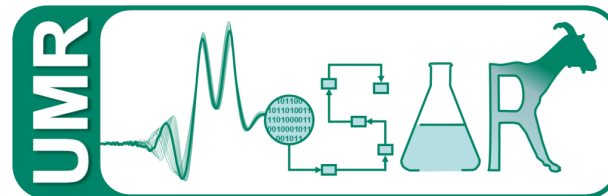


Influence of climatic conditions on lactation dynamics in dairy goats

A. HARNOIS GREMMO ^{1,2}, N. Gafsi ^{1,2}, F. Bidan ², O. Martin ¹, L. Puillet ¹

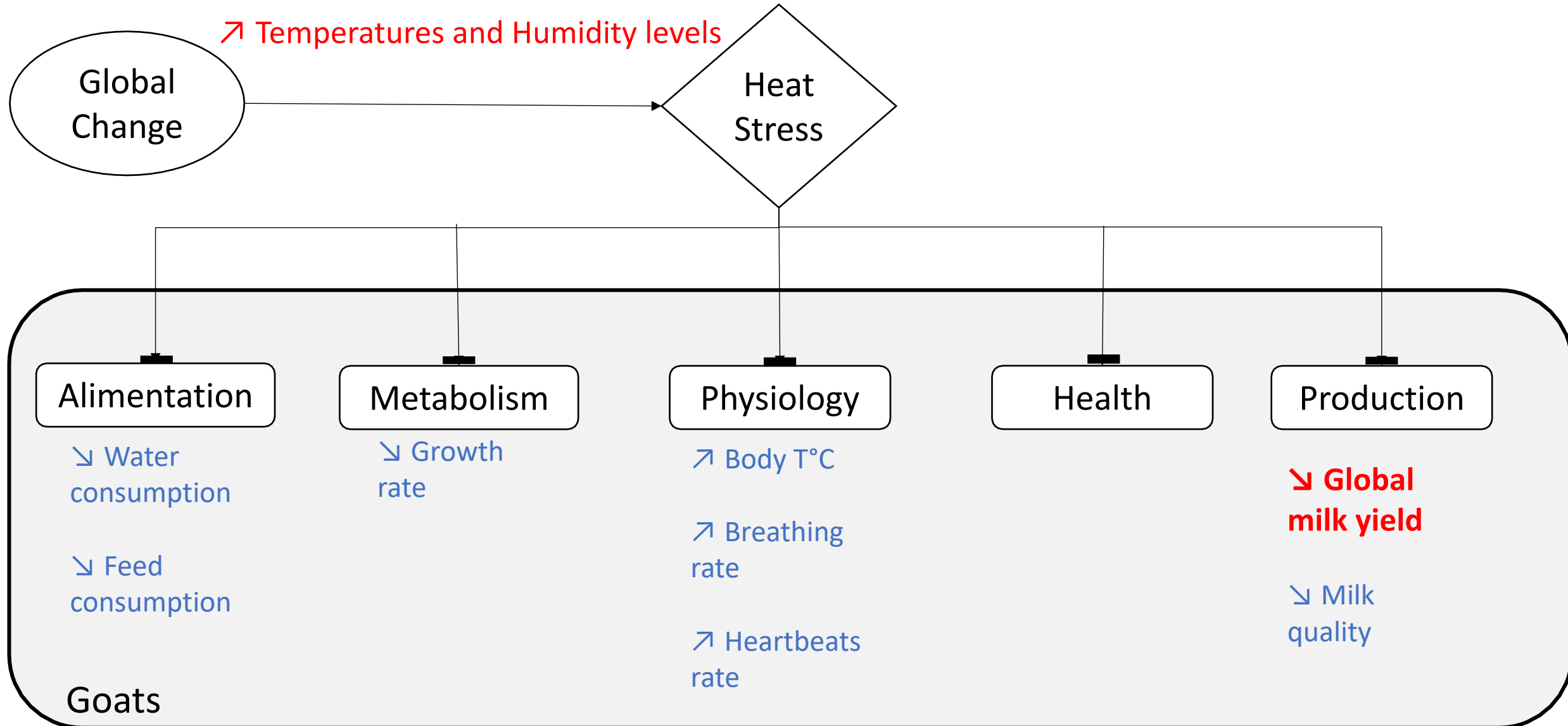
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Context





Research Question

Do climatic disruptions, observed in temperate zones, contribute to perturbations in milk production in goats?

