

Changes in climate variability and persistence in Switzerland

Martin Beniston and Stéphane Goyette,
University of Fribourg, Switzerland
Martin.Beniston@unifr.ch

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Institute for Environmental Science and
Sustainability, University of Geneva, Switzerland

Overview

- Introduction
- Observed changes in means, variance and persistence of temperatures
- Possible changes in the 21st century
- Conclusions

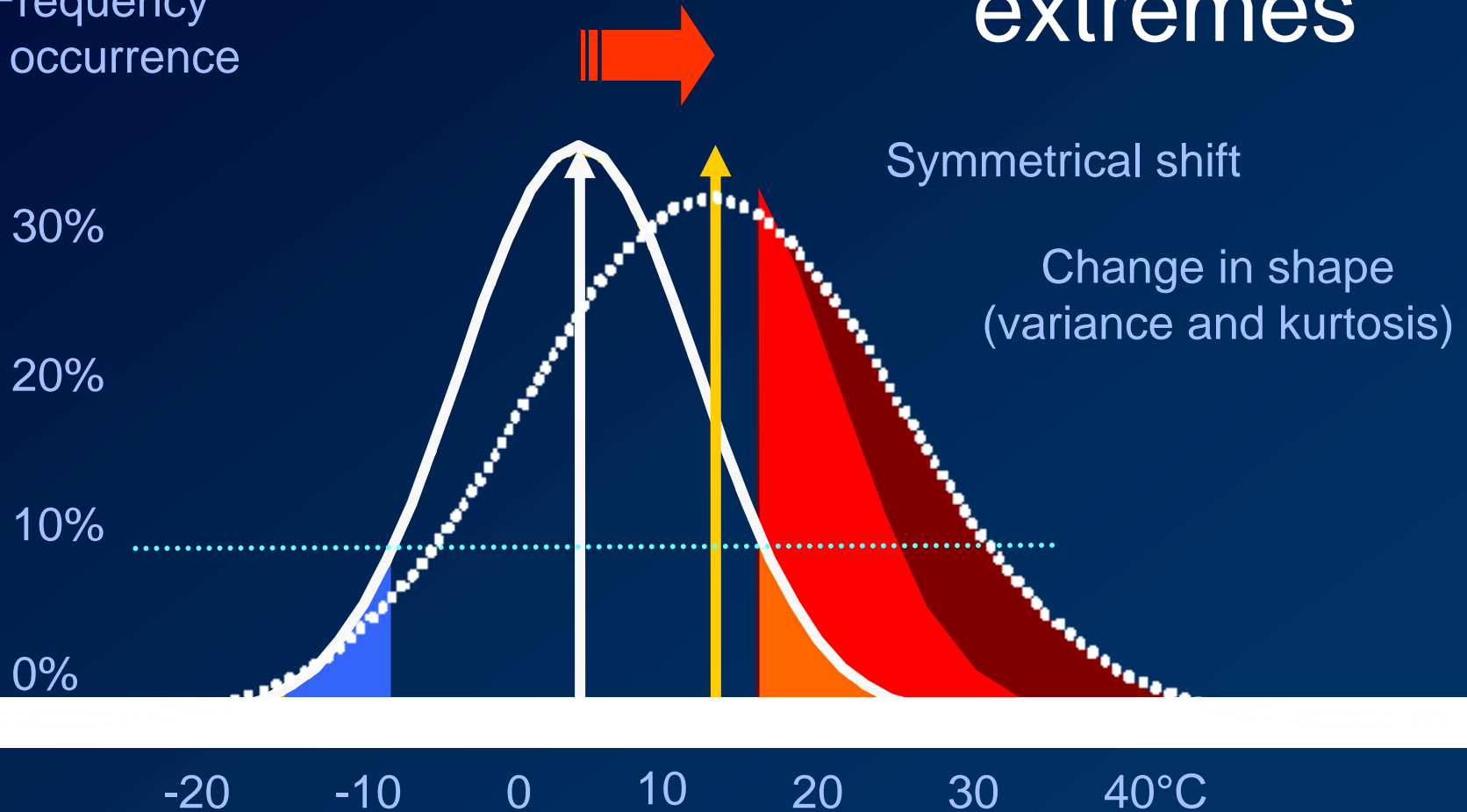
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Changes in means and variance

