ADEME
French Environment and Energy Management Agency

REFERENCE PROCEDURES FOR THE MEASUREMENT OF GASEOUS EMISSIONS FROM LIVESTOCK HOUSES AND STORES OF ANIMAL MANURE

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from knowledge to uncertainties…

FOOD & NUTRITION
AGRICULTURE
ENVIRONNEMENT
Rennes Research Center
INRA

outlines

- Context and objectives of the project
- Described methods
- Experimental results
- Conclusions

partners

Context and objectives

- emission measurement is a key technology that should be shared by many people (system+time period+Δconc.+ventilation)
  -> such as composition analysis of soils, feed, manure, carried out by several laboratories
- procedures for emission measurement should be described in a way allowing Quality Assurance / Quality Control,
  and comparisons between laboratories, when it is required
- sharing a set of procedures and softwares and observed data is a first step in this direction
  it will allow people to evaluate how they can include this topic in their strategy
- this first set of procedures should result from existing well-known methods,
  discussed by people who practice them since several years





Method description

(http://www4.inra.fr/animal_emissions_eng/)

- Mass balance during manure storage (using weight or P tracing)
  - Emission measurement using dynamic closed chamber
  - Emission measurement using SF_6 tracing for manure storage
  - Emissions from livestock houses and manure stores using a model calibrated with intermittent measurements of concentrations
- Ventilation measurement in mechanically ventilated houses using air speed measurements
- Ventilation measurement using CO_2 produced by animals
- Ventilation measurement using heat produced by animals
- Ventilation measurement using SF_6 tracing
  - Emission measurement using ventilation and concentration gradient
  - Emission measurement using reverse modelling
- Generate a predefined ammonia concentration and measure it with acid bubbling
  - Uncertainty calculation applied to the measurements of gaseous emissions from animal houses and manure stores

Method comparison

(http://www4.inra.fr/animal_emissions_eng/)

- **Organisation**
  - Two methods / two labs
  - Comparison of measured emissions with losses estimated from mass budgets of water, nitrogen, carbon after some weeks

- **Building experiment in winter conditions**
  - Reverse modelling, SF_6 tracing, CO_2 and heat balance
  - 1 flock of broilers in a commercial house

- **Storage experiment in summer conditions**
  - Two tanks: one covered (13,4 m^3), the other not (9,2 m^3)
  - Covered tank: dynamic chamber + greenhouse ventilation
  - Uncovered tank: dynamic chamber + tracing