Objectives

- Identify animal factors affecting the perturbation in milk production
- Put in light the influence of climatic conditions on lactation dynamics



Methods

Grignon, French experimental farm :

649 goats (1 608 lactations) from 2006 to 2021

Goat characteristics

- Breed : Alpine and Saanen
- Parity : (Min) 1 to (Max) 9

Milk production

Daily lactation data

Fitted using Perturbed Lactation Model (PLM)

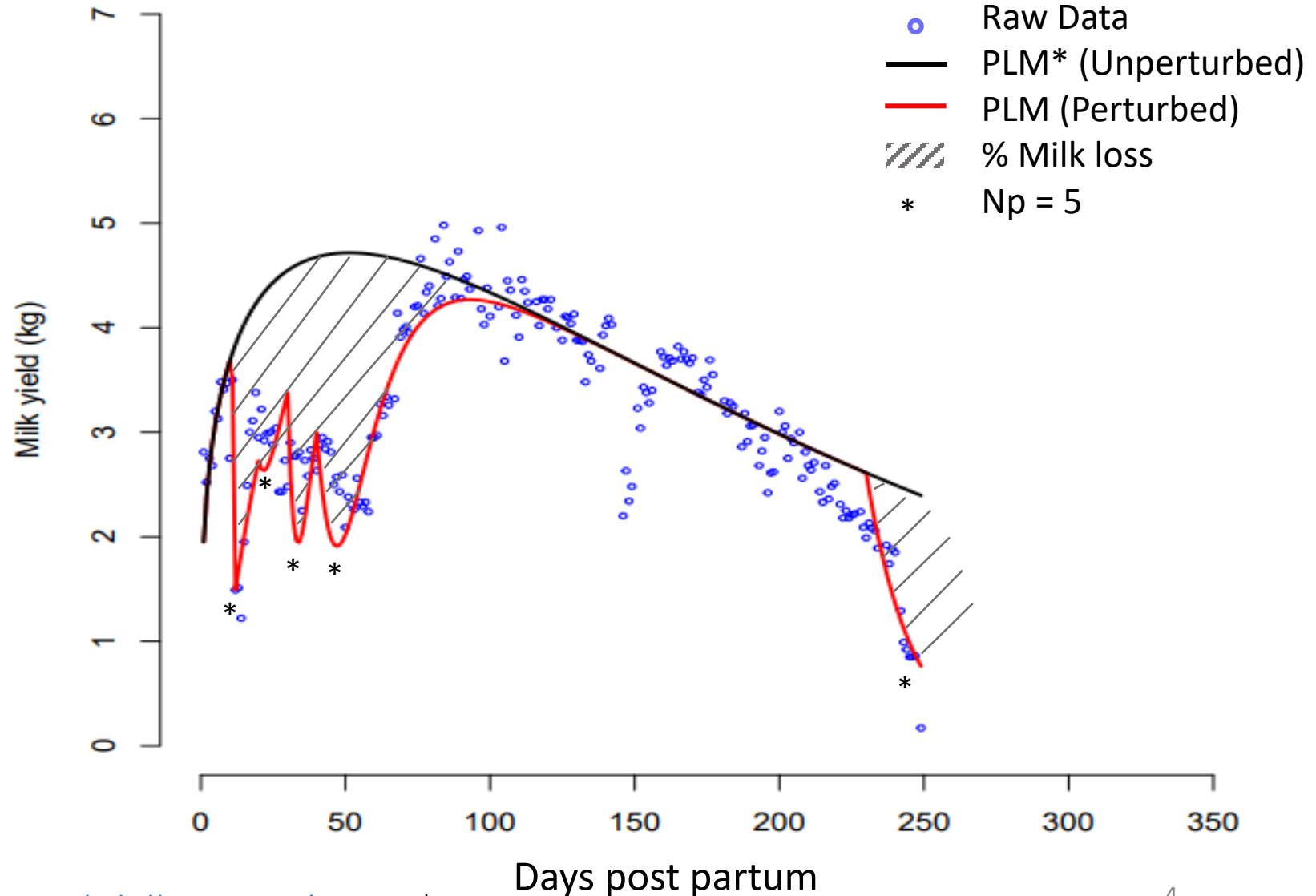
Unperturbed curve (Wood,1967)

