# An integrated modelling approach to assess optimisation potentials for cattle housing climate

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**Objectives:** Our international, interdisciplinary team develops an integrated model to support sustainable, regional and animal-specific adaptation of naturally ventilated dairy barns to climate change. We link numeric models with different temporal and spatial scales and cross-validate with on-farm data and lab experiments.

## The OptiBarn project – Facts and Figures

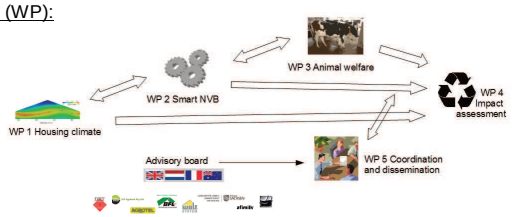
Duration: 12/2014 to 11/2017

Consortium: 4 countries - 6 institutes - various disciplines

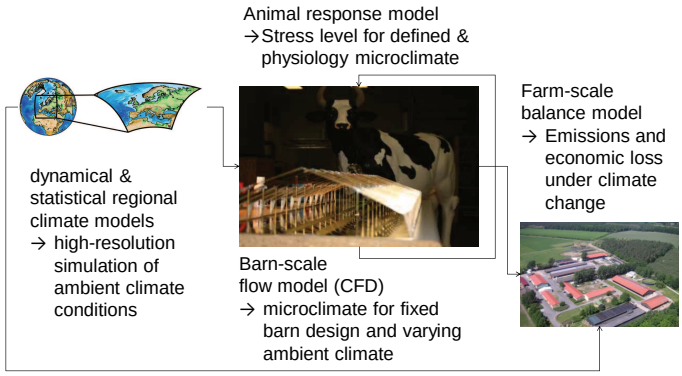
Funding: FACCE-ERANET+ "climate smart agriculture"

Support: companies and stakeholders from 5 countries

5 work packages (WP):




## Integrated Model

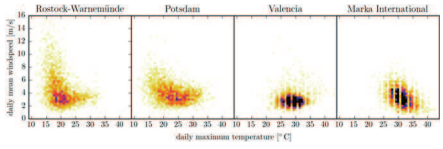


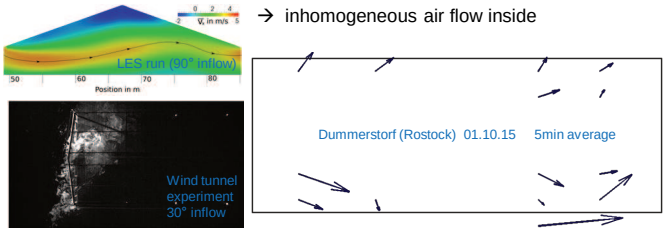

| Model scales | Module | Space | Time |
|---|---|---|---|
| | Ambient climate | RCM ~ 12km<br>Weather station (dist.≤20km) | days to hours |
| | Barn | ~ 0.1m | ~ seconds |
| | Animal | per cow | hours |
| | Farm | per barn / farm (~ 1 km) | days |

➢ **Model development, validation and linkage to improve assessment of climate change impacts on animal husbandry**

## Preliminary results

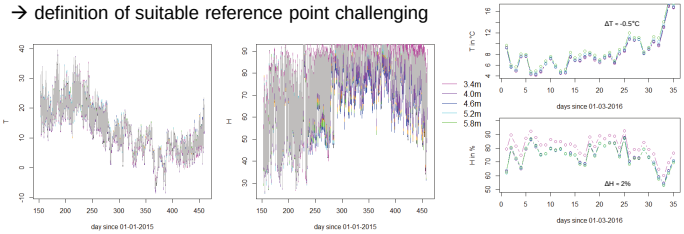
Climate observations (1981-2010):
temperature ↑
wind speed ↓
→ heat stress ↑



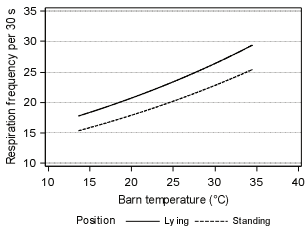

→ inhomogeneous air flow inside

→ heterogeneous distribution of temperature and humidity
→ definition of suitable reference point challenging




→ stress reaction depends animal physiology and activity

*Example 1:* *Respiratory rate – RF (Germany)*



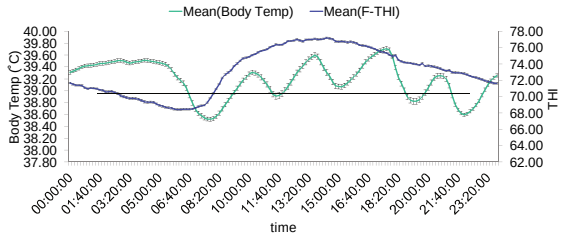

| Effect | | Mean RF per 30 s | Limits of 95% confidence interval | |
|---|---|---|---|---|
| Behaviour | Lying | 22.4 | 21.6 | 23.1 |
| | Standing | 19.0 | 18.5 | 19.5 |

(t-Test, α=0.05, 47 FG)

| Effect | | Mean RF per 30 s | Limits of 95% confidence interval | |
|---|---|---|---|---|
| Lactation | 1 | 20.1 | 18.9 | 21.3 |
| | 2 | 19.9 | 19.2 | 20.5 |
| | 3+ | 21.9 | 21.3 | 22.6 |

(adj. t-Test, α=0.05, 49 FG)

*Example 2:* *Body temperature (Israel)*




→ wide spread in thresholds of different heat stress indicators
→ THI don't capture fast variations in physiologic stress response

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