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Federal Department of Home Affairs FDHA
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Better climate information for a better future

Christof Appenzeller
Head Climate Services

P. Ceppi, A. Fischer, S. Scherrer, C. Frei, A. Weigel, M. Begert, M. Maspoli, M. Liniger

11th Swiss Global Change Day, 20 April 2010 in Bern

Winter 2009/2010:
Cold & snow all over Europe

Snow strands drivers, causes crashes in Europe

Airports, ferries, trains see disruptions; Britain expects long cold spell

Frostige Temperaturen und viel Schnee

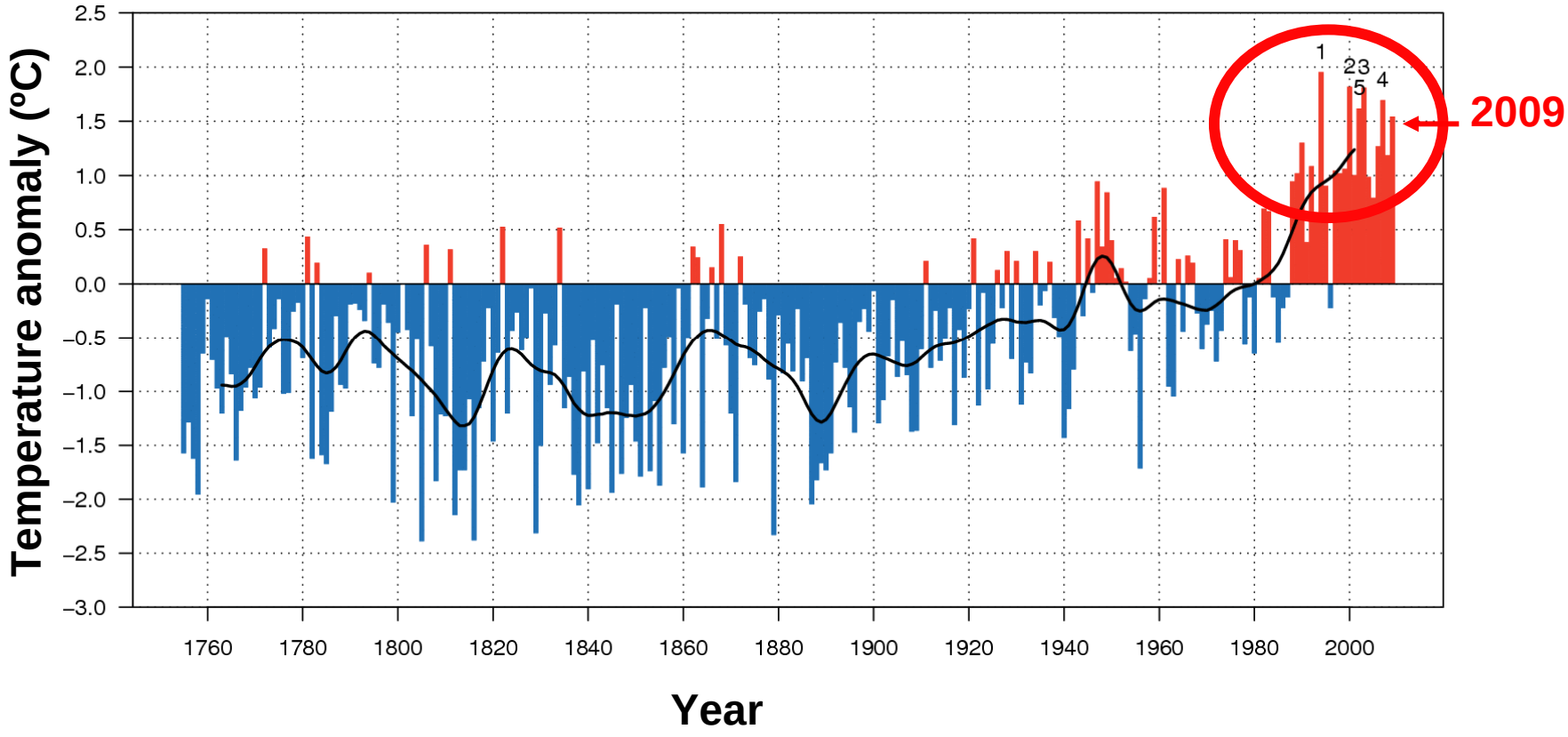
Der Winter hat Europa fest im Griff

Die Schweiz erlebte den kältesten Januar seit über 20 Jahren.

Coldest January since 20 years

Source: www.meteoschweiz.ch

Inter-annual variability in temperature (annual mean at Basel)



Begert et al. (in preparation)

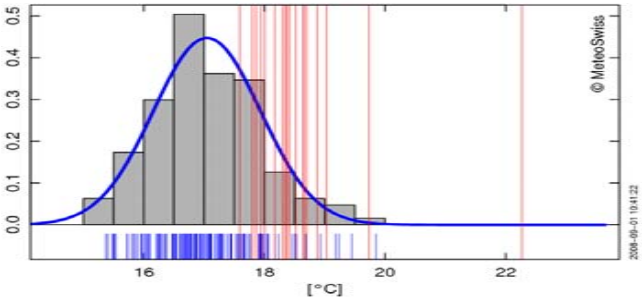
Content:
Climate Change in Switzerland

Example 1
→ Revisiting temperature trends

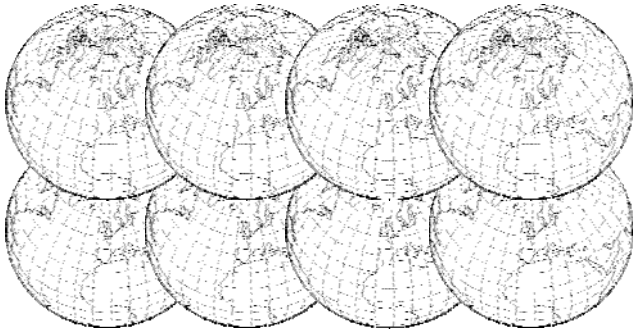
Example 2
→ Climate change scenarios

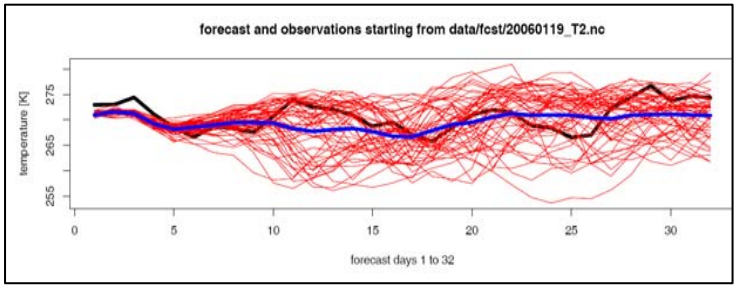
The basics of “climate information”

from measurements (observational data)



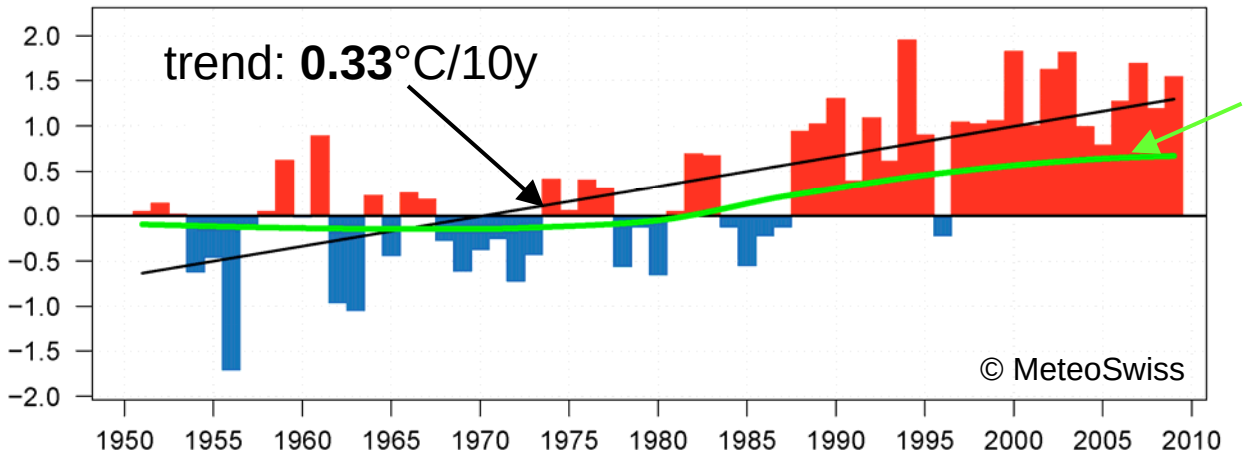
from weather and climate models (ensembles)

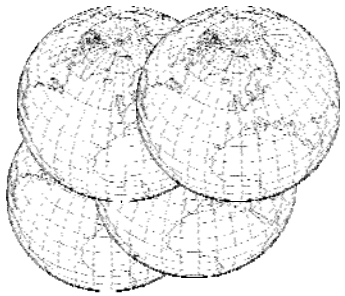




Annual temperature (Basel)