Perturbed curve

Number of perturbations (N_p)

% Milk loss

Perturbation characteristics



(Ben Abdelkrim et al. 2021)



Methods

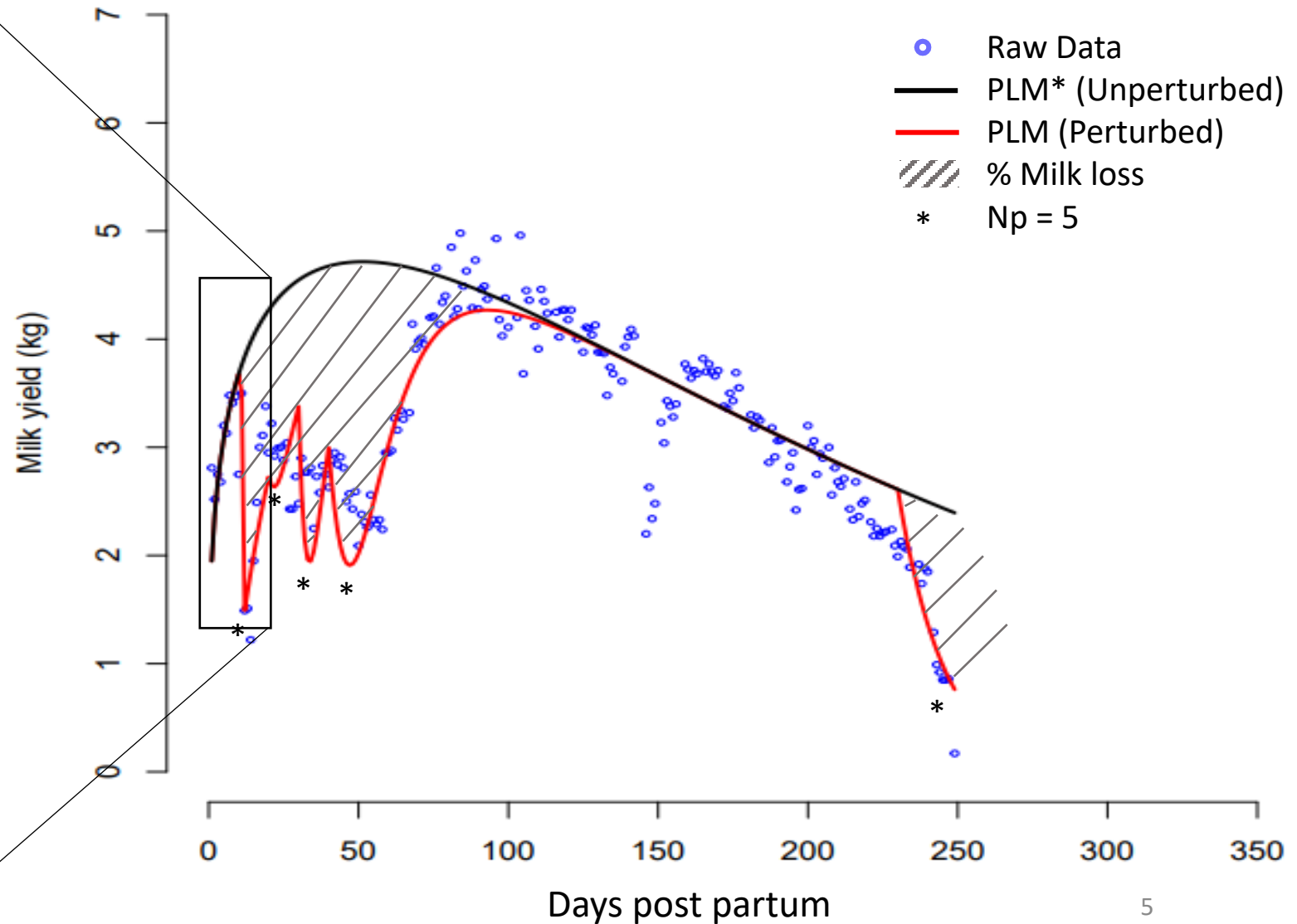
(Ben Abdelkrim et al. 2021)

