Effect of heat stress on methane emissions of Dutch Holstein population

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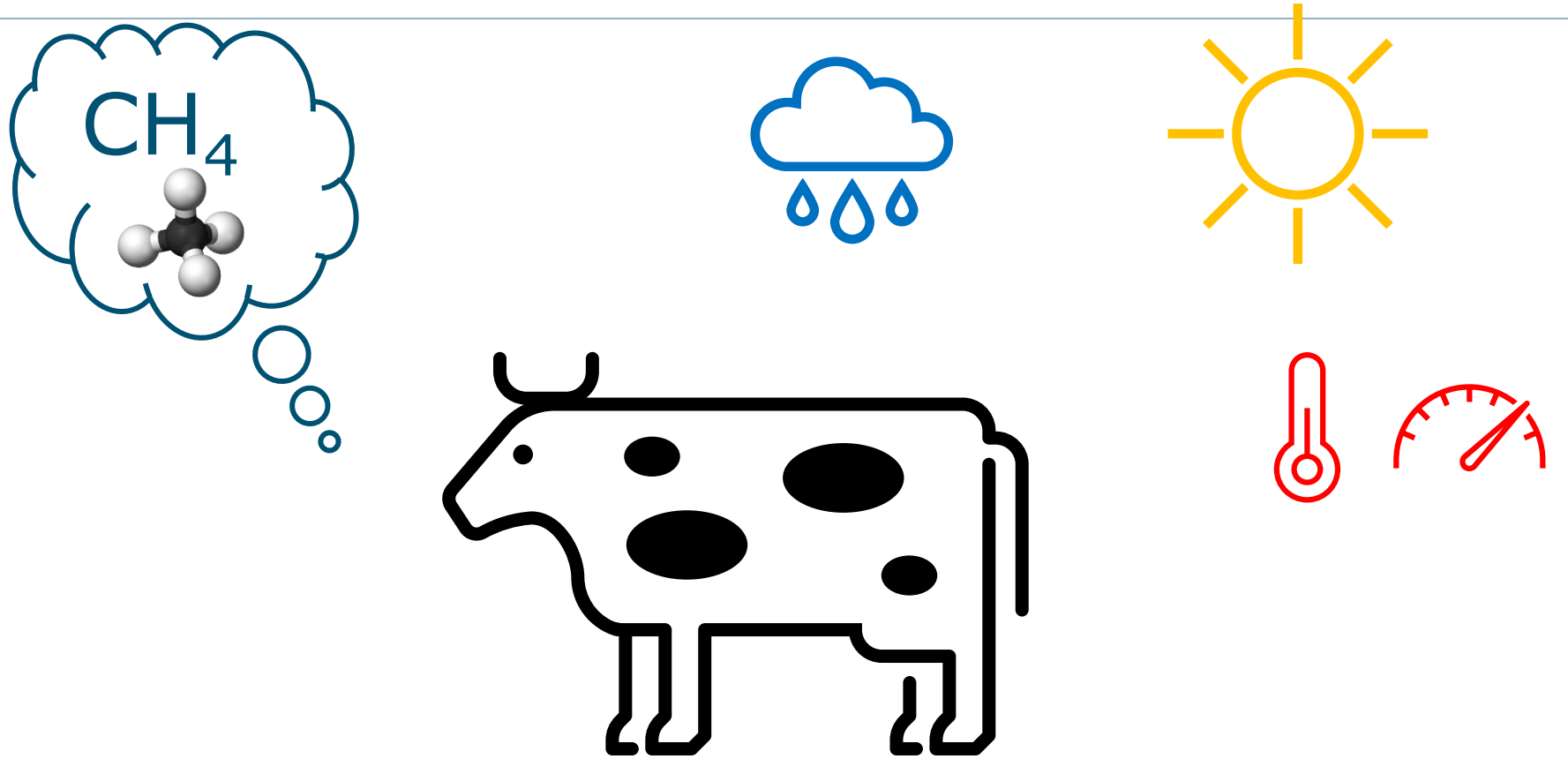
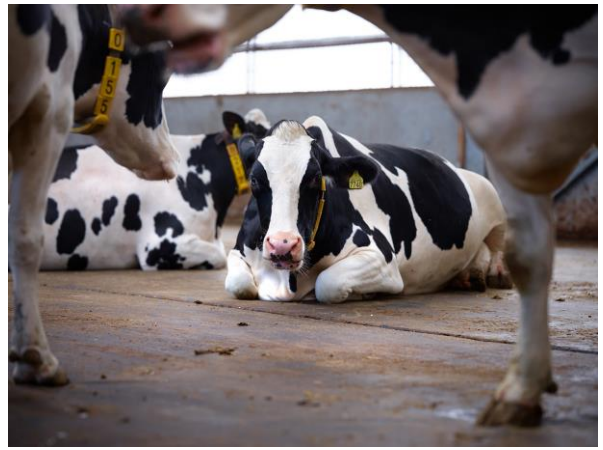
Introduction



Objectives

Investigate the *potential impact* of *temperature and humidity* on *methane emissions* in the Dutch Holstein population.