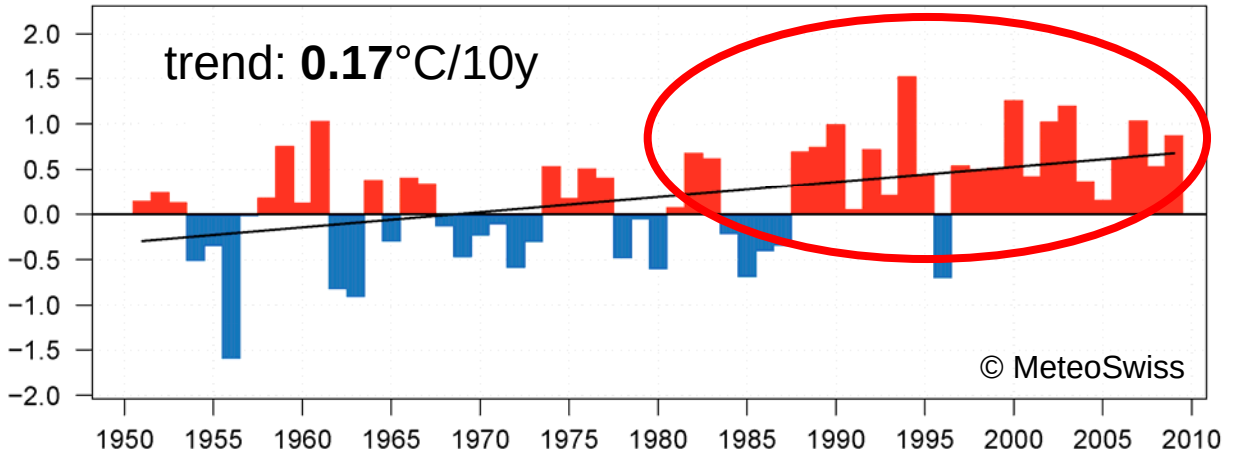
Observations 1951-2009





State of the art Regional Climate Models RCM's (multi-model mean)

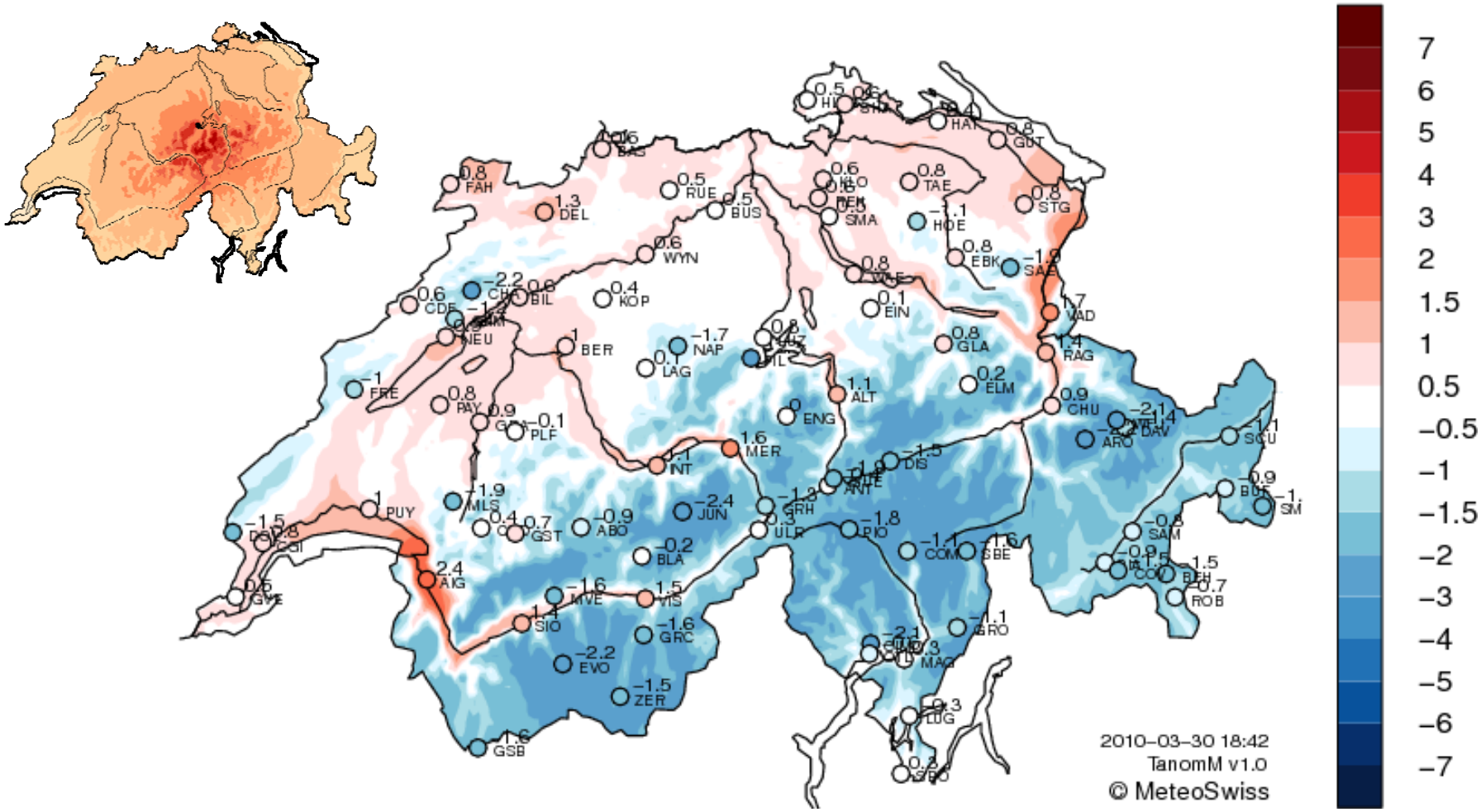
"RCM's anthropogenic part removed"



Still warmer than expected by RCM models

Spatial distribution of temperatures

Gridded temperature anomalies in December 2009 (°C)

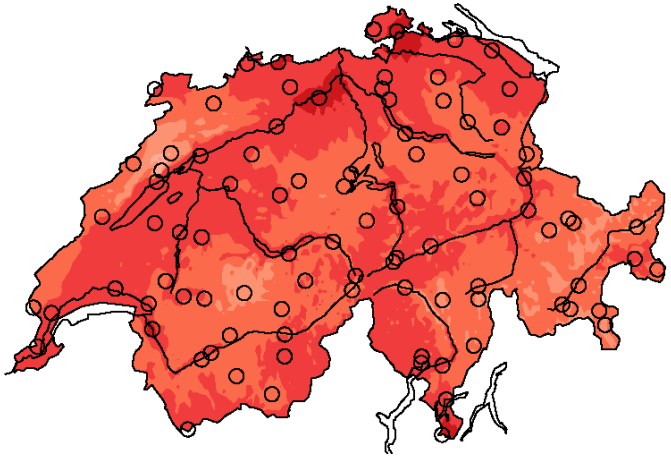


Frei et al. (in preparation)

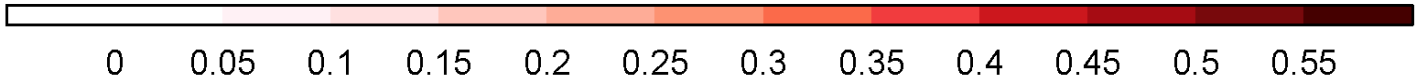
Observed temperature trends

(°C/10y, 1959-2009)

Year mean: 0.35

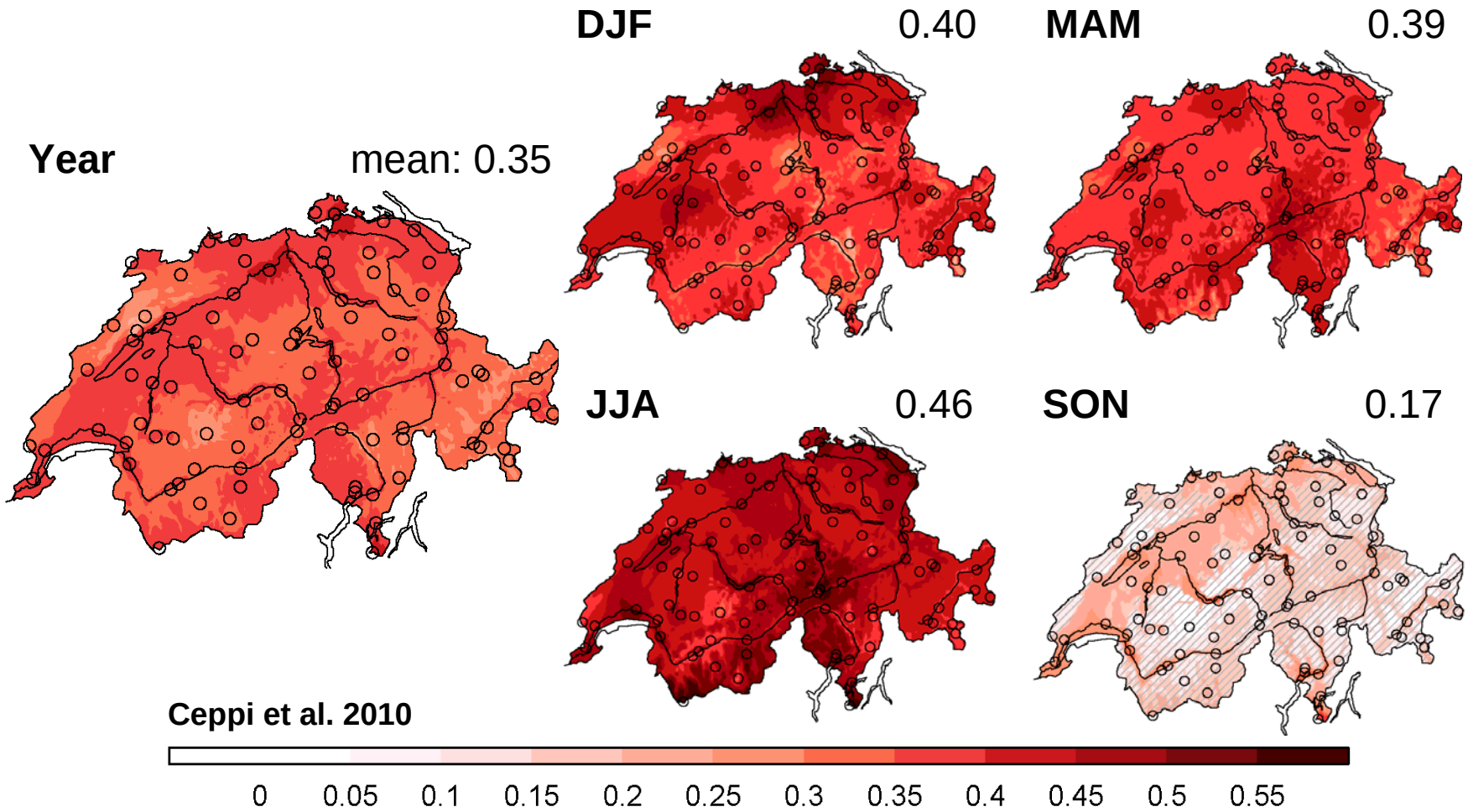


Ceppi et al. 2010



Observed temperature trends

(°C/10y, 1959-2009)



