Observed temperature dependence of snowfall and snow pack in the Swiss Alps

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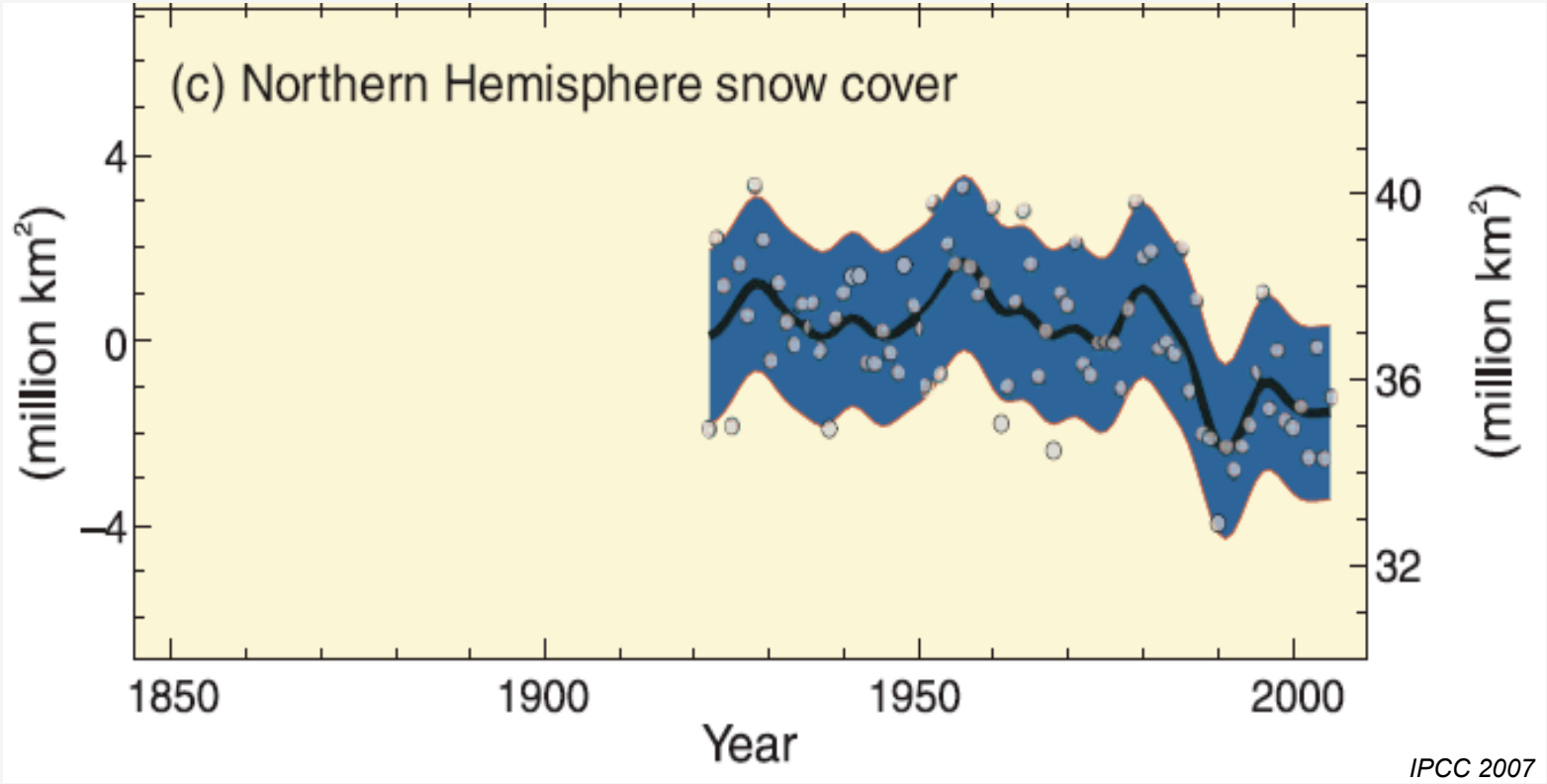
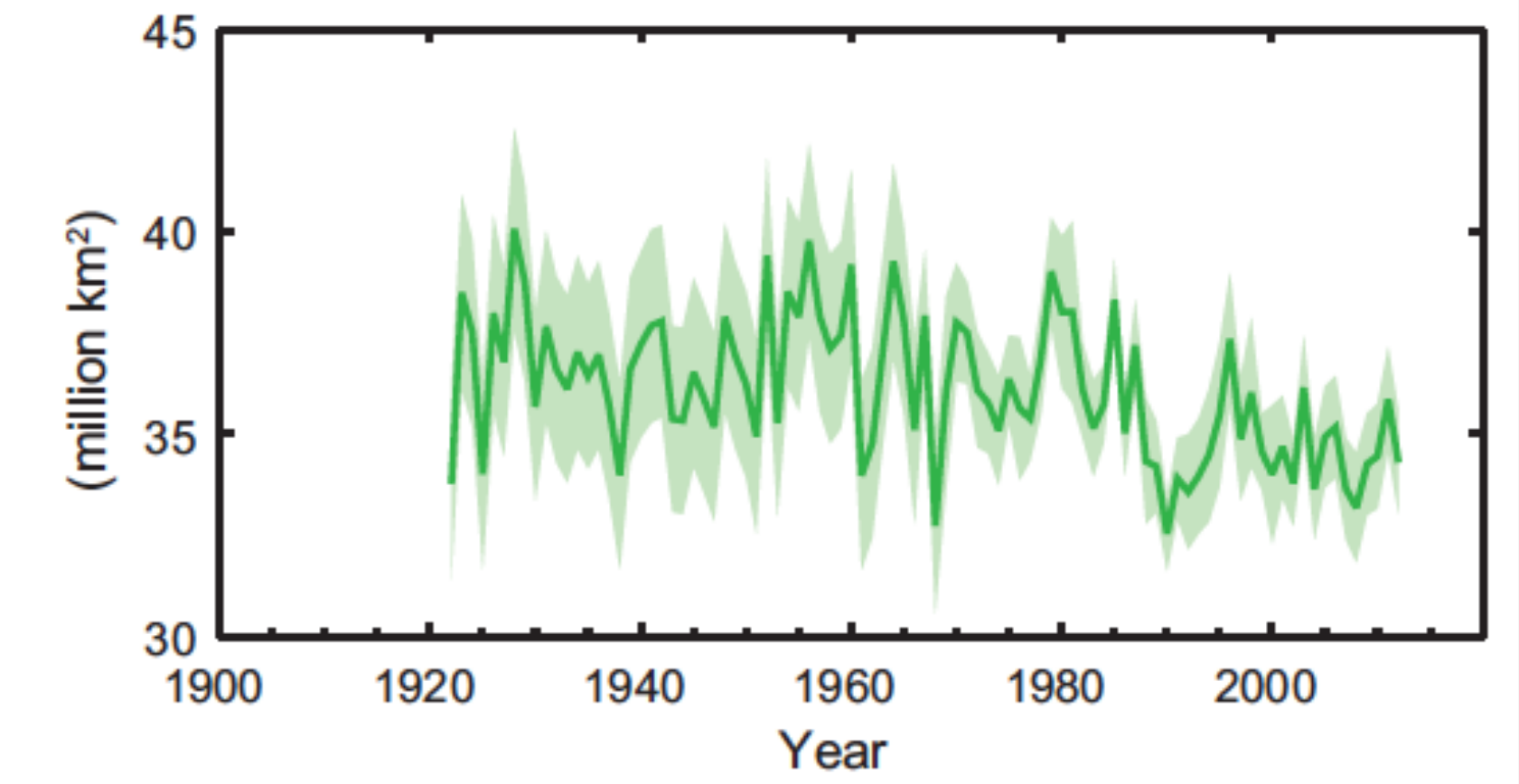

