Assessing meteorological conditions effects on MIR predicted methane emissions of Holstein cows under a temperate environment

M.-L. Vanrobays[1], N. Gengler[1], H. Soyeurt[1], P.B. Kandel[1] & H. Hammami[1,2]

[1] Department of Agricultural Science, Gembloux Agro-Bio Tech, University of Liege, B-5030 Gembloux, Belgium

[2] National Fund for Scientific Research (F.R.S.-FNRS), B-1000 Brussels, Belgium

Contact: mlvanrobays@ulg.ac.be

GGAA·2013 DUBLIN IRELAND

Poster 488

Background

- Need to mitigate enteric methane (CH_4) emissions produced by ruminants
- CH_4 emissions could be partly influenced by meteorological conditions
  (Lassey, 2007, Agr. Forest. Meteorol. 142: 120-132)
- Temperature Humidity Index (THI)
  - Index to assess temperature & humidity of the day

Objective: To assess the impact of meteorological conditions on CH_4 emissions of Holstein cows

Conclusions

- Permanent environmental & year of calving x herd variances evolve largely with THI
- THI seems to affect CH_4 emissions of dairy cows

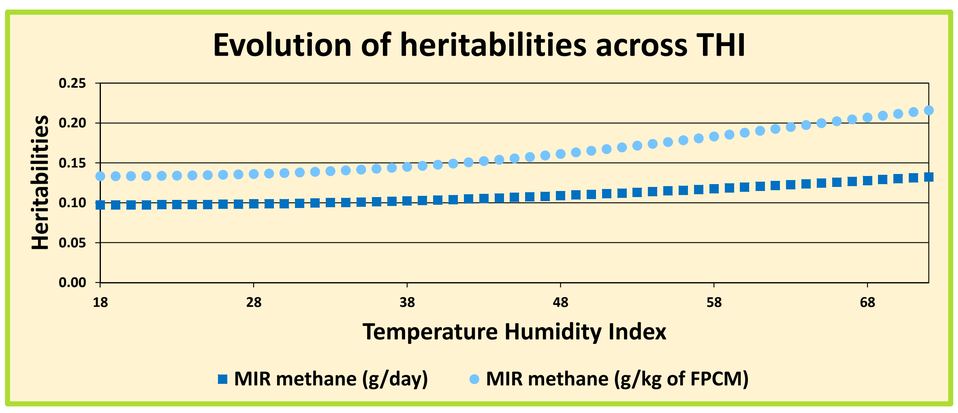
Results

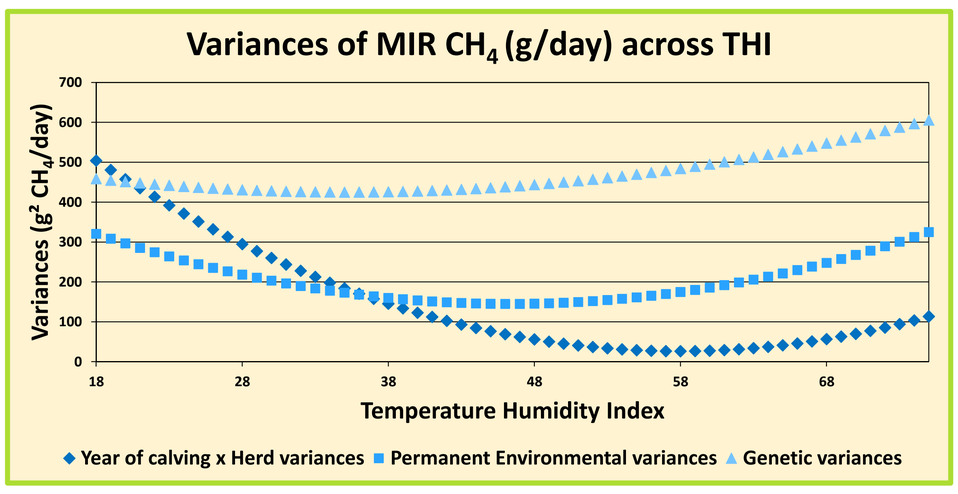
Table 1. Descriptive statistics of the dataset

