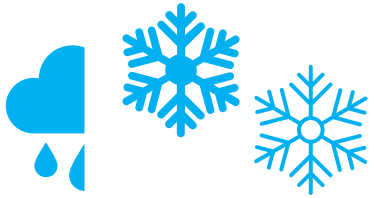


Standard approach:

-risk of under-estimating the water content in soil during spring time

WINTER



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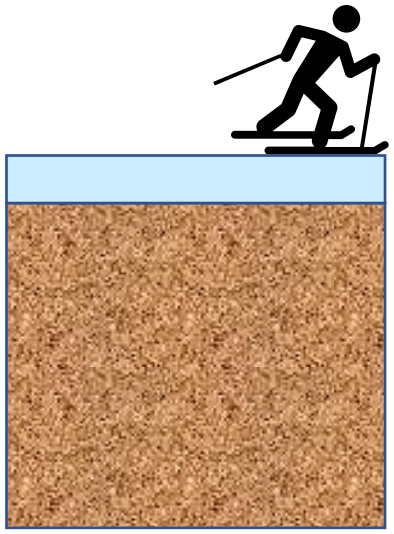

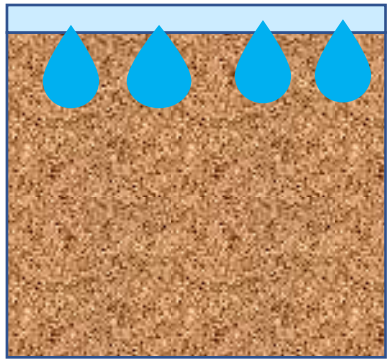

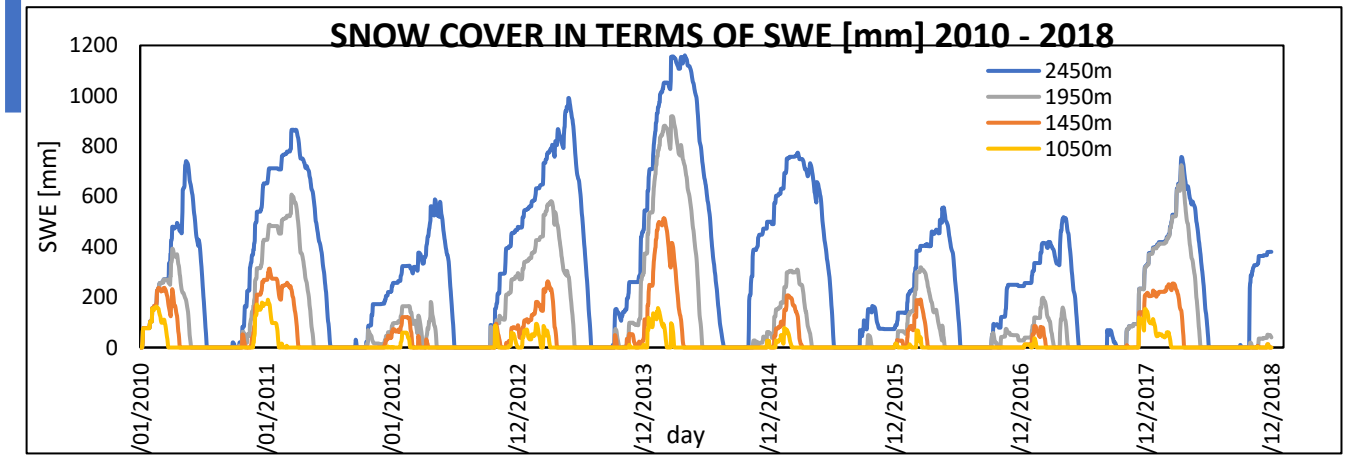

The NEW model

Slope stability model

Infinite planar slope

Mohr Coulomb failure law

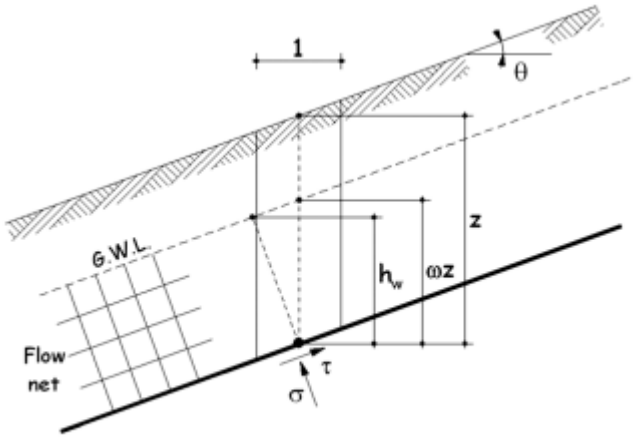