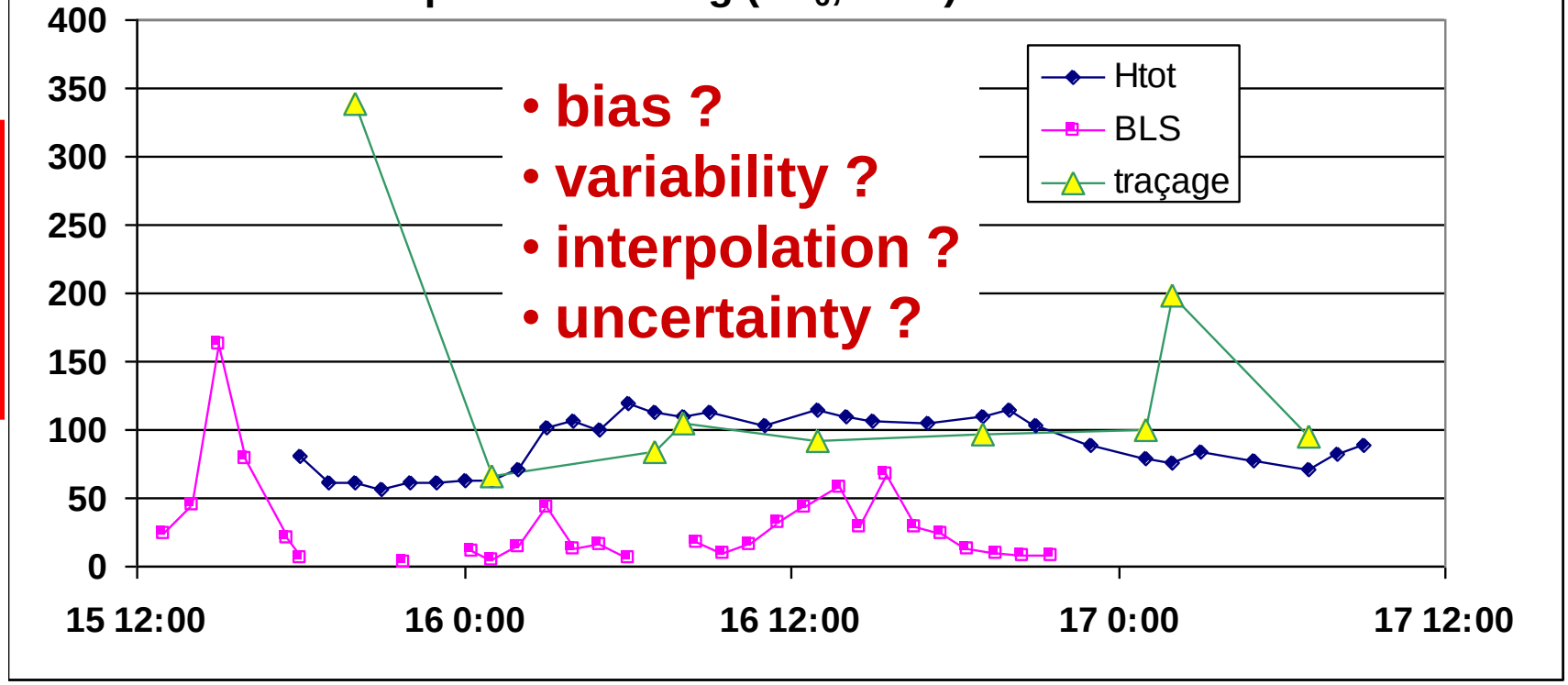


Observed results of method comparison : 1- building

Daily emission of ammonia from poultry house

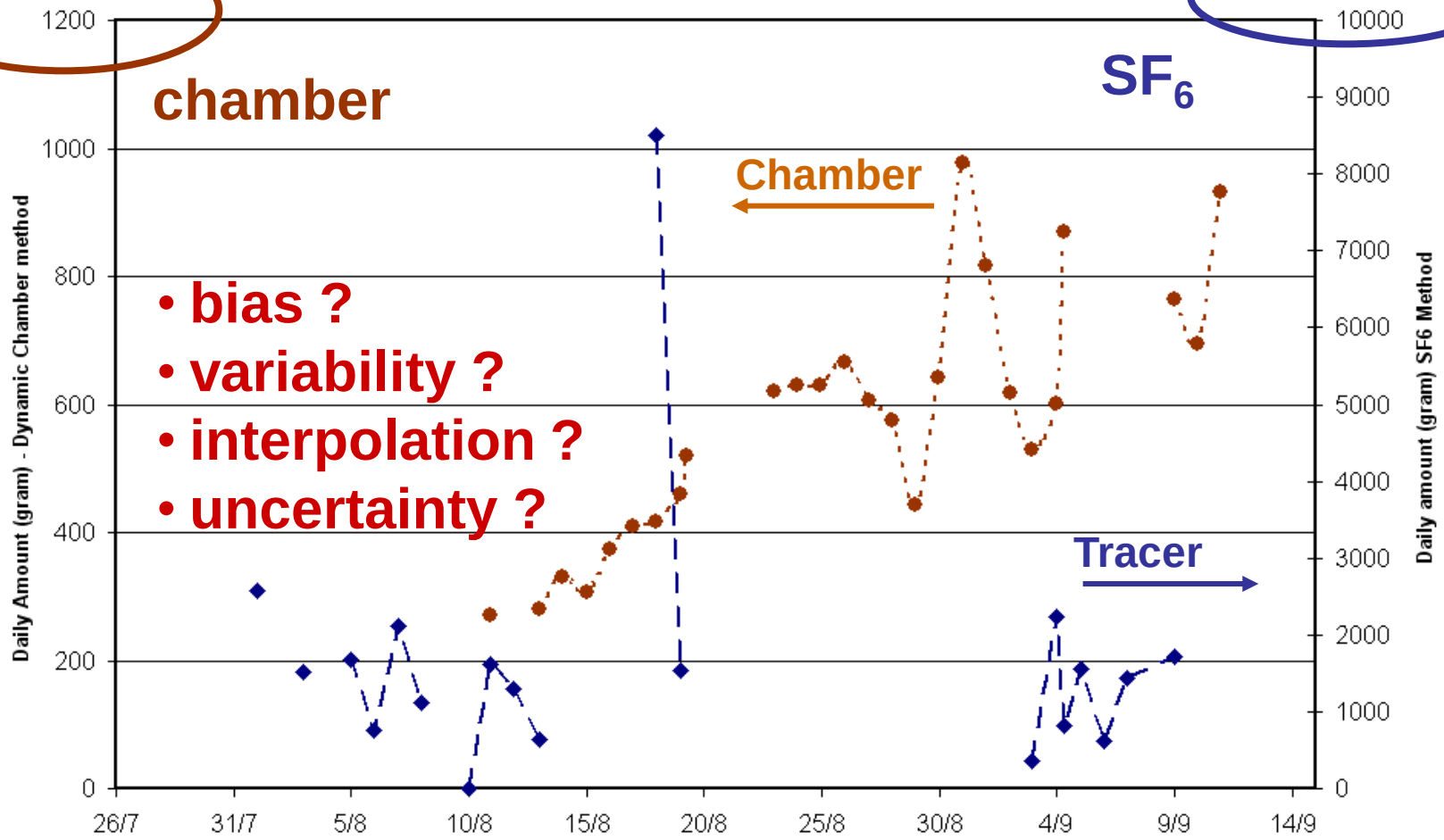
émission NH_3 (mg $NH_3.s^{-1}.bat^{-1}$) [15 - 17 dec. 2008]

comparison tracing (SF_6; heat) & BLS



Observed results of method comparison : 2- storage

Daily emission of methane from slurry store



Conclusions

(http://www4.inra.fr/animal_emissions_eng/)

Existing methods

- several methods exist since many years
- inaccuracy of description can induce differences in results

➔ improved description can be useful to compare results: what is needed ?

Uncertainty

- uncertainty is difficult to estimate, it depends on several measuring details
- improved description of measuring procedure can help to improve uncertainty calculations; repeated controls are necessary

➔ general procedures for uncertainty estimates need further work

Mass balance

- Mass balance can be achieved using observations, sometimes completed with models and/or references; if not uncertainty of emissions increases
- Coupling mass balance of C, N, H_2O, P, K ensures correct sampling, gives physical limits of emission, improve emission reliability





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