Measuring CH_4

- Breath sample devices to measure enteric methane (CH_4) and carbon dioxide (CO_2)

- Unit is concentration in parts per million (ppm)

Databases

CH_4 phenotypes

- 7,669 Holstein cows
- 130K weekly records
- 375 DIM
- 66 farms
- 2019-2023 recording
- Parities 1-4+

Temperature-Humidity Indicator

- Formula from National Research Council
- Daily meteorological records from Netherlands Meteorological Institute
- 24 stations closest to the farms
- THI weekly average

First analysis (model) Population level

$$y = Fixed\ Effects + a + pe + e$$

$$HYS + Lact_{week} + par.ACC + THI$$

First results: Population level

Descriptive Statistics

Trait	Mean	SD	CV %
CH_4 ppm	573.8	297.1	51

Second analysis (model) Individual level

$$y = Fixed\ Effects + a + a.THI_{46} + pe + e$$

$$HYS + Lact_{week} + par.ACC + THI\_group$$

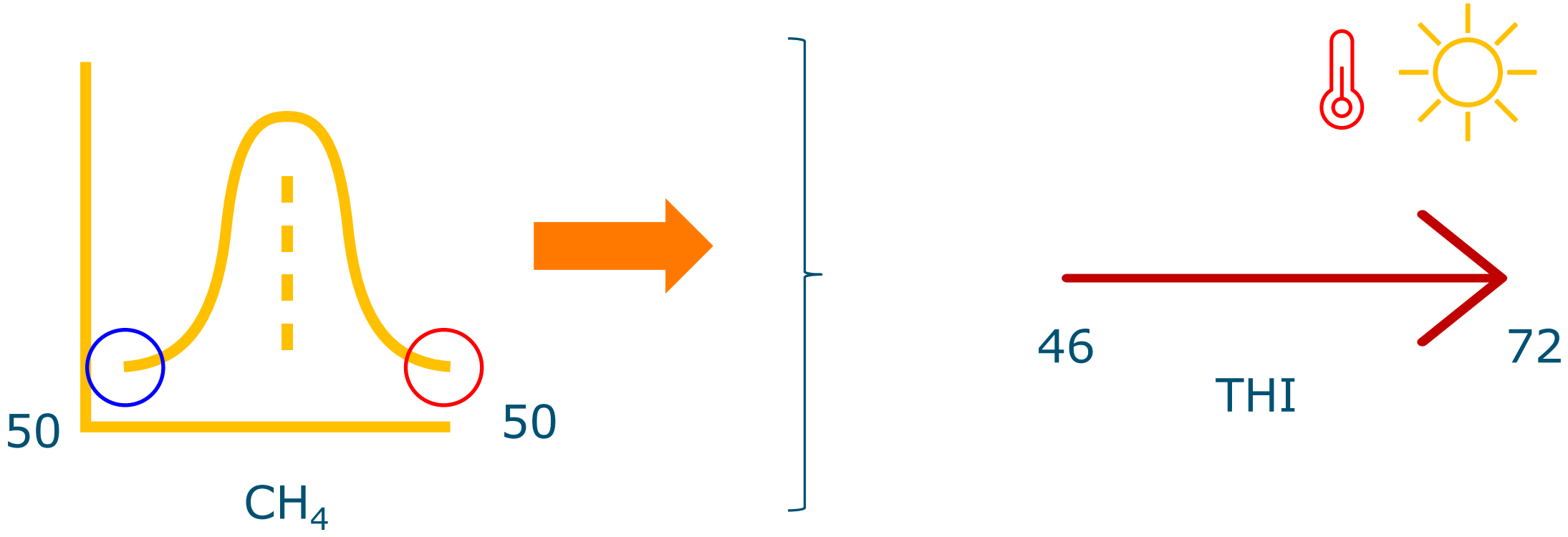
