



Risks and Opportunities for the Agriculture of the Alpine Region in a changing climate

Pierluigi Calanca

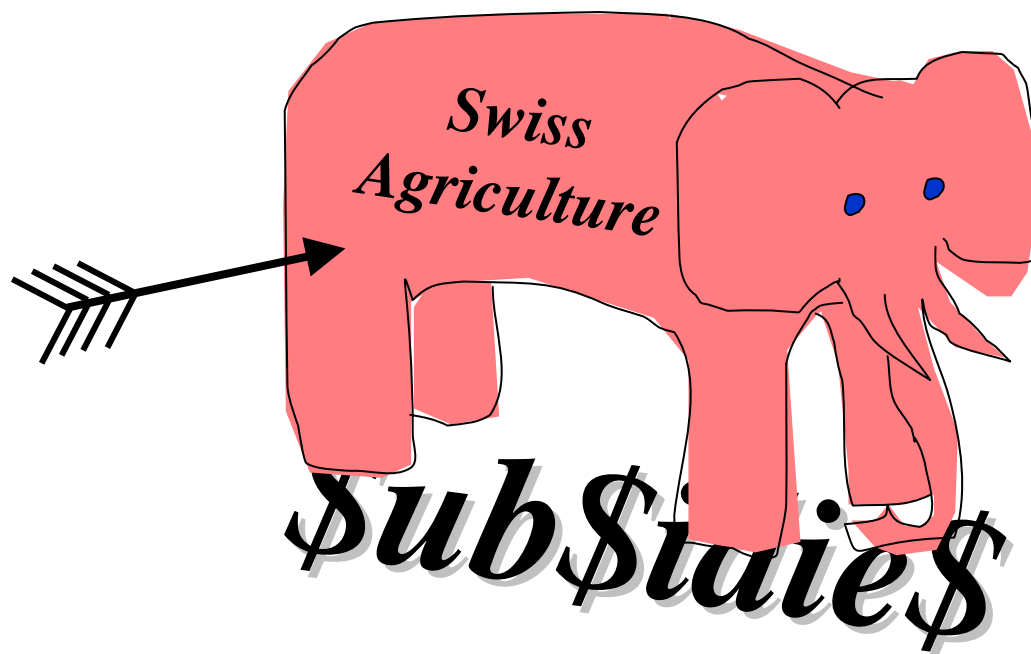
Daniele Torriani, Stéphanie Schmid,

Patrick Lazzarotto, Karsten Jasper,

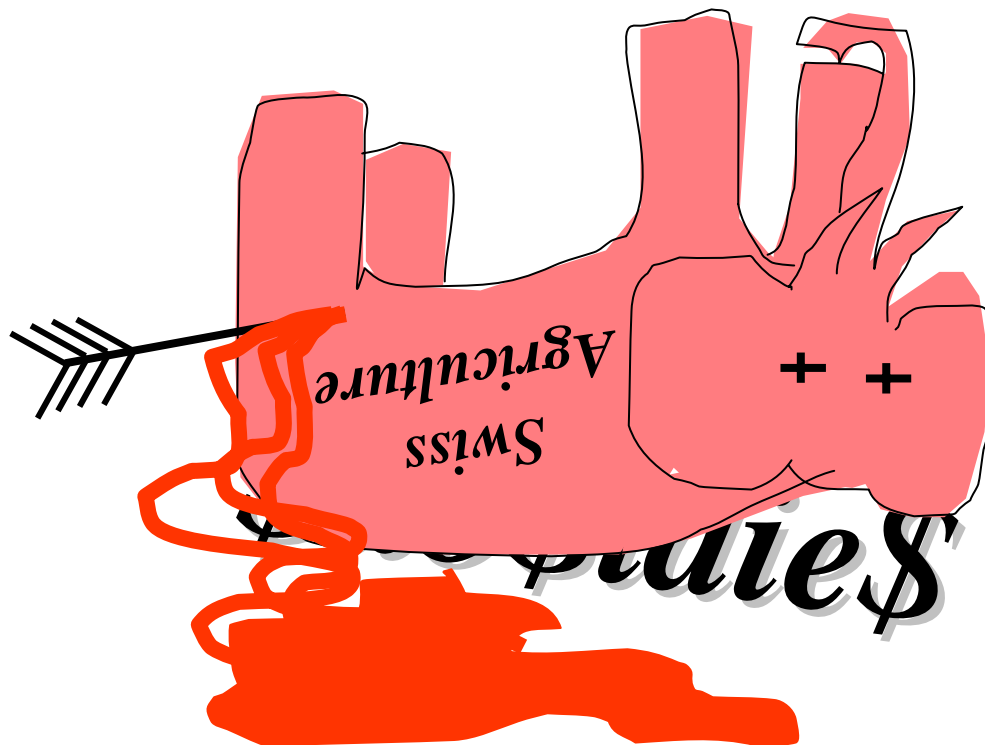
Sybille Dueri, Jürg Fuhrer

Agroscope Reckenholz-Tänikon, Zurich, Switzerland

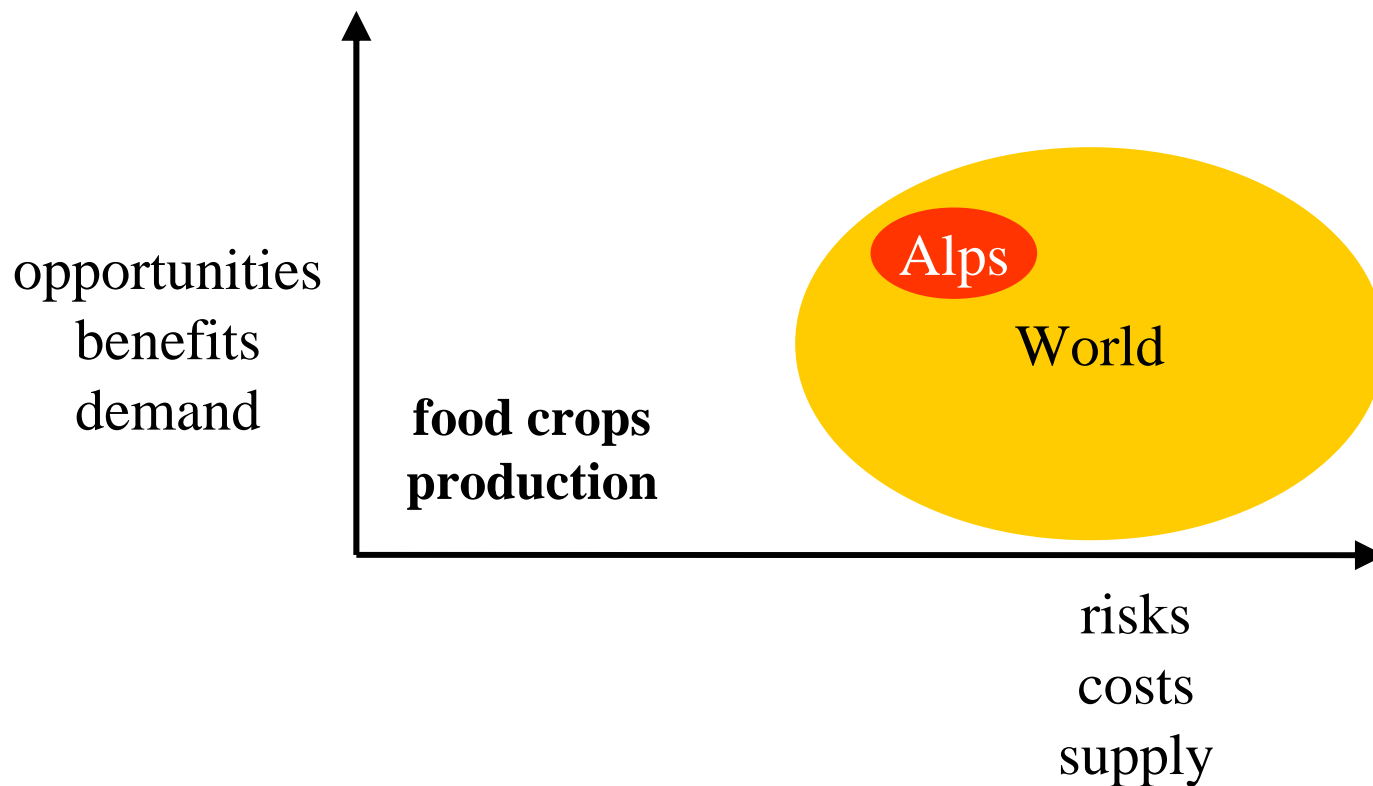
The pink elephant?



Kill it?



Agriculture in the Alpine region: a future?





The global context

Porter and Semenov (2005)

- “Developing countries are (overall) more vulnerable to climate change than developed countries”
 - “World population is increasing, in particular in the developing world”
 - “Under global warming, crop production in regions such as southern Europe, the Indo-Gangetic plane or China is at risk”
