



A dynamic model of ammonia emission and concentration in fattening pig buildings

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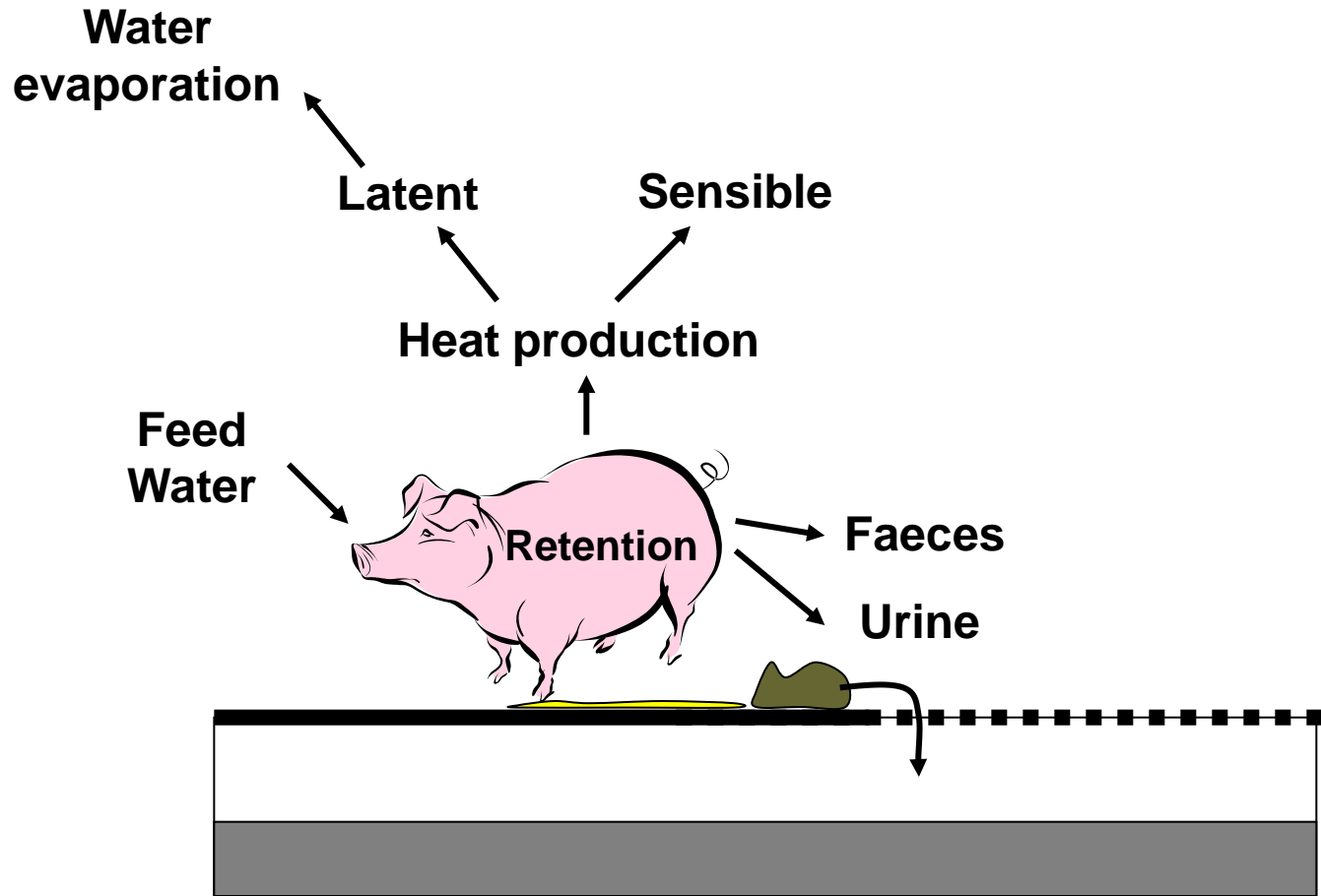
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St-Malo, France