ktps : time of the beginning of the perturbation

k0 : Intensity

k1 : Collapse Speed

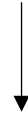
k2 : Recovery Speed





Methods

Outside Temperature and Humidity data from Plaisir Grignon station (SICLIMA database)



Climatic indicators

- Temperature and Humidity Index (THI)
 - Daily average temperatures
 - Daily maximal temperatures
- THI 1 : [West \(1994\)](#)
- THI 4 : [Finocchiaro and al. \(2005\)](#)



Classification into 4 levels of stress

- Heat Stress
 - Severe
 - Moderate
- Neutral
- Cold Stress



Methods

Step 1 : Multivariate analysis at lactation level

Milk Loss = μ + Np + parity + breed + parity*breed

Number of perturbations = μ + breed + parity + breed*parity + year

Step 2 : Multivariate analysis at week scale to better understand the effects of climatic conditions

Weekly Milk Loss = μ + lactation stage + type of stress + animal effect

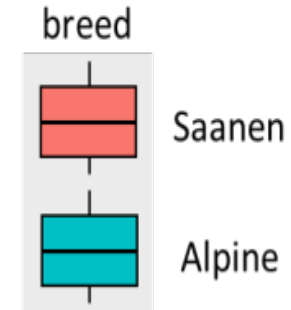
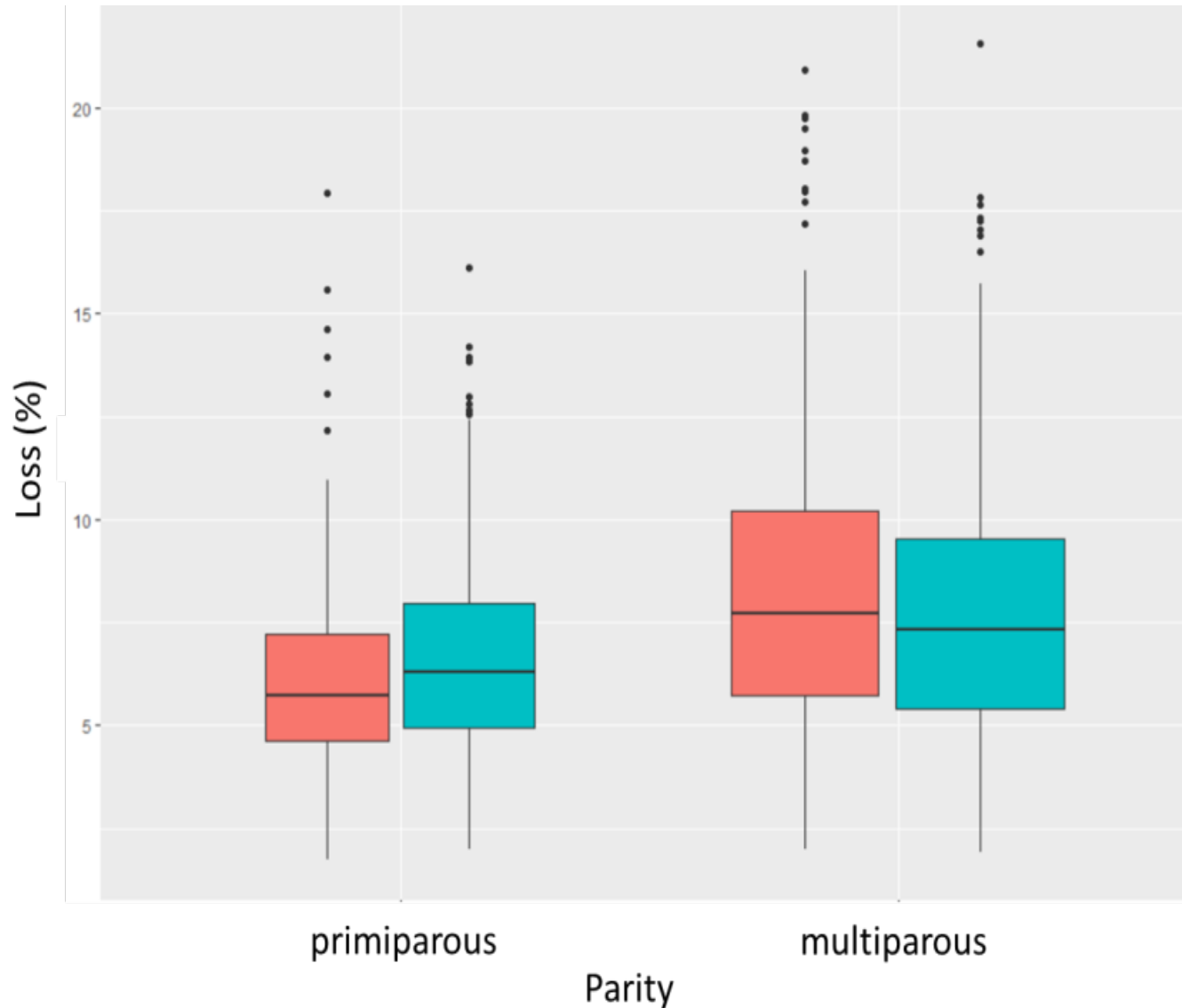
Step 3 : Analysis at the perturbation level