- ⇒ “Consideration should be given to the situation where crop production in [central] and northern Europe needs to be increased.”

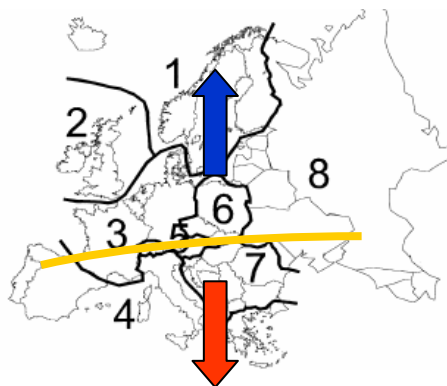
The global context

Ewert et al. (2005)

- “It has been calculated that in order to meet future demands, cereal yields in developed countries will have to increase by 32% in 2020 compared to 2000.”

Olesen and Bindi (2002)

- Food crop productivity

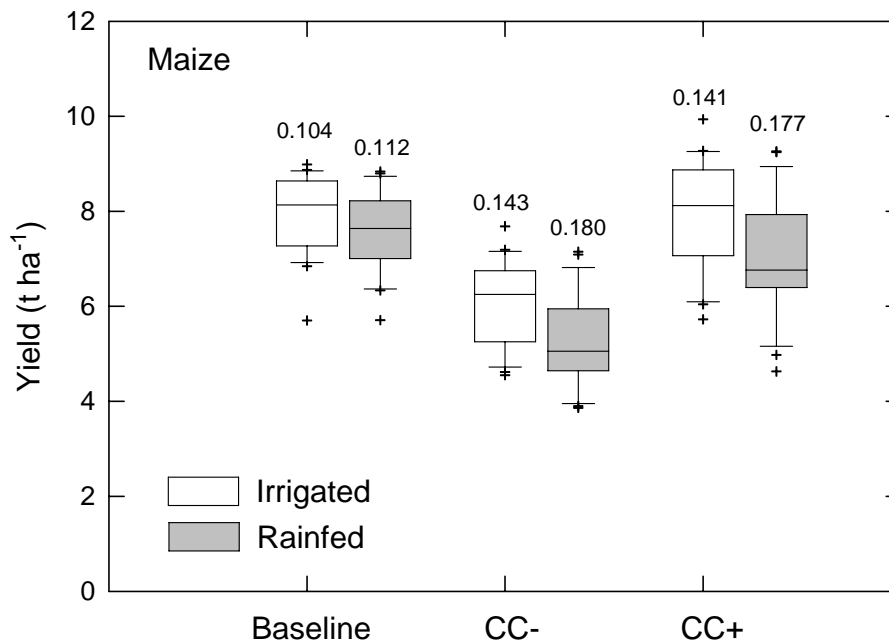




Crops: biophysical response to climate

- increasing CO_2 \Rightarrow positive effect on assimilation
- increasing T \Rightarrow positive effects on grassland (overall extension of the growing season) but negative effects on seasonal crops (shortening of time available for grain filling);
- decreasing summer precipitation \Rightarrow negative impact

