



Federal Ministry
of Education
and Research



Niedersächsisches Ministerium
für Wissenschaft und Kultur

Uncertainties of forest risks assessment under climate change.

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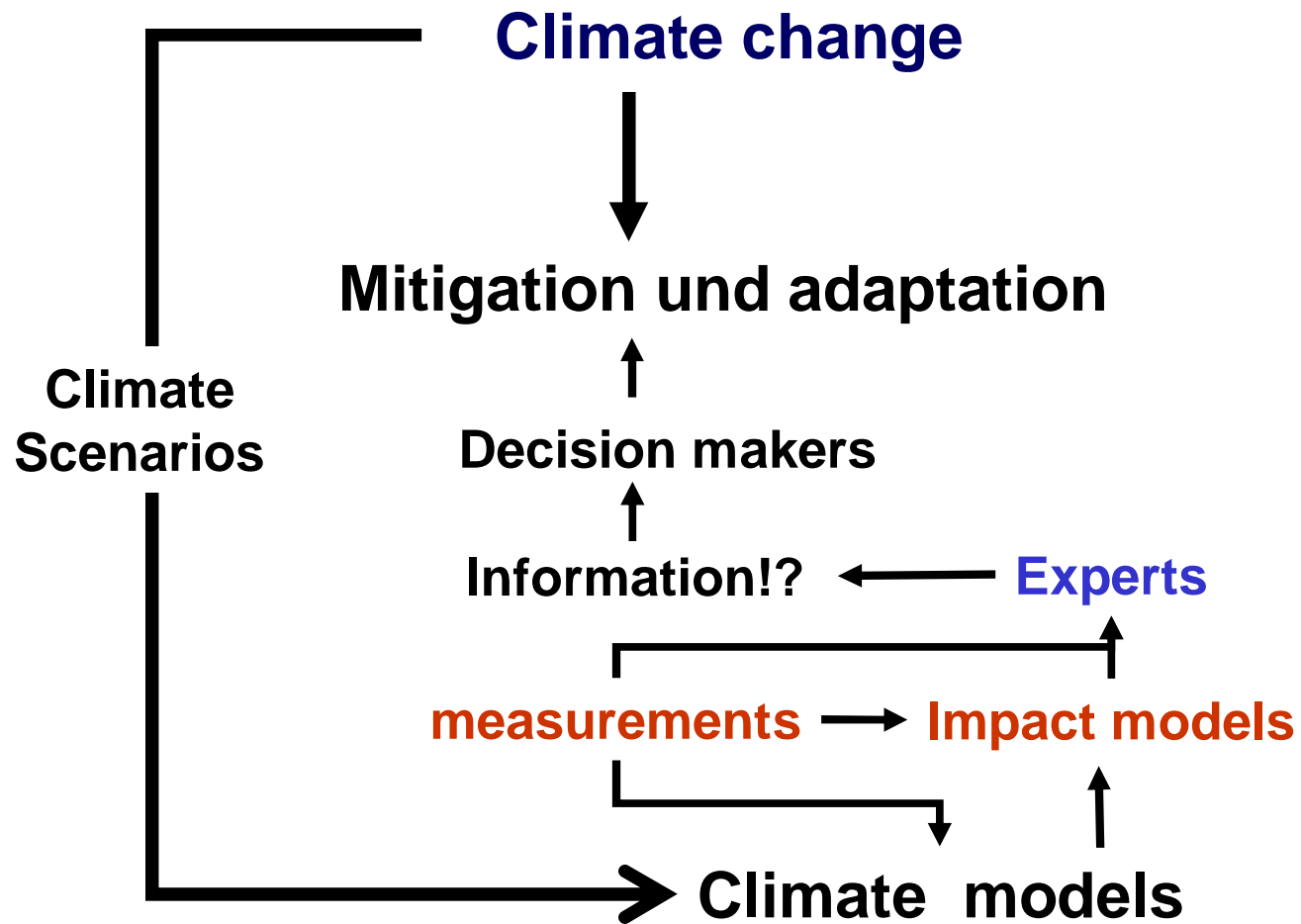
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Motivation



Adaptation to what?

Wir müssen wissen, was uns erwartet. Nur dann können wir uns optimal und zu vertretbaren Kosten an den Klimawandel anpassen

A. Troge (UBA Präsident)

We have to know what to expect. Only in this case we can perform optimal adaptation to climate change for a reasonable price.

A. Troge (President of Federal Environmental Bureau, Germany)

Adaptation in forest sector

- **Which species to plant?**
- **Abiotic risks**
- **Biotic risks**
- **Mutual influences and trade-offs**
- **Management influence**



Objective

To quantify forest ecosystem fluxes and risks in the 21st century using impact models taking uncertainties into account

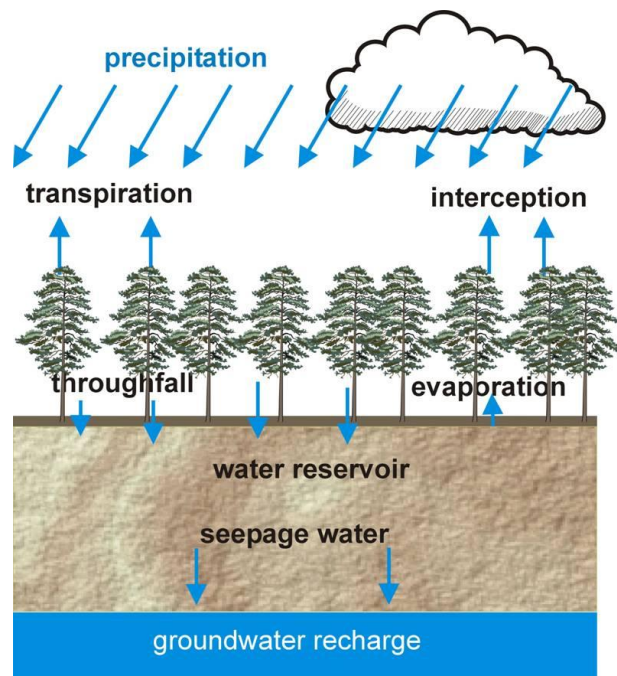
Indicators:

**Drainage at 2m depth
Drought stress
Wind damage**



Tool: coupled model

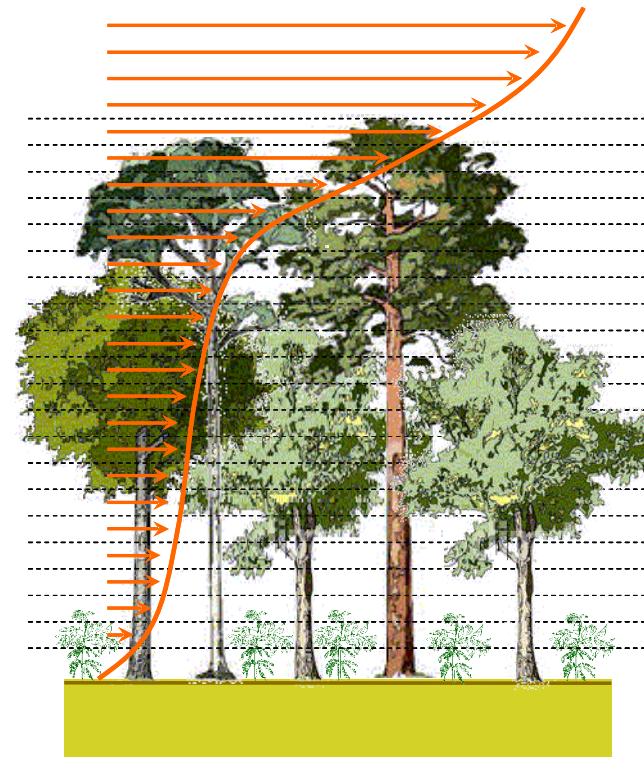
Water budget



BROOK90 (Federer et al. 2003)

Version 4.4e

3D Wind model



SCADIS (Sogachev et al., 2002)

From Olchev et al., 2004

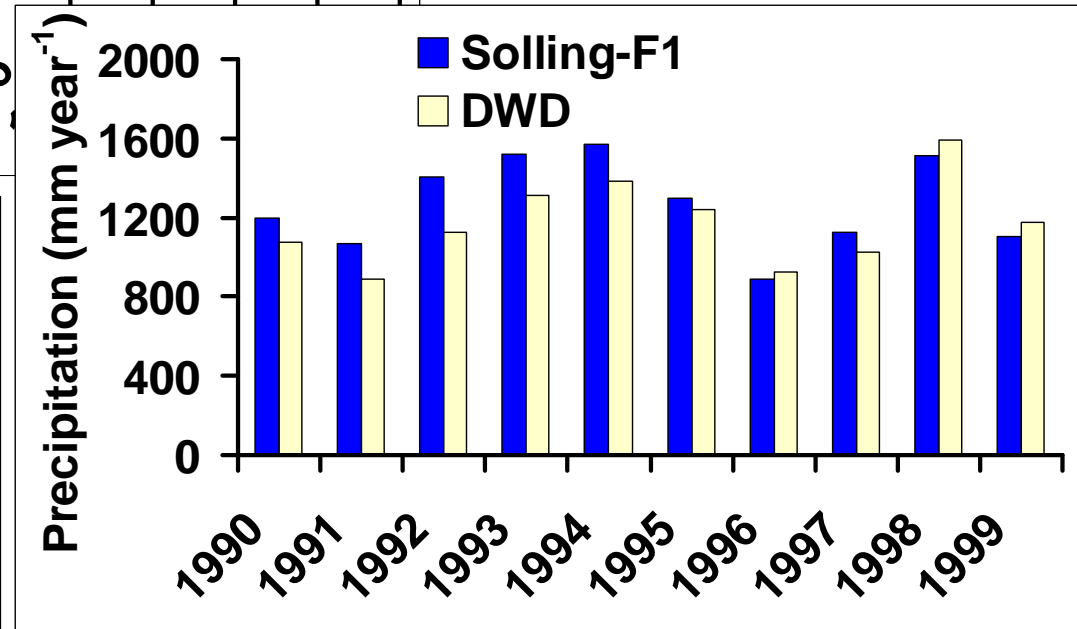
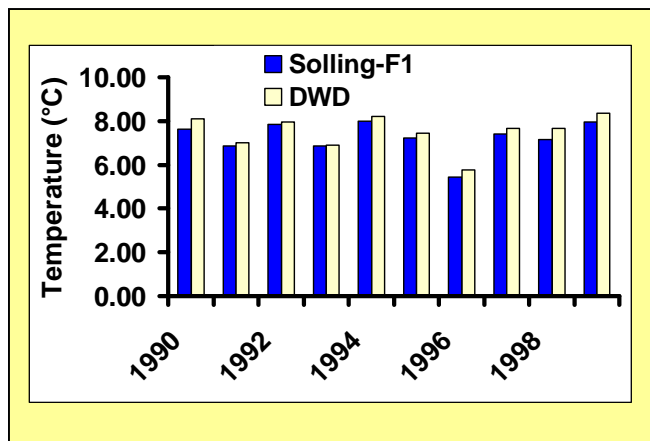
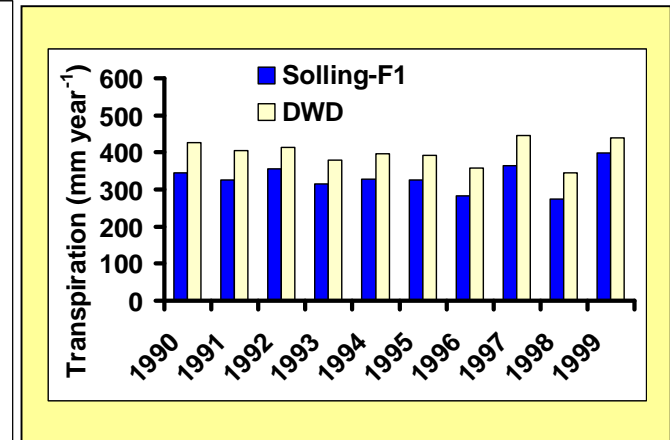
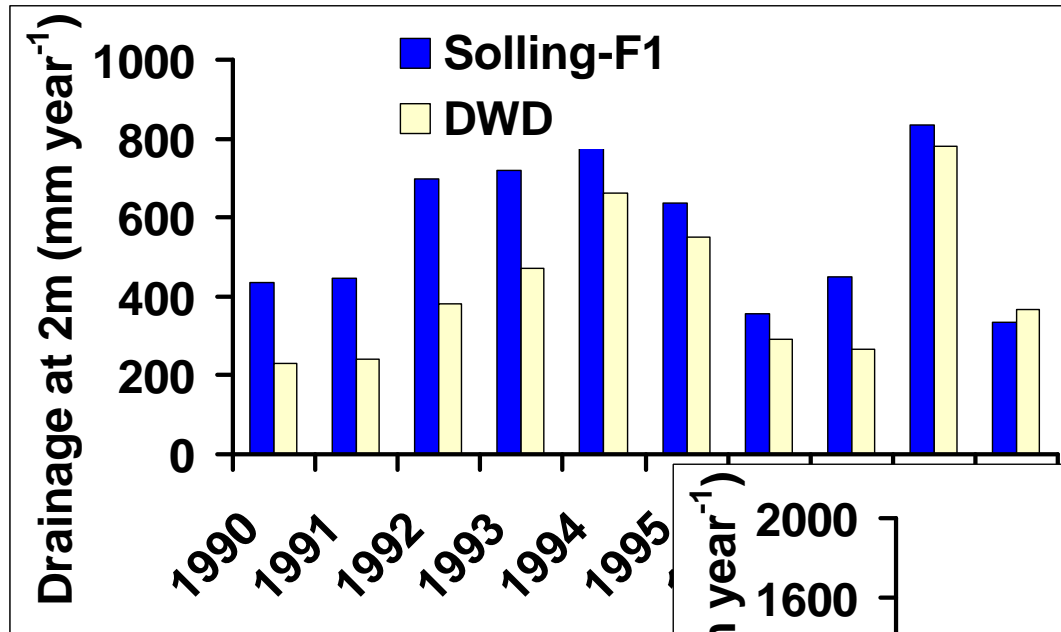
Results