(c) Northern Hemisphere snow cover
(million km²)
4
0
−4
40
36
32
(million km²)
1850
1900
1950
2000
Year

IPCC 2007

Northern Hemisphere spring snow cover



IPCC 2014

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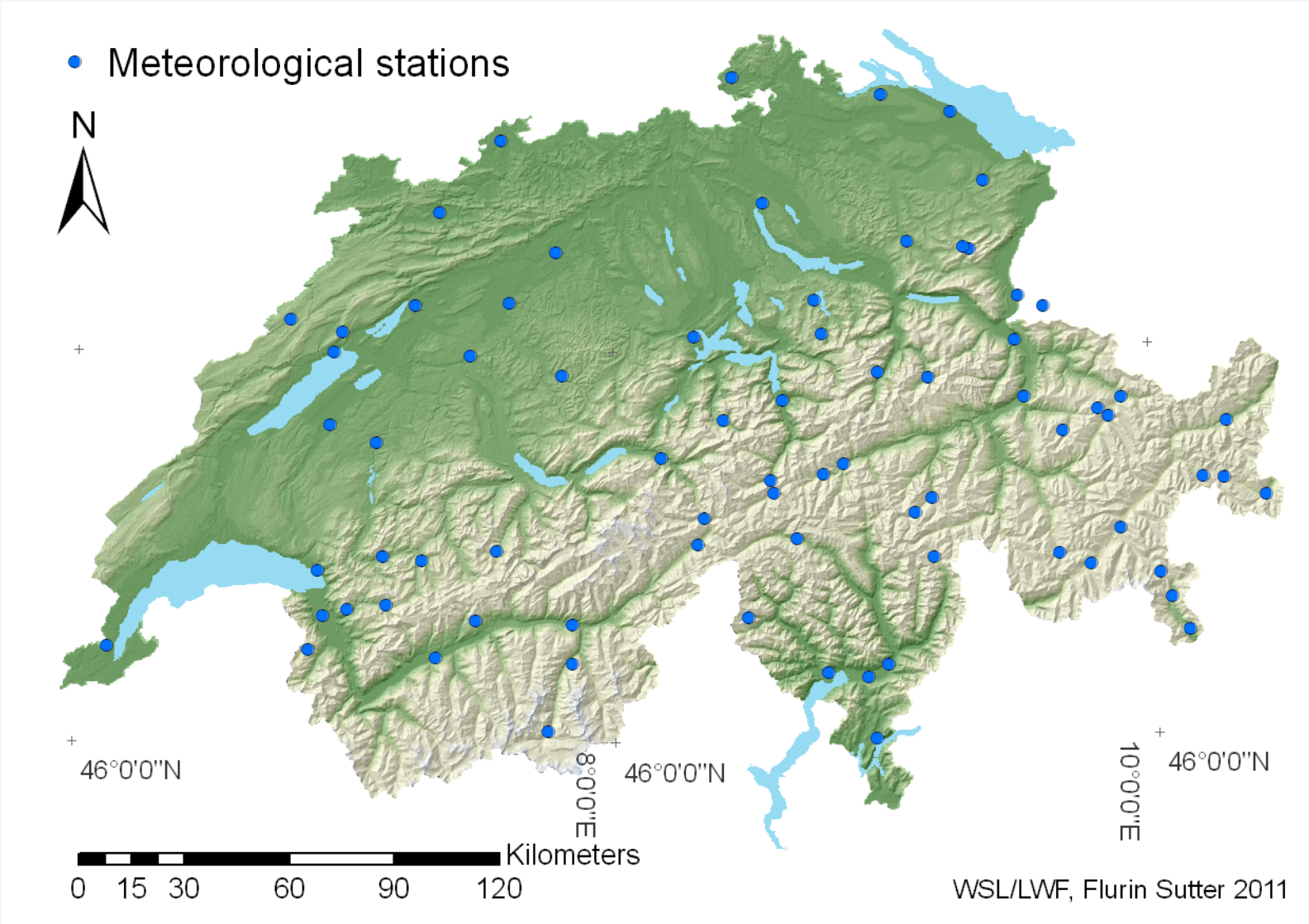