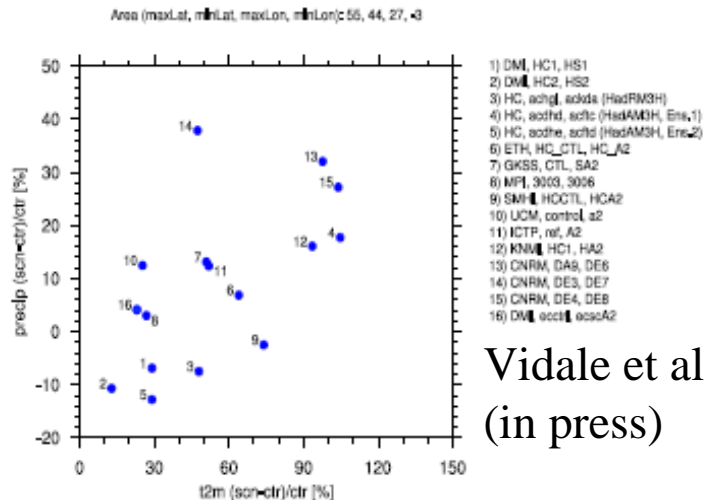
Food crop productivity



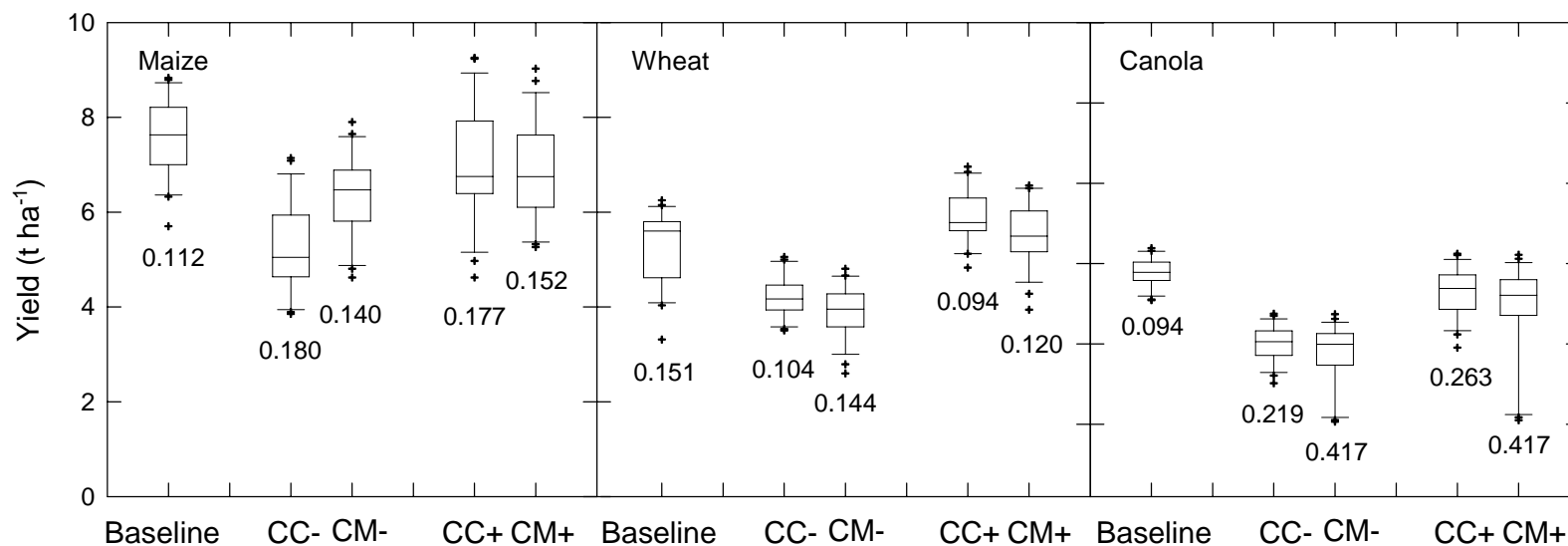
Simulations with cropping system model CropSyst (Torriani et al., submit.)

Yield stability

Area average of standard deviations (JJA, Europe)

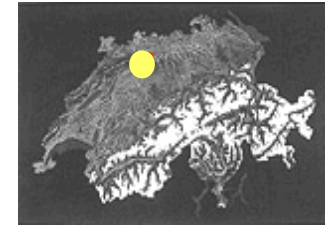
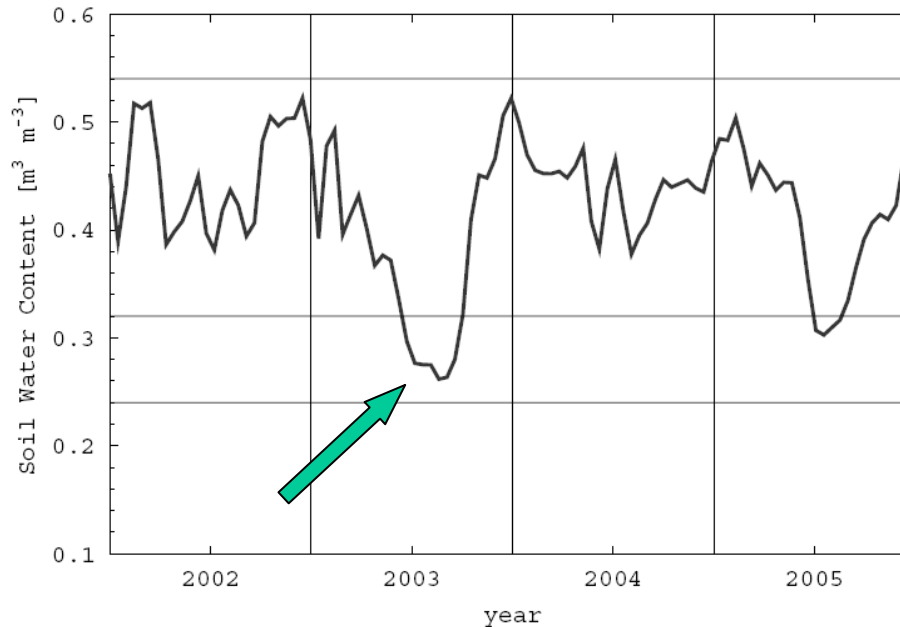


Vidale et al.
(in press)



Simulations with cropping system model CropSyst (Torriani et al., submit.)