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Model results (Forest Climate vs DWD)

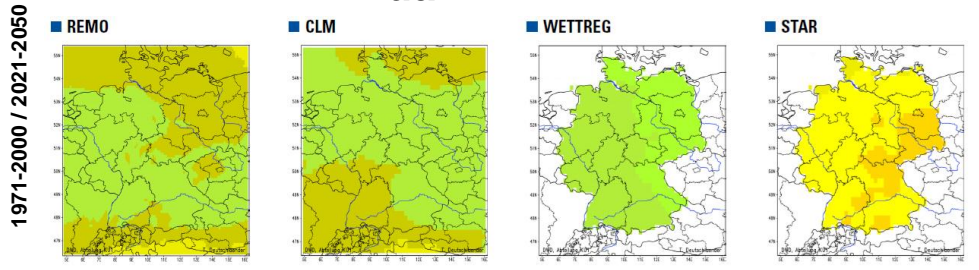


Conclusion 1

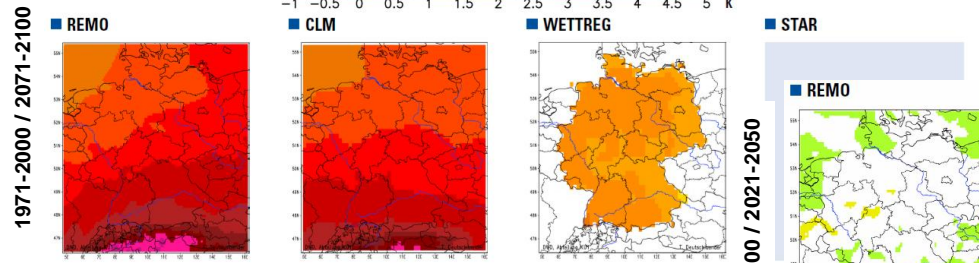
Direct implementation (with simple height correction) of weather stations-data for the description of forest microclimate and functioning is not advisable at the given density of weather stations.

Choice of RCM: climate change signals?

