Internship offer

Stochastic Weather Generators to evaluate climate change impact on apples

Main adviser: David Métivier is permanent INRAE junior researcher (*chargé de recherche*).

When: Starting February 2025 (flexible) for 4 to 6 months.

Location: UMR MISTEA (Mathematics, Informatics, and Statistics for Environment and Agronomy), 2 Pl. Pierre Viala, 34000 Montpellier, France

Teasing: Study the present and future climate variability and its impact on the blooming date of Apple and Vine trees.

Contact: Please send your application with a CV and a few motivational lines to: david.metivier@inrae.fr. You can add link to scientific (unrelated) projects you did, if any. Don't hesitate to ask questions about the internship (**do read the whole announcement first!**).

Context

Climate change is causing increasingly significant disruptions in the phenological cycles of many plants, particularly fruit trees and grapevines. These changes, such as early blooming or shortened dormancy periods, impact agricultural yield and production quality. Phenological models help predict dormancy break and flowering dates based on the weather. However, they typically underestimate the climate variability, which is challenging to anticipate using traditional weather forecasts. To model this variability, one can use Stochastic Weather Generators (SWG). These are statistical models specifically designed and trained to generate realistic weather sequences, even extreme ones. Coupling phenological models with SWGs trained with climate change scenarios could help us measure the future risks in agronomy.

Internship objectives and expected work

This internship aims to develop a coupled model between a spatial Stochastic Weather Generator for temperature and phenological models for apple and grapevines. Once the prototype is done, its results will be analyzed using different climate scenarios. The intern will work on:

1. **Stochastic Weather Generator** Review the literature and adapted models. Here are some related keywords: ***Stochastic processes***, ***Hidden Markov Models***, Autoregressive models, Copulas, Geostatistics. Select and train a model to generate realistic temperature series, even for extreme events.

2. **Phenological modeling** Coding and understanding some pre-existing phenological models for apple and grapevine.

3. **Results** Coupling the previous models and analysis the output with different climate i.e. different France regions and different IPCC climate change scenarios.

Perspectives   The results of this work may be published in scientific articles and serve as the basis for a prototype to develop a serious game on climate change awareness.

Required Skills

- Strong knowledge in mathematical modeling and statistics.

- Skills and interest in scientific programming. The programming language will be **Julia** (no prior knowledge required, but at least look up what it is).

- Interest in agronomy and/or climate issues.

Terms of the internship

The intern will work at the MISTEA lab with David Métivier and Benedicte Fontez and also collaborate with the AGAP lab (same campus) specialized on phenological modeling with Jean-Jacques Kelner, Isabelle Farrera. The student receives a "*gratification*" around 600€/month. The canteen is subsidized. We can help students find housing, but we sadly cannot pay for it, nor pay for the trip to Montpellier.