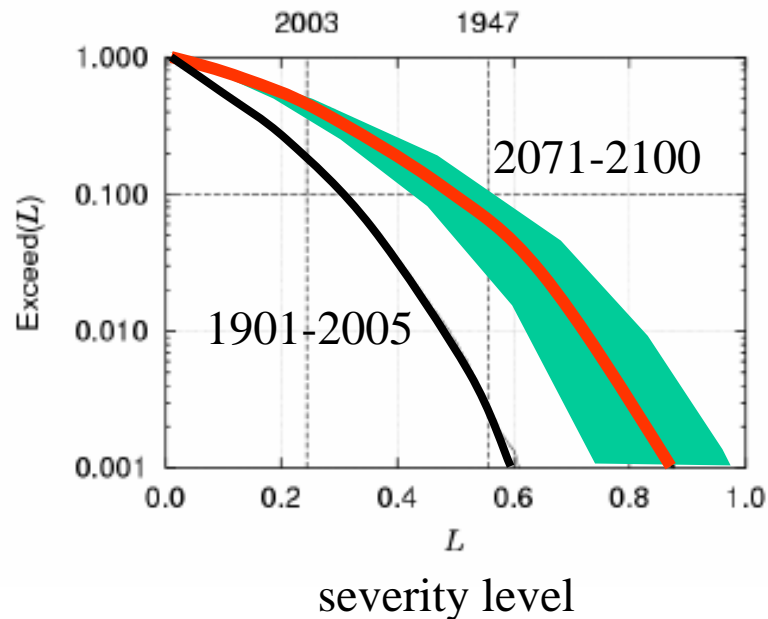
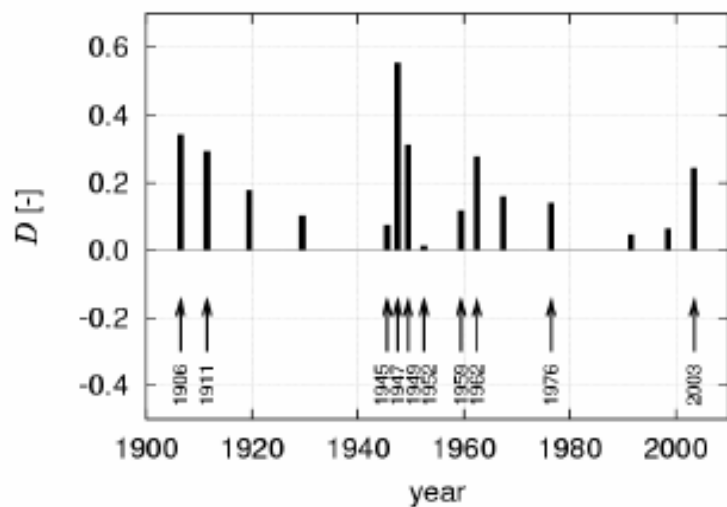
Summer droughts: the 2003 event



(Neftel et al.)

- ⇒ 14 billions US \$ losses in Europe (SwissRe, 2004)
- ⇒ 400 millions US \$ losses in Switzerland

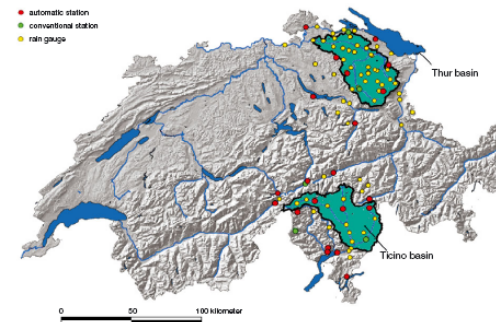
Droughts: occurrence and severity



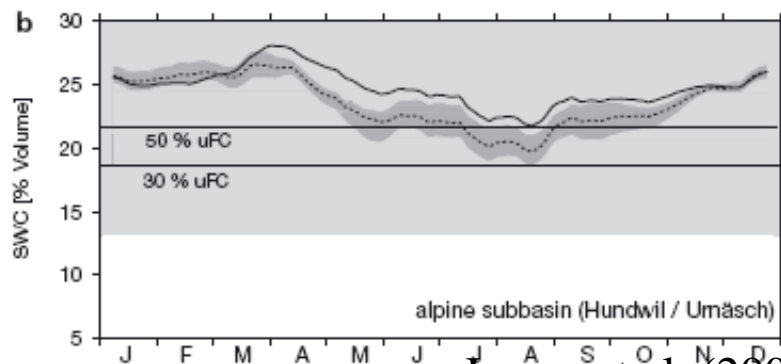
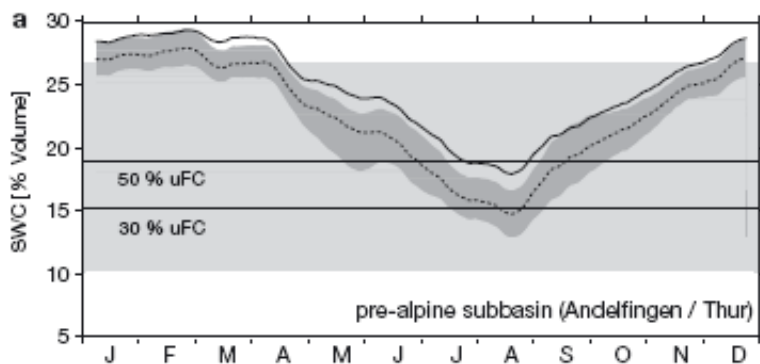
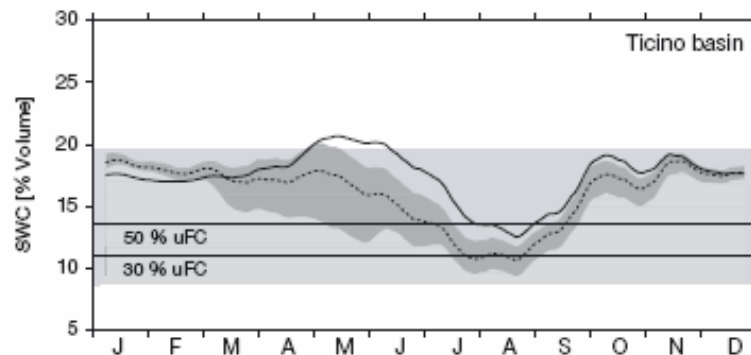
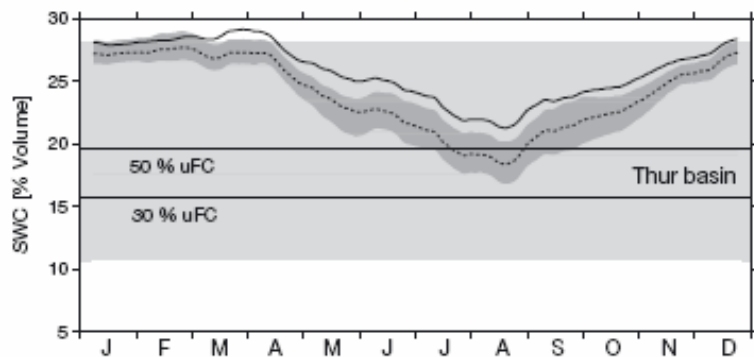
1901 - 2005 \Rightarrow $\sim 18 \%$