T_{Annual} change

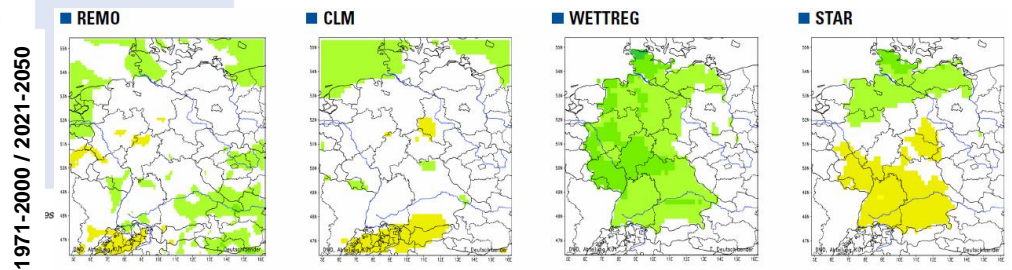


Different magnitude

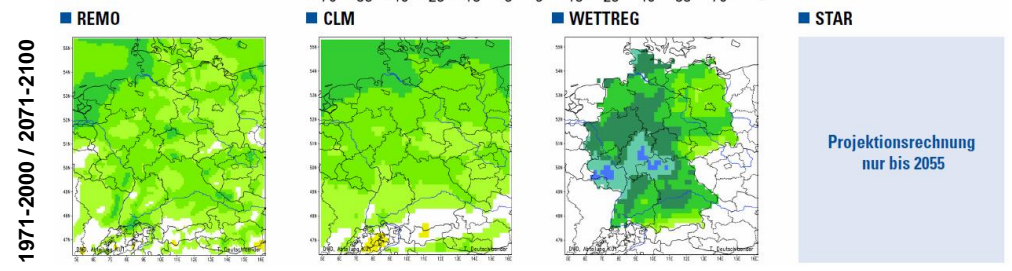


REMO: MPI-M I.A. des Umweltbundesamtes, 2006 | CLM: MPI-M/MaD I.A. des BMBF, 2007 | WETTREG: Meteo Research I.A. des Urm