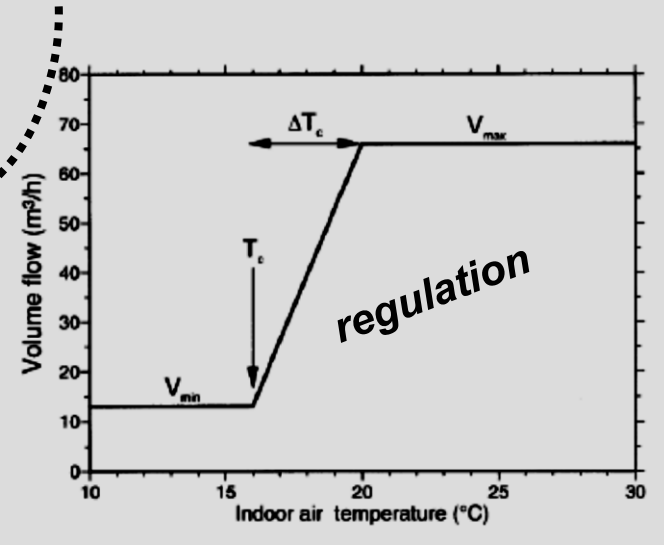
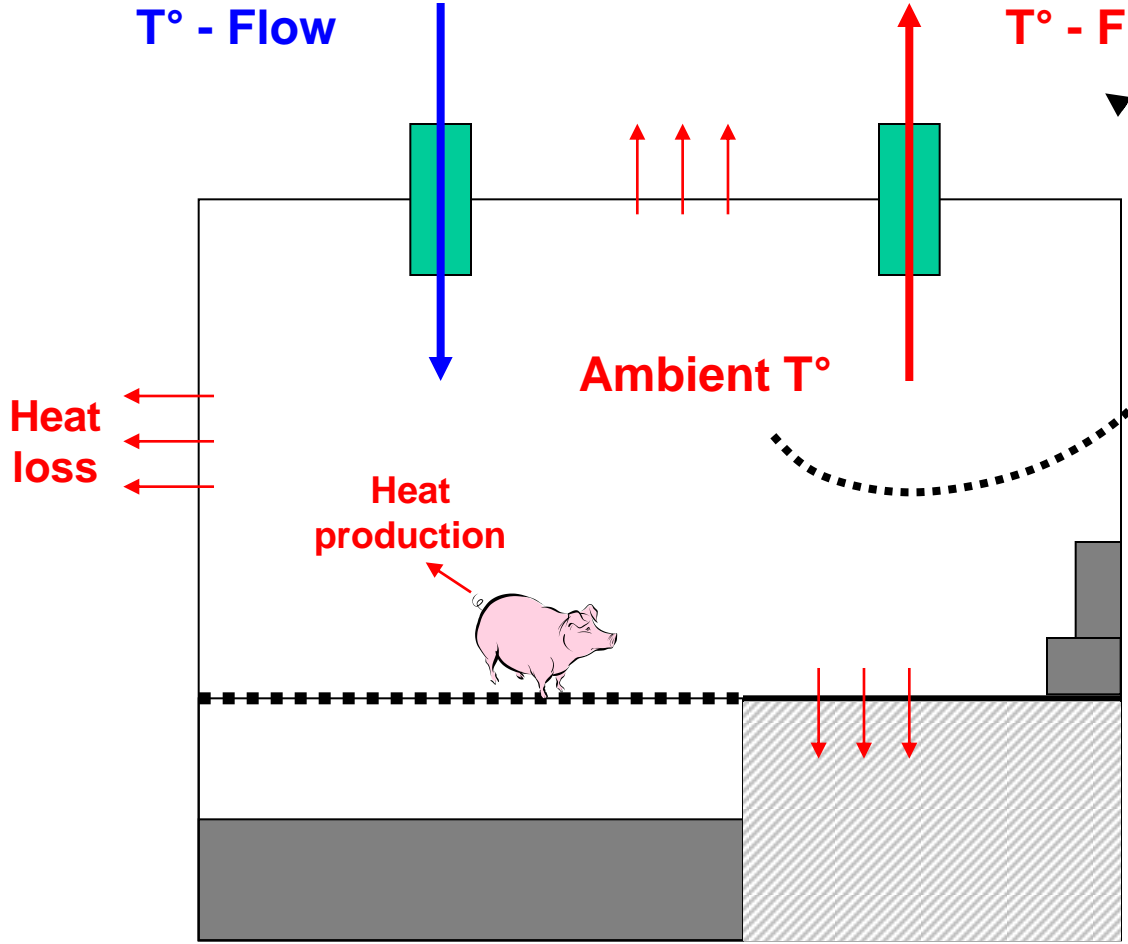
Dynamic modelling approaches available in literature