- low
- medium
- high

Heritabilities and permanent enviromental ratio

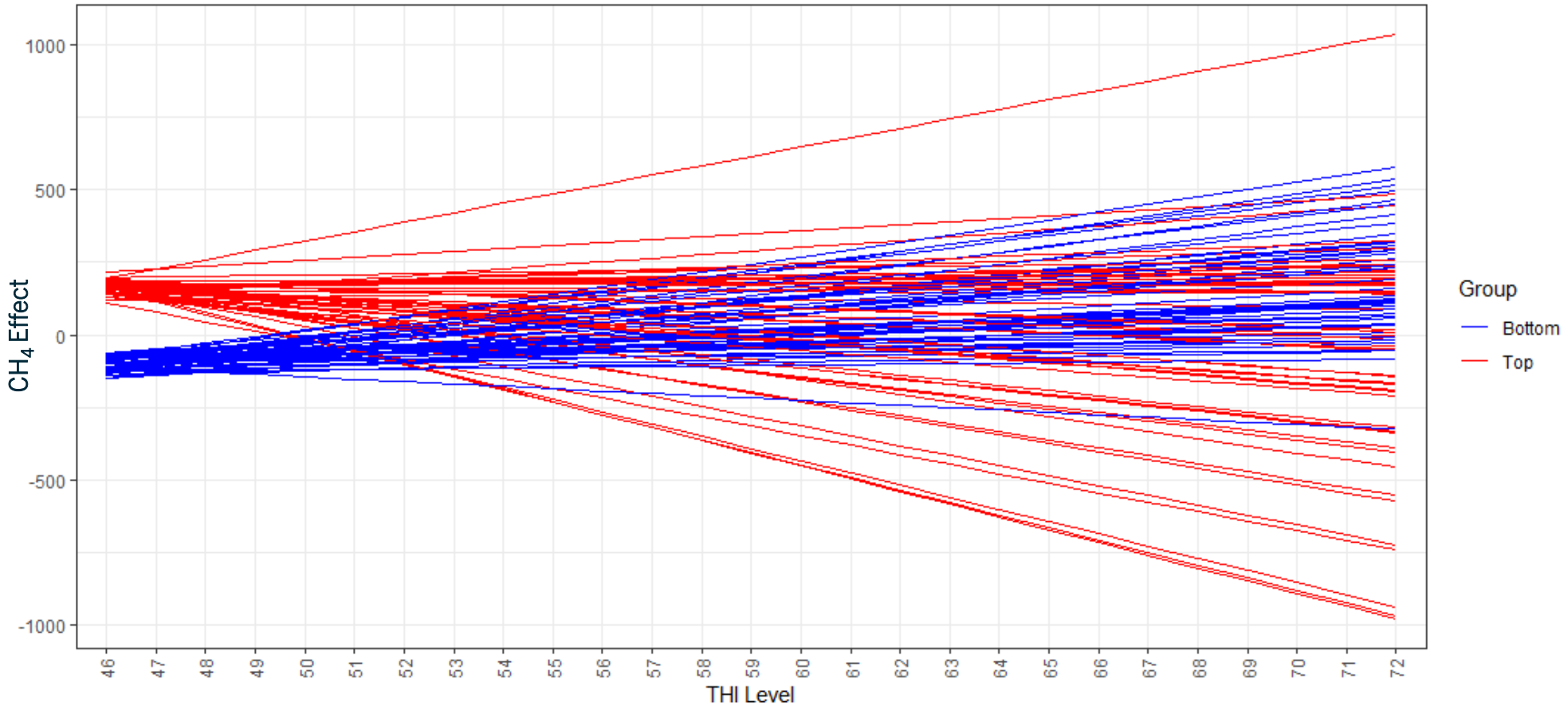
Trait	h^2	a.Thi ratio	pe^2
CH_4 ppm	0.27 (0.01)	0.003 (0.01)	0.28 (0.01)

	r_g
a - a.THI	-0.80 (0.02)

Choosing top and bottom animals



Plotting EBV of 50 top and bottom animals



Conclusions

- There is a *strong negative correlation* between genetic effect and the *interaction* with *THI*
- *High CH_4 emitting animals could reduce* their CH_4 emissions at higher *THI*
- *Low CH_4 emitting animals* had a *slightly increase* on CH_4 emissions

Implications

We should put attention to this *genetic interaction with THI*, given we want to select for *low CH_4 emitting animals* and with global warming *THI levels* can *increase* in the future.

Thank you for your attention

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