P_{winter} change



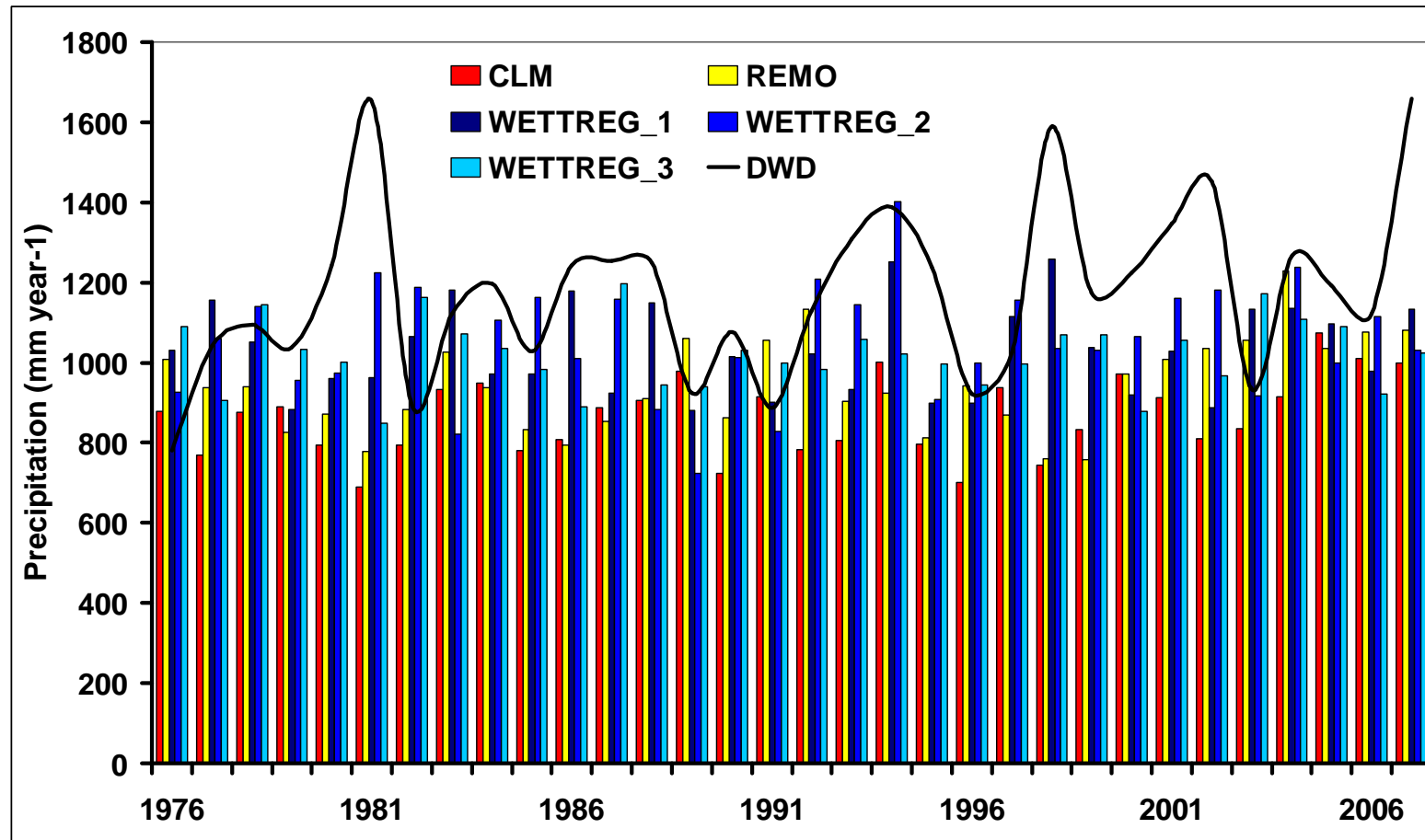
Different magnitude
Different sign



Projektionsrechnung
nur bis 2055

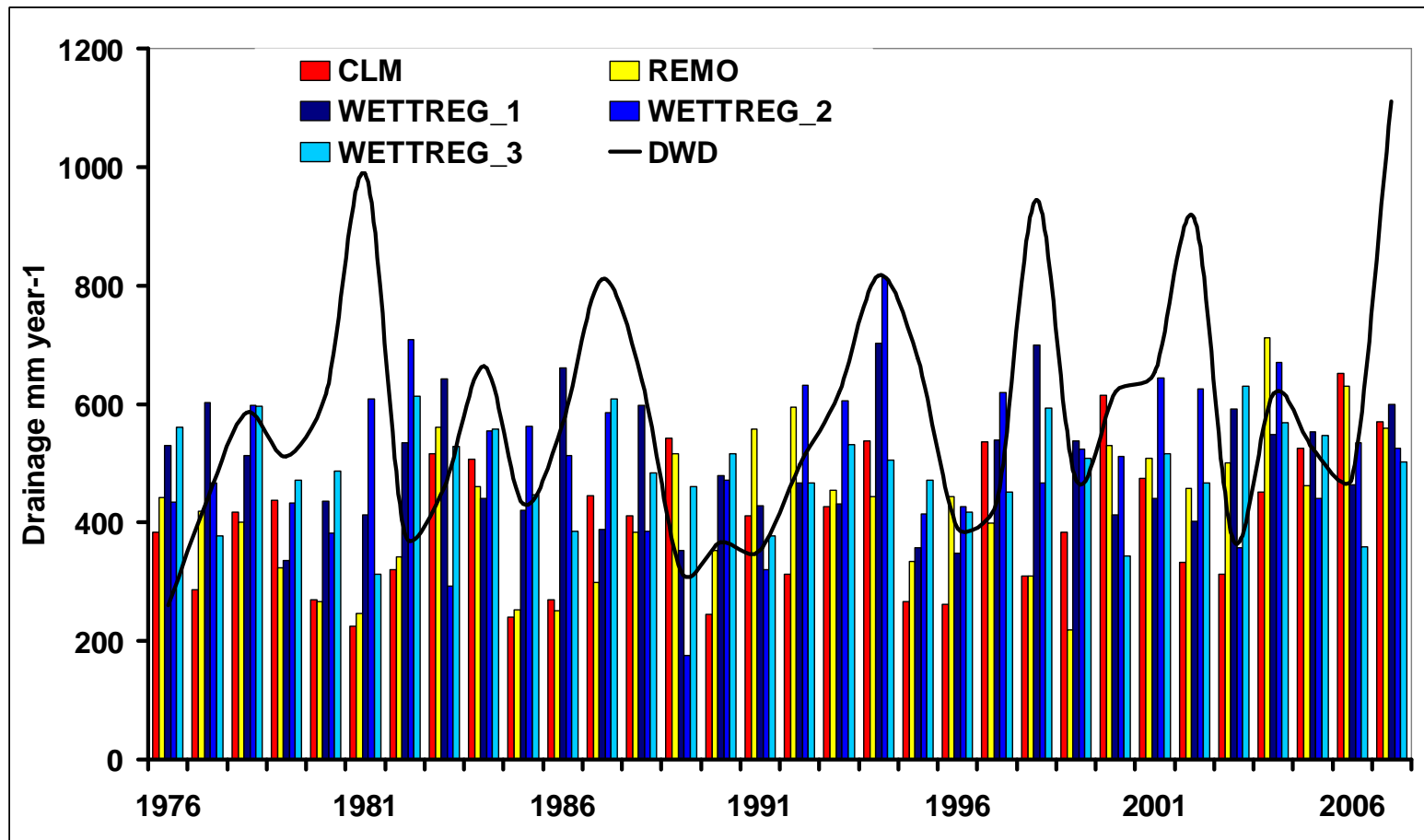
RCMs validation runs, study site, 1976-2008

Precipitation (Bias-corrected REMO and CLM)



RCMs validation runs, study site, 1976-2008

Drainage



RCMs validation runs, study site, 1976-2008

Critical conditions for drought.

Number of events

DWD: 0

WETTREG_{mean}: 10 (0-42)

CLM: 0

REMO: 0



RCMs validation runs, study site, 1976-2008

Critical conditions for windthrow.

Number of events:

DWD: 18

WETTREG_{mean}: 9 (5-13)

CLM: 7

REMO: 0



Conclusions 2

- Ø It is not advisable to use the outputs of GCMs or RCMs directly for local scale impact modelling.
- Ø Dynamical downscaling to local scales ($\ll 1$ km) is required
- Ø The key requirement is the increasing of density of observation (current trend – decreasing)

Possible solutions?

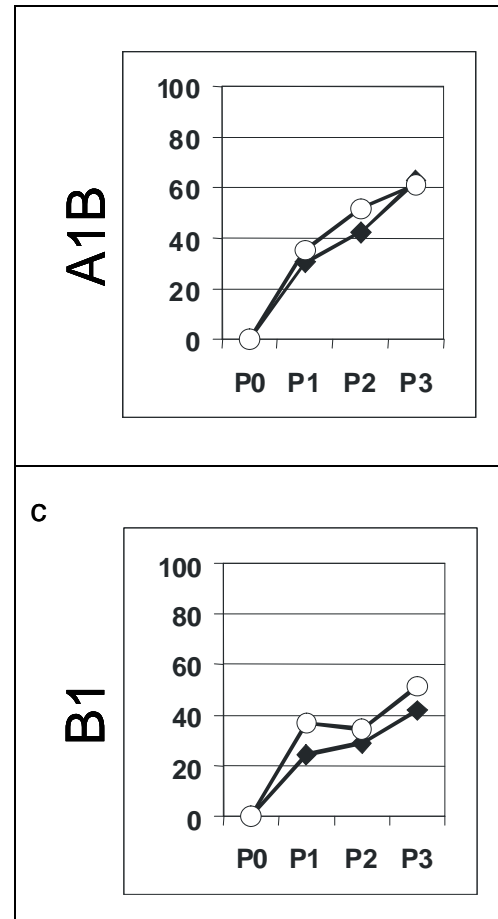
Suggested solutions

- 1. Evaluating 30 years periods and trends**
- 2. Calculating with high resolution**



Adaptation: evaluation of risks

Scenarios of wind damage (%)



◆ Cambic Podzol

○ Podzol

P0=1971-2000

P1= 2011-2040

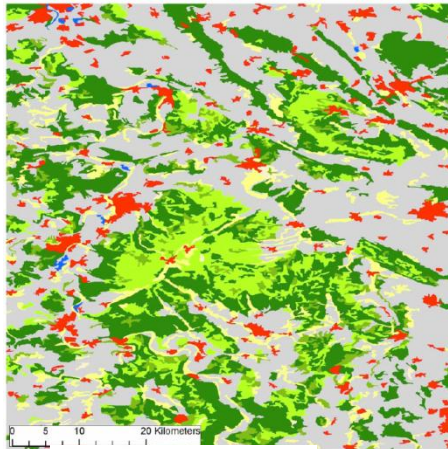
P2=2041-2070

P3=2071-2100

High resolution example 1: effect of thinning methods

Scenario A1B. Change of abiotic risks in 2071-2100 comparing to now, in influence of thinning: (A) no thinning, (B) DBH > 45 cm, (C) DBH > 40 cm.