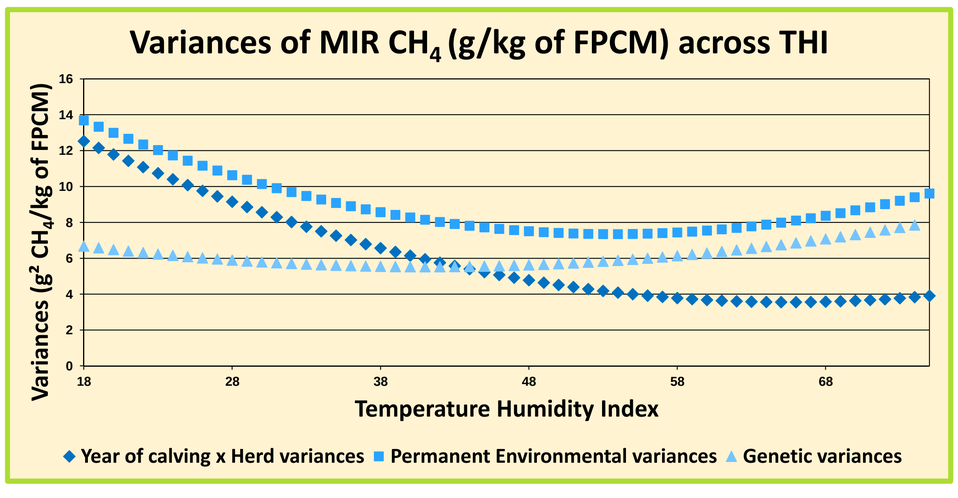
Traits (N=257,635)	Mean	SD
MIR CH_4 (g/day)	558.05	89.89
MIR CH_4 (g/kg of FPCM)	25.64	7.76
THI	48.63	10.06

Table 2. Variances of the slope relative to the variances of the intercept associated to THI

Traits (N=257,635)	YxH	PE	G
MIR CH_4 (g/day)	3.71	1.23	0.21
MIR CH_4 (g/kg of FPCM)	0.65	0.50	0.37







Material & Methods

Data

- Prediction of daily CH_4 emissions from milk mid-infrared (MIR) spectra (R^2 of cross-validation = 0.70) *(Vanlierde et al., 2013, Poster 433, GGAA, Dublin)*
- 257,635 milk MIR spectra & test-day (TD) milk yield records (kg/day) collected between January 2007 & December 2010
- 51,782 primiparous Holstein cows from 983 herds
- 2 studied traits:
  - g CH_4 per day
  - g CH_4 per kg of fat and protein corrected milk (FPCM)
- Daily meteorological data from 4 public weather stations

Temperature Humidity Index

$$THI = (1.8 \times T_{db} + 32) - [(0.55 - 0.0055 \times RH) \times (1.8 \times T_{db} - 26)]$$

where T_{db} = Dry bulb temperature

RH = Relative humidity *(NRC, 1981)*

Model

- Random regression TD mixed model → resolved using REML

$$y = Xb + Q_1 (Wh + Zp + Za) + e$$

where y = Vector of observations (g MIR CH_4/day or g MIR CH_4/kg of FPCM)

b = Vector of fixed effects

h = Vector of year of calving x herd (YxH) random regression coefficients

p = Vector of permanent environment (PE) random regression coefficients

a = Vector of additive genetic (G) random regression coefficients

Q_1 = Covariate matrix for 1st order Legendre polynomials related to THI

X, W & Z = Incidence matrices

e= Error

The Ministry of Agriculture of Walloon Region of Belgium (Service Public de Wallonie – Direction générale de l'Agriculture, des Ressources naturelles et de l'Environnement, Direction de la Recherche) is acknowledged for its financial support through the research project D31-1304. The authors gratefully acknowledge funding from the National Fund for Scientific Research (FNRS, Brussels, Belgium) and from the European Commission, "GreenHouseMilk" project (FP7 Marie Curie ITN).