2071 - 2100 \Rightarrow $\sim 50 \%$

Calanca (2006)

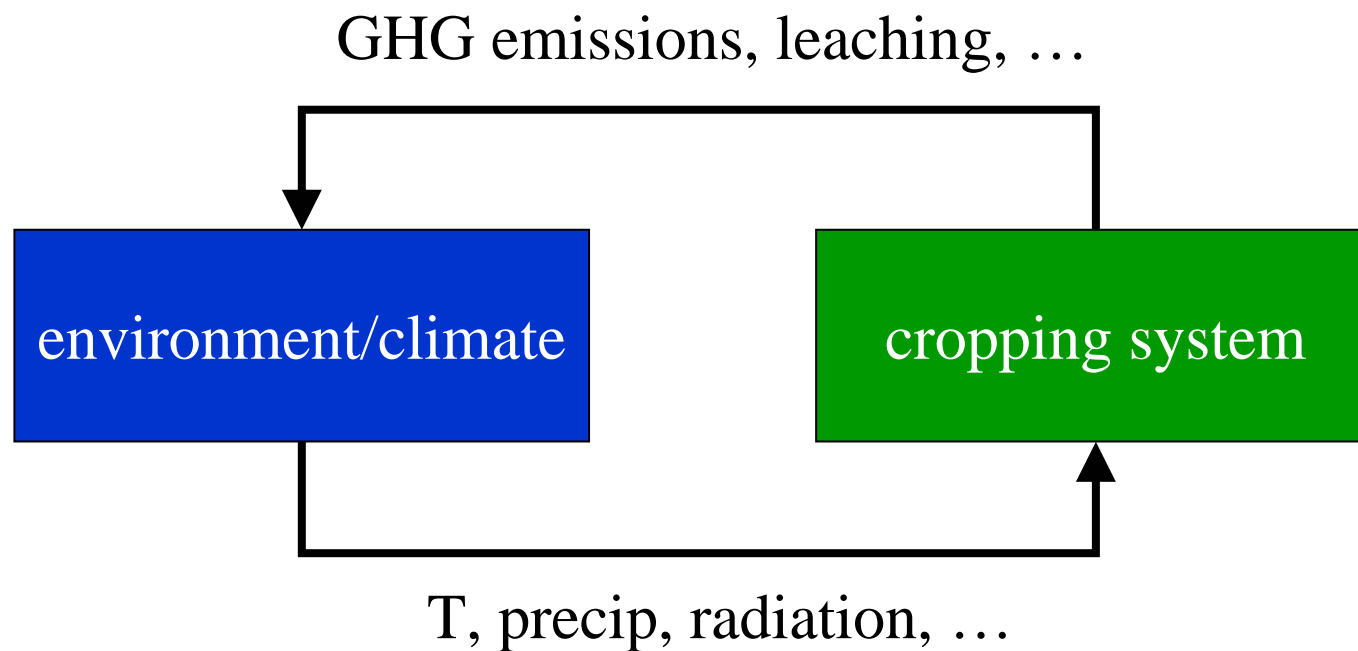


Regional patterns



Jasper et al. (2004)