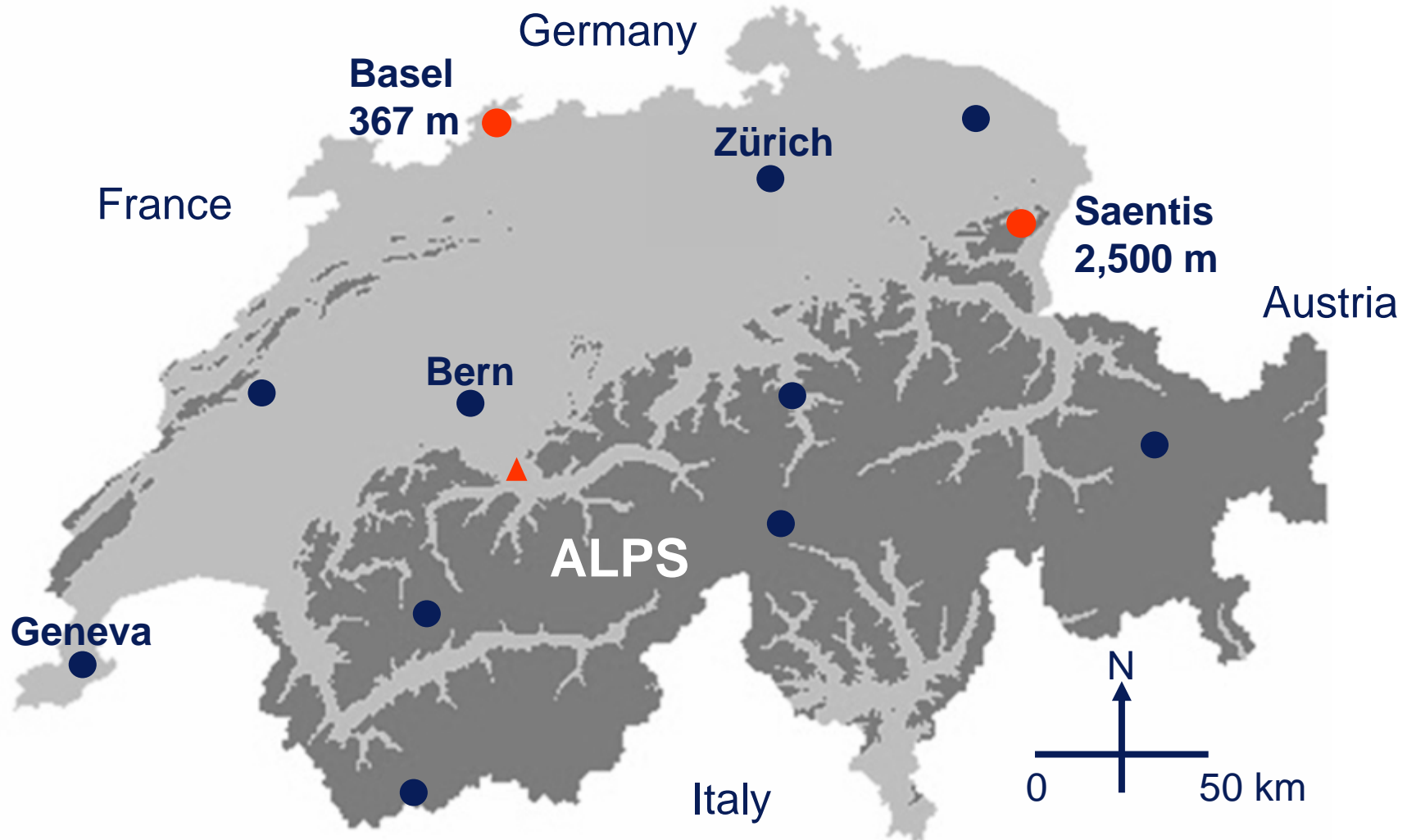
- It is often suggested that a warmer climate may be accompanied by a greater variability (IPCC, 2001)
 - ◆ i.e., warmer temperatures induce larger variance...
- However, an analysis of 20th century records in Switzerland shows that warmer temperatures have not experienced an increase in variance – rather the contrary!

PDFs and extremes

Frequency of occurrence



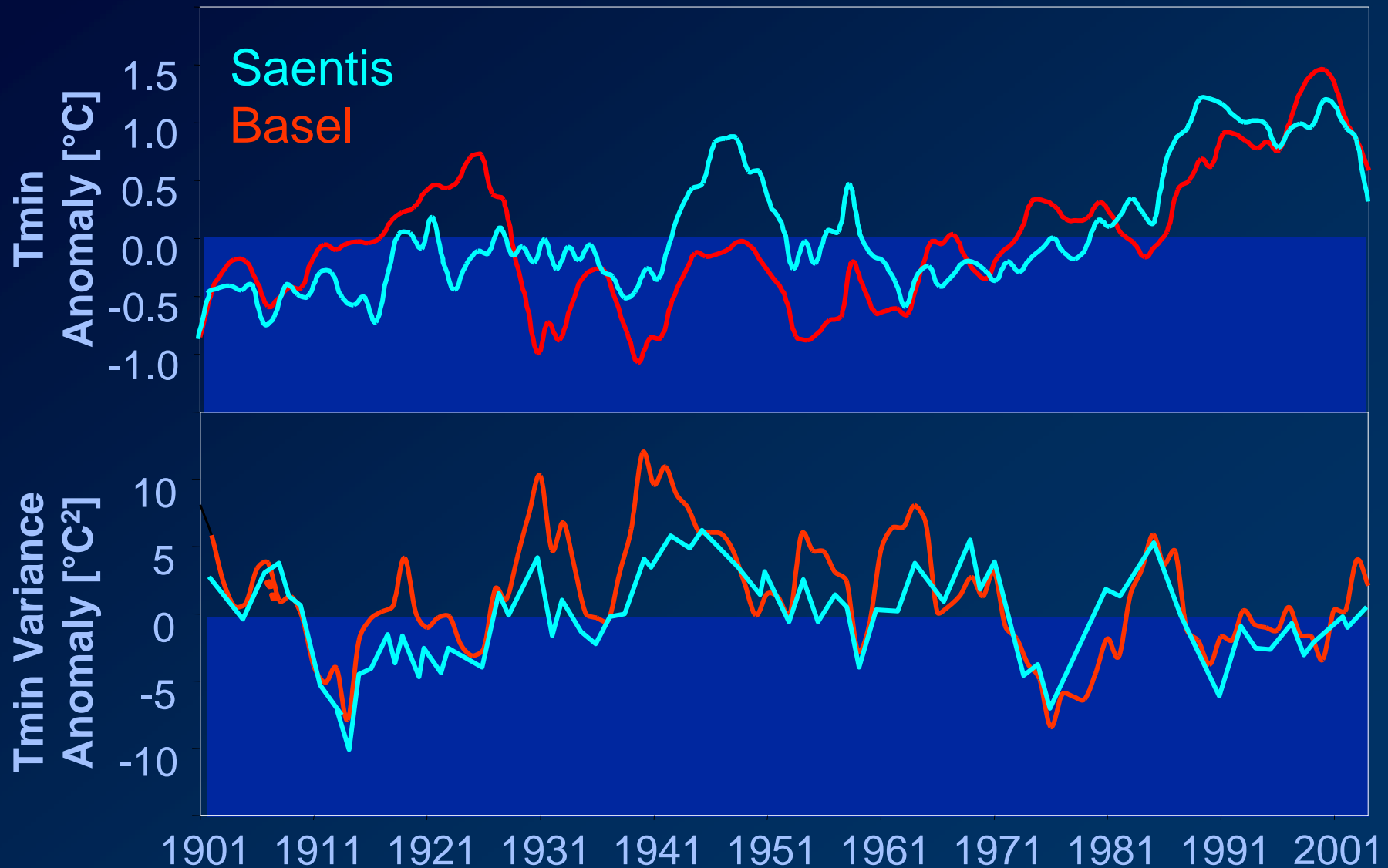
Data from low elevation and high elevation sites in Switzerland