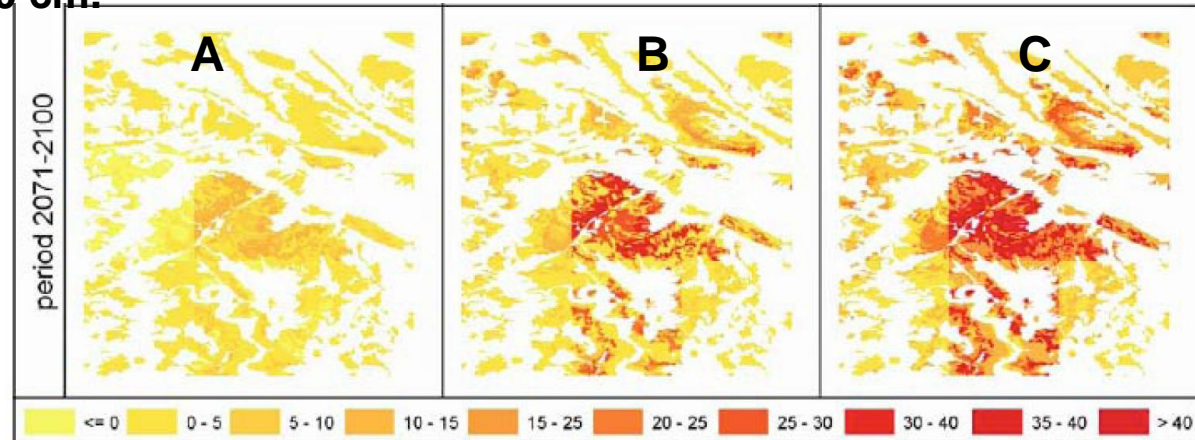
Solling



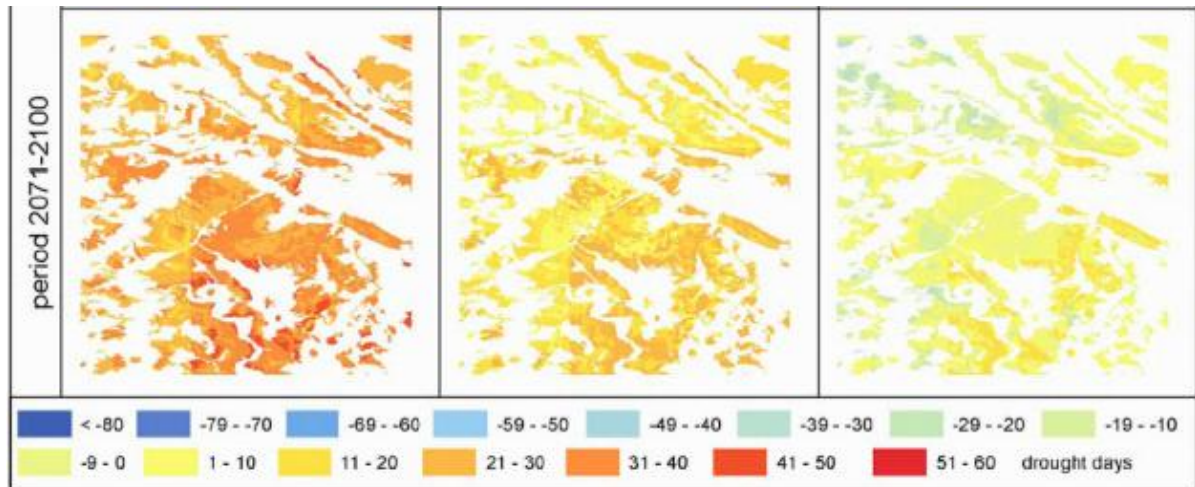
land use



Windthrow



Drought



High resolution example 1: effect of thinning methods

Scenario A1B. Change of abiotic risks in 2071-2100 comparing to now, in influence of thinning: (A) no thinning, (B) DBH > 45 cm, (C)