- **Models to predict animal excretion and characteristics of manure**
- **Models to predict ammonia release from manure**
- **Models to predict the indoor climate and ventilation rate**
- ⊗ **Objective : integrated dynamic model of ventilation, climate, emissions and concentrations in a room for fattening pigs**

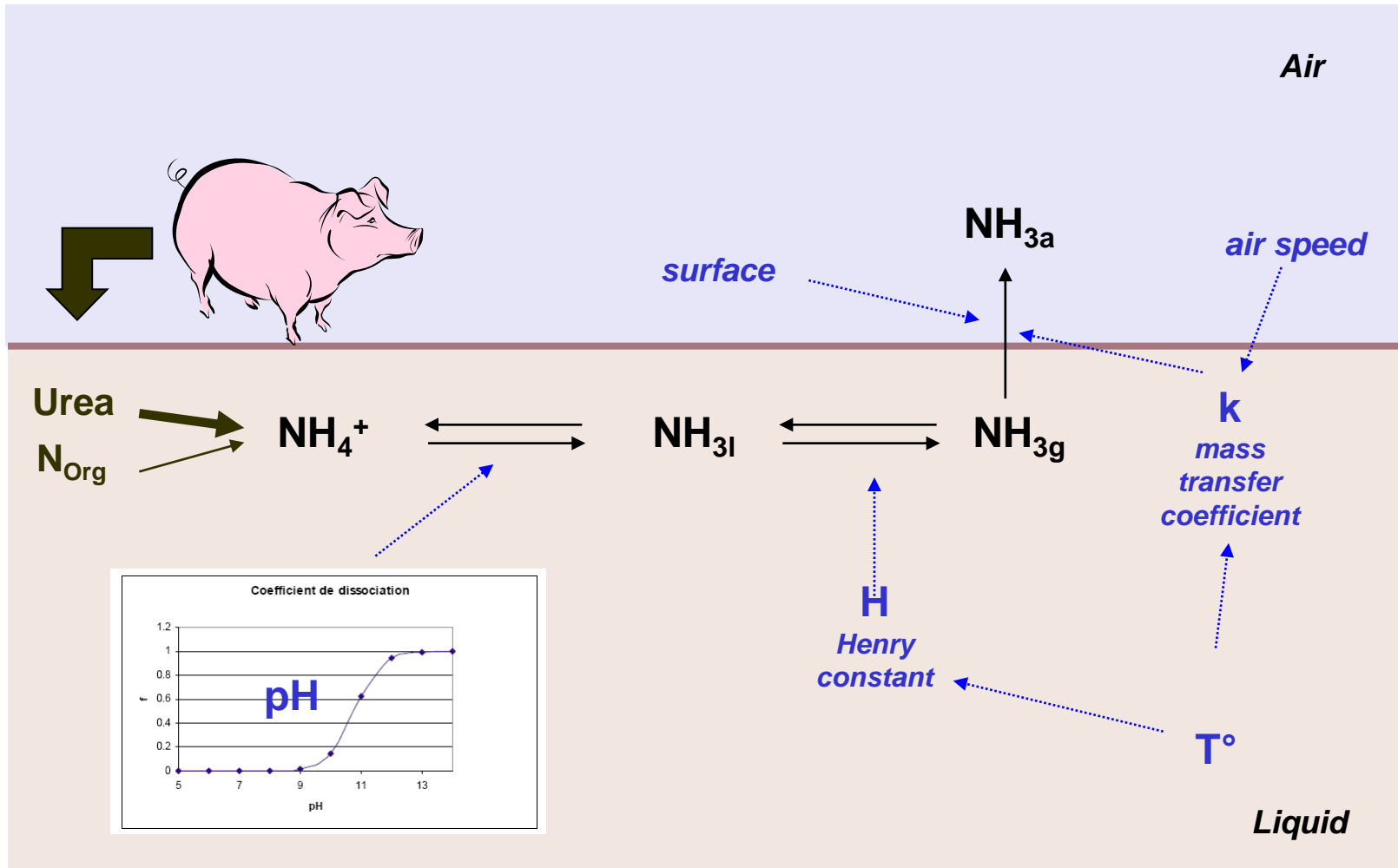
Animal and excretion



Climate and building



Ammonia emission



Development of the model

- **Using «vensim»[®] modeling platform**
- **Time step of 1 mn**
- **Inputs**
 - **Housing design (type of floor, type of ventilation, animal density, ...)**
 - **Animal performance (ADG, FCR) and feeding**
 - **Outdoor climate**
- **Outputs**
 - **Manure volume and composition**
 - **Flow and concentration of NH₃**
 - **Indoor climate**