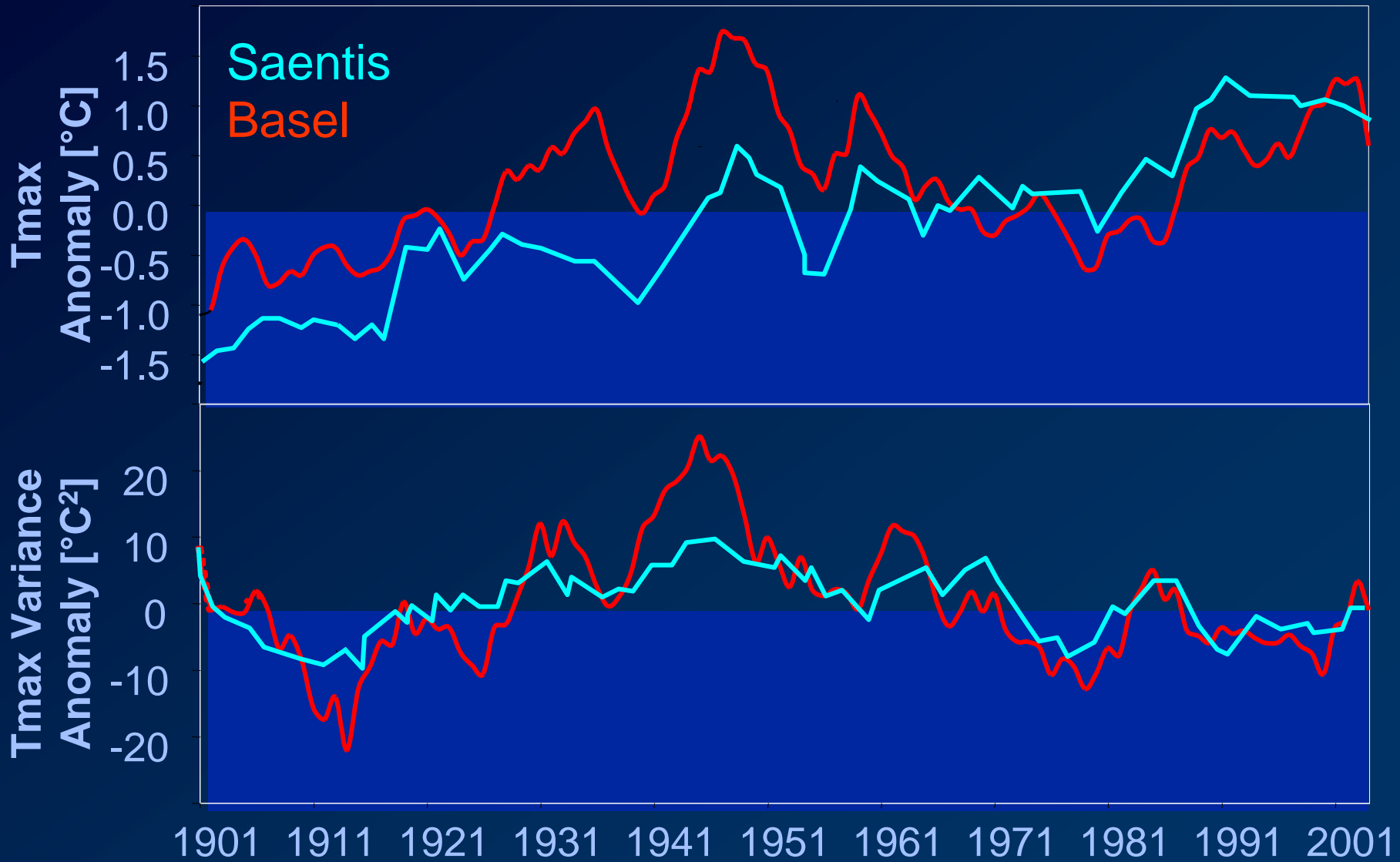
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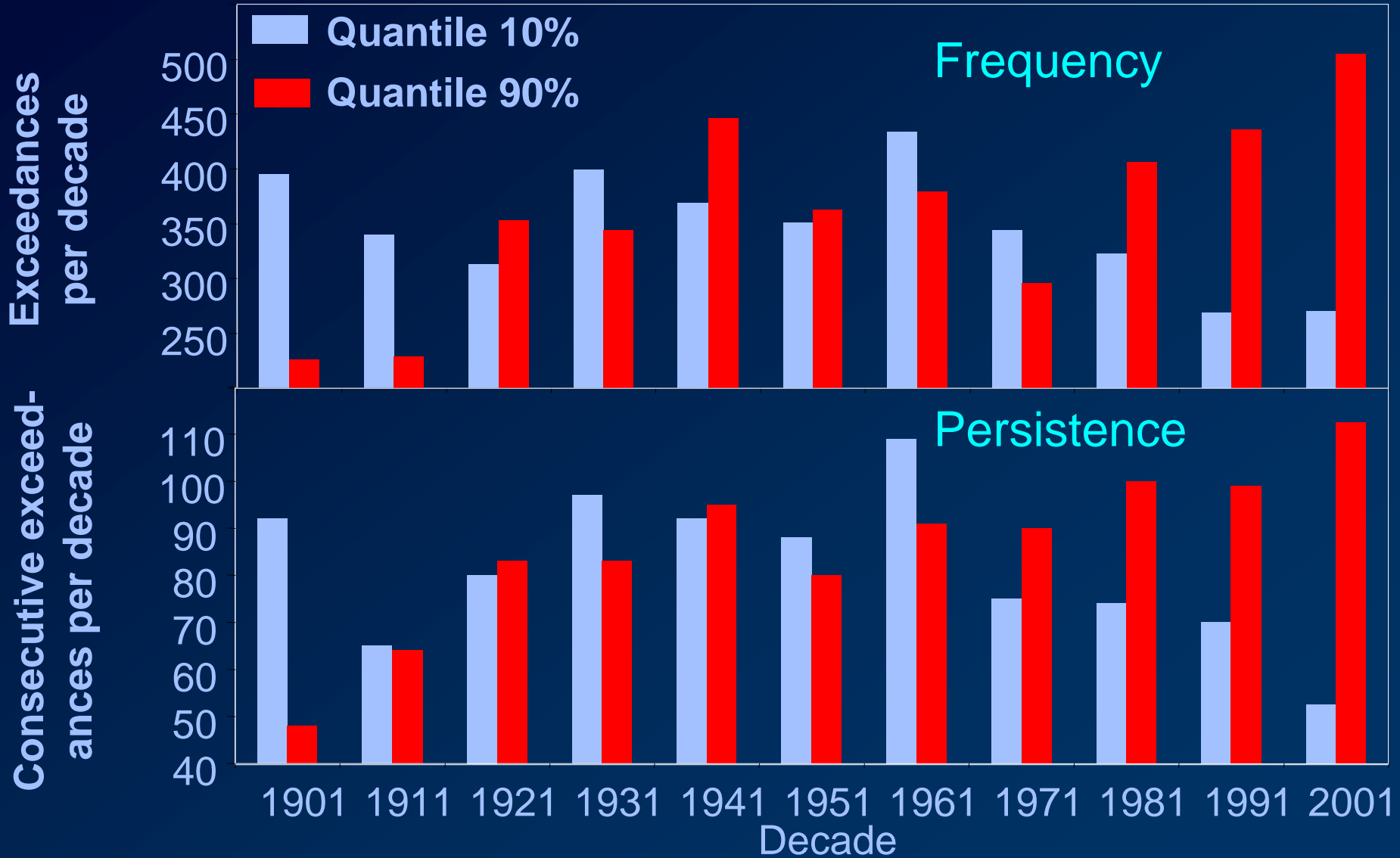
20th century Tmin mean and variance



