Use of at-market sensor technologies to develop proxies for resilience and efficiency in dairy cows

Yvette de Haas, Wijbrand Ouweltjes, Claudia Kamphuis



WAGENINGEN
UNIVERSITY & RESEARCH

100years
1918 — 2018

GENTORE

Last week @ICAR



From: Reinhard Reents

Today ...

... An example of novel traits,

predicted based on sensor data,

different sensors on different farms,

independent of DHI





WAGENINGEN UNIVERSITY & RESEARCH

100years 1918 — 2018

GENTORE

Data from research farm Dairy Campus

- Cow data
  - 1800 cows, 5771 lactations (1995-2016)
- Sensor data
  - SRC tags: activity, rumination
  - Live weight at/during milking
  - Milk yield per milking
- Other data
  - Health events, inseminations, calving dates



What is Resilience

The capacity to respond and overcome environmental perturbations and, thus, safeguard future ability to contribute genes to the next generation.

Validate against ability to re-calve (Friggens and De Haas, 2019)

Impaired resilience negatively impacts repro performance

But....how to make *that* operational?



WAGENINGEN
UNIVERSITY & RESEARCH

100years
1918 — 2018

GENTORE

Calculating lifetime Resilience score

- 500 plus points for each calving
- Age at 1st calving compared to herd mean
  - 1 plus/minus point for each day difference (1st parity)
- Calving interval compared to herd mean
  - 1 plus/minus point for each day difference (>1st parity)
- Number of inseminations
  - 25 minus points for inseminated culled cows (last lactation only)
- Number of events
  - 1 minus point for each curative treatment
  - 1 minus point for each day culled before 100 DIM
- 305d Milk yield: weight 0 (currently lack of reliable data)

Lifetime Resilience scores

1800 cows, 5771 lactations received a score

1518 points on average (31 to 6031 points)

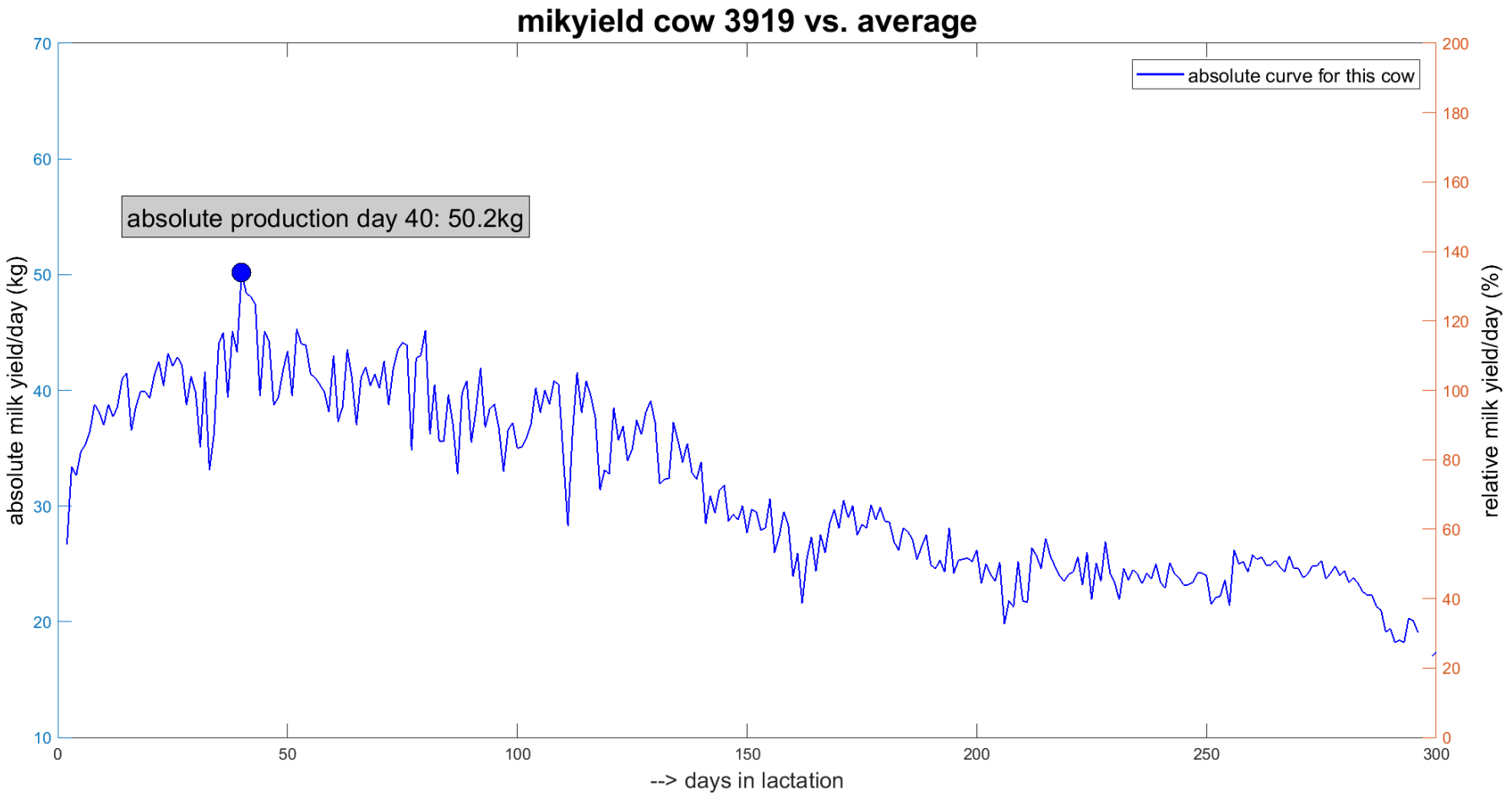
Parity	N	Total score	lac 1	lac 2	lac 3	lac 4	lac 5
1	315	412	412				
2	387	907	497	410			
3	385	1401	497	495	409		
4	313	1907	497	505	485	421	
5	227	2428	498	510	492	496	432
>=6	173	3266	502	523	508	506	495