Serquet et al., 2011

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Analysis of the snow precipitation

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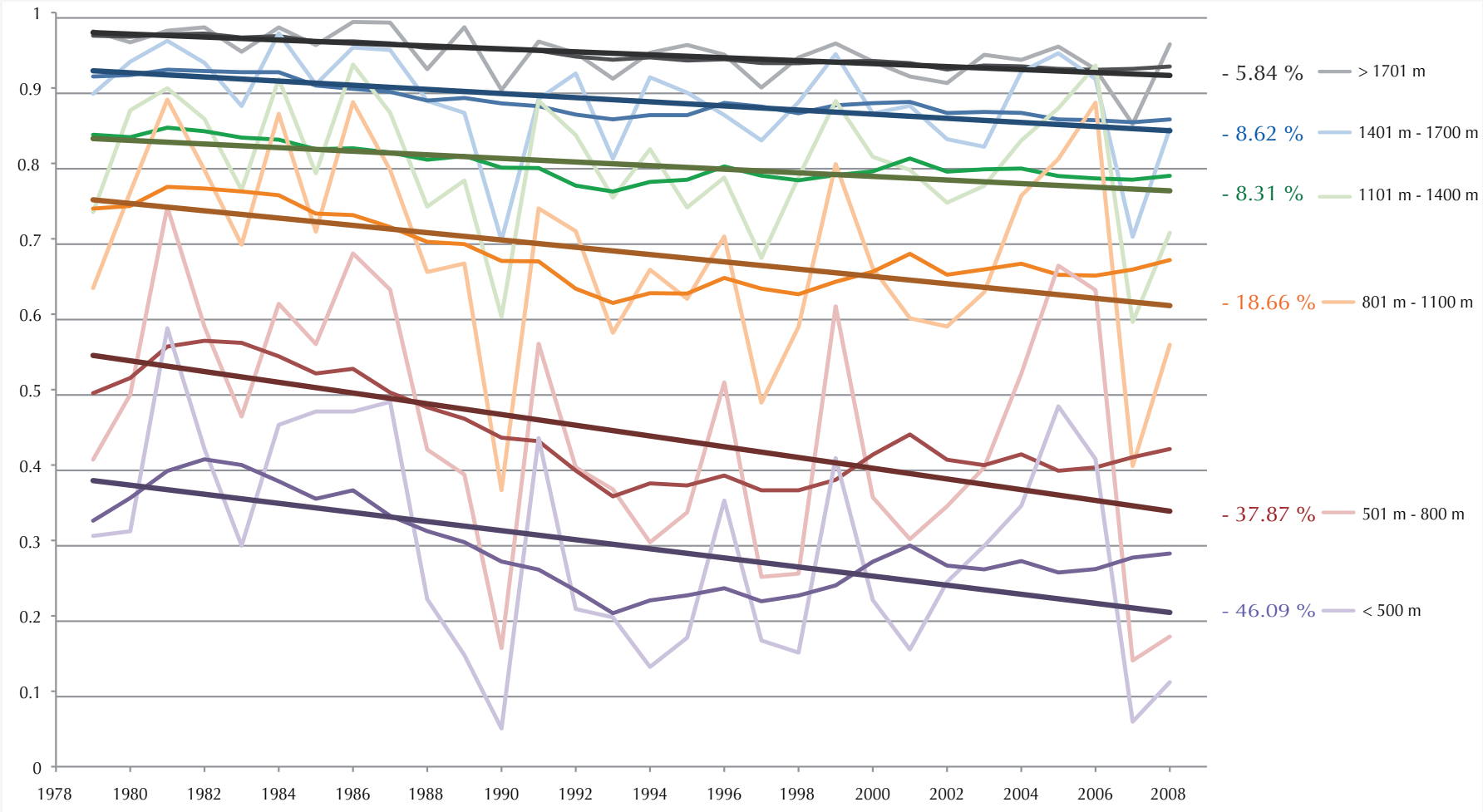
Snowfall days / precipitation days (DJF)