Figure 1. One-dimensional sketch for slope equilibrium.

Rosso et al., 2006

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Hydrological model

Darcy law for flow propagation

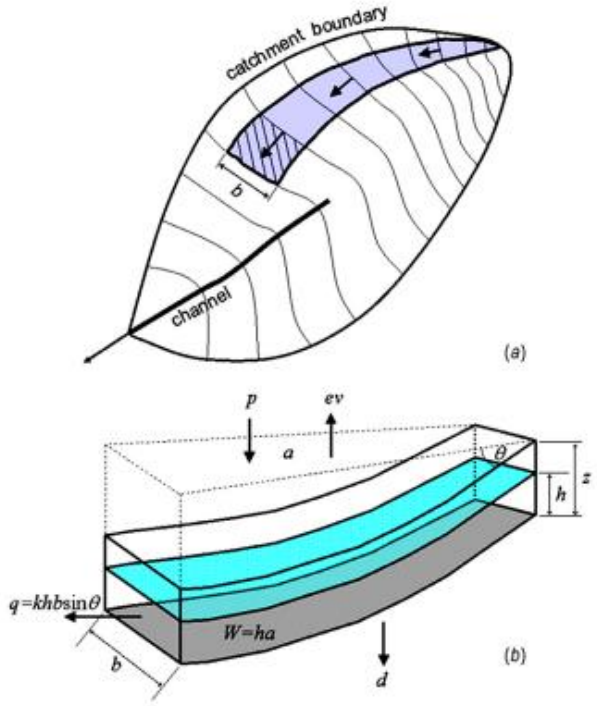

Figure 2. Sketch of an elementary drainage area: (a) planar view and (b) hydrological fluxes.

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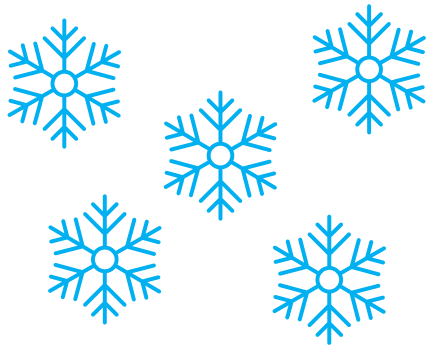
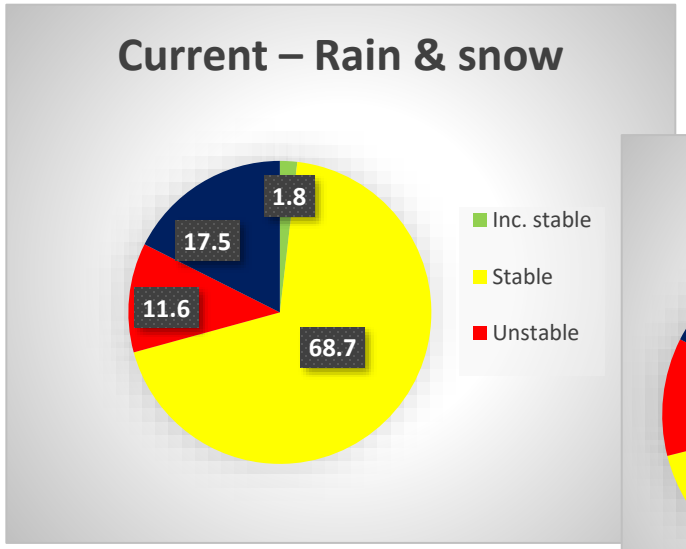