→ **Do dates of perturbations corresponded with episodes of climatic stresses?**

→ **Can the characteristics of a perturbation be explained by goat characteristics and episodes of climatic stresses?**

Perturbation characteristic = μ + breed + parity + lactation stage + type of stress + animal effect

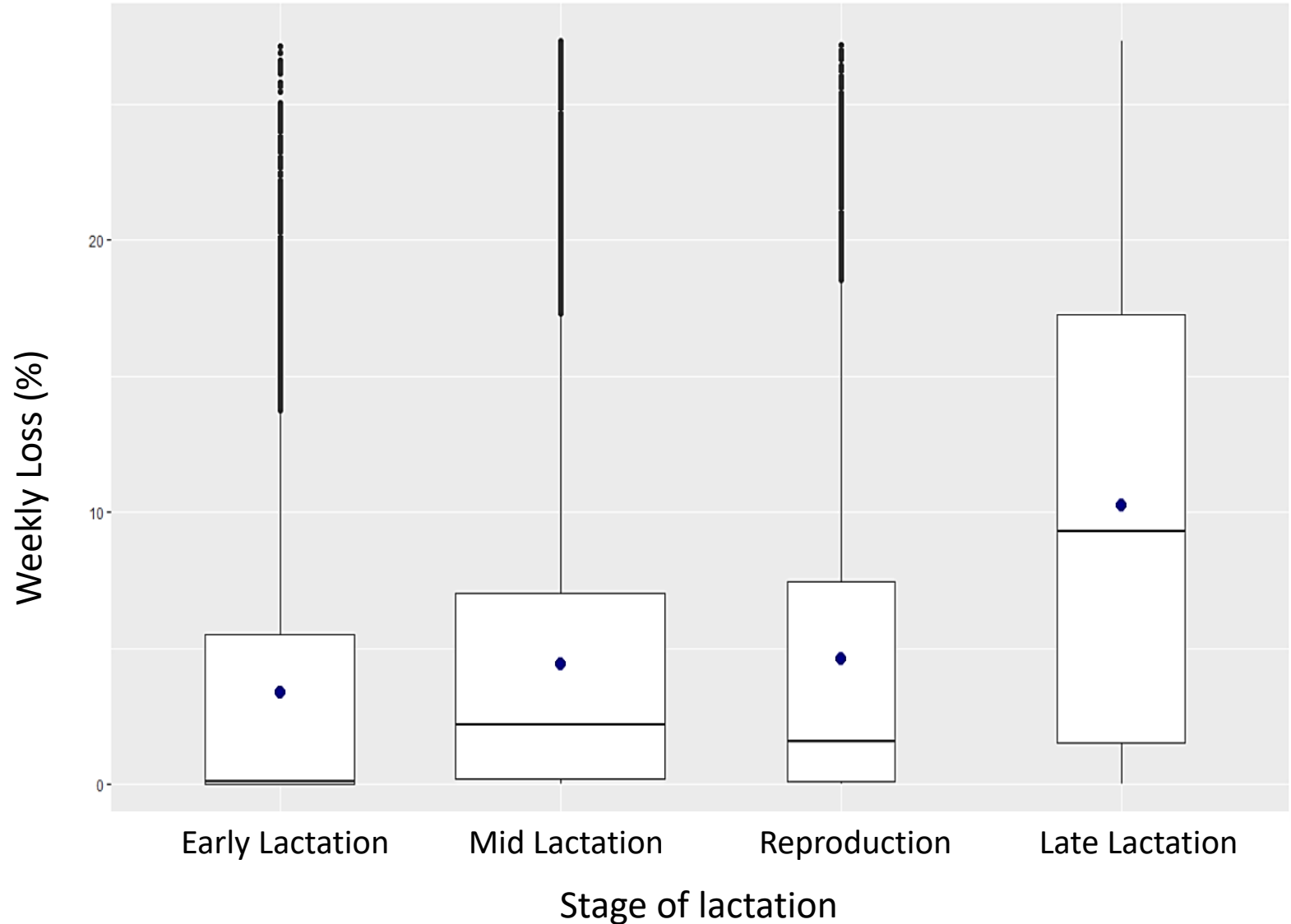
Results – At lactation level



% Loss

- ↗ Loss with ↘ Np
- Multiparous > Primiparous
- Saanen = Alpine
- $(\text{Alpine})_{\text{primiparous}} > (\text{Saanen})_{\text{primiparous}}$;
 $(\text{Alpine})_{\text{multiparous}} < (\text{Saanen})_{\text{multiparous}}$