WAGENINGEN UNIVERSITY & RESEARCH

100years 1918 — 2018

GENTORE

Defining sensor parameters

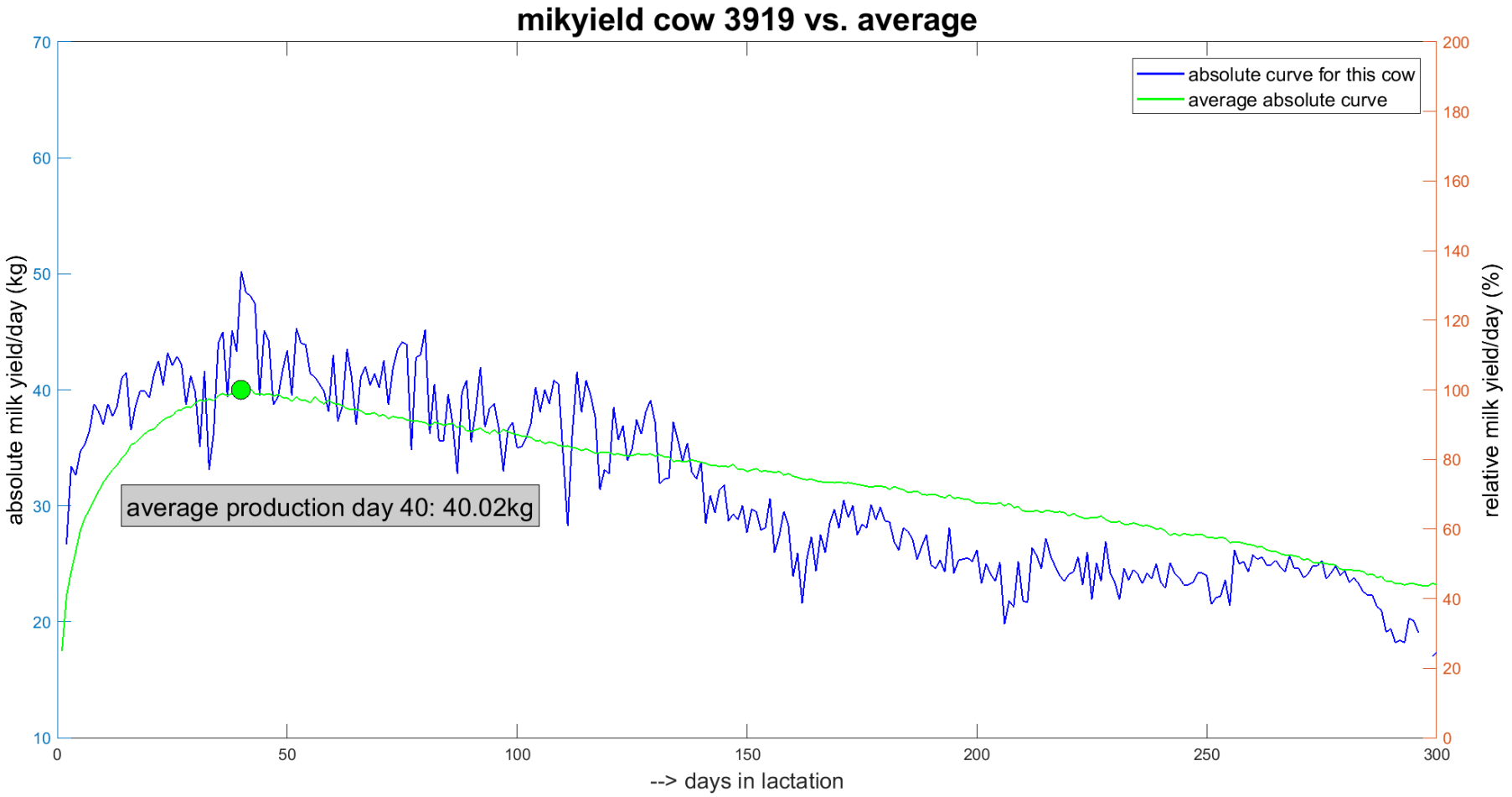


WAGENINGEN UNIVERSITY & RESEARCH

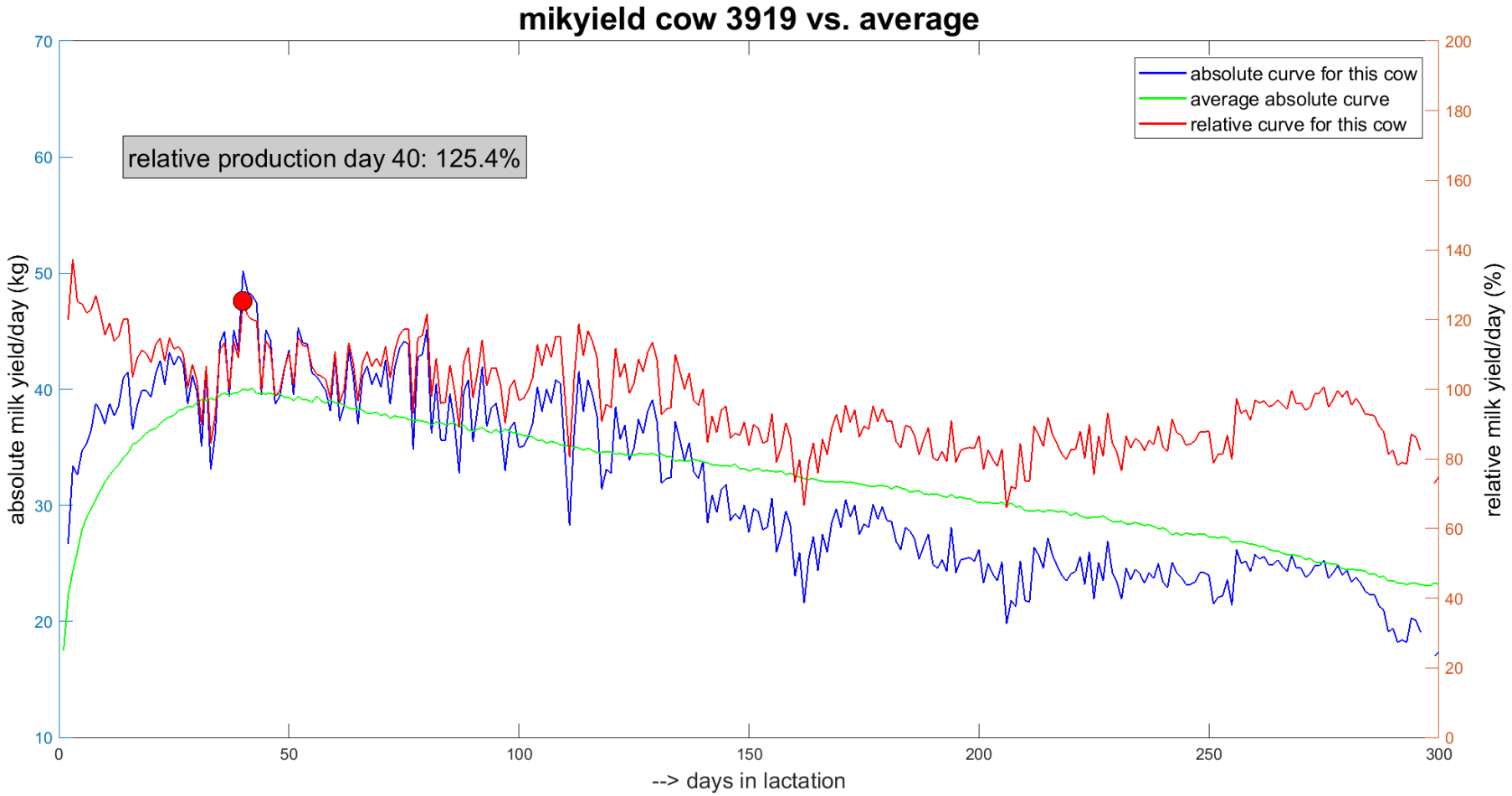
100years 1918 — 2018

GENTORE

Defining sensor parameters



Defining sensor parameters

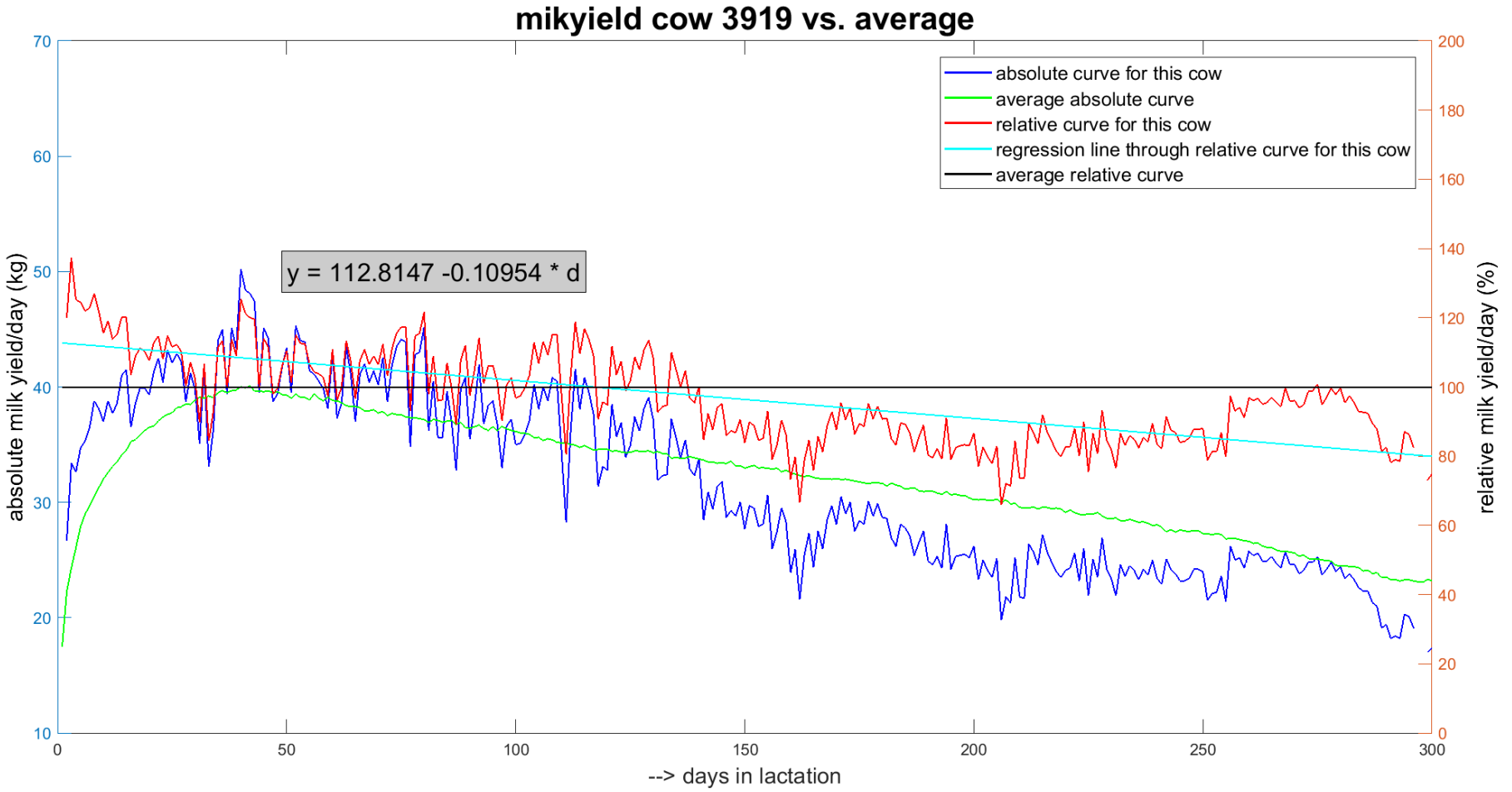


WAGENINGEN
UNIVERSITY & RESEARCH

100years
1918 — 2018

GENTORE

Defining sensor parameters

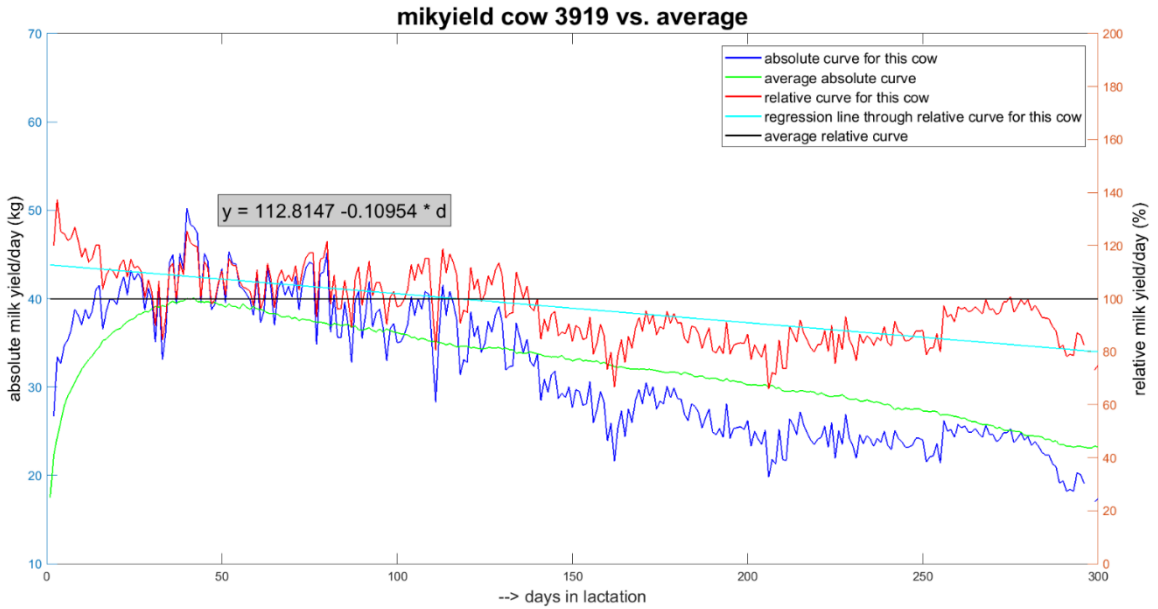


WAGENINGEN UNIVERSITY & RESEARCH

100years 1918 — 2018

GENTORE