20th century Tmax mean and variance



Cold and warm extremes (Saentis)

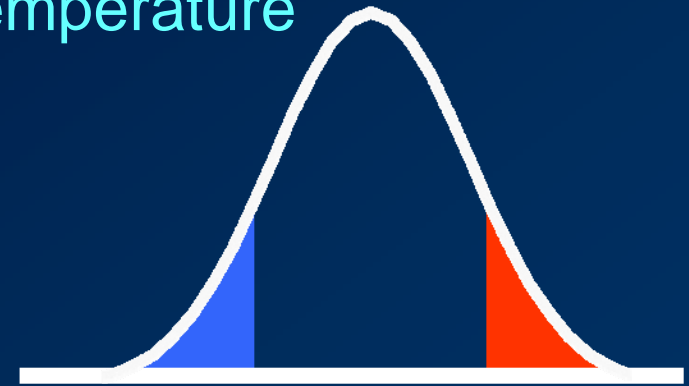


Shifting weather regimes

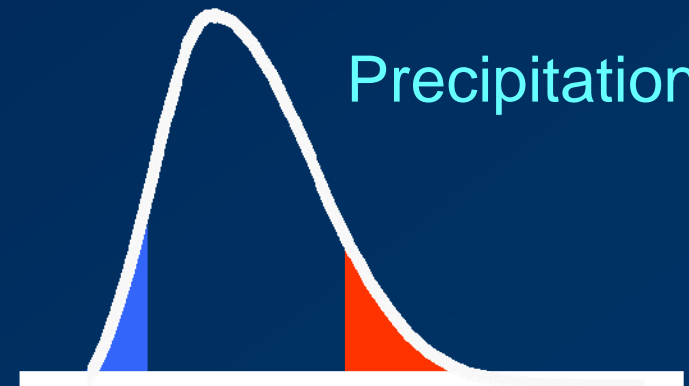
Characterize weather patterns in a quantitative manner based on combinations of quantiles of temperature and precipitation at the 25% and 75% levels