Ceppi et al. 2010

Christof.Appenzeller@meteoswiss.ch

Trends positive everywhere, and mostly significant

Influence of atmospheric circulation

- Hypothesis: Warming not explained by “RCM’s” is related to decadal variability in atmospheric circulation
  → use a regression model

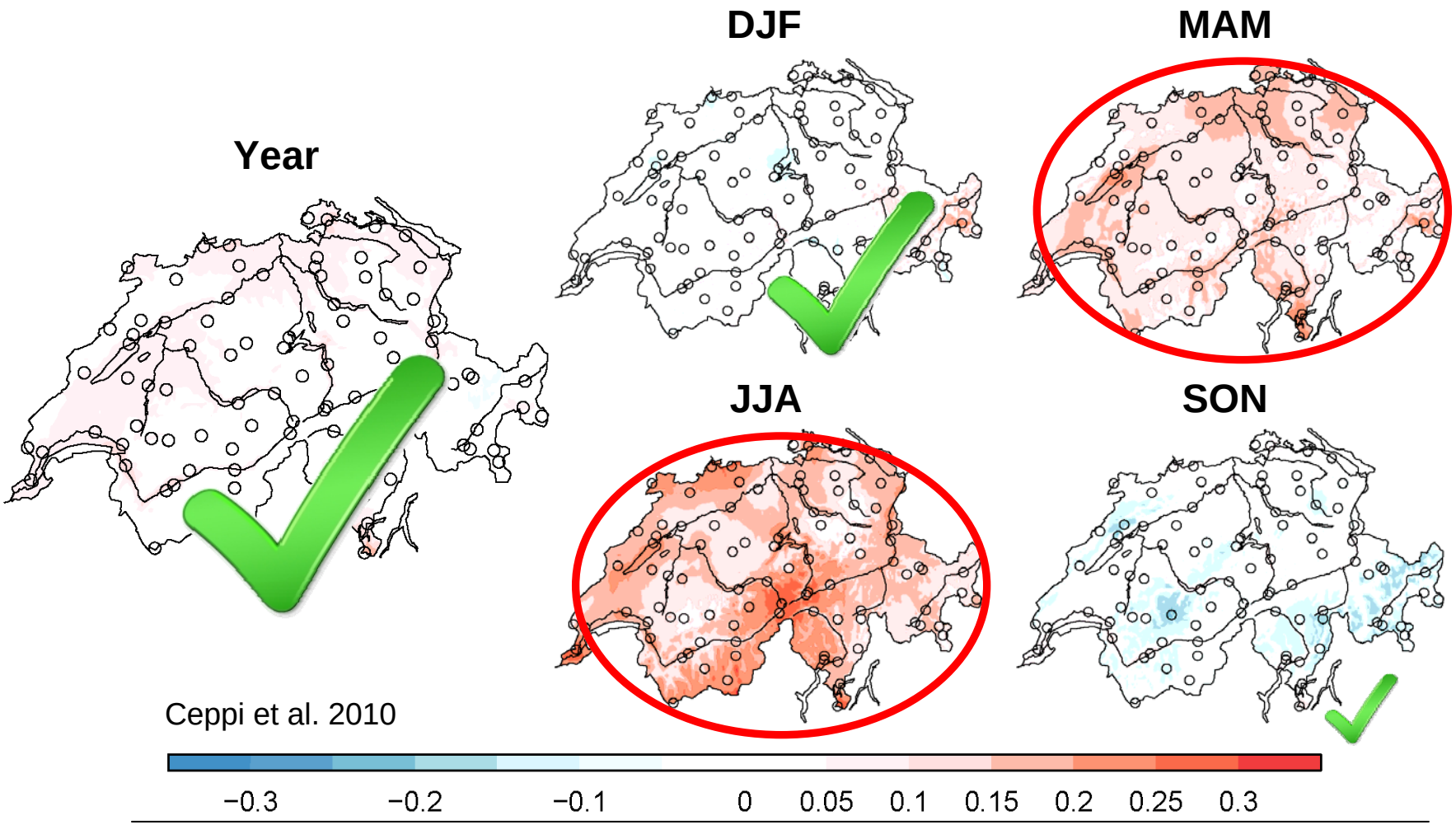
$$T_{OBS}(x,y,t) - T_{RCM}(t) = \sum_{i}^{m} \beta_i(x,y) PC_i(t) + \varepsilon(x,y,t)$$

Swiss gridpoint temperature	**RCM ensemble mean temperature**	**Decadal atmospheric circulation EOF’ SLP**	“error” **other effects**

- PCs of geopotential height (500 hPa) over N. Atlantic /Europe
- Model calibration 1959-83 / model validation 1984-2008

Trend differences

Observed minus constructed trends (°C/decade)



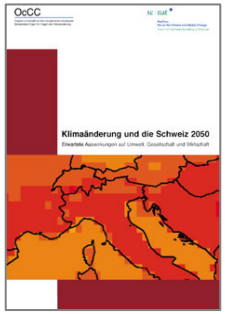
Ceppi et al. 2010

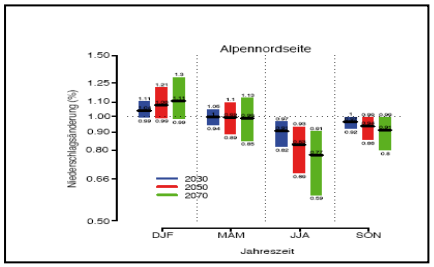
Other effects seem to be important

Intermediate conclusion

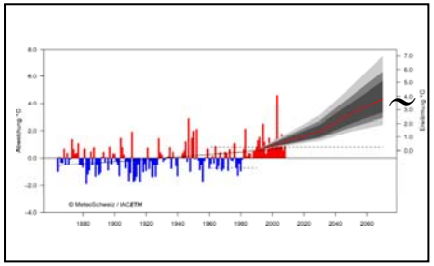
- Swiss temperature trends
  - Observed trends are positive in all seasons and higher than expected from state-of-the-art Regional Climate Model' s (RCM).
  - Some of the differences can be explain by decadal changes in atmospheric circulation but not all
  - Possible reasons:
    - unresolved problems with model
    - radiative effects, land-atmosphere interactions, …
    - on local scales: snow-albedo feedback, fog, ….

Swiss Climate Scenarios CH2011



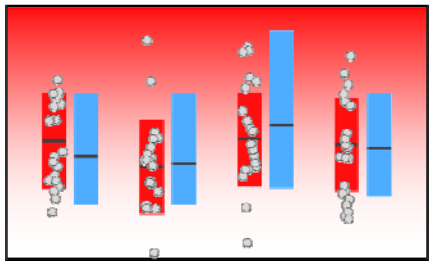


Klimaänderung und die Schweiz 2050
OcCC & ProClim (2007)
→ 1 chapter



Das Klima ändert – was nun?
OcCC (2008)
→ ½ chapter

CH2011



Swiss Climate Scenarios CH2011
→ Full report
→ Collaboration between MeteoSwiss, ETH, ART, OcCC, NCCR-Climate, C2SM
→ Spring 2011

Swiss Climate Scenarios CH2011

- **Coordination Group**
  - C. Appenzeller (MeteoSwiss), C. Schär (ETH Zürich), R. Knutt (ETH Zürich), I. Bey (C2SM), J. Fuhrer (ART), C. Kull (OcCC), M. Croci-Maspoli (MeteoSwiss)
- **Writing and data providing team**
  - Mostly in kind contributions from many scientists ……!

- **Goal:**
  - To provide the end-users a comprehensive overview about the current status of Swiss Climate scenarios.

