Geophysical Research Abstracts
Vol. 14, EGU2012-2892, 2012
EGU General Assembly 2012

Monthly forecasting of agricultural pests in Switzerland

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Given the repercussions of pests and diseases on agricultural production, detailed forecasting tools have been developed to simulate the degree of infestation depending on actual weather conditions. The life cycle of pests is most successfully predicted if the micro-climate of the immediate environment (habitat) of the causative organisms can be simulated. Sub-seasonal pest forecasts therefore require weather information for the relevant habitats and the appropriate time scale. The pest forecasting system SOPRA (www.sopra.info) currently in operation in Switzerland relies on such detailed weather information, using hourly weather observations up to the day the forecast is issued, but only a climatology for the forecasting period.

Here, we aim at improving the skill of SOPRA forecasts by transforming the weekly information provided by ECMWF monthly forecasts (MOFCs) into hourly weather series as required for the prediction of upcoming life phases of the codling moth, the major insect pest in apple orchards worldwide. Due to the probabilistic nature of operational monthly forecasts and the limited spatial and temporal resolution, their information needs to be post-processed for use in a pest model. In this study, we developed a statistical downscaling approach for MOFCs that includes the following steps: (i) application of a stochastic weather generator to generate a large pool of daily weather series consistent with the climate at a specific location, (ii) a subsequent re-sampling of weather series from this pool to optimally represent the evolution of the weekly MOFC anomalies, and (iii) a final extension to hourly weather series suitable for the pest forecasting model.

Results show a clear improvement in the forecast skill of occurrences of upcoming codling moth life phases when incorporating MOFCs as compared to the operational pest forecasting system. This is true both in terms of root mean squared errors and of the continuous rank probability scores of the probabilistic forecasts vs. the mean absolute errors of the deterministic system. Also, the application of the climate conserving recalibration (CCR, Weigel et al. 2009) technique allows for successful correction of the under-confidence in the forecasted occurrences of codling moth life phases.

Reference:
Weigel, A. P.; Liniger, M. A. & Appenzeller, C. (2009). Seasonal Ensemble Forecasts: Are Recalibrated Single Models Better than Multimodels? Mon. Wea. Rev., 137, 1460-1479.