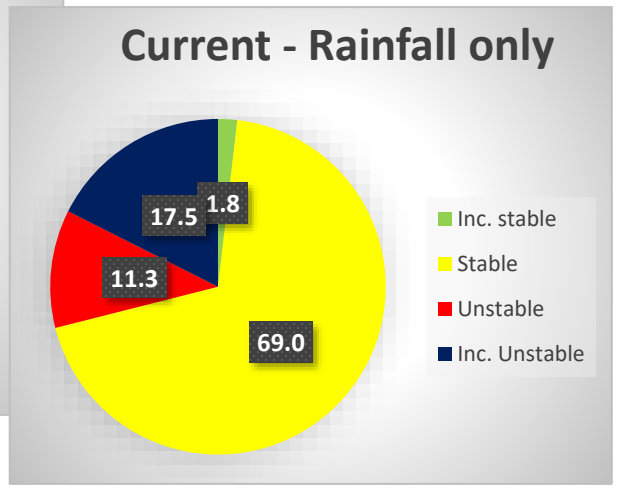
Snow and snowmelt effects

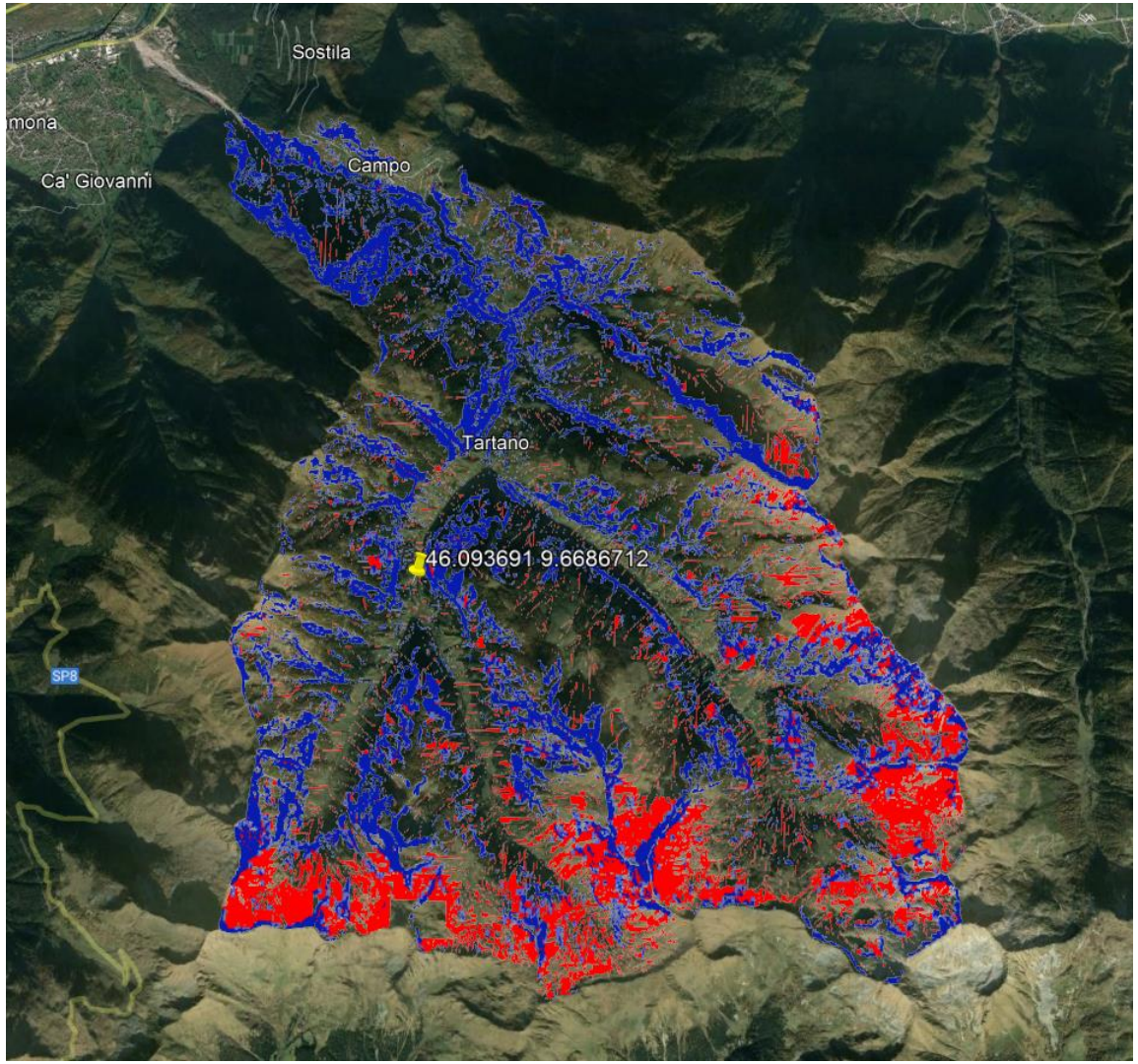
- Continuous simulation including snowmelt*
- IDF curves including snow melt