Serquet et al., 2011

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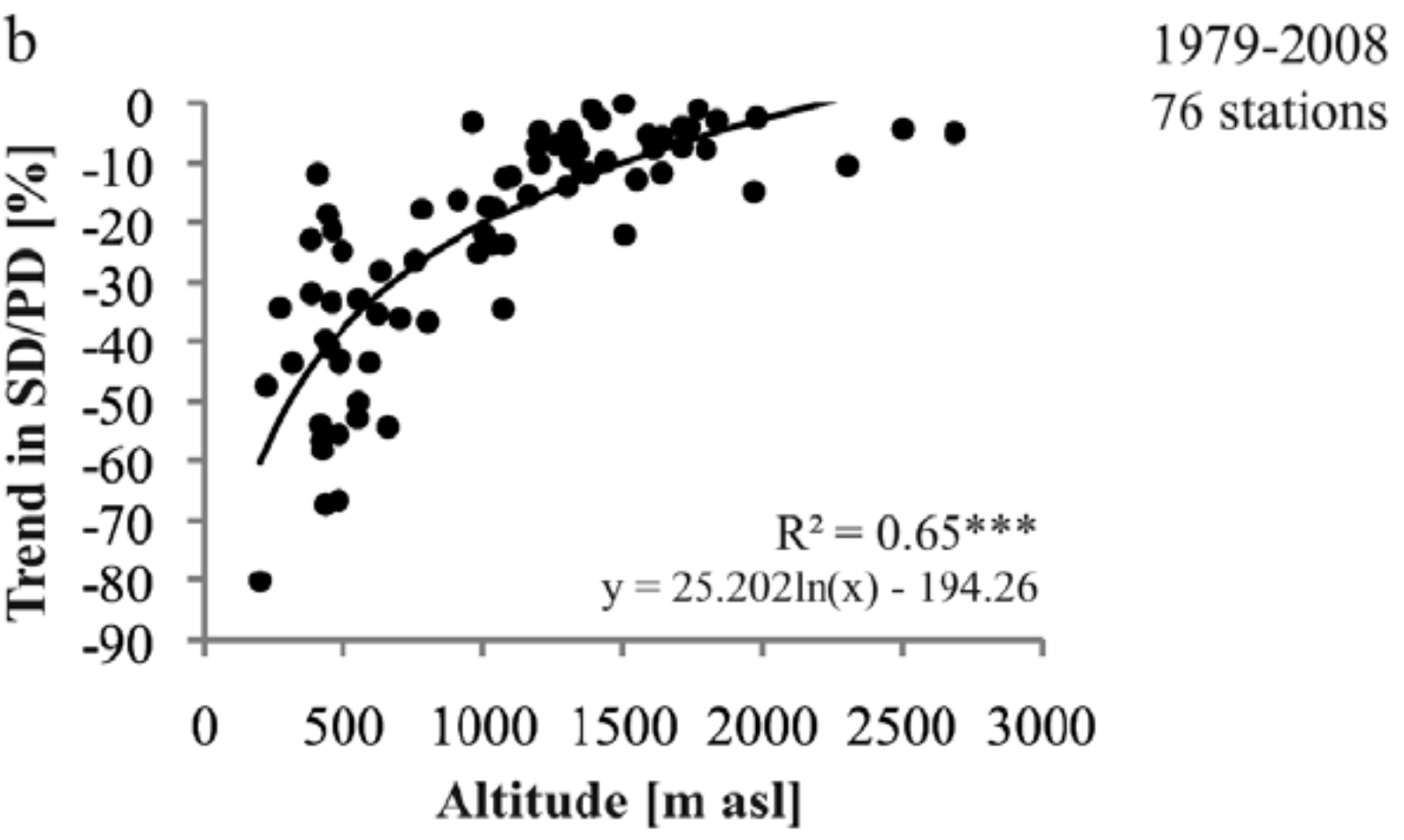
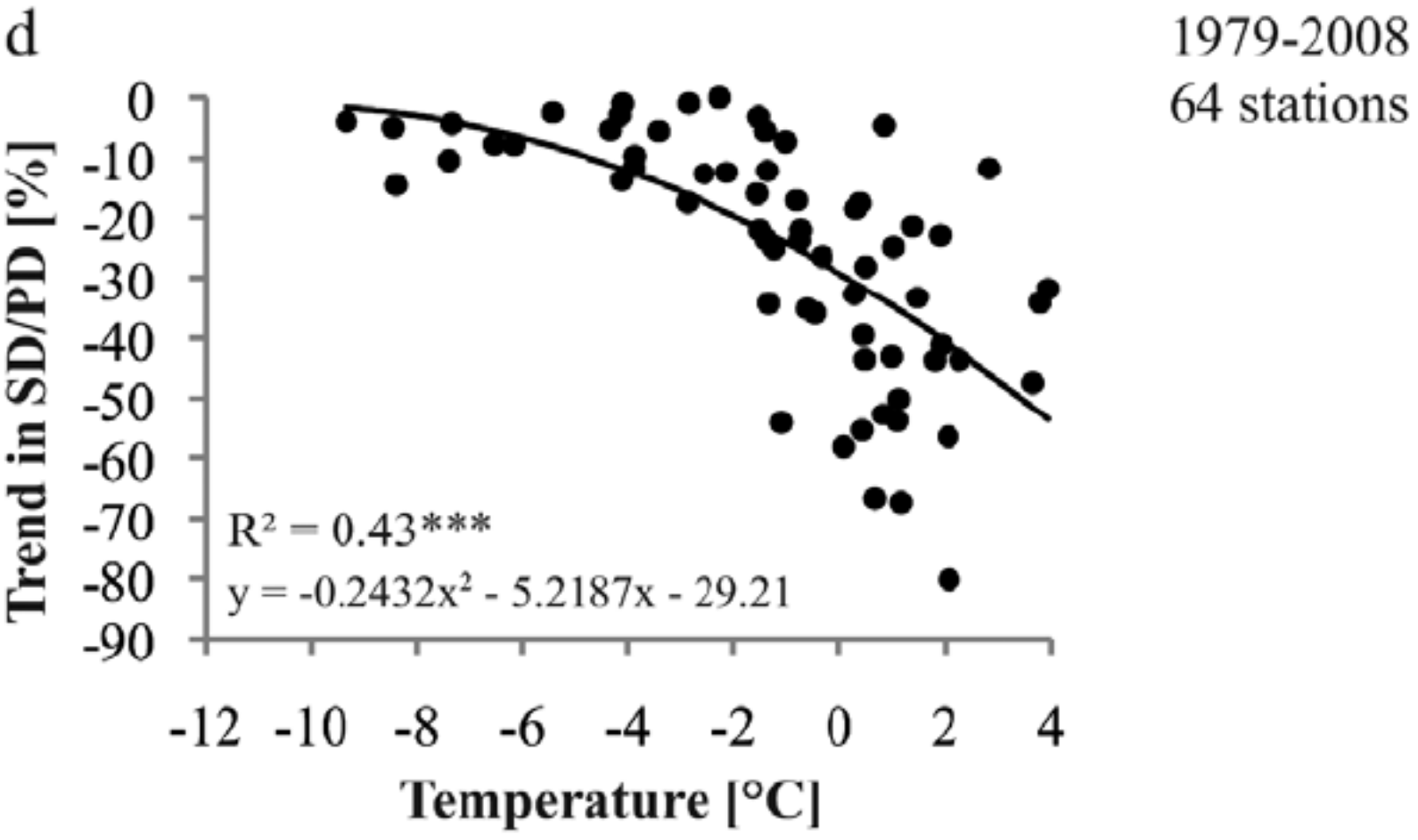
Changes in wintertime (DJF) SD/PD as a function of altitude