- **Report**
  - Scientific developments, climate scenarios, comparison to CH2050, good practice guide

- **Data dissemination**
  - Access via Centre for Climate System Modeling C2SM webpage

Methodology

Global climate models

CMIP3, ENSEMBLES

A1B (+ b.a.u., 2°C target)

2000 - 2100

Post-Processing
Pattern-scaling

Regional climate models
Dynamical Downscaling

ENSEMBLES
A1B

2000-2100

2000-2050

Post-Processing
Seasonal PDF's (Bayes)

Statistical downscaling
Delta Change

ENSEMBLES
A1B

2000 - 2050

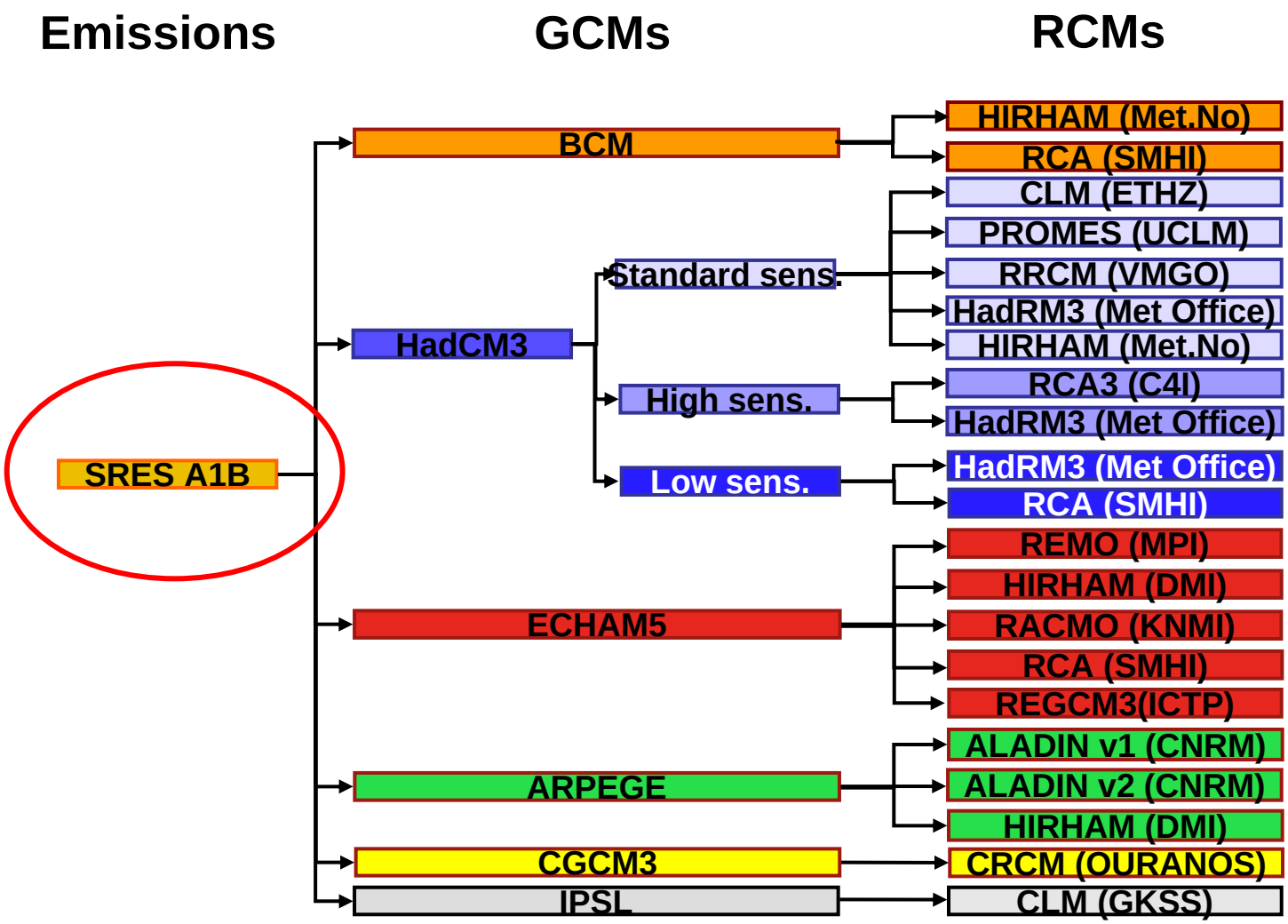
Post-Processing
Delta change factors

Extremes

1) Simple graphics
2) Literature review

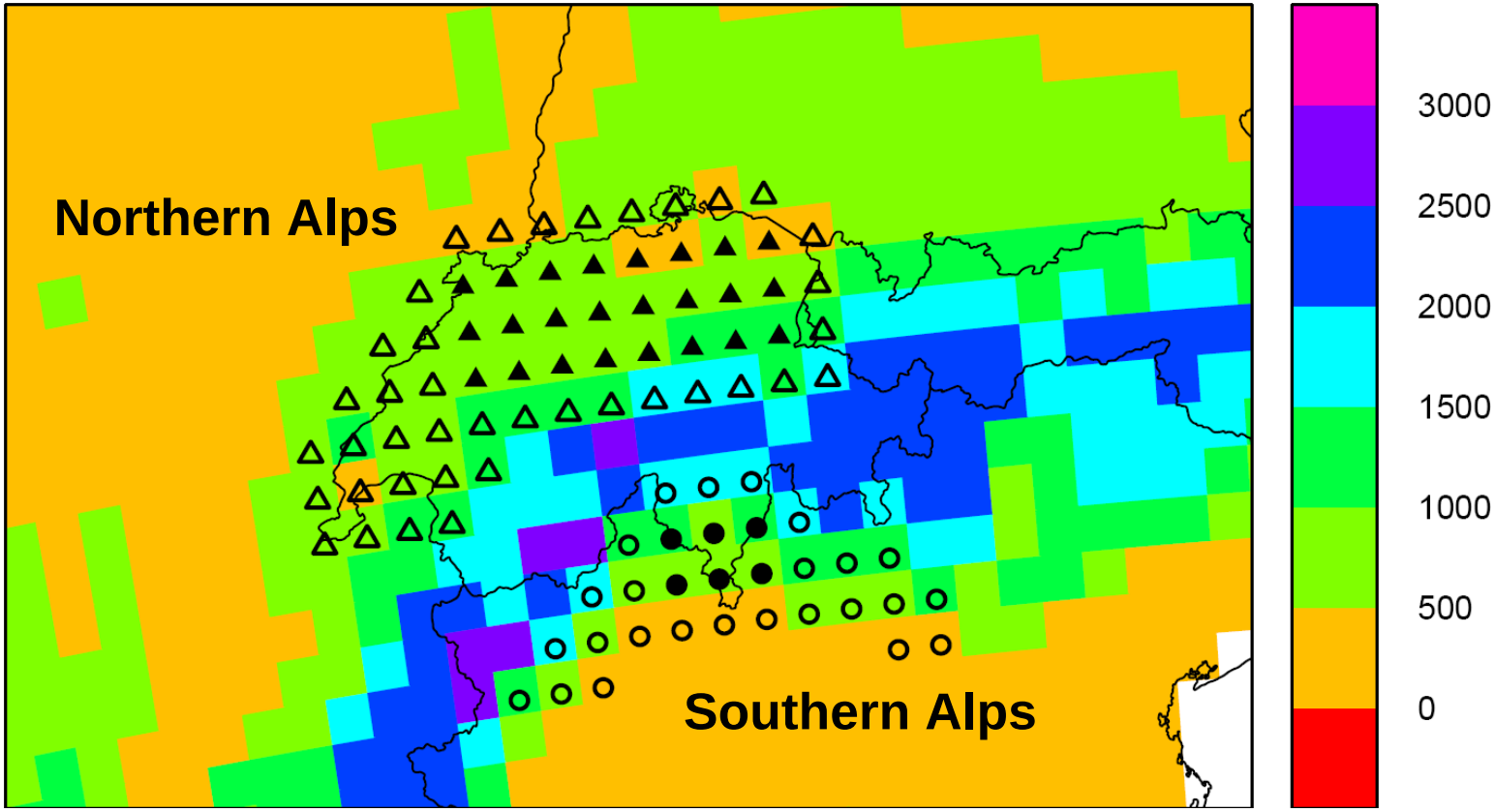
Fischer et al. (in prep.)
Buser et al. (2009)

ENSEMBLES R2TB model-chain



EU FP7 ENSEMBLES Project 2009

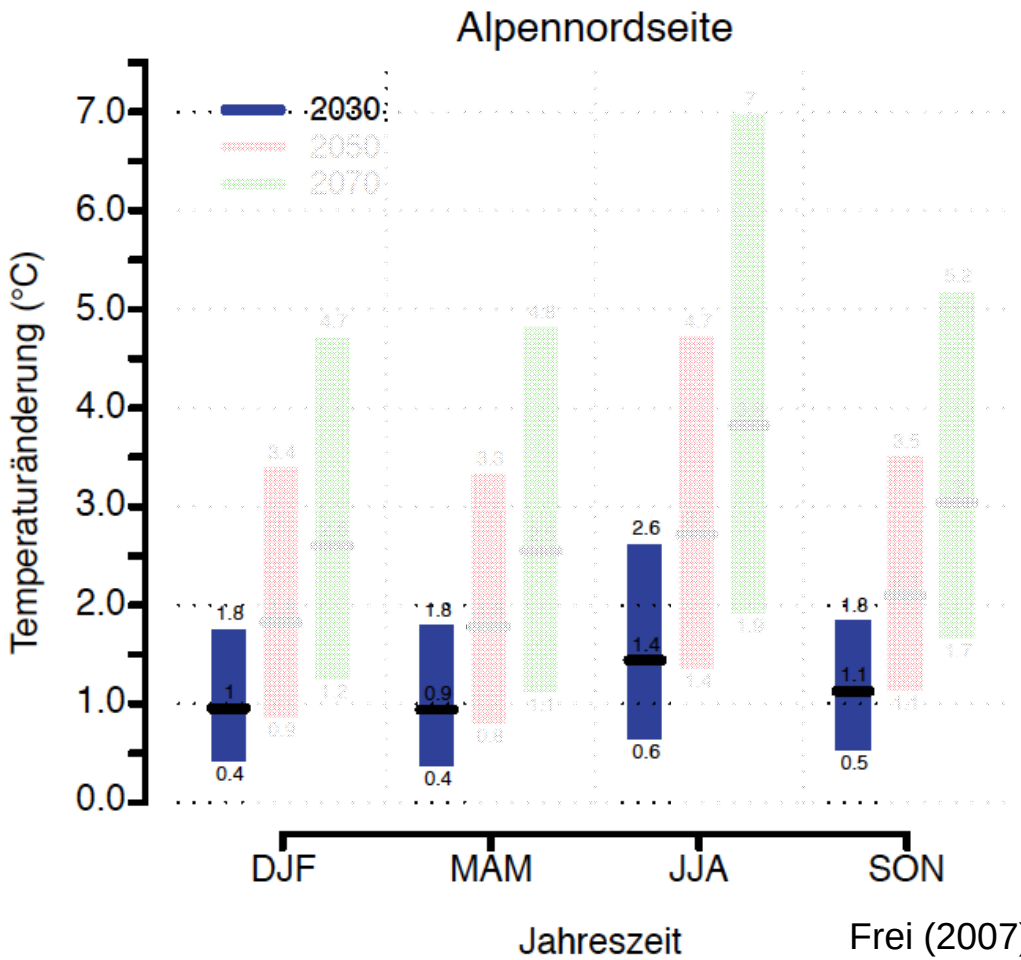
Regional aspects



(courtesy of Fischer, Weigel)