Results

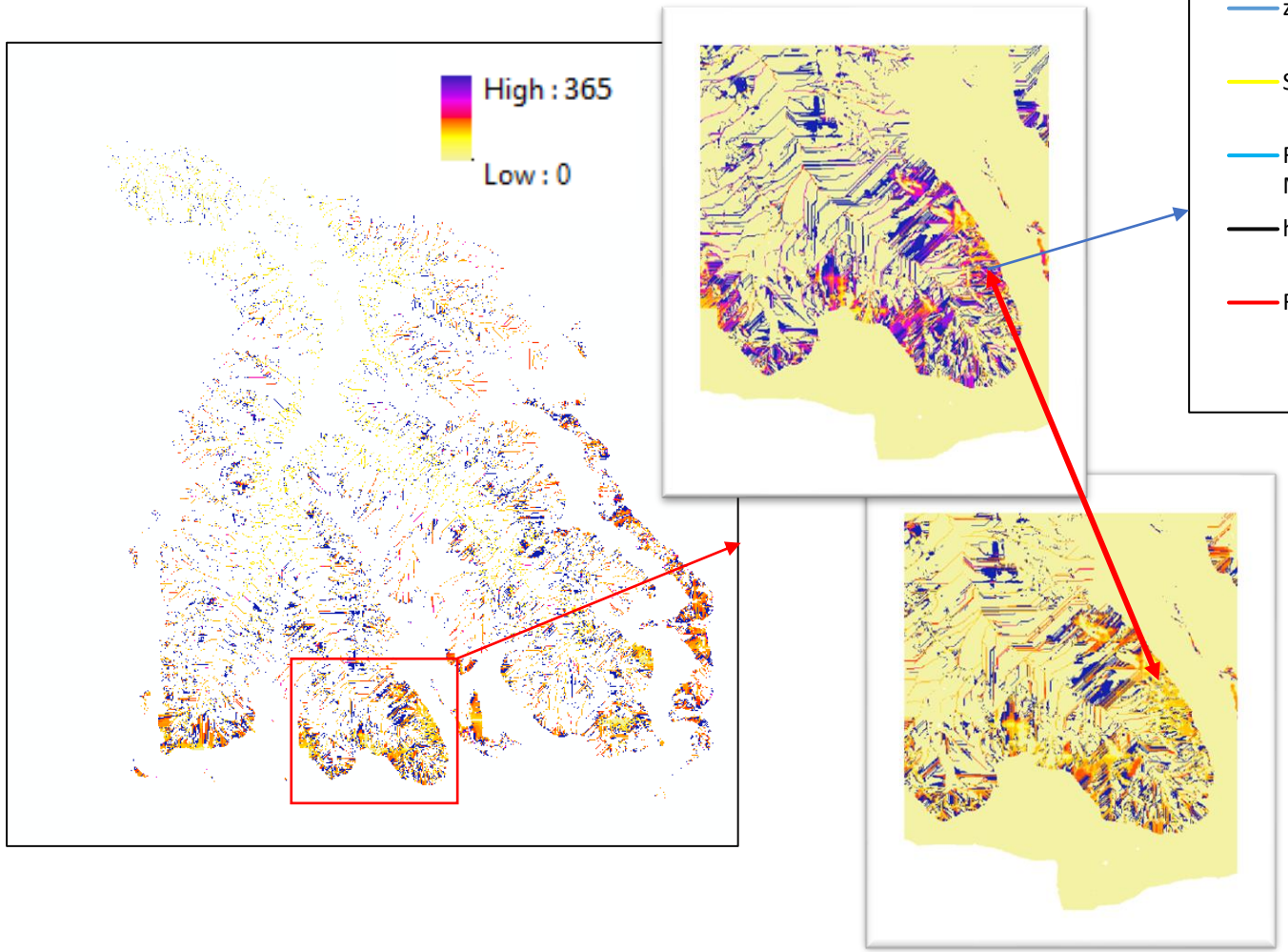
- About 11.5% of the basin is susceptible to shallow lansdslide.
- Shallow landslides are mainly predicted at the higher elevation, in areas with no or only few sparse houses and infrastructures.
- By including snowmelt effect, the potential unstable areas remain more or less the same but…

