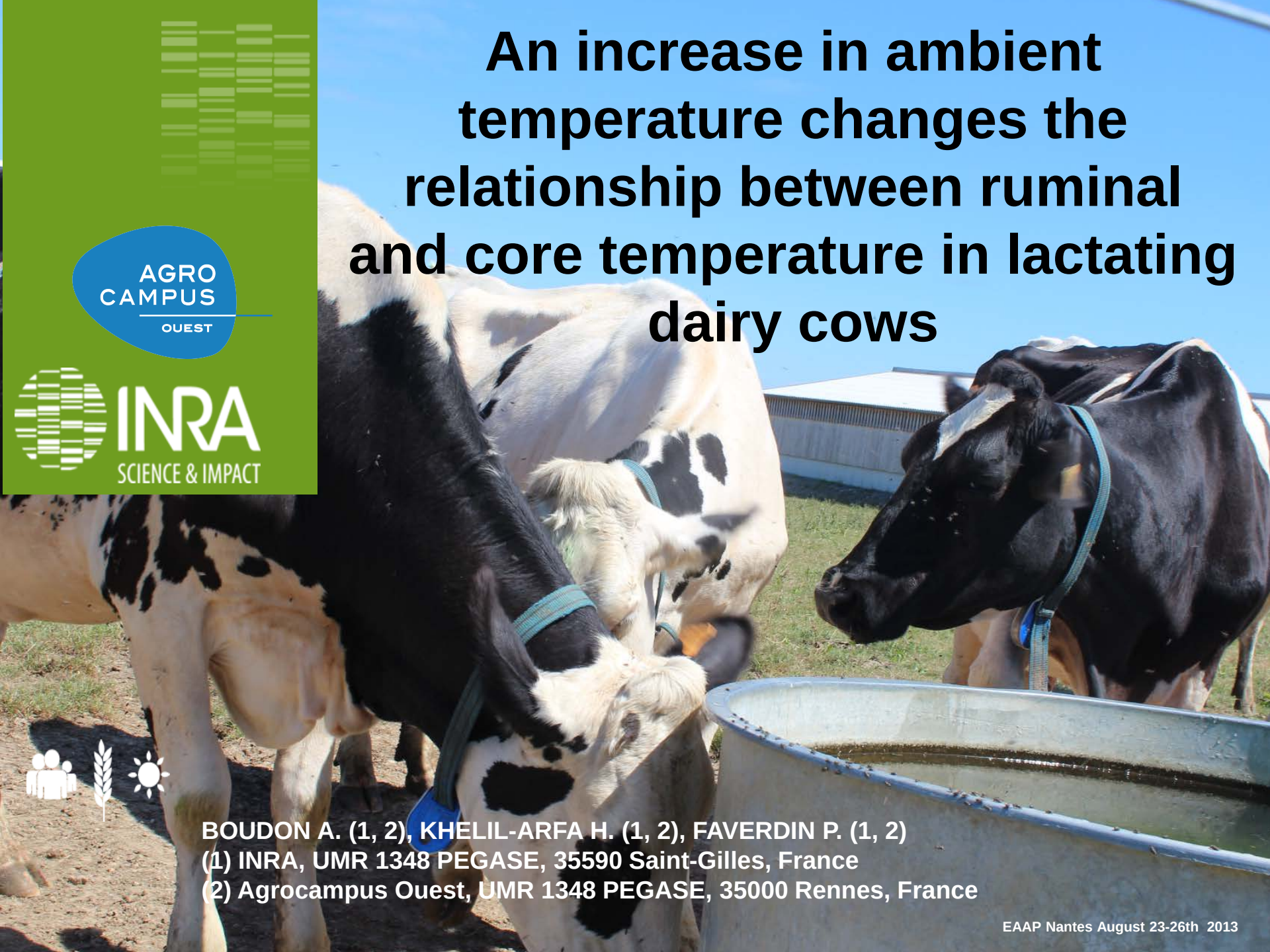
An increase in ambient temperature changes the relationship between ruminal and core temperature in lactating dairy cows



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EAAP Nantes August 23-26th 2013