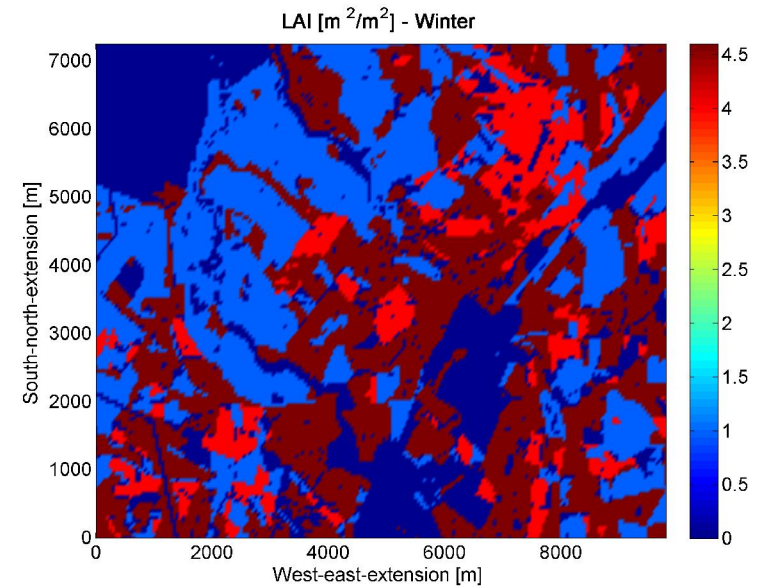
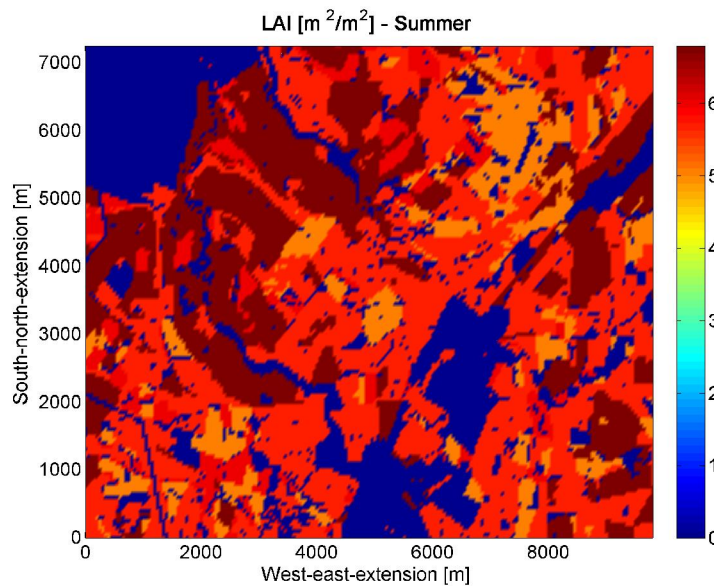
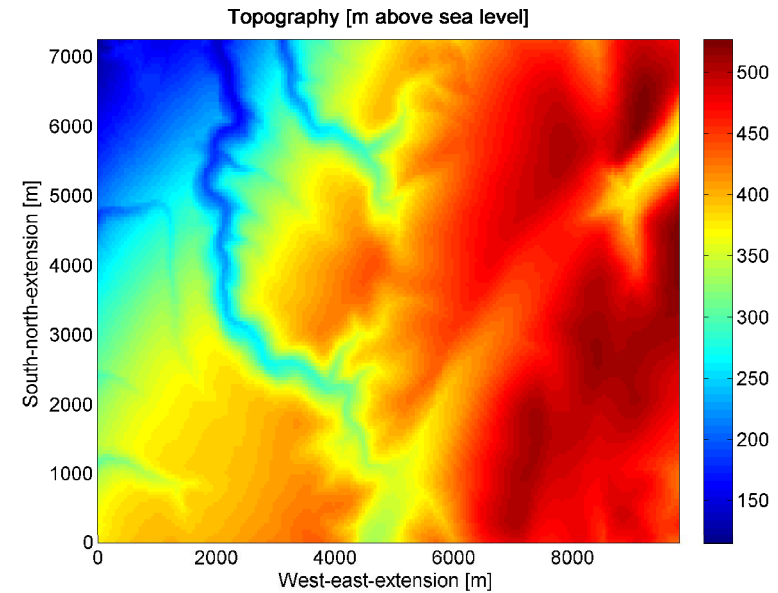
Thinning increases the risk of windthrow, but
decreases the drought risk!



High resolution example 2: wind simulation of the Solling region.

25 m, 50 m and 100 m
horizontal grid resolution.

Wind directions: 320° summer;
285° winter.