Expected temperature change in 2030

Comparison of CH2011 to CH2050 in respect to 1990 (Northern Switzerland)

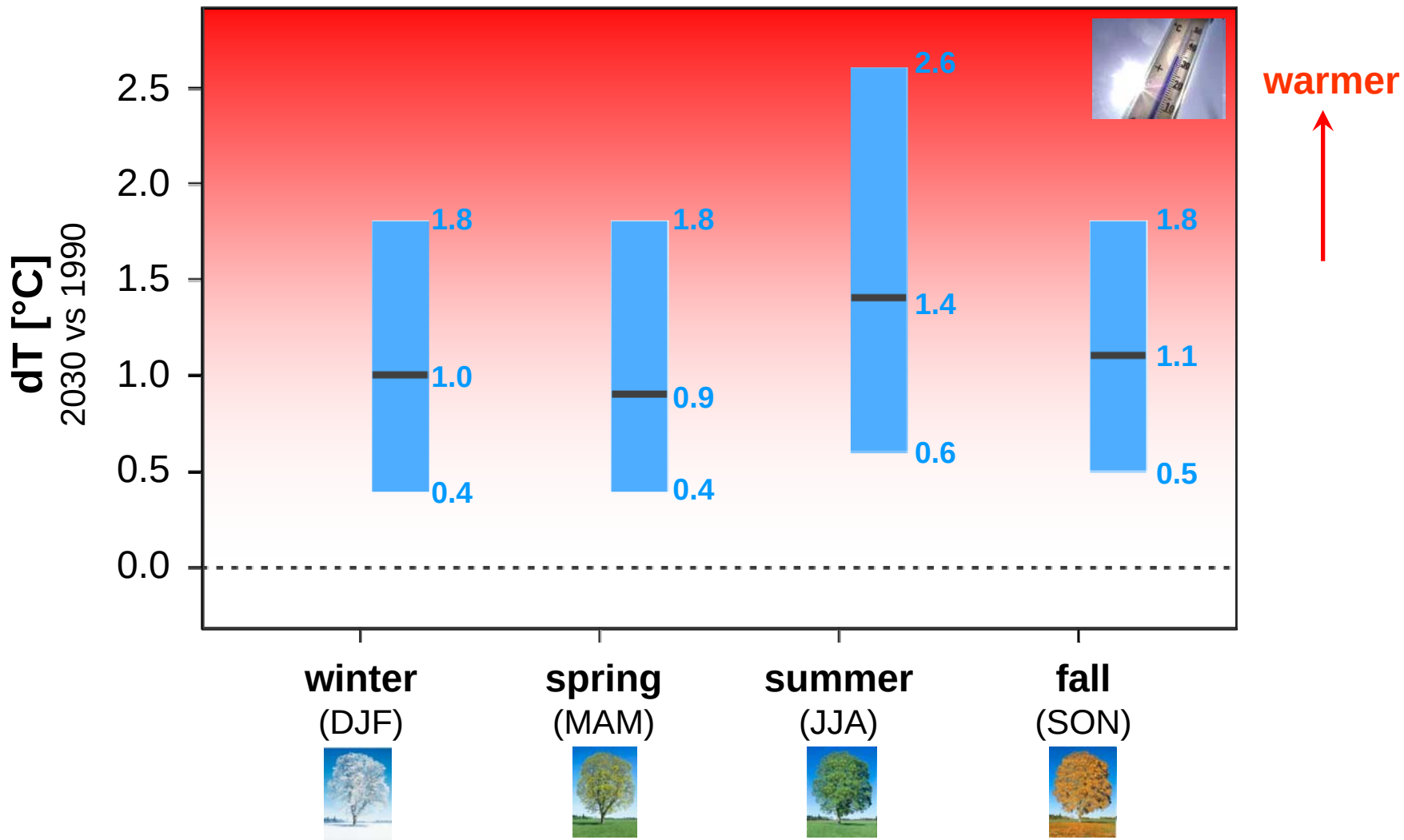


Frei (2007) in OcCC (2007)

Temperature change 2030 vs 1990

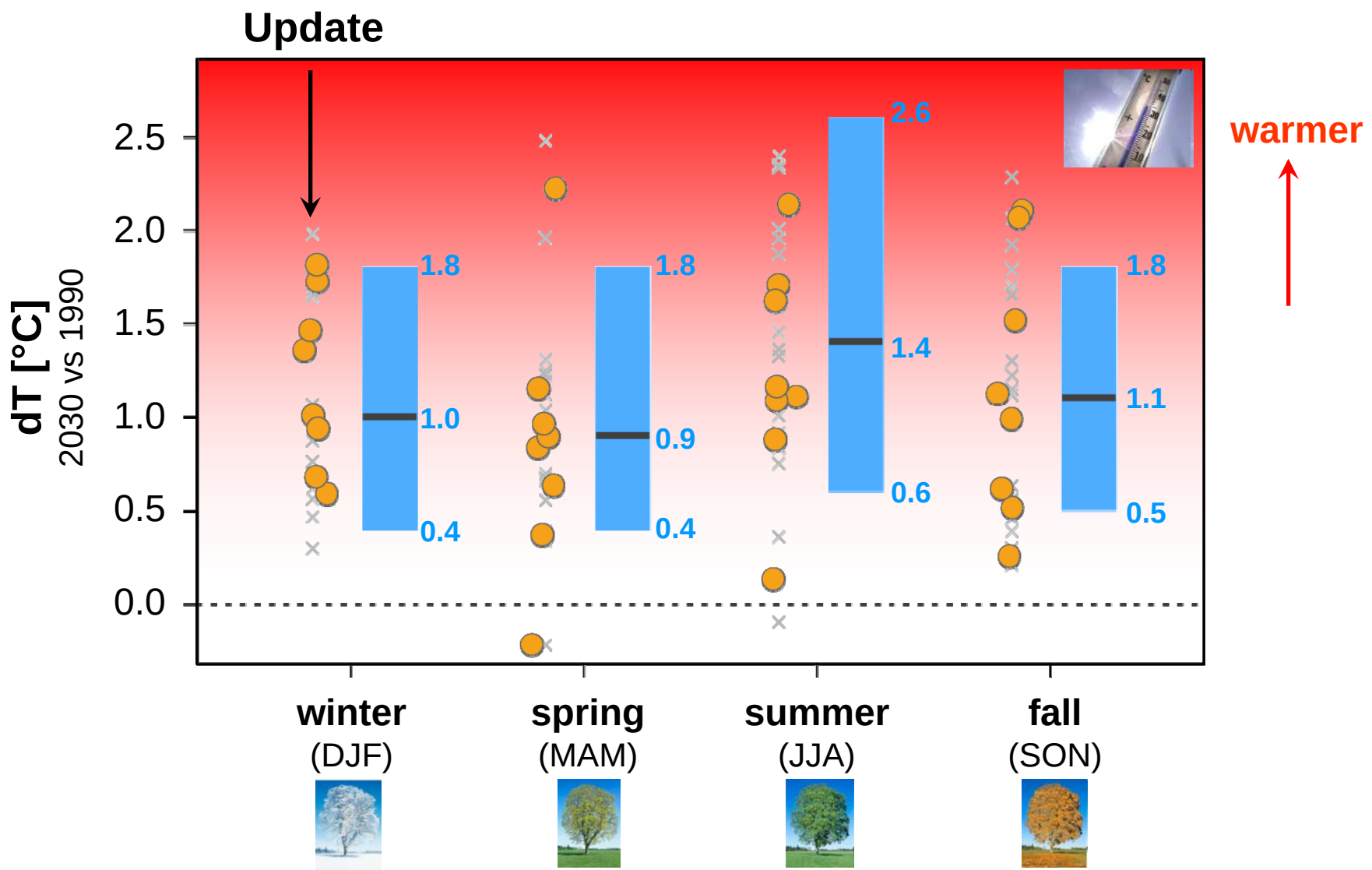
CH2050 (Northern Switzerland)

OcCC (2007)