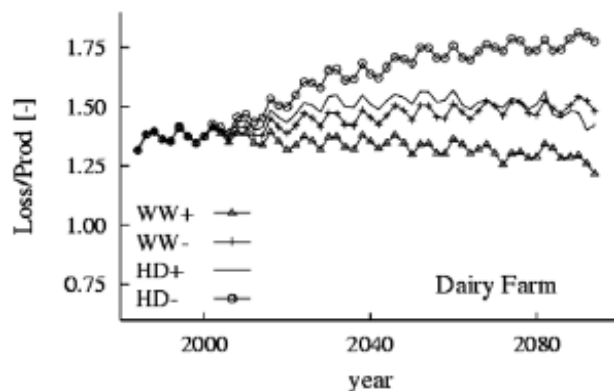
Other issues: environmental impacts



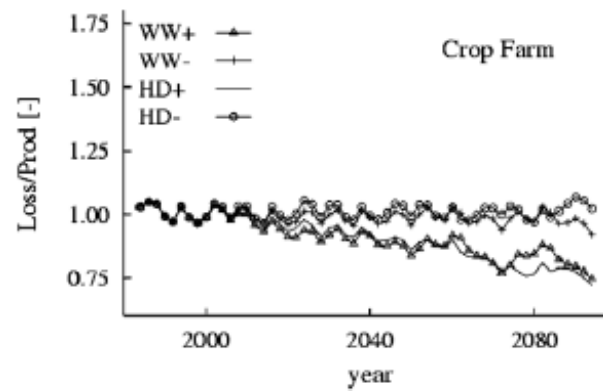
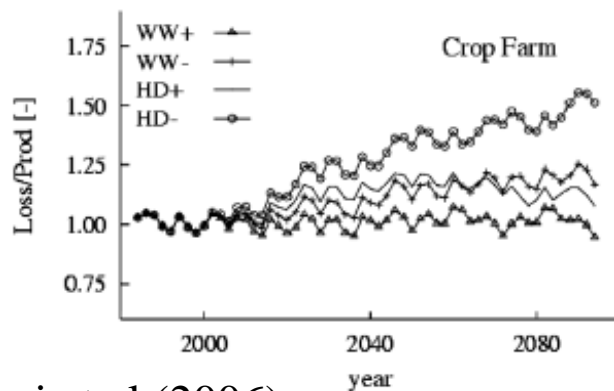
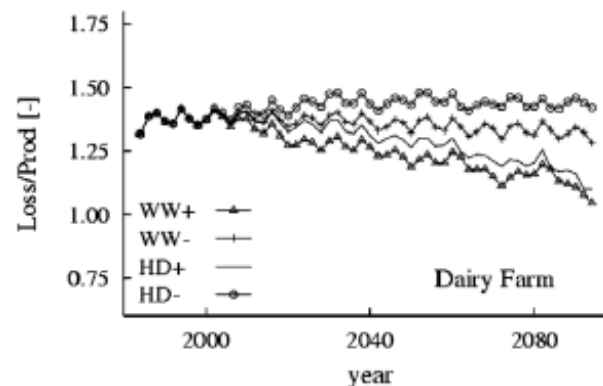
Dueri et al (2006)

Environmental impacts

without adaptation

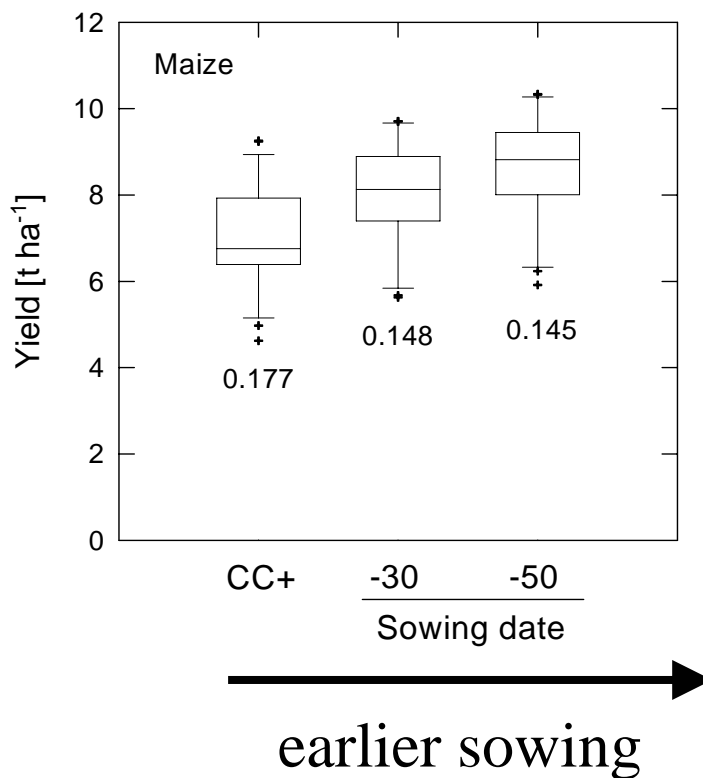


with adaptation



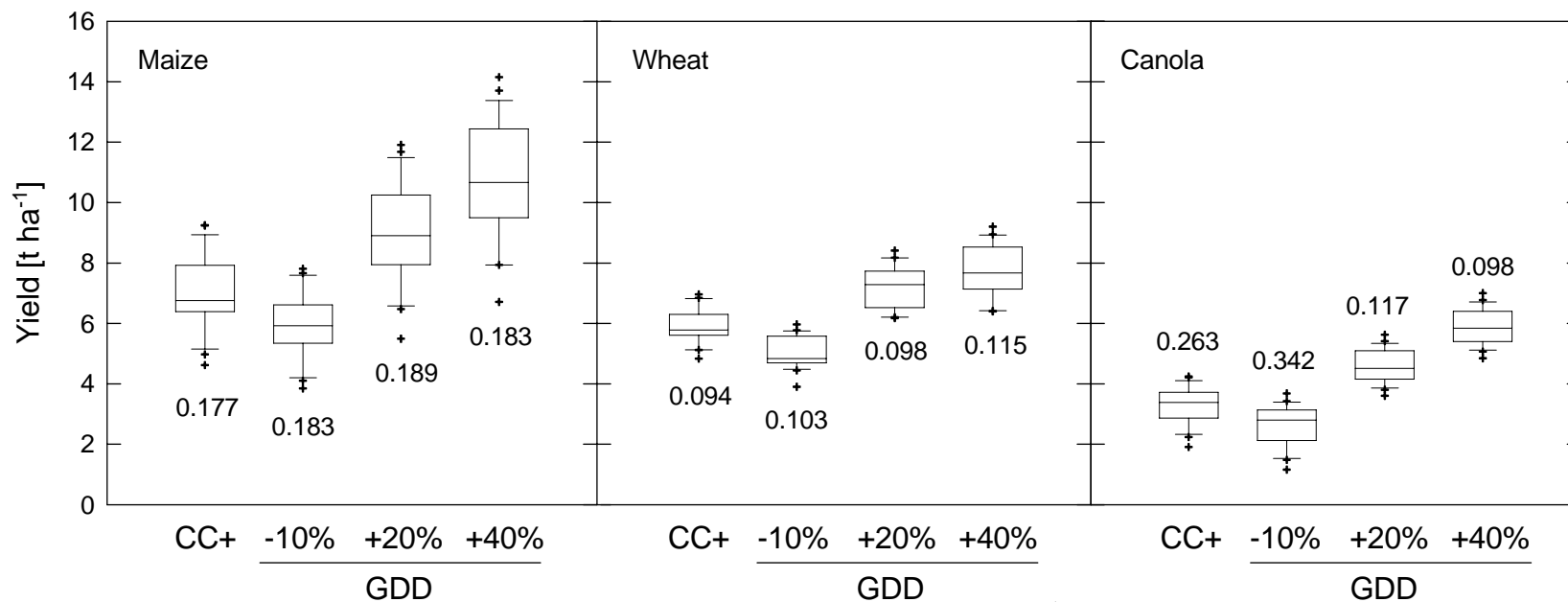
Dueri et al (2006)

