Impact of climate change on the water cycle of agricultural landscapes in Baden-Württemberg

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Introduction

For agricultural production and life in general, water is a necessity. To ensure food and drinking water security in the future an understanding of the impact of climate change on the water cycle is indispensable.

Baden-Württemberg is one of Germany's most effected regions by climate change. In addition nearly half of the regions land surface is agriculturally used.

Therefore, the central question of this PhD research is how climate change will alter the regional water cycle of agricultural landscapes in Baden-Württemberg.

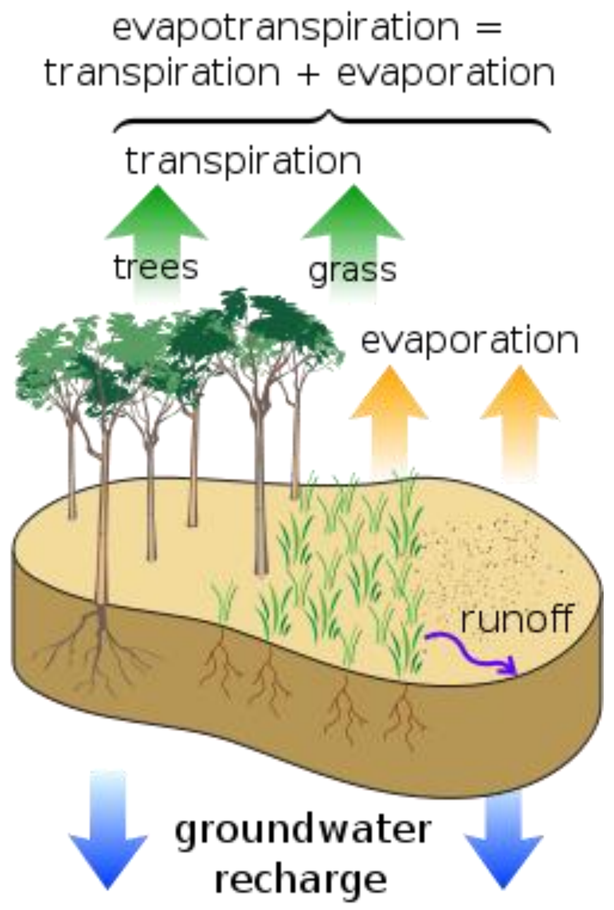

Figure 1: Water cycle of agricultural landscapes (Wikipedia).

Expected results

- **Sufficient model strength → forecasts of future cultivation conditions in Baden-Württemberg**
- **Decrease in water use efficiency**
- **Increasing discharge in winter and decreasing discharge in summer**

Aims

- **Achieving reliable projections about future cultivation conditions**
- **Developing mitigation strategies based on these projections**

Objectives

A) To assess how higher temperatures, higher atmospheric CO2 concentration and changing precipitation patterns will alter water use efficiency of plants and groundwater recharge of agricultural landscapes in Southwest Germany.

B) To asses epistemic uncertainty as well as to identify ensemble members with the best trade-off between model complexity and aleatory uncertainty.

