# Estimating the sensitivity and variability of climate impact projections for horticultural models







Holger Hoffmann **Thomas Rath** 





### **Introduction & Motivation**

Impact models are used to assess climatic impacts on horticultural production. Hereby concatenation of climate and impact models is a source of uncertainty. The objective is to quantify this uncertainty and to estimate the time of emergence of the climate impact signal. Hence, the impact signals of 3 horticultural production systems were analyzed

## Methodology

- Climate scenario: A1B
- Climate models: REMO<sup>[1]</sup>, CLM<sup>[2]</sup>, ENSEMBLES<sup>[3]</sup>
- Number of climate runs: 1 13
- Number of impact models: 1 7
- Spatial resolution: 0.1°, 0.2°
- Bias correction: 1d, 2d quantile mapping<sup>[4]</sup>
- for Lower Saxony (Germany) and put in relation to climate model variability.
- Calibration of empirical models with observations
- Estimation of time of emergence<sup>[5]</sup>

### Results

Parameters	Projected changes			
	Climate	Climate impact		
	Air temperature (2 m above ground)	Greenhouse energy consumption <sup>[6]</sup>	Bloom of <i>Malus domestica</i>	Cultivation time of <i>Brass. ol.</i> var. <i>botrytis</i> L.
data & models GCM RCM, no. of runs Impact Model	ECH5REMO 3xECH5CLM 2xENSEMBLES8xbias-corr. 1d	ECH5 REMO 1x Hortex bias-corr. 2d	ECH5REMO 3xThermal-time ± day lengthECH5CLM2xSequential ± day lengthENSEMBLES8xParallel ± day lengthbias-corr. 1dModified Utah	ECH5REMO 3xBlukowinCLM1xbias-corr. 1d



\* Time of emergence after Mann-Kendall tau-b (Sen's method)

### **Discussion and conclusions**

While the time of emergence of projected temperature was estimated with approx. 35 years, for most impact models it is in the range of 50 years. Hereby the dominating source of uncertainty for the near future was the internal variability (0.21 K, 2.7 d), followed by climate run variability. However,

projections for the second half of the 21st century were dominated by impact model properties. Based on these results, ongoing research focuses on establishing robust climate impact projections.



[1] MPI, 2008. http://www.remo-rcm.de/REMO-UBA.1189.0.html [2] Jaeger, Anders, Lüthi, Rockel, Schär, Seneviratne, 2008. Meteorol Z 17, 349–367. [3] http://ensembles-eu.metoffice.com/ [4] Hoffmann, Rath, 2012. Theor Appl Climatol 110, 129-141.

[5] Hawkins, Sutton, 2009. B Am Meteorol Soc 90: 1095-1107. [6] Hoffmann, Rath, 2012. Eur J Hortic Sci 77, 241-248.

#### hoffmann@bgt.uni-hannover.de