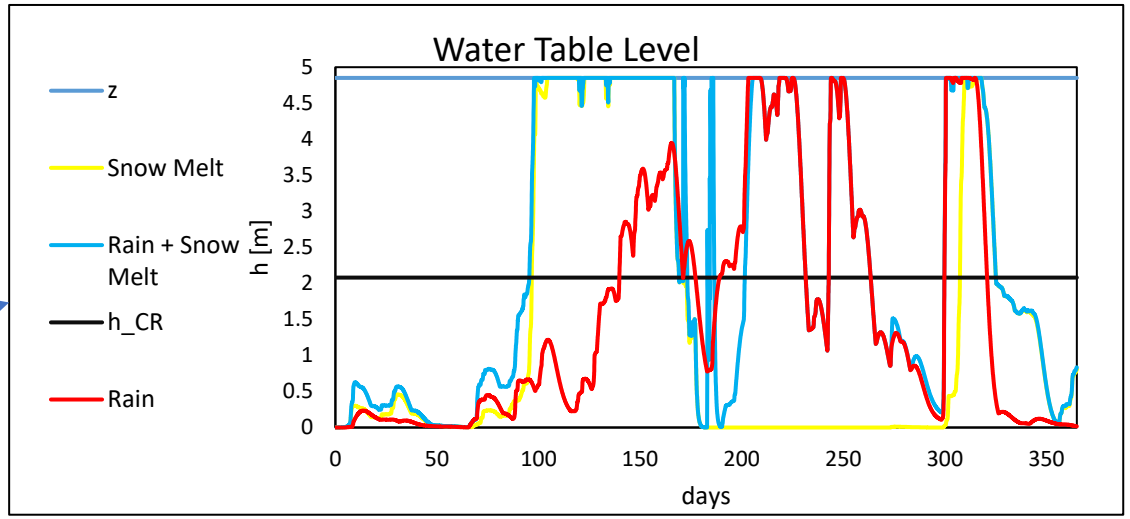






Results



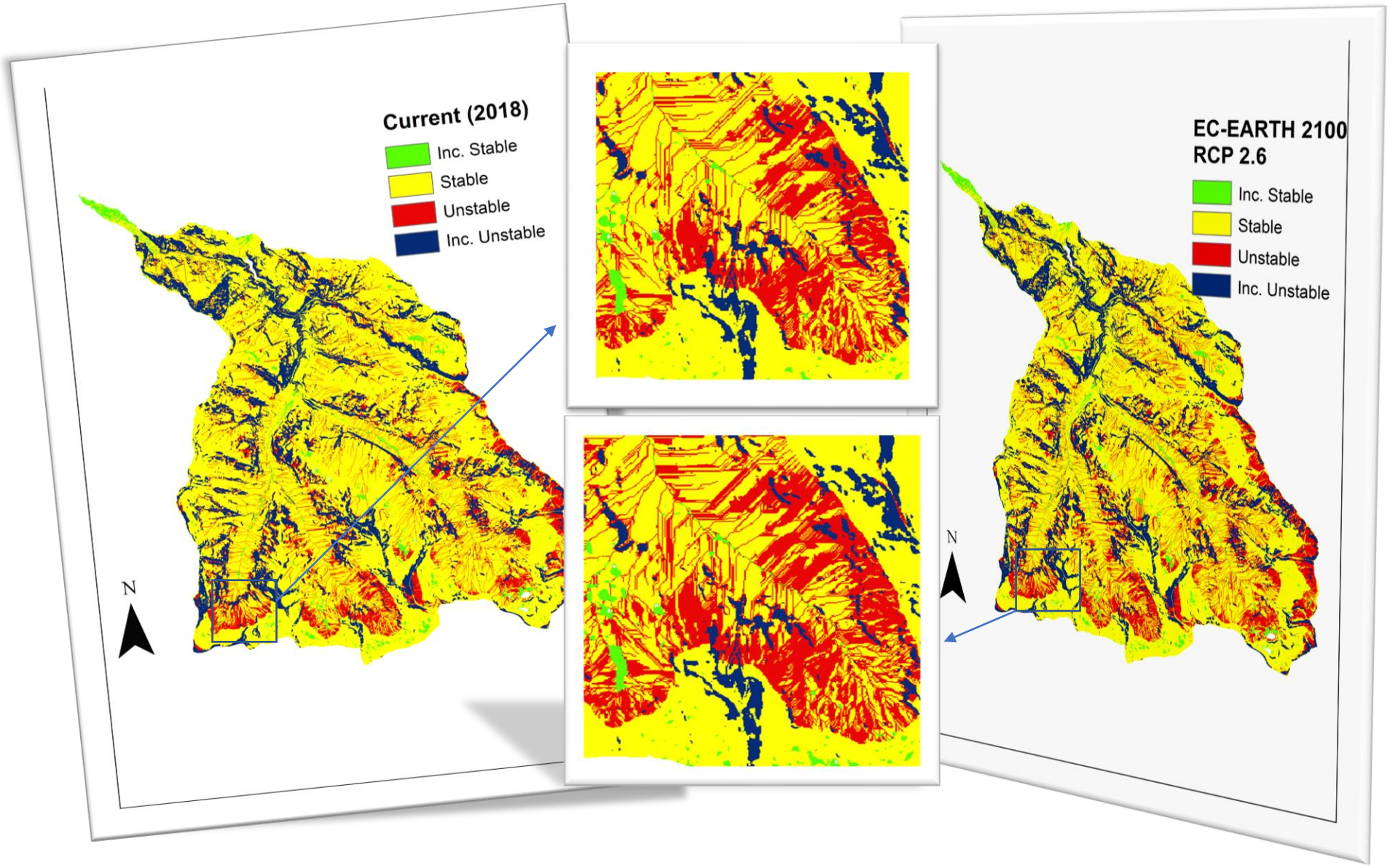


Rainfall only: peak on October, 28°

Including snowmelt, the majority of instabilisation:

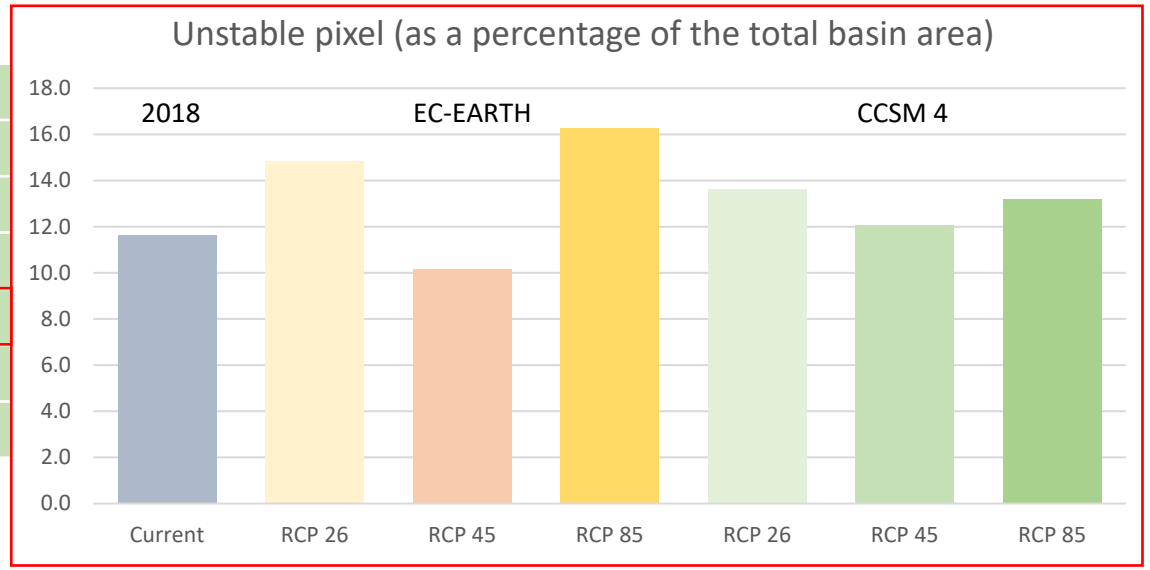
< 1000mlsm -> **Anticipated of 5 months** in April-May
1000-1500m-> **Anticipated of 3-4months** in May-June
> 1500m -> **Anticipated of 2-3 months** in June-July

Results – present VS future



Results – future instability

		EC EARTH			CCSM 4		
	2018	RCP 26	RCP 45	RCP 85	RCP 26	RCP 45	RCP 85
Inc. stable	1,8	1,8	1,8	1,8	1,8	1,8	1,8
Stable	68,7	65,5	70,2	64,1	66,7	68,3	67,2
Unstable	11,6	14,9	10,2	16,3	13,6	12,1	13,2
Inc. Unstable	17,5	17,5	17,5	17,5	17,5	17,5	17,5
	99,7	99,7	99,7	99,7	99,7	99,7	99,7



		EC EARTH			CCSM 4		
	Current	RCP 26	RCP 45	RCP 85	RCP 26	RCP 45	RCP 85
Average yearly precipitation [mm]	1521,5	1320,3	1533,7	1591,5	1362,7	1630,5	1234,6
Maximum hourly Precipitation peak [mm/h]	13,6	16,8	18,5	23,2	18,4	16,1	10,7
Precipitation hours in a year [h]	2174,7	1558,9	1547,0	1467,6	1475,1	1623,3	1316,8
Average precipitation intensity [mm/h]	0,7	0,9	1,1	1,1	1,0	1,0	1,0
Maximum volume of a single event [mm]	345,1	117,0	94,1	115,5	127,4	126,0	139,6
Duration of the longest event [h]	301,3	152,5	123,7	75,8	124,8	118,5	122,1

«Study nature,
Love nature,
Stay close to nature.
It will never fail you.»
F.L.Wright

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