Adaptation: simple measures



Simulations with cropping system model CropSyst (Torriani et al., submit.)

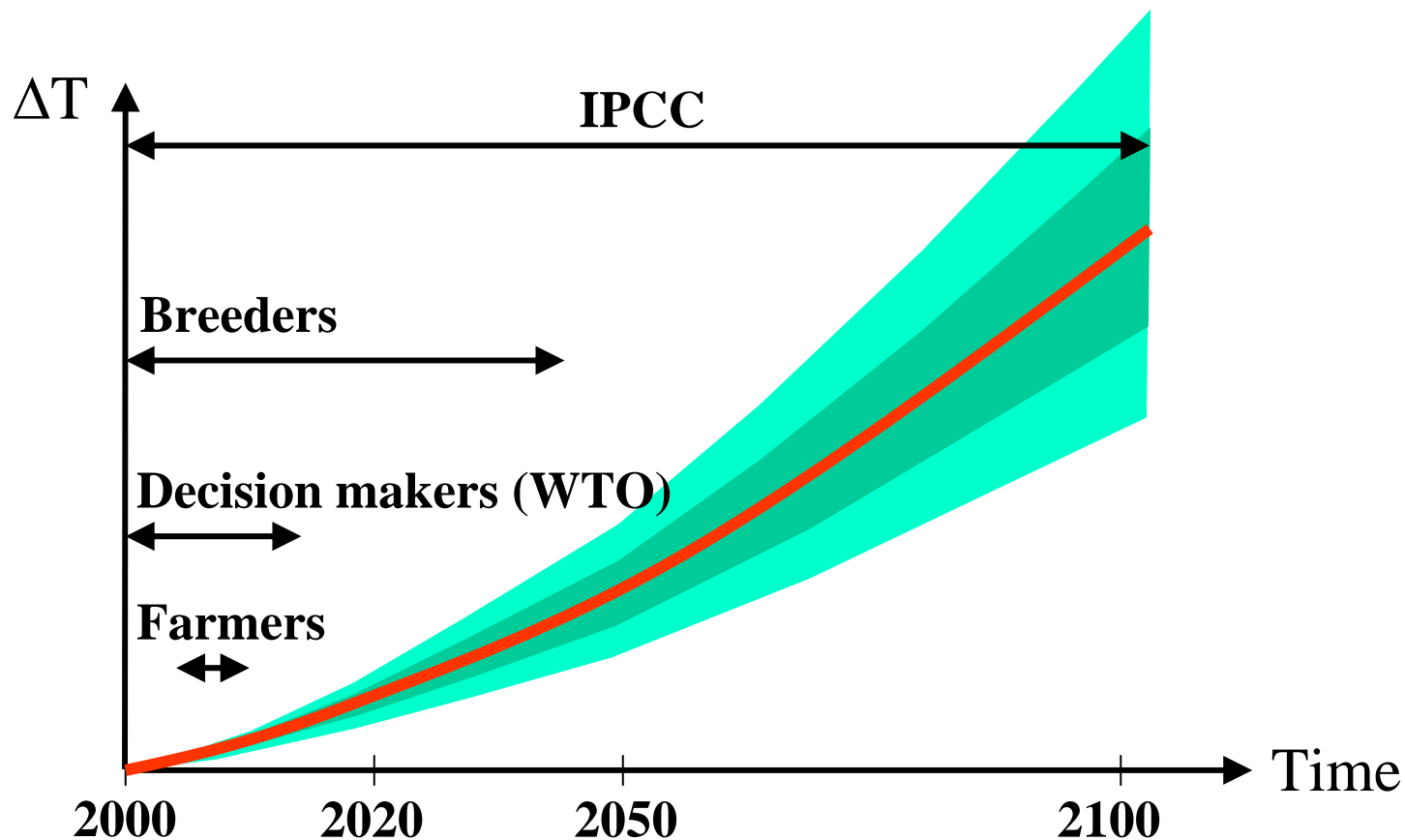
Adaptation: breeding



Increasing thermal time (heat) requirements

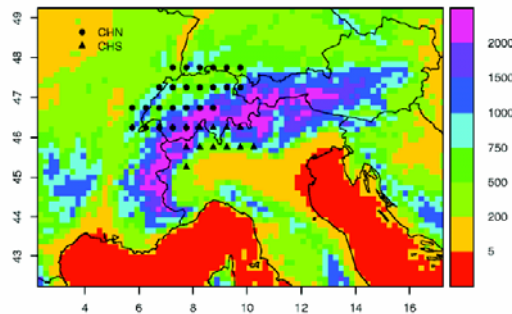
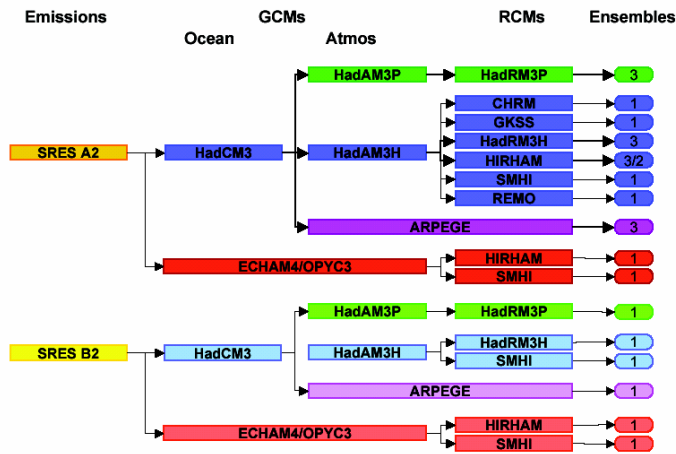
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Time perspective(s)