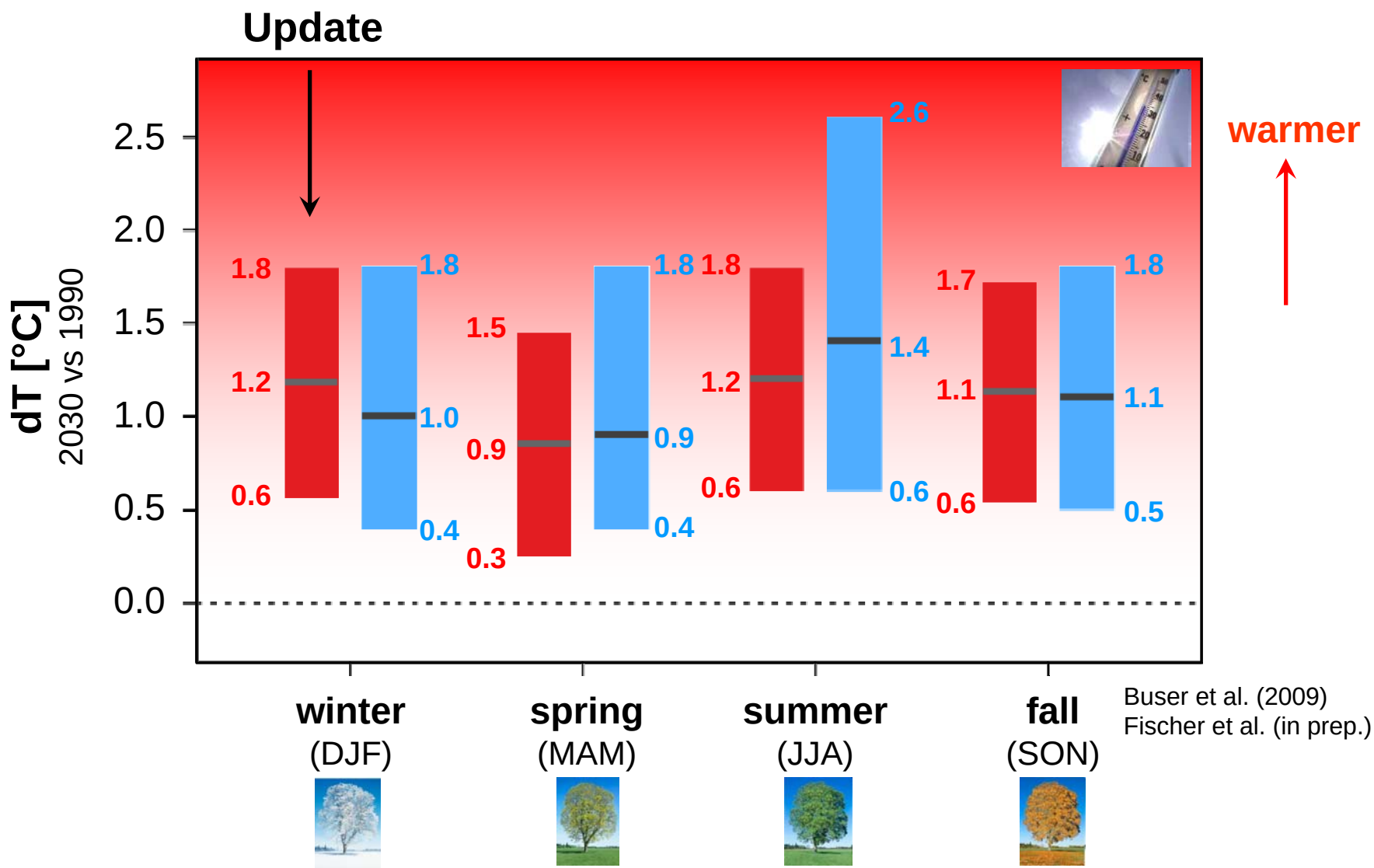
Temperature change 2030 vs 1990

CH2050 plus ***CH2011 raw data*** (Northern Switzerland)



Temperature change 2030 vs 1990

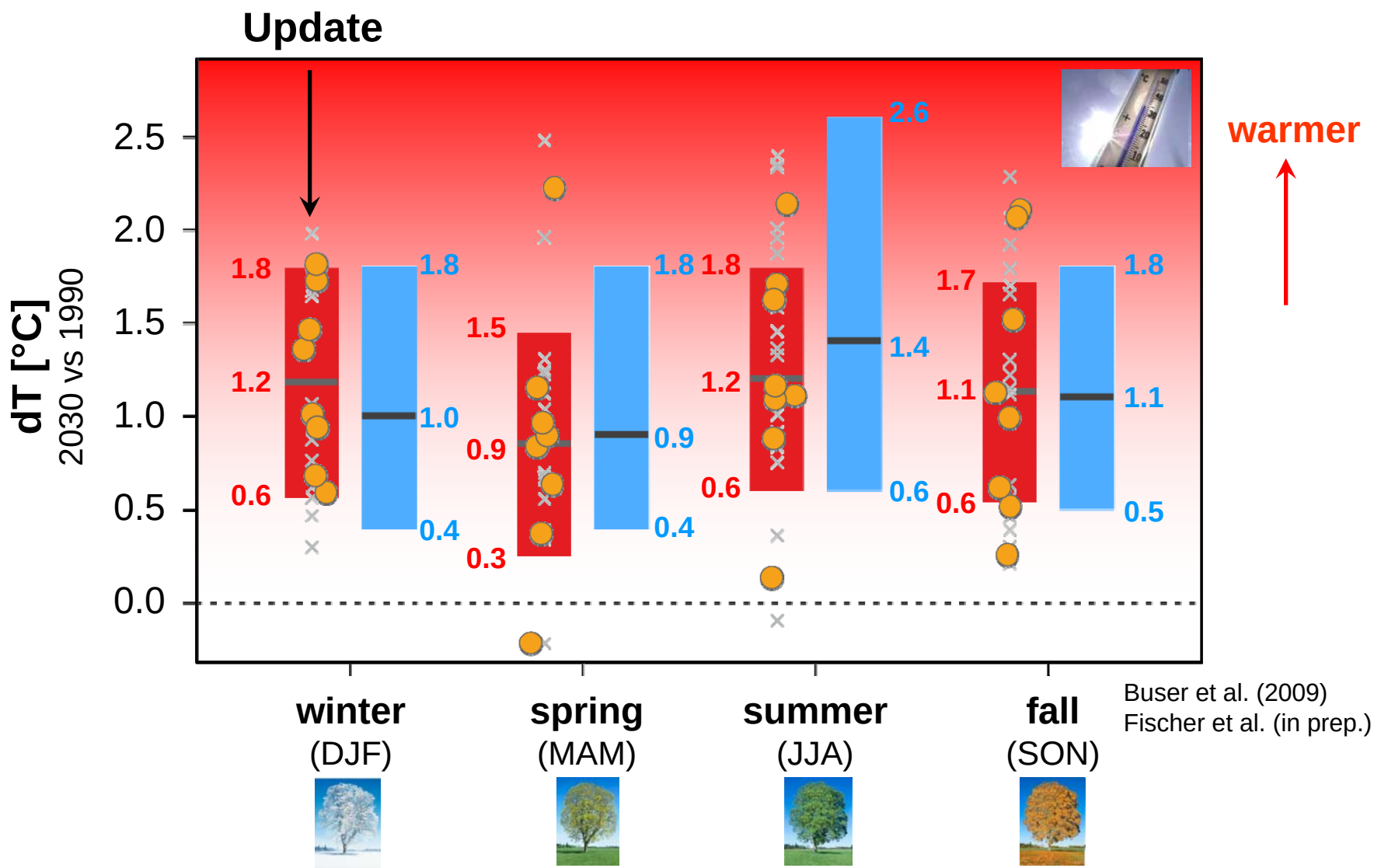
CH2050 plus ***CH2011 Bayes Approach*** (Northern Switzerland)



Buser et al. (2009)
Fischer et al. (in prep.)

Temperature change 2030 vs 1990

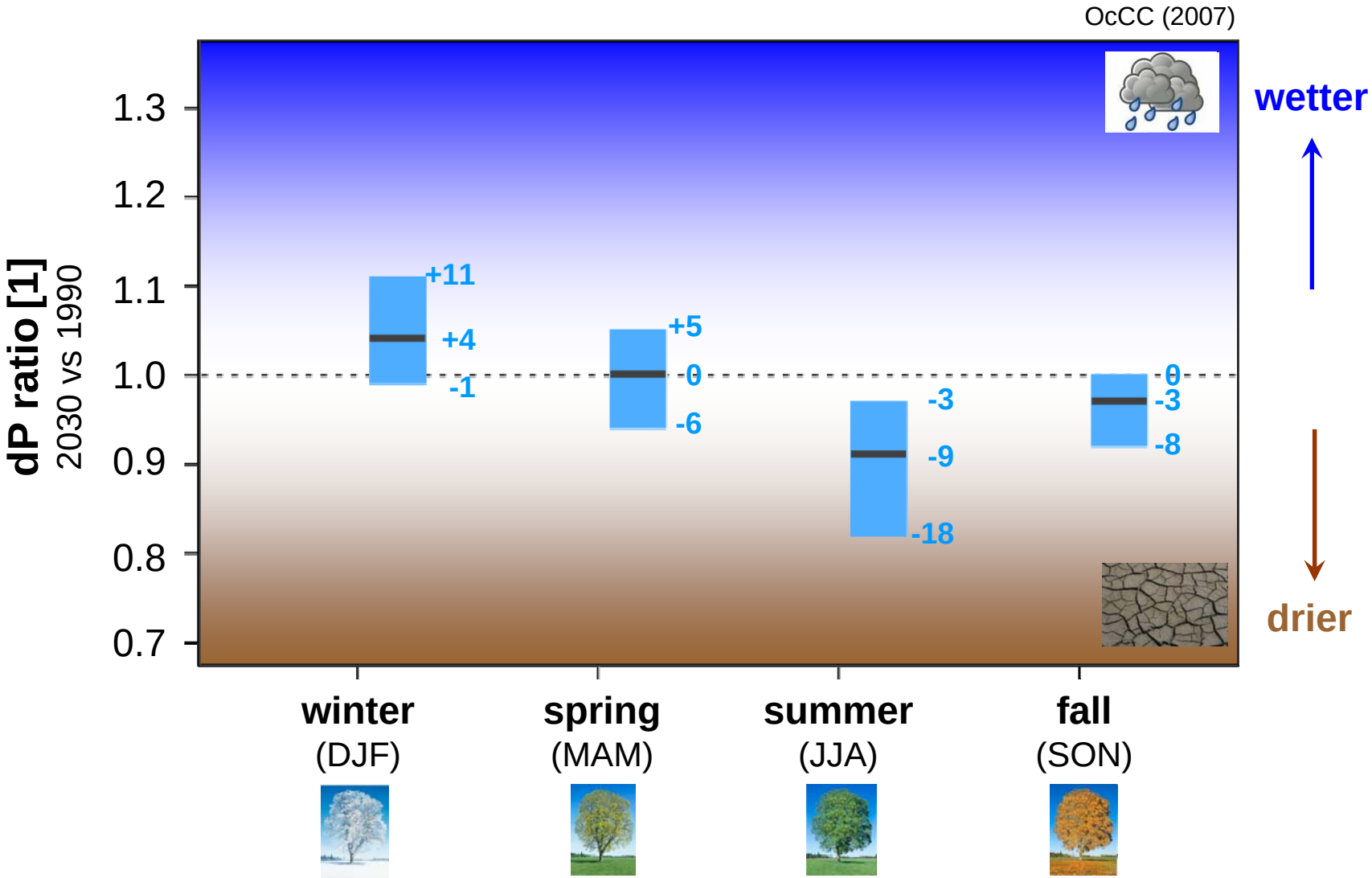
CH2050 plus ***CH2011 raw data + Bayes approach*** (Northern Switzerland)



