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# High-resolution climate change scenarios for impact studies

## Pests in a future climate as an example

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**Summary**

- Accelerated development of codling moth and increased risk of an additional generation under future climate conditions in Switzerland.
- Application-specific downscaling allows to successfully propagate the climate models uncertainty range into the impact model and test the sensitivity of the latter wrt. climate change.

### 1. Background

Climate change will directly affect agricultural cropping systems by increased temperature and altered precipitation, and indirectly by increased pest outbreaks due to the temperature dependence of the development, reproduction and distribution of arthropods.

***Figure 1.*** *Codling moth larva feeding in an apple.*

Here, we investigated the effect of projected climate change in Switzerland on codling moth (Fig.1), the major insect pest in apple orchards. Such impact studies require a downscaling of the seasonal and regional CH2011 climate scenarios (Fischer et al. 2011) to the relevant temporal and spatial scales. In the example of insects, hourly data are required to adequately model the dependence of the pest development on weather variables (Samietz et al. 2008).

### 2. Methods

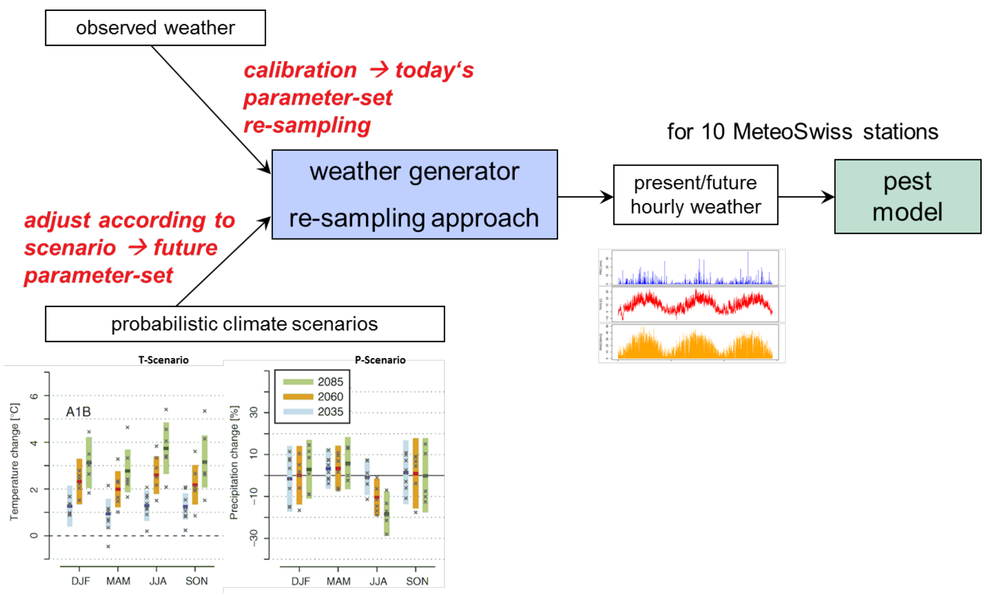


***Figure 2.*** *Overview on the downscaling of the CH2011 Swiss climate change scenarios for pest modeling.*

### 3. Results

- Earlier occurrence and accelerated sequence of codling moth life phases under future climate conditions (Fig. 3).
- Substantial risk for an additional 3rd codling moth generation/year in future climate (Fig. 3 and 4).
- Potential risk for 3rd generation amounts to ~25% – ≥95% in Northern CH as indicated by the climate models' uncertainty range for the 2045–2074 time period.
- Actual future risk will also depend on pace of genetic adaptation (diapause induction) (see poster from Stoeckli et al.).

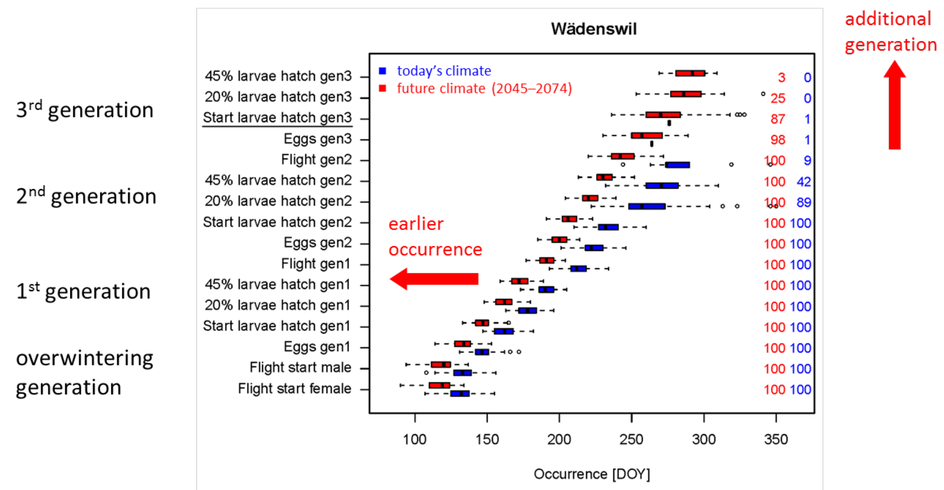


***Figure 3.*** *Occurrences (as day of year, DOY) of important codling moth life phases in the course of the year for present and future climate (1980–2009 and 2045–2074 time periods). The y-axes display the life phases for three generations (denoted "gen1–3") over one year. The boxplots were derived from synthetic weather data representing 100 years in the present and future climate (median signal). The numbers on the right of the panels denote the percentage of years when the respective phase was reached based on the respective climate.*

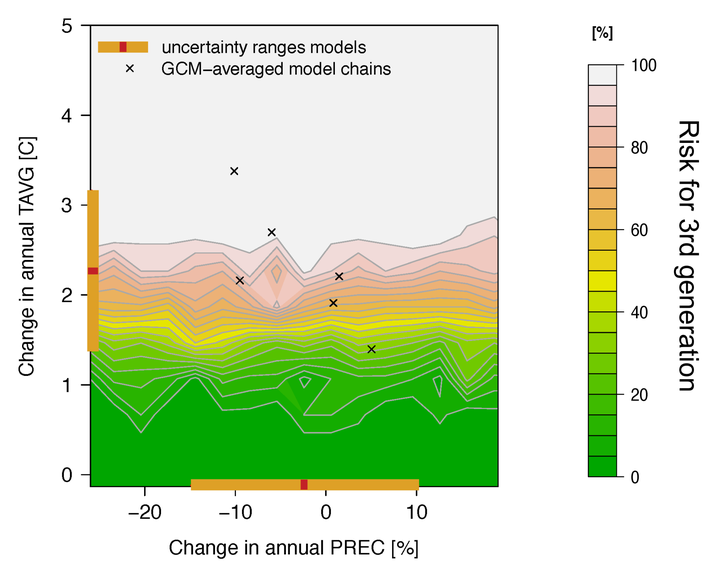


***Figure 4.*** *Impact response surfaces of the potential risk for a 3rd codling moth generation in Wädenswil wrt. to mean annual temperature and precipitation changes. Also shown are the climate models ' uncertainty range of the probabilistic scenarios of the 2045–2074 time period (see Fig. 2).*

**References**

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