Materials and Methods

A)Setup multi-model ensemble of 24 soil-crop models

→ Agro-ecosystem model package Expert-N

B) Model calibration against measured field data

→Two study sites – Swaibian Alb and Kraichgau 2009 - 2014

→Plant performance data, weather data, soil data, water- and nitrogen content

C) Validation of 24 soil-crop models

D) Uncertainty assessment

→ epistemic for multi-model ensemble

→ aleatory for each soil-crop model

E) Scenario simulations 2015-2050

→ Reliable projections of future cultivation conditions

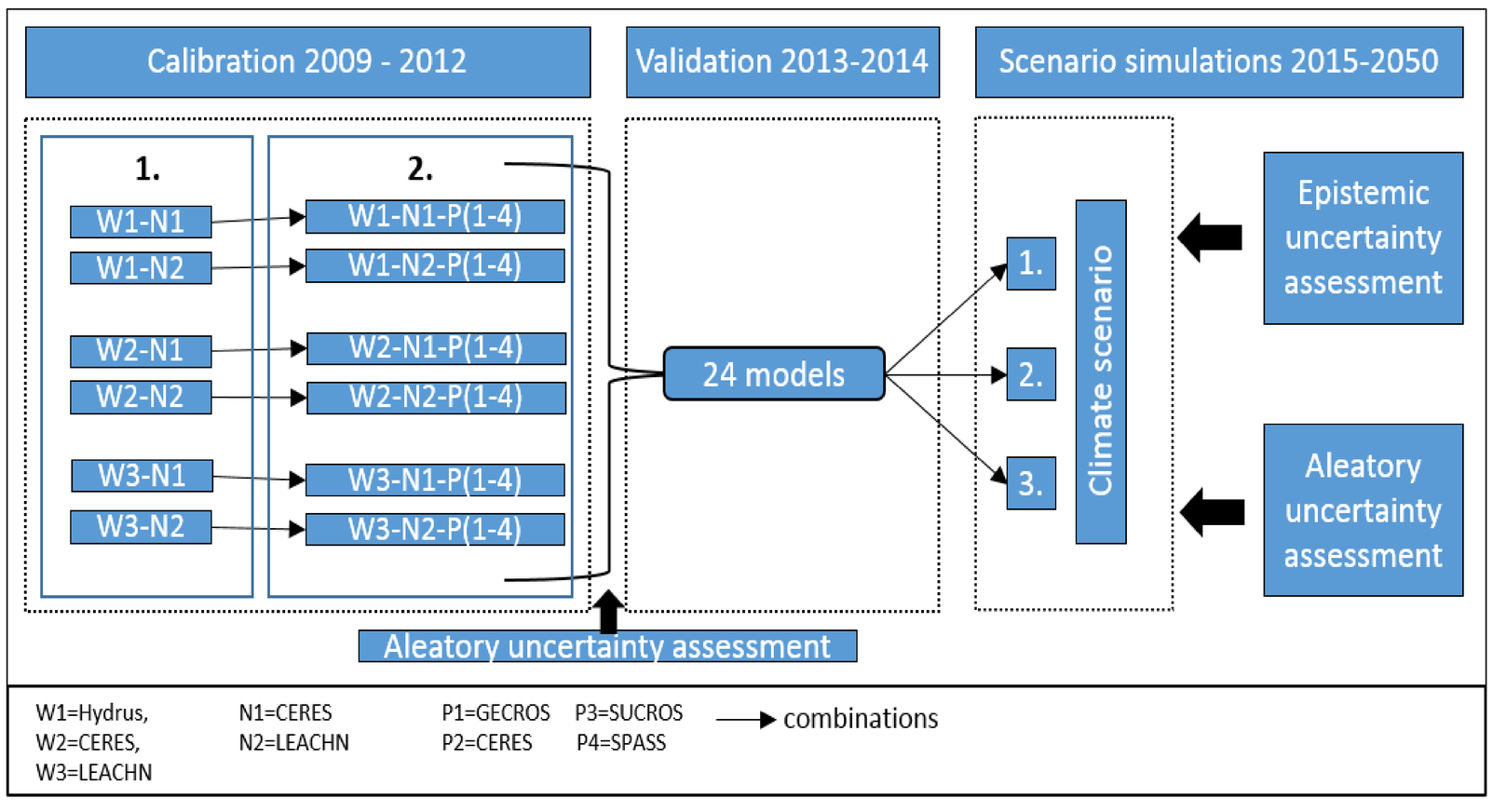

Figure 2: schematic overview of the modeling procedure.

Figure 3: Landscape of study site Kraichgau (Bad Rappenau).

Figure 4: Landscape of study site Swabian Alb (Burladingen).

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