Buser et al. (2009)
Fischer et al. (in prep.)

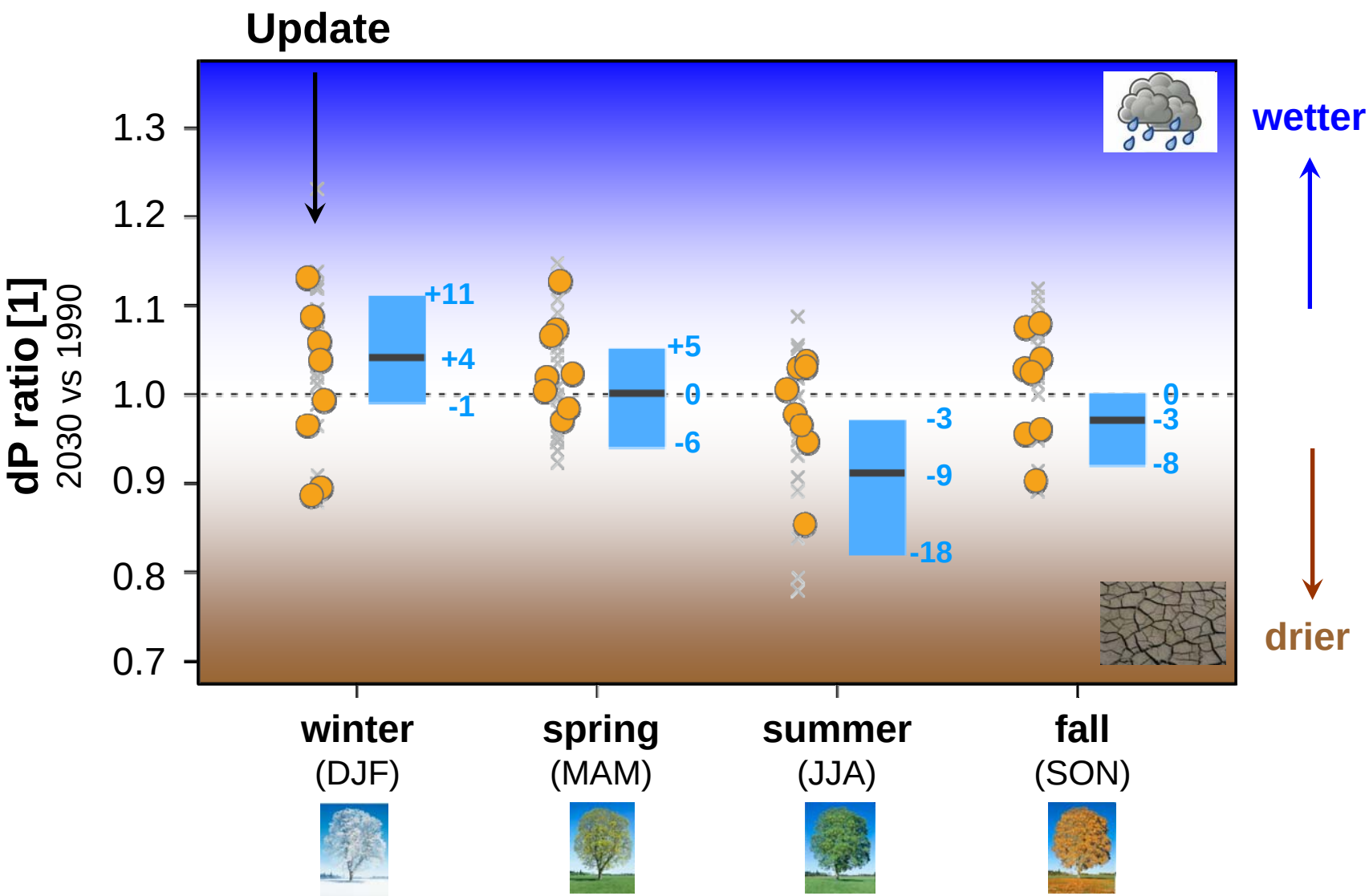
Precipitation change 2030 vs 1990

CH2050 (Northern Switzerland)



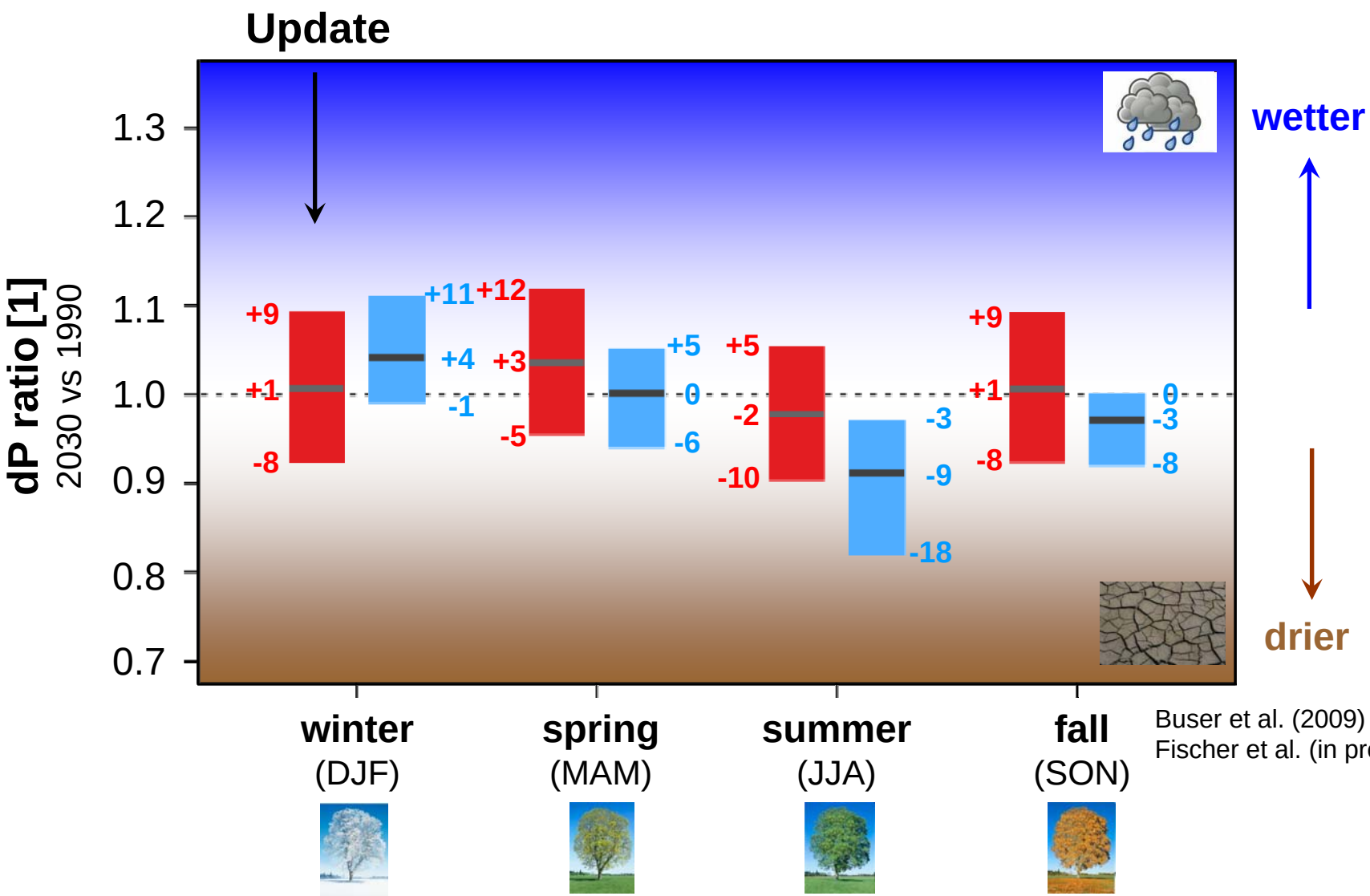
Precipitation change 2030 vs 1990

CH2050 & CH2011 ***raw data*** (Northern Switzerland)



Precipitation change 2030 vs 1990

CH2050 & ***CH2011 Bayes approach*** (Northern Switzerland)



