ArtisaneFood Meeting

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Bonjour!

- I am Subhasish Basak
- PhD student (1st year) at L2S, CentraleSupélec and ANSES
  - Supervisors: Prof. Emmanuel Vazquez (L2S) & Prof. Julien Bect (L2S) & Dr. Laurent Guillier (ANSES)
- My thesis is a part of the project ArtisaneFood
- This project is in collaboration with CNIEL and Actalia
- Objectives
  - Build sequential strategies for estimating and optimizing the quantities of interest
  - Propose methodological recommendations to the industry

AQR simulator(Perrin et al. 2014)

- A stochastic quantitative microbial risk assessment model
- Estimates the risk of HUS from raw milk cheese consumption

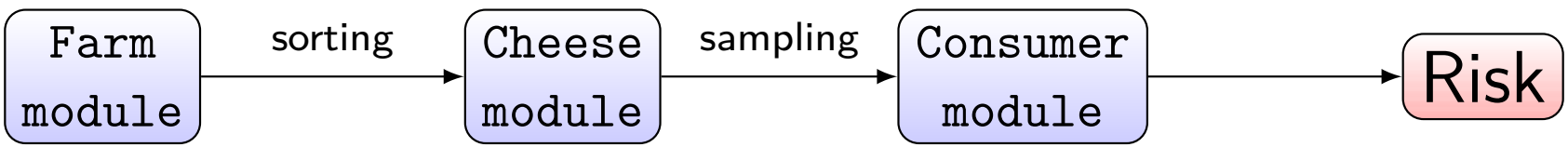


Figure 1: structure of the simulator

- Uses ODEs to model the growth of STEC in raw milk cheese
- Estimation of risk with the simulator takes several hours of computational power

AQR simulator

- Interventions
  - Preharvest: milk sorting
  - Postharvest: cheese sampling
- Quantities of interest (QoI)
  - No. of farms discarded (due to sorting)
  - No. of batches discarded (due to sampling)
  - Risk of HUS
- Modules contain both stochastic & fixed inputs
- Control variables: inputs used to control the QoI

Farm module

Control variables in the sorting step

- How often milk is tested$= 10$ days
- Threshold for milk sorting$= 50$ E.Coli cells

Outputs of interest from the farm module

- STEC concentration in CFU/mL
- Milk loss (due to sorting)
- Total milk utilized (after sorting)
- No. of farms discarded (due to sorting)