- ◆ Cold/dry: T25/p25
 - ☞ « Stable winters »
- ◆ Cold/moist: T25/p75
 - ☞ « Perturbed winters »
- ◆ Warm/dry: T75/p25
 - ☞ « Stable summers »
- ◆ Warm/moist: T75/p75
 - ☞ « Perturbed Summers »

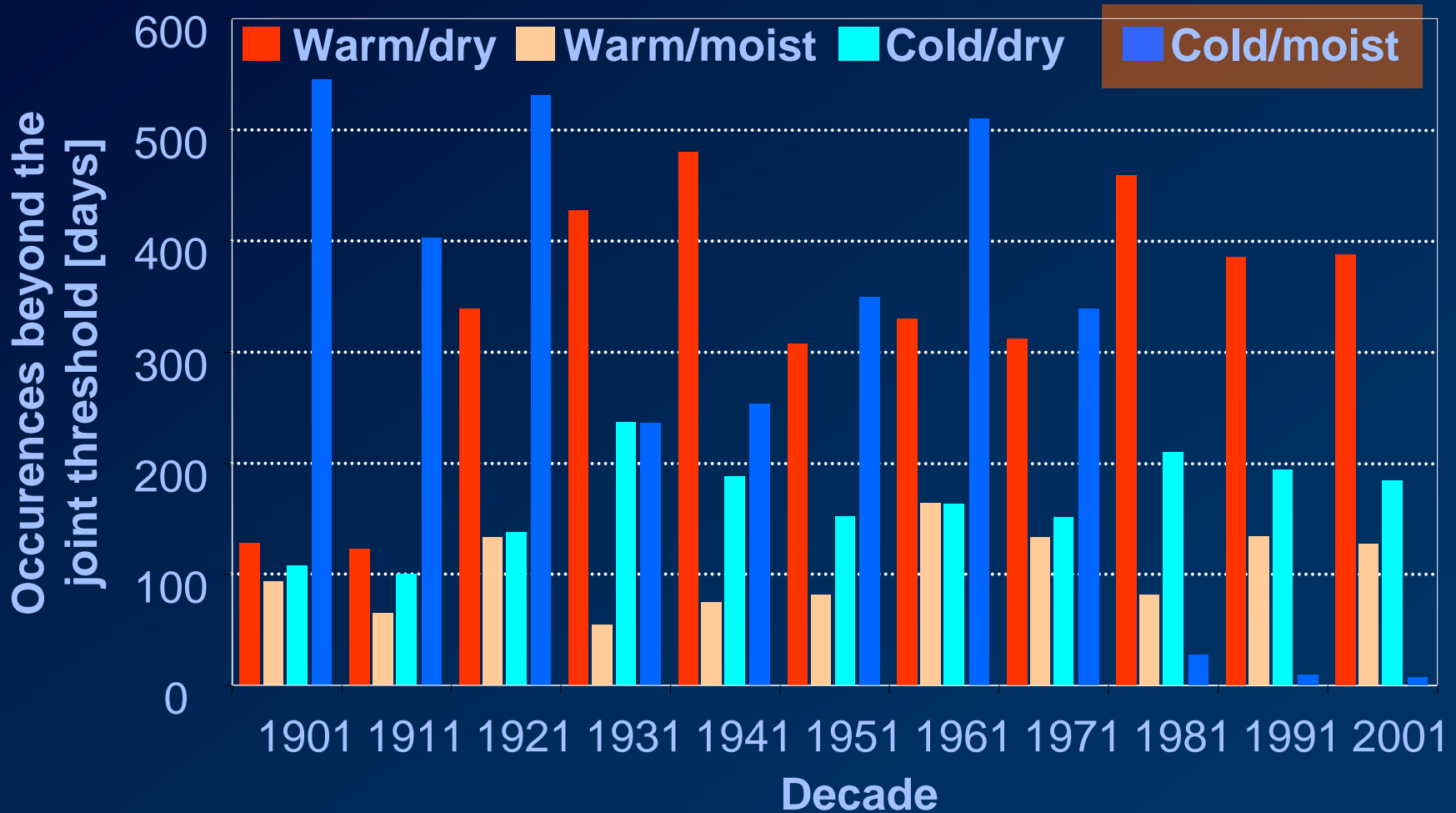