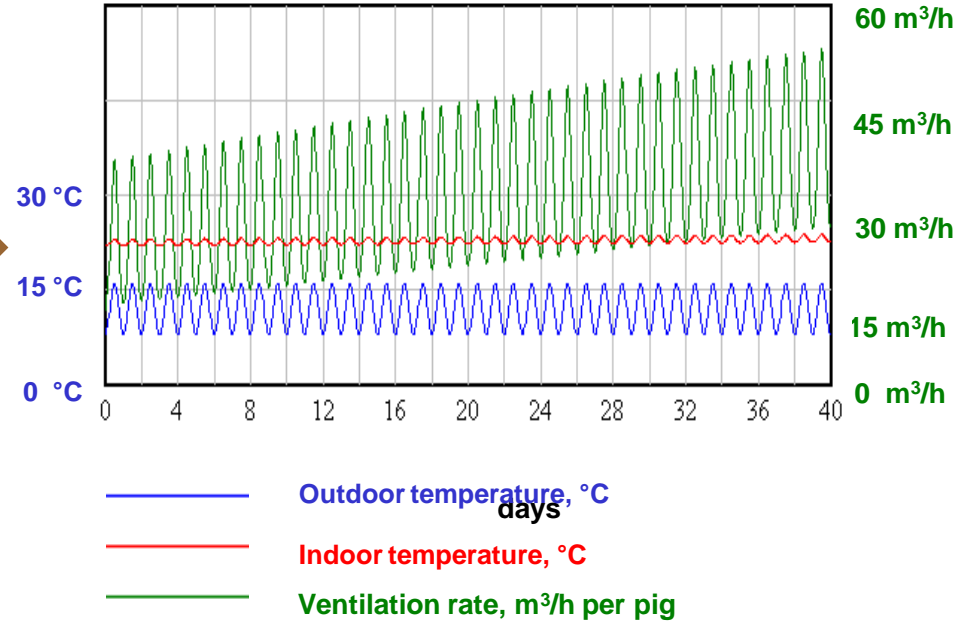
Results

-

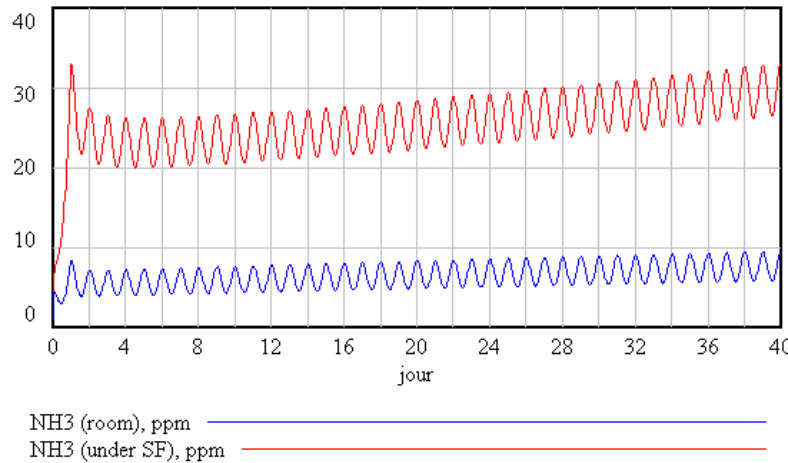
Sensitivity analysis



Predictions of variations in ambient temperature and ventilation rate



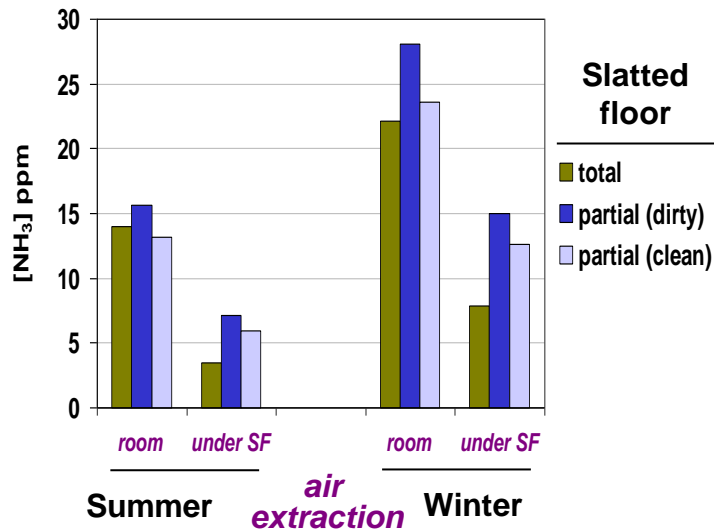
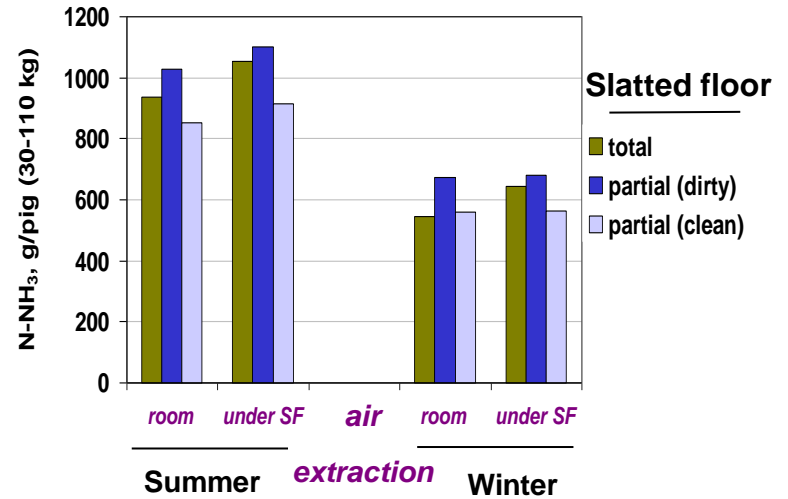
Totally slatted floor – air extraction under SF



Predictions of variations in NH₃ concentration in the room and under the slatted floor

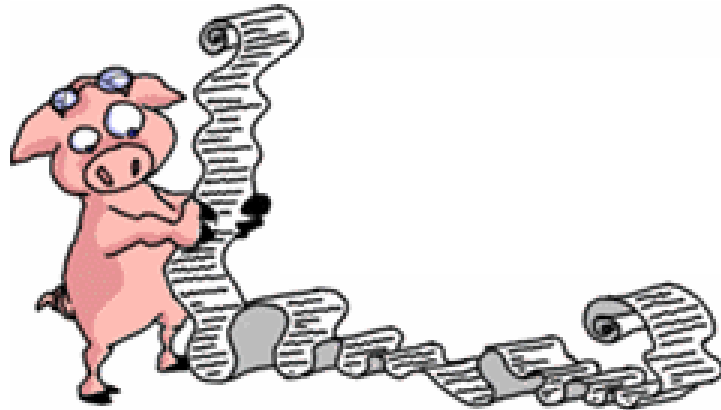


Predicted effects of season, slatted floor and ventilation on cumulated N-NH₃ emission



Predicted effects of season, slatted floor and ventilation on NH₃ concentration in the room