Defining sensor parameters



Mean and **autocorrelation** on relative curve (red line)

Standard deviation, **skewness**, and **slope** of regression line through relative curve (light blue line)

WAGENINGEN UNIVERSITY & RESEARCH

100years 1918 — 2018

GENTORE

Results resilience

- Significant curve parameters:

  slope milk, sd BW, skewness activity

- Predictive performance ordinal logistic model:

Average chance a cow that truly is in L is predicted to belong in L = 6.8%

	Gold standard		
	Low (L)	Middle (M)	High (H)
Prediction	n=90	n=202	n=78
Low (L)	0.068	0.134	0.037
Middle (M)	0.130	0.300	0.117
High (H)	0.045	0.112	0.057

Average chance a cow is predicted in the right category is 42.5%

Take home message - 1

- Sensors can help as proxies for resilience
- Prediction models are work in progress
- Fine-tuning is required! Options to do so might be:
  - Improve definition?
  - Improve sensor parameters?
  - Define sensor parameter for part(s) of lactation?

Take home message - 2

Food for thought:

- Is there a future for a trait like this?
  - For management purpose only?
  - For (international) genetic evaluations as well?
- If so, topics to address:
  - Data ownership, unlocking data
  - Available sensors => trait definitions differ
    - Different algorithms for different sensor companies
    - Length of available sensor data / cow

GenTORE *@GenTORE_H2020*

Genomic management Tools to Optimise Resilience and Efficiency

THANK YOU

FOR YOUR ATTENTION!

This project has received funding from the European Union's Horizon 2020
research and innovation program under Grant Agreement No 727213