Solling, summer, 320°

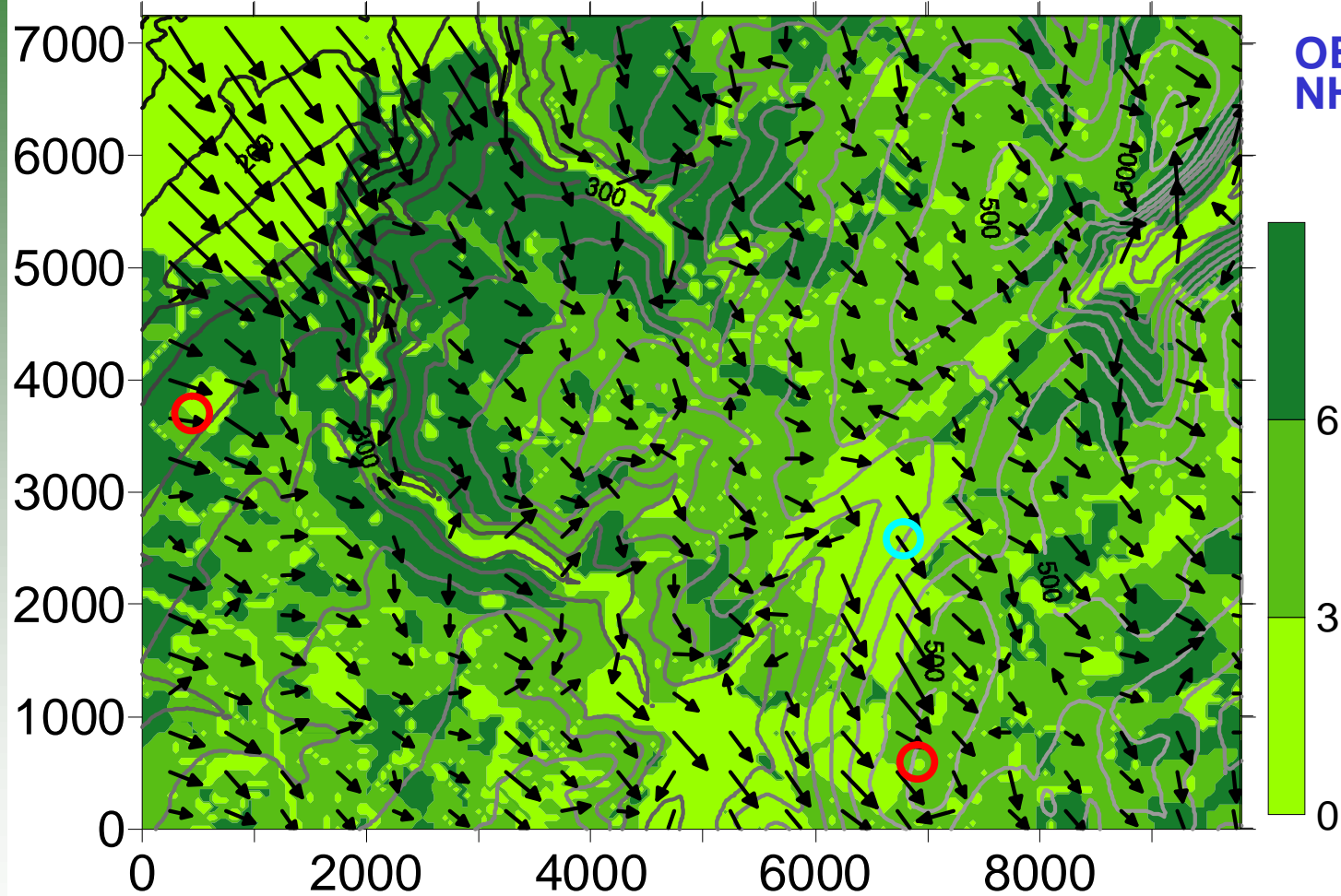
Reference Vectors
0.01 8

Meas. Model

DWD 4.34 4.34

OB 1.51 1.50

NH 1.70 1,71



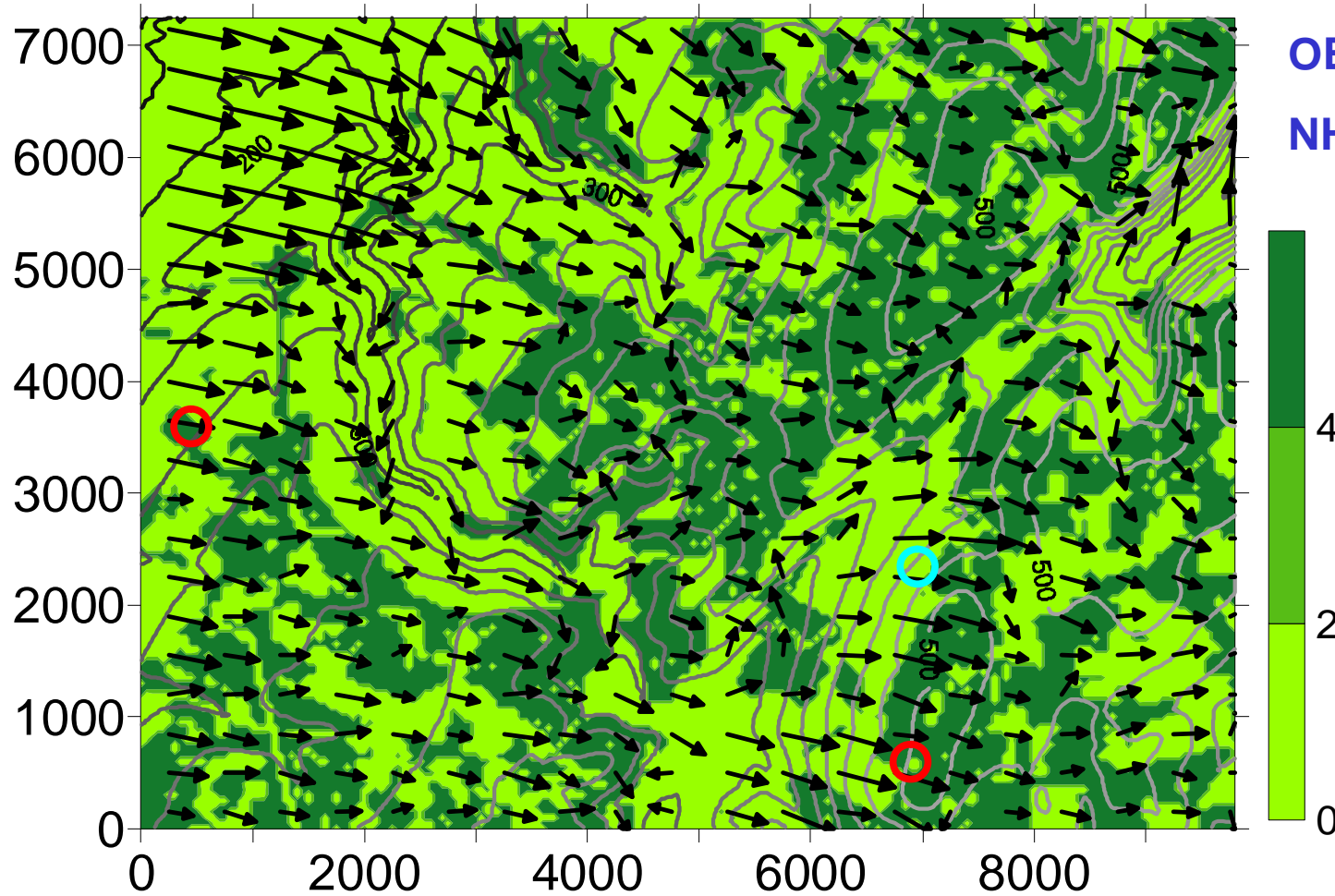
Solling, winter, 285°

Meas. Model

DWD 4.34 4.34

OB 2.11 2.28

NH 2.64 2.51



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Conclusion:

Even if a RCM gives the correct input data for the DWD station, already for the direct surroundings of the DWD station these values are not any more appropriate and representative!

Therefore high resolution modelling is fundamental for reliable impact modelling.

A photograph of a forest stream with large, moss-covered tree trunks and exposed roots. The water is calm and reflects the surrounding greenery. The scene is peaceful and natural.

Acknowledgement

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for Science and culture of Lower
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We gratefully acknowledge this
support.**

**Many thanks for
your attention**

Questions?