Serquet et al. 2011

Changes in wintertime (DJF) SD/PD as a function of temperature



Serquet et al. 2011

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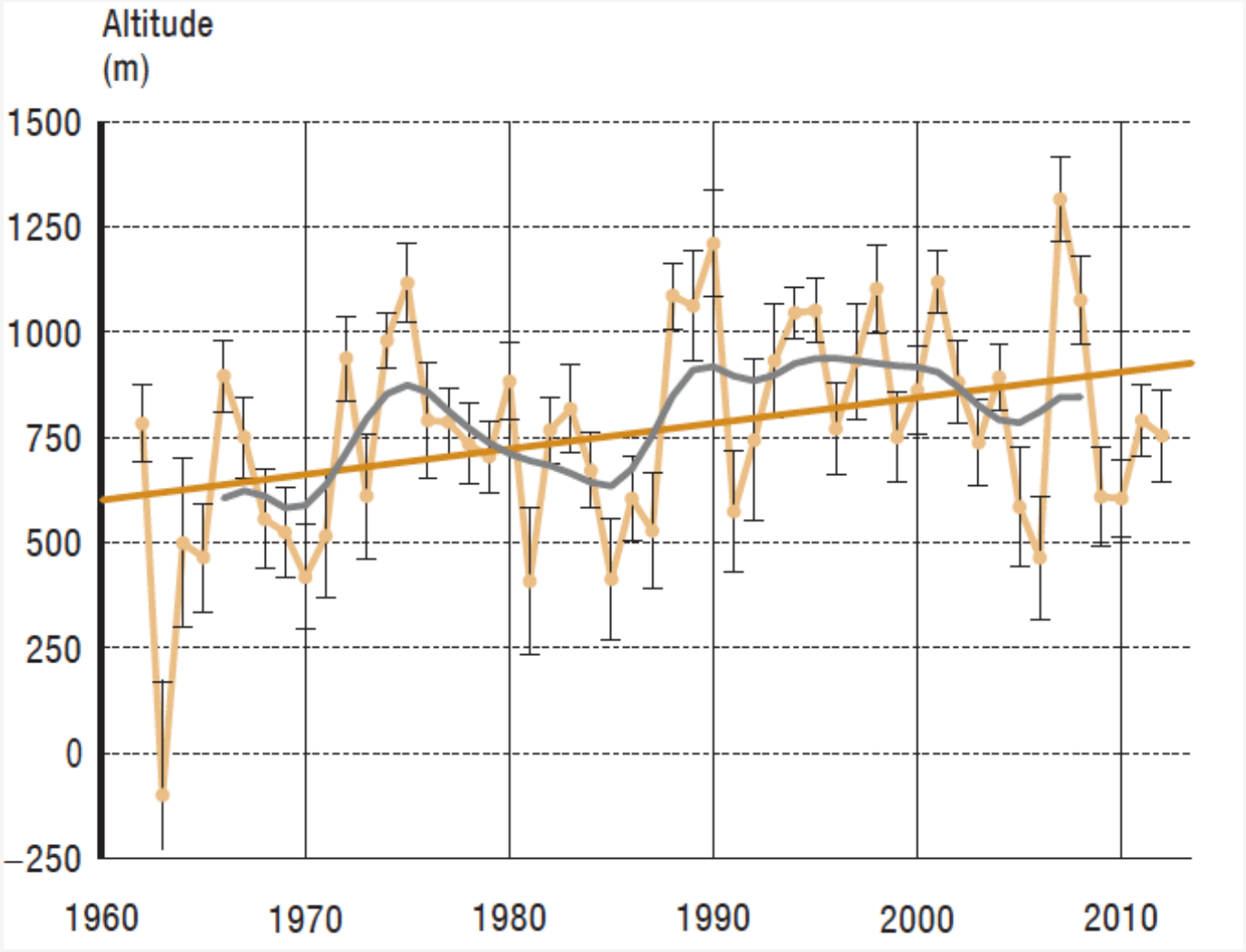
Altitude of the zero degree limit (DJF)