Temperature



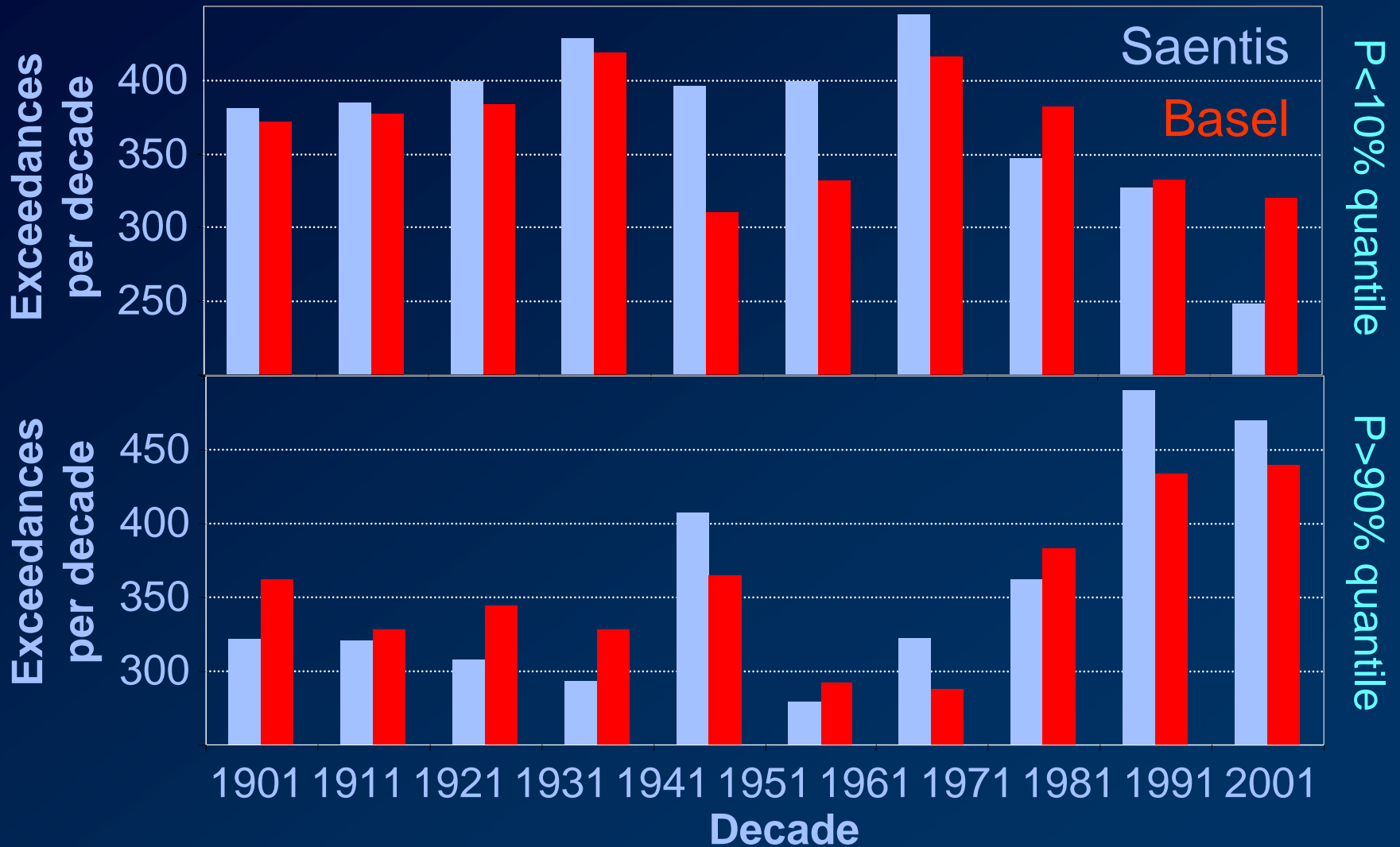
Precipitation



Changing frequencies of weather regimes



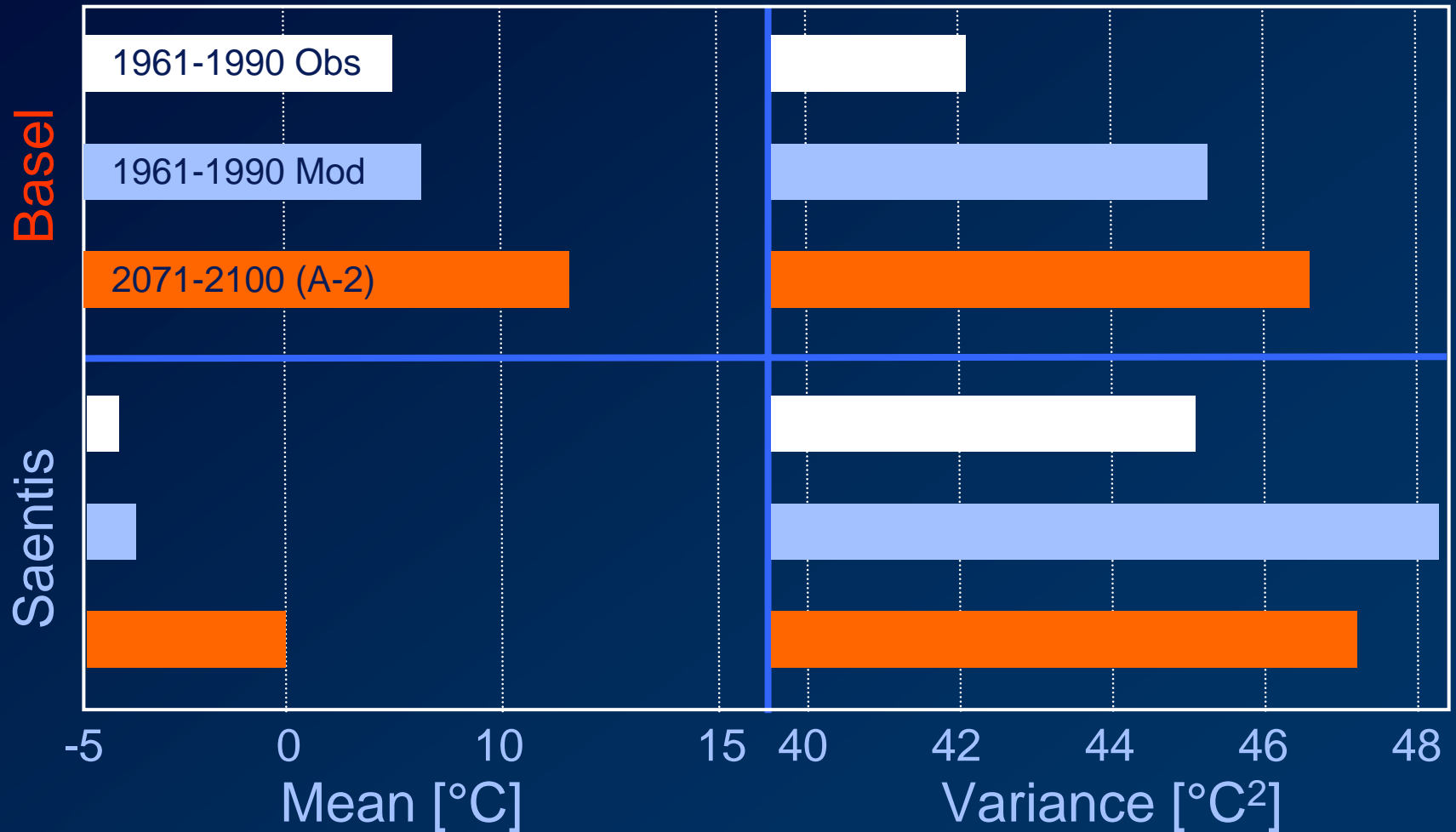
Persistence of cyclonic and anticyclonic regimes