Results – At calendar week level

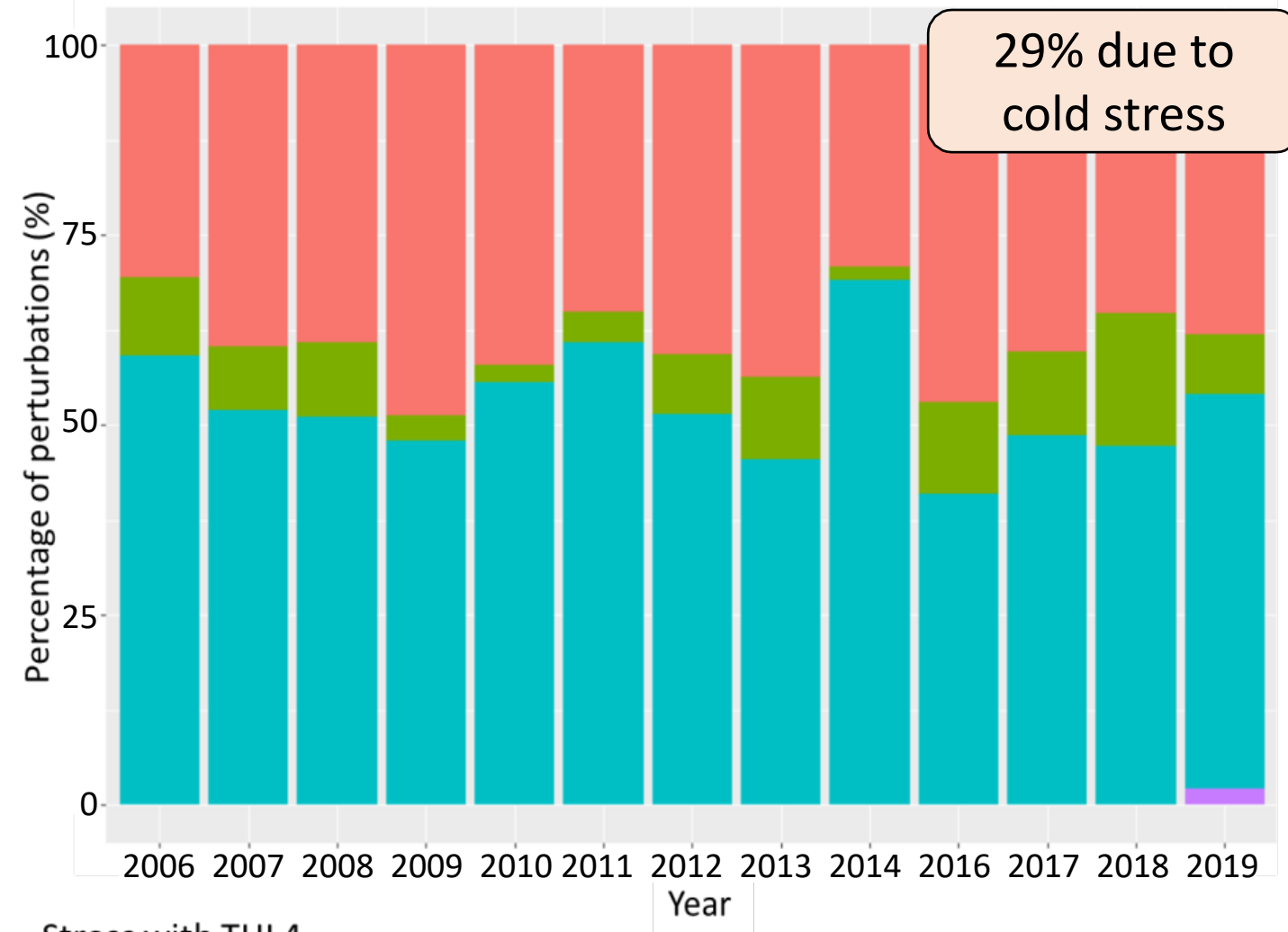


Weekly % Loss

- $(LOSS)_{Late\ Lactation} > (LOSS)_{Reproduction}$
 $> (LOSS)_{Mid\ Lactation} > (LOSS)_{Early\ Lactation}$
- Week Loss is affected by cold stress
- Individual Variability



Results – At perturbation level



Stress with THI 4

Cold Stress

Moderate Heat Stress

Neutral

Severe Heat Stress

29% due to cold stress

Collapse Speed (k1)

- $(k1)_{\text{Early Lactation}} = (k1)_{\text{Mid Lactation}} >$

$(k1)_{\text{Reproduction}}$

- $\nearrow k1$ with \nearrow Heat stress events

- Individual Variability

Intensity (k0) and Recovery Speed (k2)

- $(k0)_{\text{Primiparous}} < (k0)_{\text{Multiparous}}$

- $(k2)_{\text{Primiparous}} > (k2)_{\text{Multiparous}}$



Take Home Message

Animal factors

- Saanen = Alpine
- Primiparous : Less milk loss but more perturbations / Lower intensity and better recovery

Climatic conditions influenced perturbations

- Cold stress increased weekly milk loss
- Heat stress led to high collapse speed
- Half of detected perturbation not linked with stress



Perspectives

- Use climatic data inside the building
- Develop thresholds more adapted to goats
- Analyze within each lactation stage
- Use a specific model for drying off to not detect it as a perturbation



THANKS FOR YOUR ATTENTION