Automatic monitoring of ruminal temperature

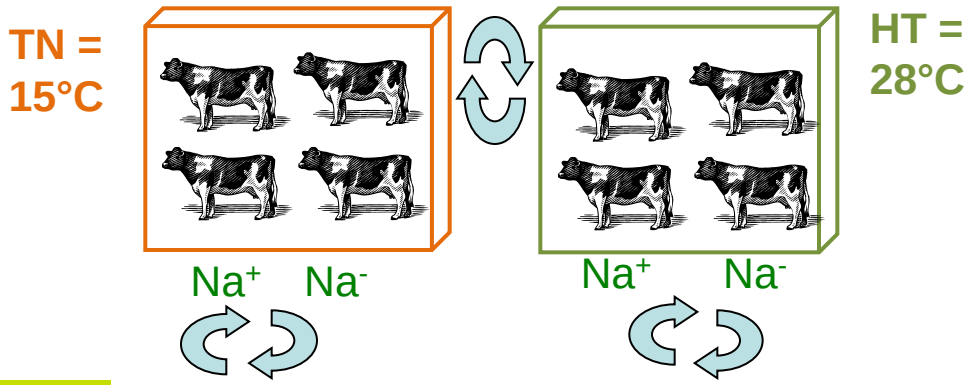
Introduction

- Automatic monitoring of ruminal temperature dynamics could be a promising tool in dairy farms for detection of physiological disorders, estrus or heat stress in dairy cows.
- However, a systematic question is to determine how variations of the ruminal temperature could be representative of those of body core temperature?
- Particular situation of heat stress = difficulties of thermoregulation and possible increase of body core temperature.
- An objective of the presented experiment was to study the relationship between body core temperature and ruminal temperature during a heat challenge in dry and lactating dairy cows.

Materials and methods: experimental design

- 4 treatments = 2 ambient temperatures (15 °C TN or 28°C HT) × 2 diet sodium contents (0.15 or 0.55 g/kg DM),
- 4 dry and 4 lactating Holstein cows, fed on a TMR based on maize silage. 99 DIM for the lactating cows at the beginning of the experiment. Non acclimated animals.
- 4 periods of 15 days according to 2 Latin squares (1/physiological stage).

2 climatic chambers with thermostatic control of ambient temperature. Temperatures maintained constant along the day. 2 dry and 2 lactating cows in each chamber.

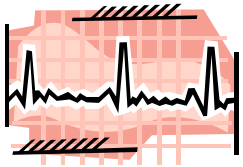


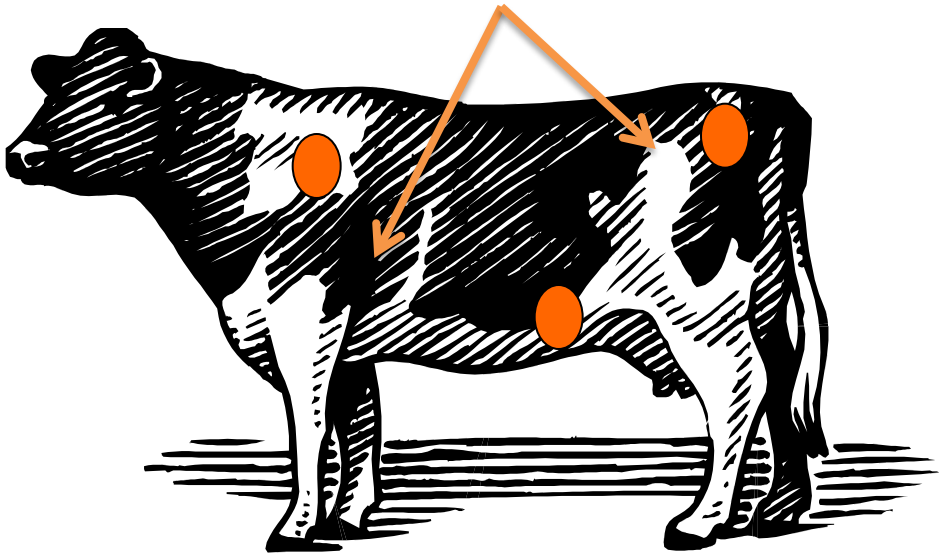
Only the effects of the ambient temperature will be presented.