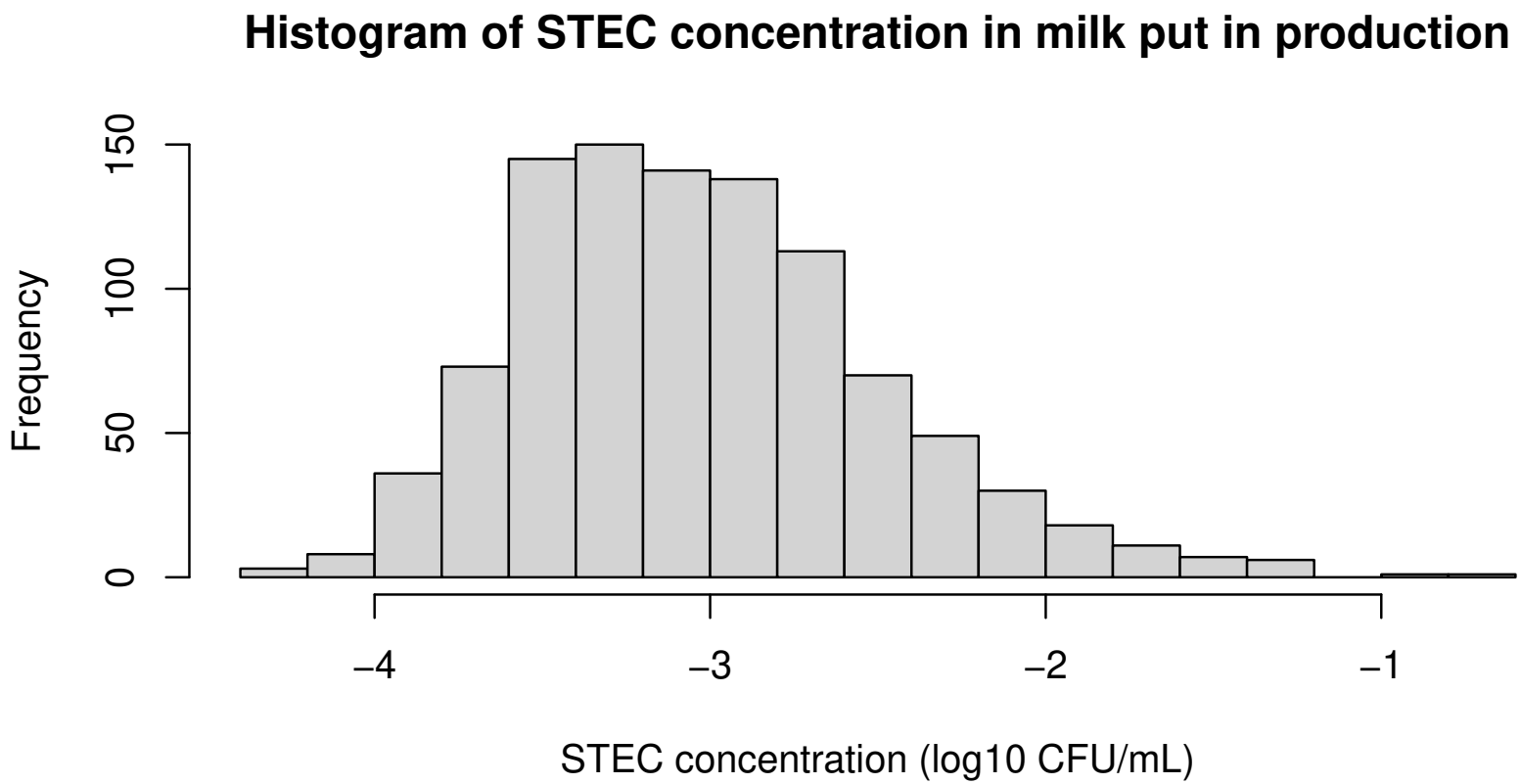


Figure 2: Distribution of STEC

Cheese module

Control variables in the storage step

- Storage temperature
- Storage duration

Outputs of interest from the cheese module

- No. of cheeses produced
- No. of colonies per cheese
- Final STEC concentration per cheese

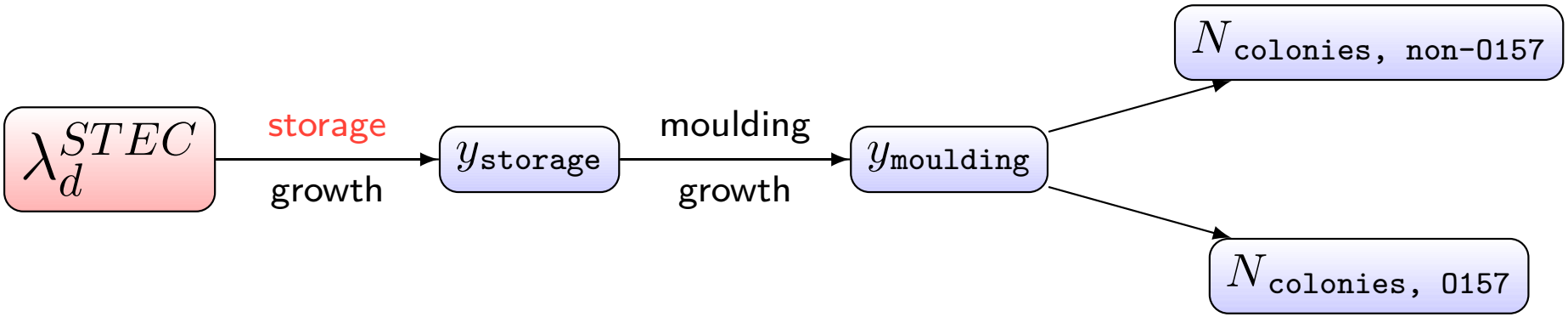
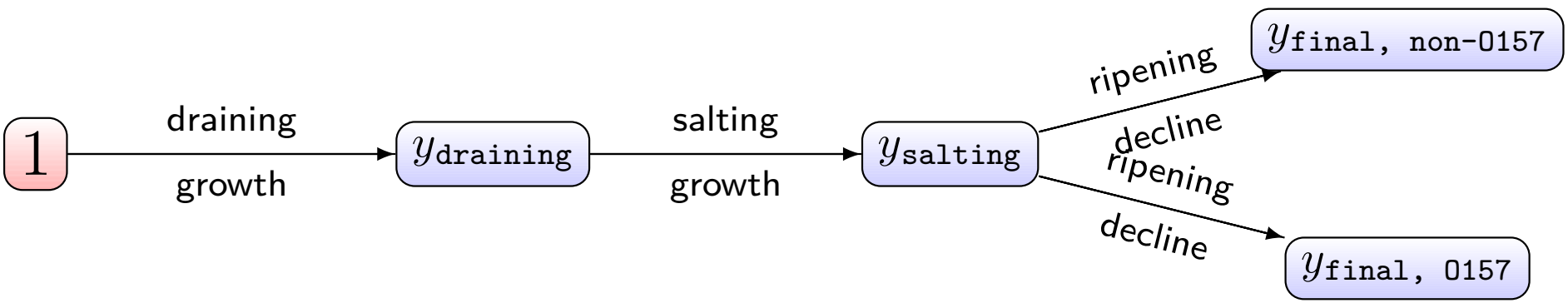


Figure 3: cheese module



Consumer module

This module computes the final risk.

- Computes the dose $D = \sum_{strain} N_{\text{colonies, strain}} \times y_{\text{final, strain}}$
- Risk of HUS per batch

$$R_{\text{batch}} = \sum_{age=1}^{15} g(age) \int_0^{\infty} [1 - (1 - r_{\text{age}})^D].f(D).dD \tag{1}$$

- Overall risk of HUS

$$R = \int_0^{\infty} R_{\text{batch}}.f(\lambda_d^{STEC}).d\lambda_d^{STEC} \tag{2}$$

Postharvest intervention

- Sampling is done at the end of the ripening phase.

Control variables in the sampling step

- Number of test portions
- Mass of each test portion

Output of interest

- Probability of rejecting a batch

Ongoing work and perspectives

- Current work
  - Implementation of the AQR simulator in R
- Next steps
  - Validation of the model
  - Finalization of the control variables and constraints
  - Formalization of the optimization problem