MeteoSwiss 2012

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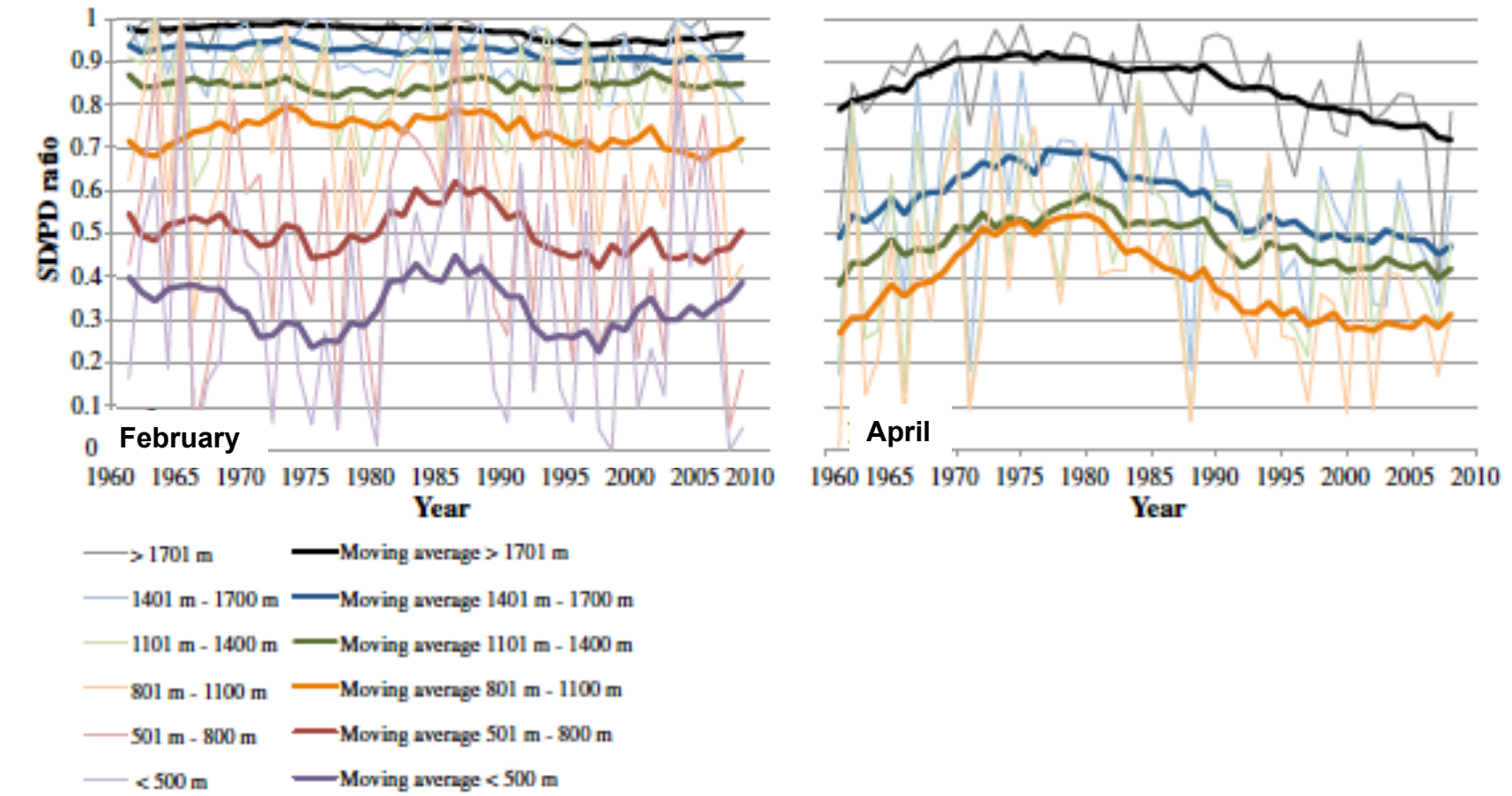
Decrease in spring snow days at higher altitude



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G Serquet, C Marty and M Rebetez 2013: ***Monthly trends and the corresponding altitudinal shift in the snowfall/precipitation day ratio, Theoretical and applied climatology***

Analysis of the snow cover

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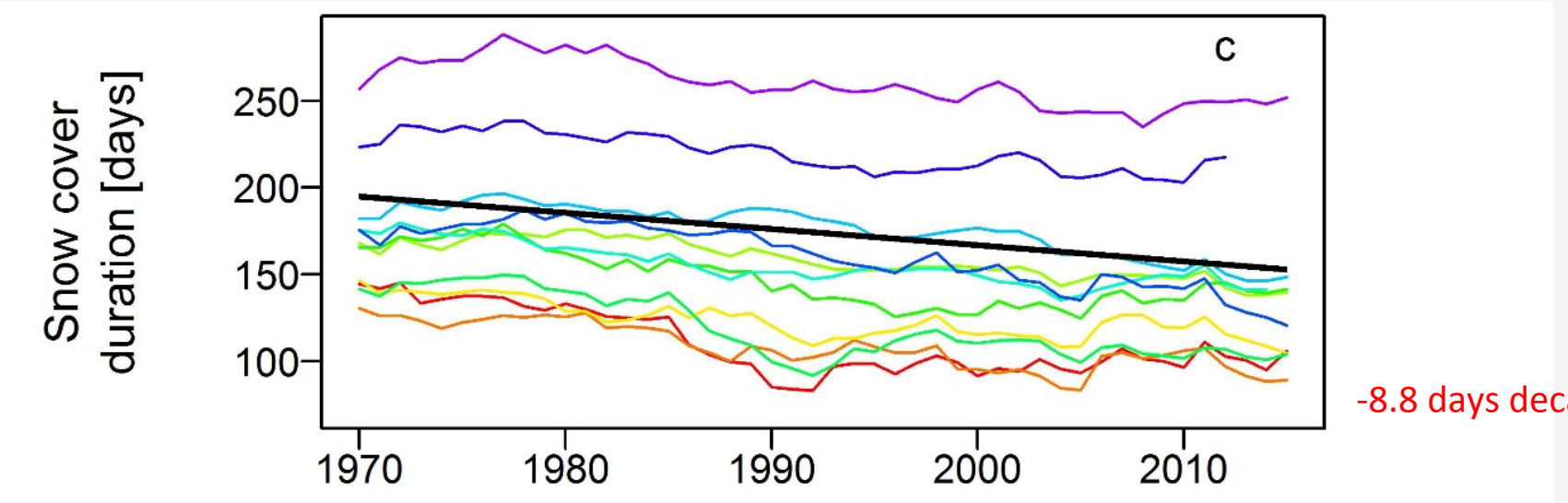
Shorter snow cover duration (1139-2540 masl)