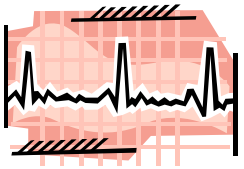
Material and methods : Measurements

Daily dynamics of ruminal and vaginal temperatures (1 measure/15 minutes, probes Vel'Phone and ThermoBolus, Medria S.A., Châteaugiron, France)

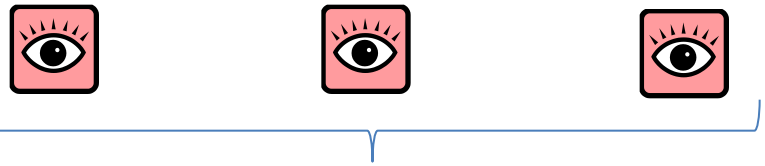
Drinking and feeding behaviours recorded each minute







Respiratory rates **Heart rates** **Surface temperatures**



3 points/day (8:00, 15:00, 21:00)

Results: thermal environment

Daily Averages	TN Thermoneutrality	HT High Temperature
Ambient temperature (°C)	15.5	28.4
SE of hourly ambient temperature / period	1.44	1.01
Relative humidity (%)	54.3	28.9
Temperature-Humidity Index (Mader et al. 2006)	59.4	73.2

Mild heat stress ?

Results: A huge effect of high temperature on DMI and MY of lactating cows

	Dry			Lactating			
	TN	HT		TN	HT		SEM
Dry Matter Intake (kg/d)	13.9	13.9	ns	21.1	18.8	**	0.47
Milk Yield (kg/d)				30.7	28.7	†	1.34
Milk DM content (g/100 g)				12.1	11.9	***	0.24

Results: Body core temperature regulation was partially impaired in lactating cows submitted to high temperature

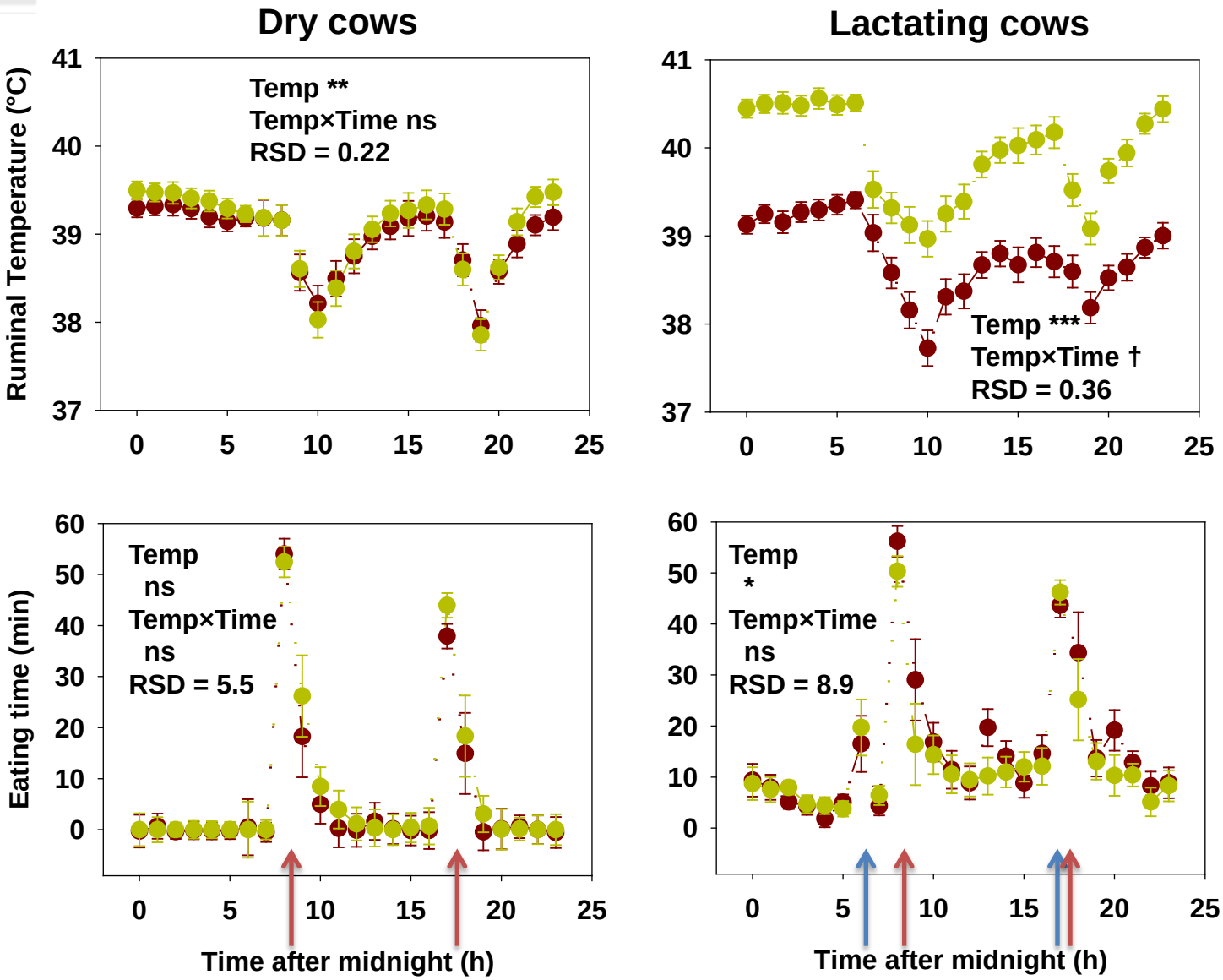
	Dry			Lactating			SEM
	TN	HT		TN	HT		
Repiratory rate (/min)	23.1	40.3	***	22.7	49.3	***	2.85
Vaginal temperature (°C)	38.3	38.4	*	38.4	39.4	***	0.09
Heart rate (°C)	59.1	56.6	ns	67.6	60.7	*	4.31