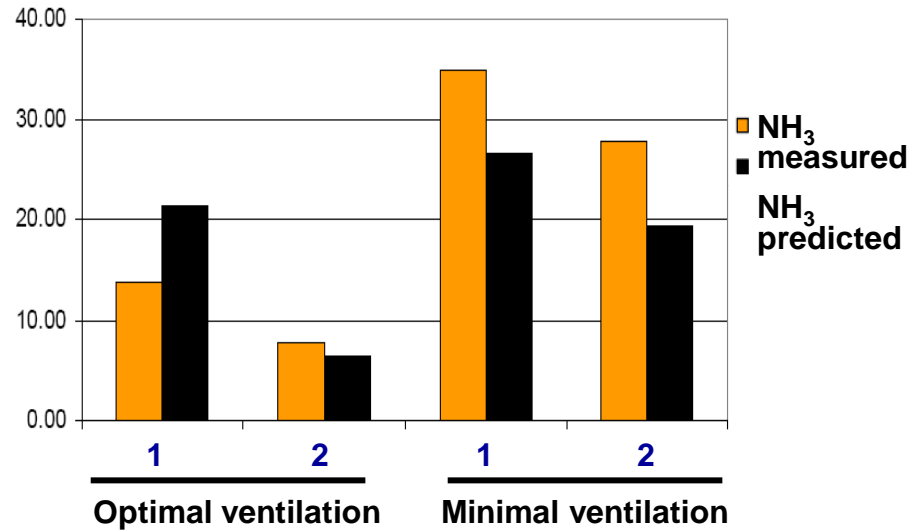
Validation



Effect of ventilation and type of slatted floor on NH₃ concentration in the room

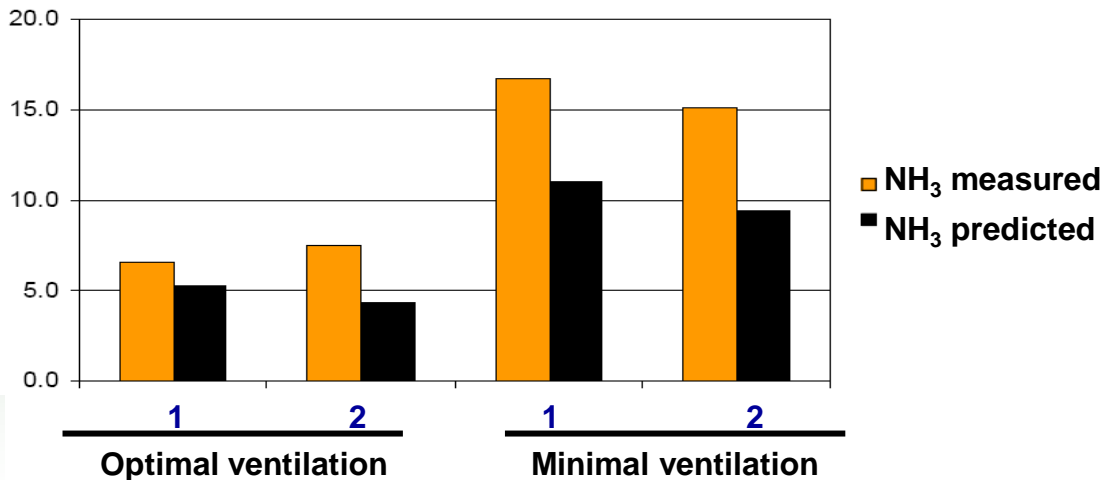


Guingand et al. (2001)



1 : Partially slatted floor – air extraction room & under SF
 2 : Totally slatted floor – air extraction below SF

Massabie et al. (2005)