-8.8 days decade^{-1}

G Klein, Y Vitasse, C Rixen, C Marty and M Rebetez, 2016: Shorter snow cover duration since 1970 in the Swiss alps due to earlier snowmelt more than to later snow onset. Climatic Change, online

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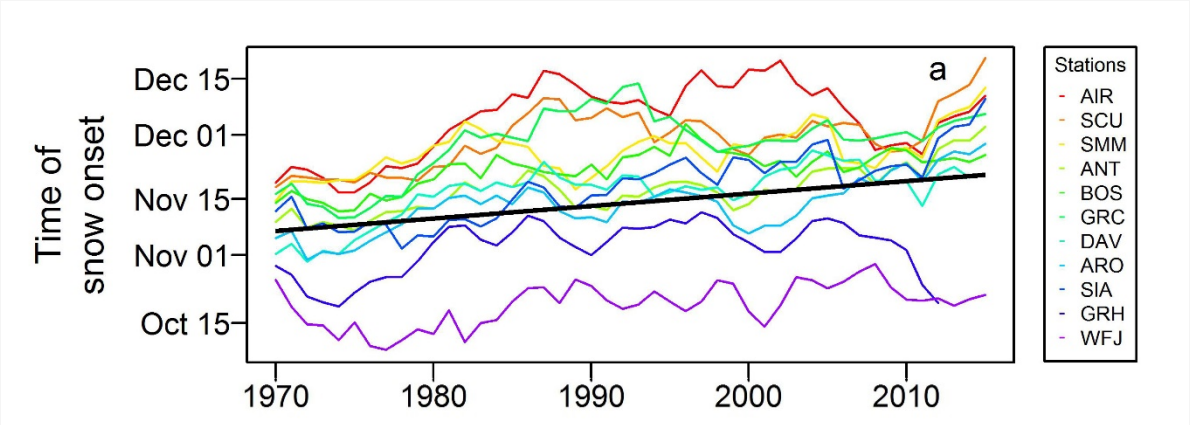
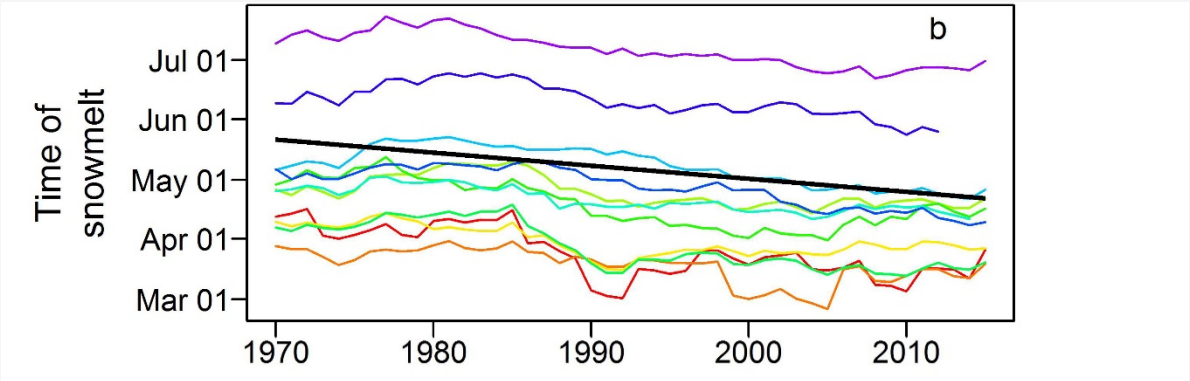
Time of snow onset and snowmelt (1139-2540 masl)



+2.8 days decade^{-1}



-5.8 days decade^{-1}

G Klein, Y Vitasse, C Rixen, C Marty and M Rebetez, 2016: Shorter snow cover duration since 1970 in the Swiss Alps due to earlier snowmelt more than to later snow onset. Climatic Change, online

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Temperatures have been increasing more in Spring

Table 2. Seasonal linear temperature trends for Switzerland (12 stations) in °C decade^{-1}

	1901–2000	1975–2004
DJF	**0.16****	0.38
MAM	0.10	**0.84****
JJA	**0.13****	**0.86****
SON	**0.15****	0.21
Year	**0.14****	**0.57****

* Significant at the 95% significance level
** Significant at the 99% significance level

Rebetez and Reinhard, 2007

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Earlier snowmelt

- Increasing temperatures
- Increasing sunshine duration (Auer et al, Histalp 2007)
- Earlier snowmelt → albedo feedback to temperature? (Peng et al 2013)

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Increasing temperatures and decrease in snowfall and snow pack in the Swiss Alps: conclusions

- Snow precipitation and snow pack have been decreasing at all altitudes (measured up to 2500 masl)
- Decrease in snow pack is stronger in spring
- Connected to increasing temperature

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