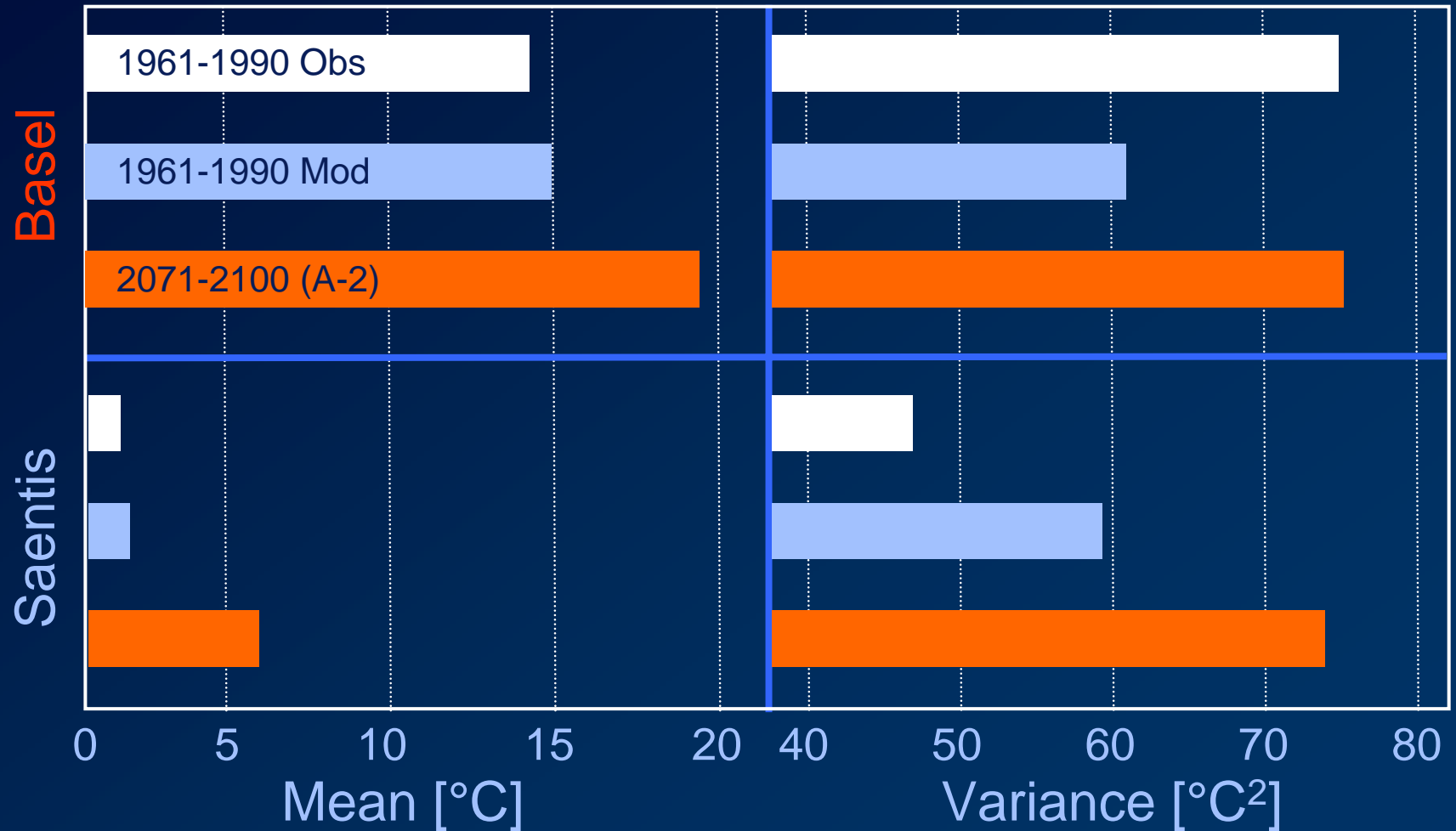
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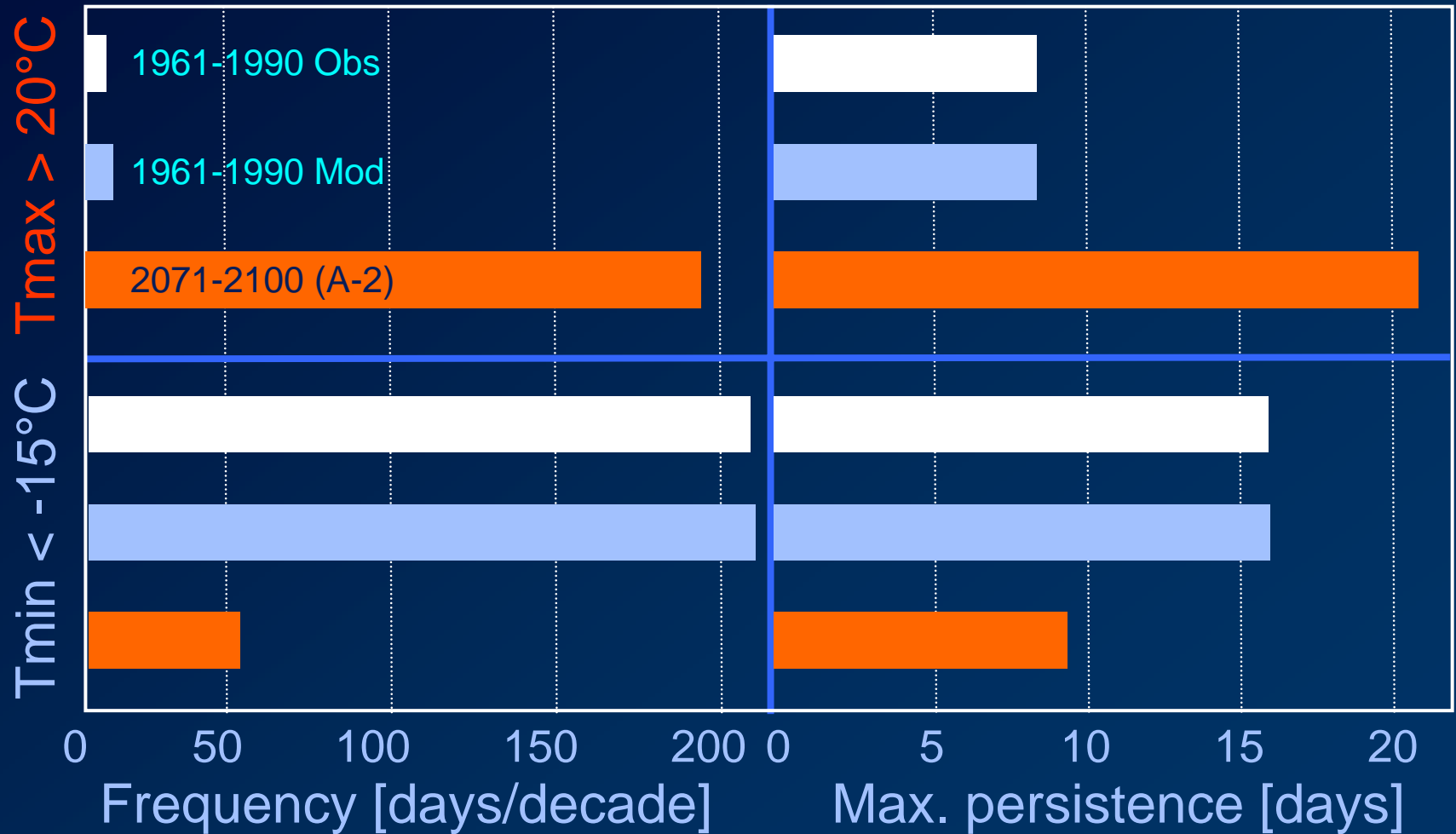
Simulated changes in Tmin mean and variance (HIRHAM RCM)



Simulated changes in Tmax mean and variance (HIRHAM RCM)



Frequency and persistence changes of cold and warm events (Saentis)




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Concluding remarks

- Minimum and maximum temperatures in the 20th century have risen strongly, while their variance has decreased
 - ◆ This seems counter-intuitive...but is it?
- These changes can be explained by subtle shifts in circulation patterns quantified by joint combinations of temperature and precipitation quantiles
- In a warmer climate, the changes in variance in relation to strong temperature increases by 2100 are unclear
 - ◆ RCMs do not simulate variance as well as means...
- The persistence of warm events more than doubles by the end of the 21st century , while that of cold events is reduced by 50%
- Stronger persistence implies that changes in means, rather than changes in variance, determine the shifts in extremes
 - ◆ Valid for Swiss sites, not necessarily elsewhere in Europe!



Beniston, M., and Goyette, S., 2006: Changes in variability
and persistence of climate in Switzerland: exploring 20th
century observations and 21st century simulations
Global and Planetary Change, in press

Many thanks for your attention