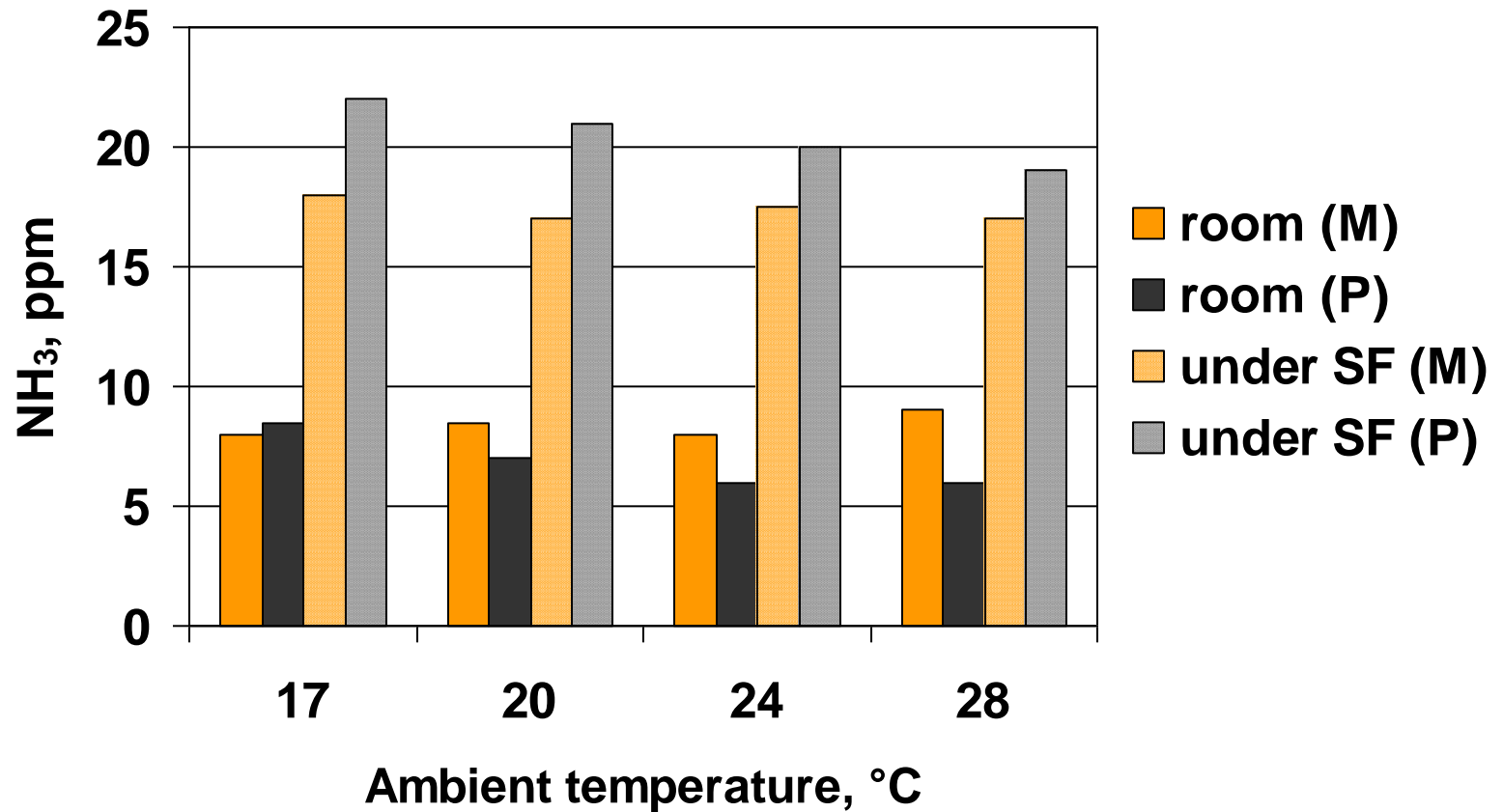
1 : Concrete slatted floor
 2 : Metallic slatted floor



Effect of ventilation and type of slatted floor on NH₃ concentration in the room

Effect of temperature on NH_3 concentration in the room and in the extracted air

Granier et al. (1996)



Conclusions

- **Interesting approach**
 - Short term variations – Cumulated effects
 - Concentration – total emission
- **Validation**
 - Concentration (room, extracted air)
 - Total emission
- **Antagonism between**
 - Reduction of total emission
 - Improvement of air quality
- **Aspects to be improved**
 - Prediction of slurry pH
 - Take better account of animal behaviour and floor dirtiness
 - Air exchanges between different areas (under SF – room)

Than you for your attention !



« Year of the pig » – Vietnam - Ho Chi Minh - 2007