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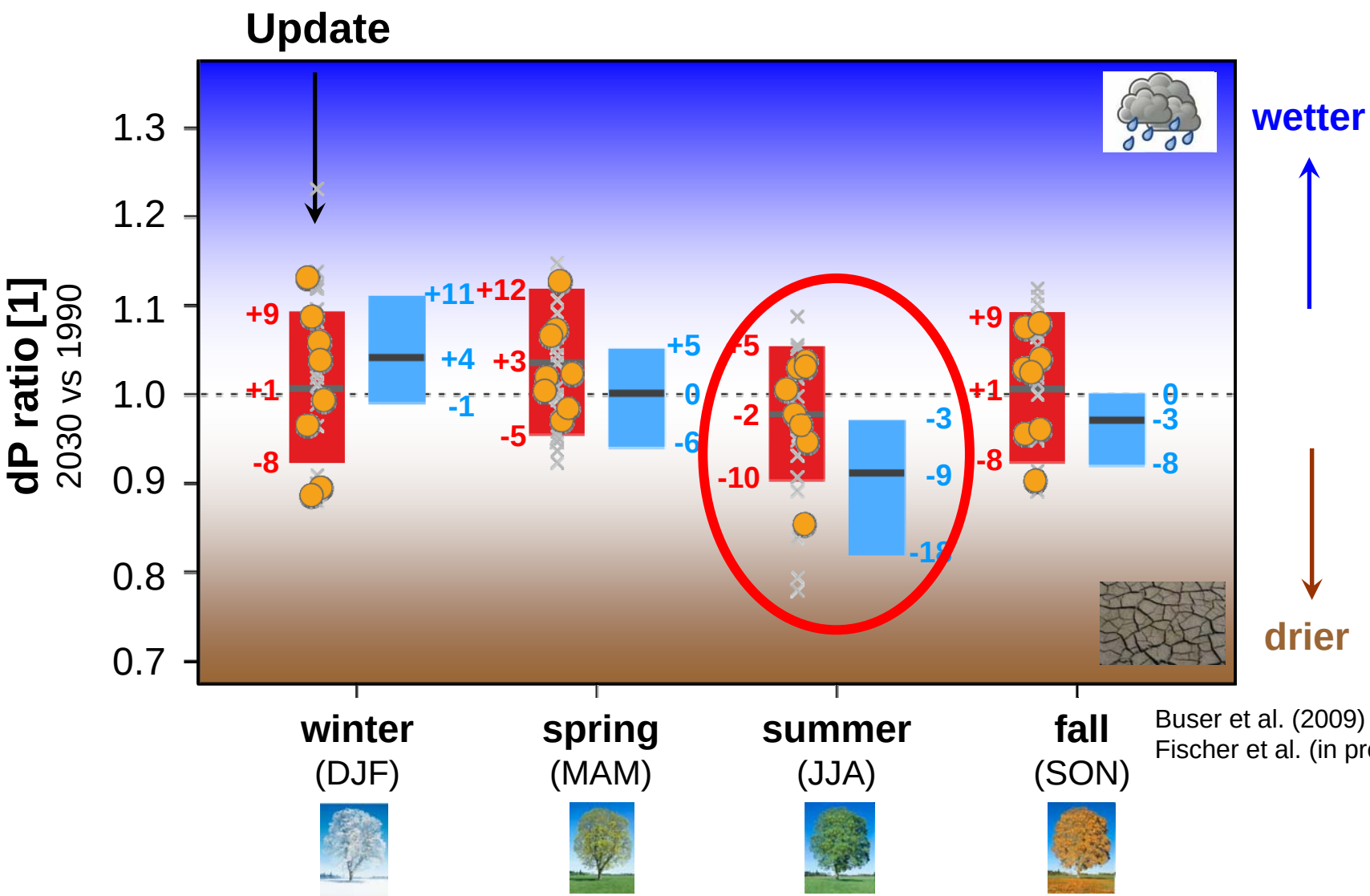
Precipitation change 2030 vs 1990

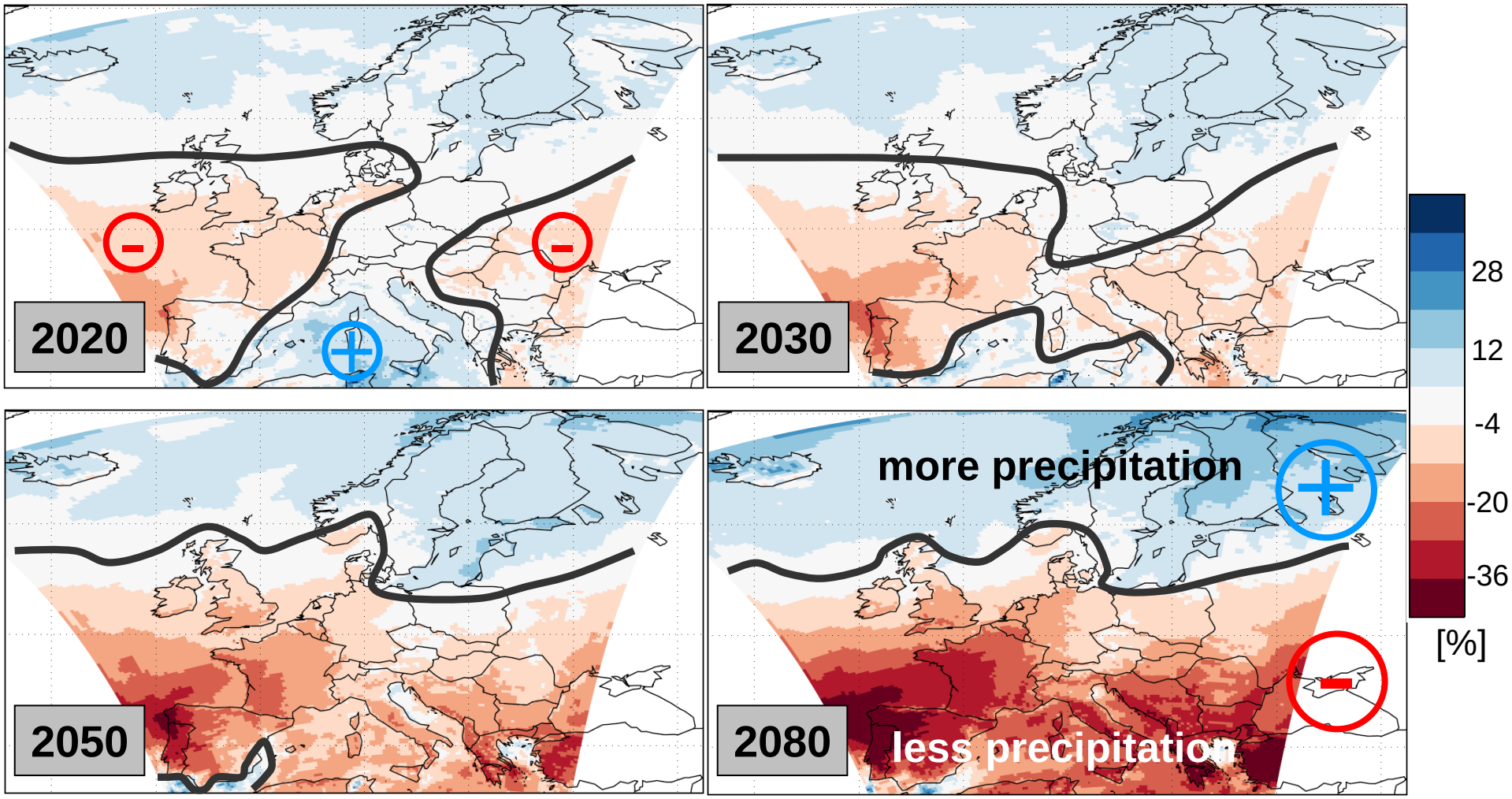
CH2050 & ***CH2011 raw data + Bayes approach*** (Northern Switzerland)



Buser et al. (2009)
Fischer et al. (in prep.)

Expected changes mean summer precipitation

transient multi model mean wrt 1990, RCM's ENSEMBLES



Fischer et al. (in prep.)

Intermediate conclusion II

- Swiss climate scenarios 2011
  - Preliminary results for seasonal mean scenarios for Northern Switzerland for 2030 relative to 1990 show:
    - expected mean change in temperature is comparable to earlier scenarios,
    - expected mean change in precipitation is slightly reduced to earlier scenarios
  - Possible reason for summer mean precipitation :
    → improved transient projections compared to pattern scaling used in time-slice experiment in CH2050.

Conclusion

- Awareness of weather & climate variability has substantially increased throughout the society.
- Decision makers ask for better advise on the past, current and future climate on local scales (region, communities, cities, ..).

- What do we need for "better climate information"?
  - state-of-the art information from observations to keep an eye on the changing climate.
  - state-of-the-art information from models to project future possible climate states.
  - In the end a clever combination of both!

- Two examples of tailored climate information :
  - Temperature trends from gridded climate information.
  - Climate scenarios from regional climate model information

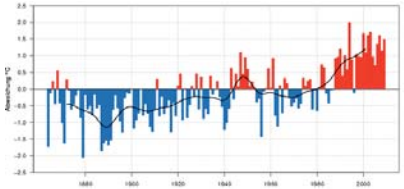
- But there is much more…

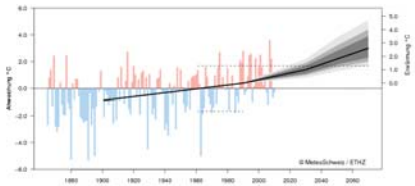
Information from web-portals

- MeteoSwiss provides a wide range of climatological information on its web

  www.meteoswiss.admin.ch

  → Climate





- Swiss Climate Scenarios (CH2011)

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www.c2sm.ethz.ch