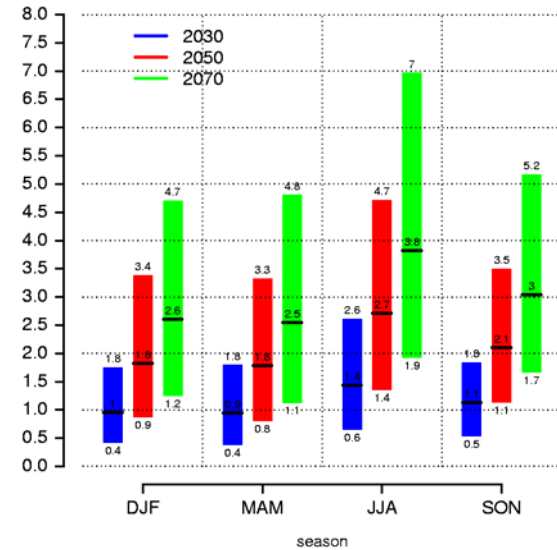
Uncertainties

The PRUDENCE Model Chains

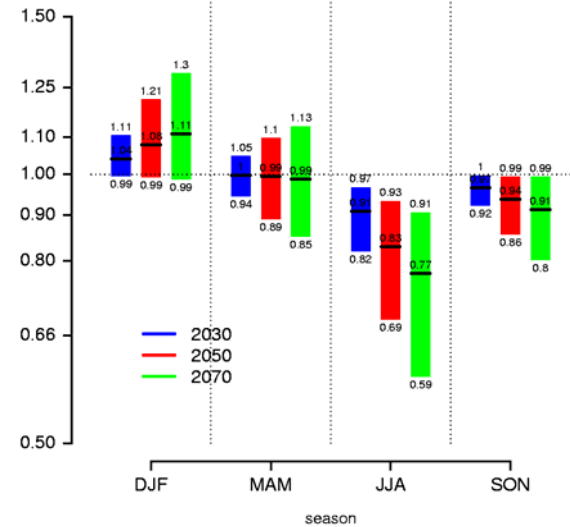


C. Frei
(pers. comm.)

T-Scenario (Ts-Tc) CHN

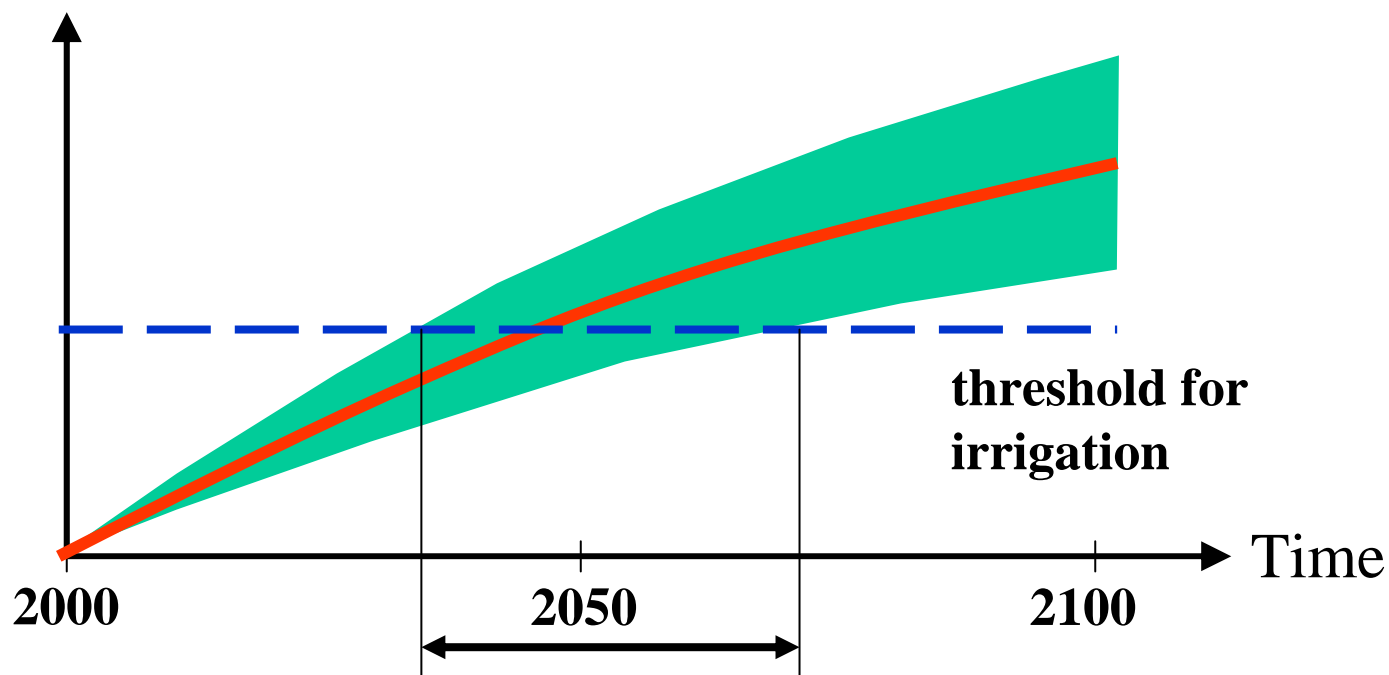


P-Scenario (Ps/Pc) CHN



Uncertainties

Risk of drought





Thank you