A drop in ruminal temperatures during the meals (?)

Results

TN

HT



Feed distributions

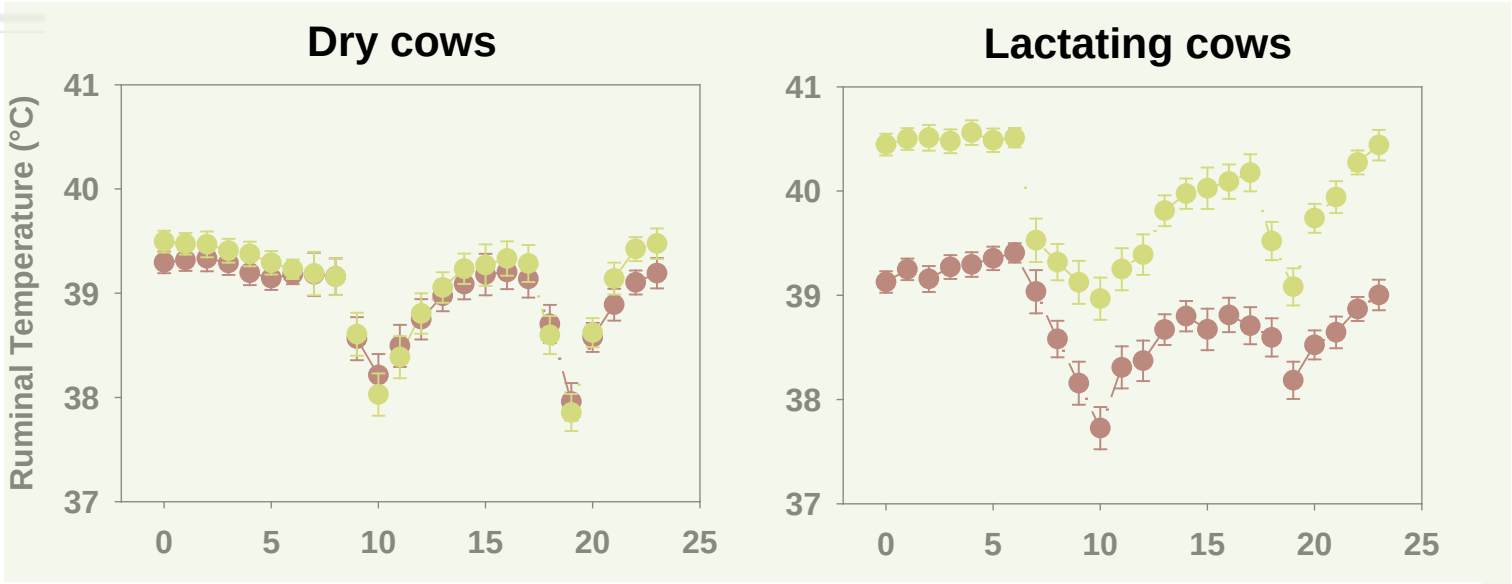
Milkings

Drinking bouts and ruminal temperatures

Results

TN

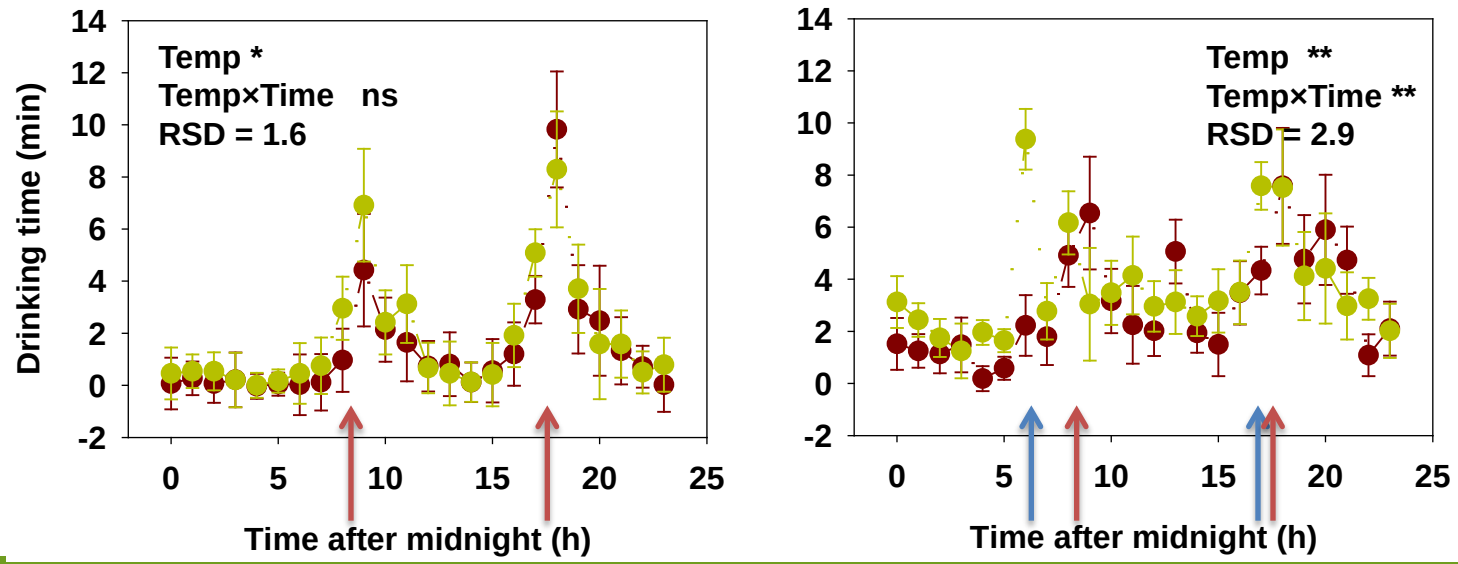
HT



Water Temperature = 8.3°C

Feed distributions

Milkings

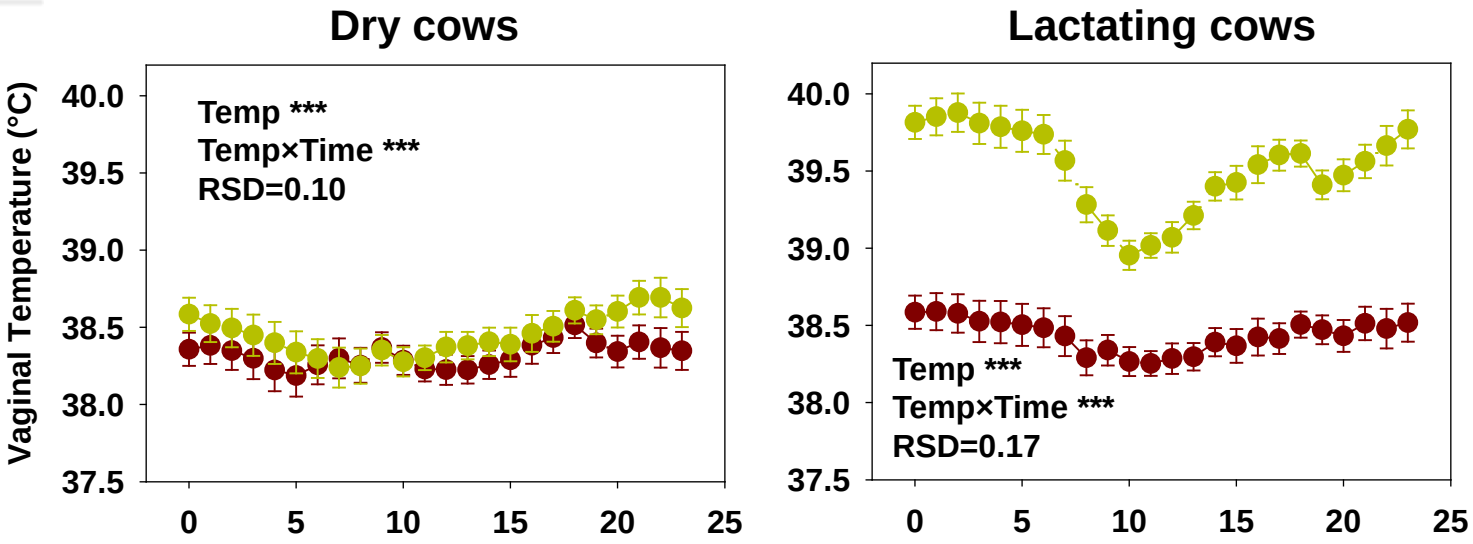


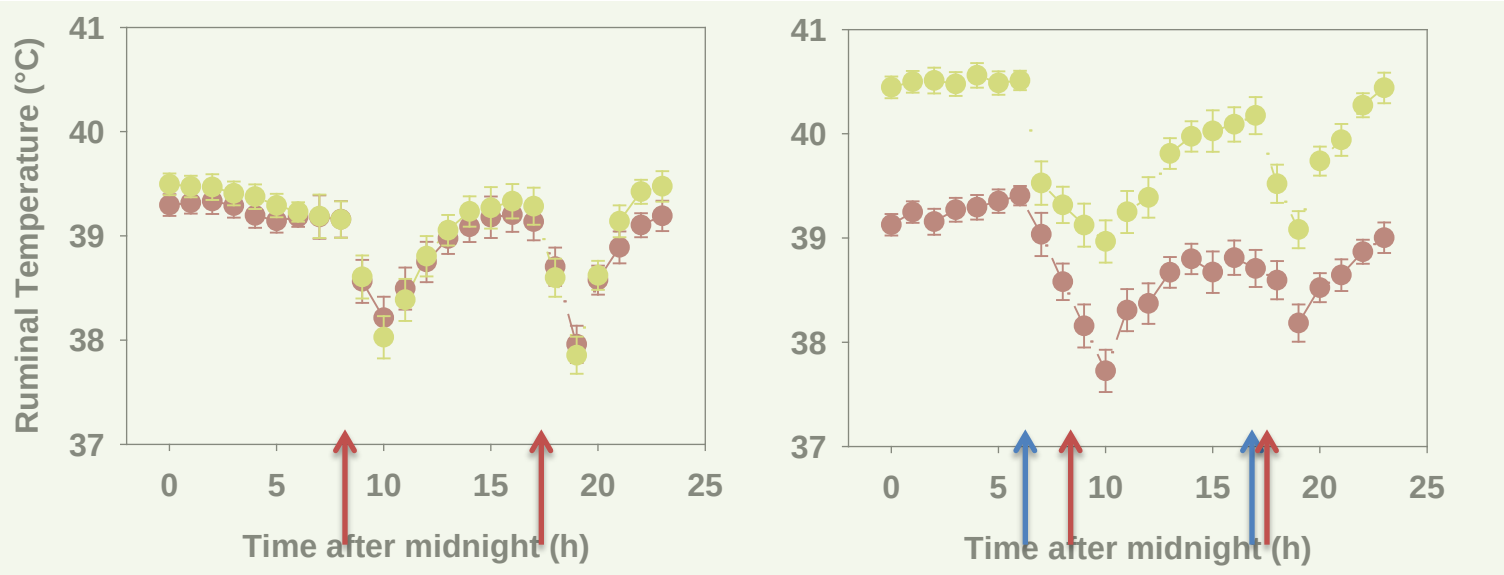
The relationship between ruminal and vaginal temperatures

Results

TN

HT





Feed distributions

Milkings

Conclusions

- This study confirmed that drinking events are major perturbations of ruminal temperature patterns.

- The ruminal temperature increased during heat stress and thus can be an indicator of heat stress, but the relationship between ruminal and body core temperature is perturbed in this specific situation.

- This study clearly illustrates that ingested cold water can constitute a heat sink for the body of cow with thermoregulation difficulties. Then, offering cold water could be a real help to heat dissipation in heat challenged cow. From a practical point of view, this could be obtained by favoring watering with water bowl plugged on the public service water during heat episodes.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Thank-you for your attention !
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EAAP Nantes August 23-26th 2013