



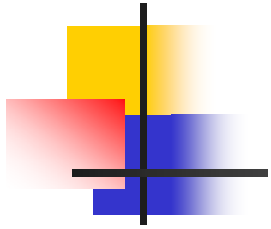
III. Flux estimation

- 1. Assuming a model of the relation between concentration and time in the enclosure**
- 2. Fitting the model to the observed concentration data**
- 3. Predicting the exchange rate**
- 4. Testing the credibility of the prediction**



Minimal requirement:

- gas concentration as a function of time**
- enclosure basal area**
- volume of enclosed air**



Mixing ratio must be converted to a mass or molecular basis using the ideal gas law, thus, temperature and pressure of the enclosed air:

$$C_i = \frac{q_i M_i P}{RT}$$

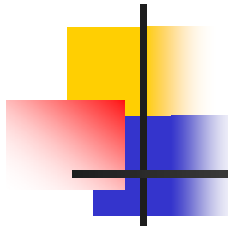
C_i = mass/vol concentration

q_i = vol/vol concentration (e.g. ppmv)

P = pressure

R = universal gas constant

T = Kelvin

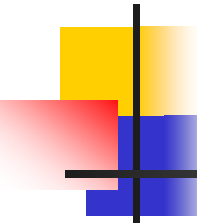


- Examples:

→ 1.7 ppmv of CH₄ (current atmospheric concentration of CH₄) = 1.13 mg m⁻³ at 20°C and 1 atm

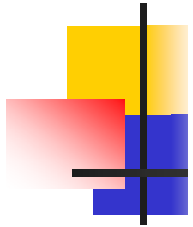
→ 310 ppbv of N₂O = 0.57 mg m⁻³

$$C_{\text{CH}_4} = \frac{\left(\frac{1.7 \text{ m}^3}{10^6 \text{ m}^3} \right) \times \left(16 \frac{\text{g}}{\text{mol}} \right) \times 1 \text{ atm}}{\left(8.2058 \times 10^{-5} \frac{\text{m}^3 \cdot \text{atm}}{\text{K} \cdot \text{mol}} \right) \times (273 + 20) \text{ K}}$$



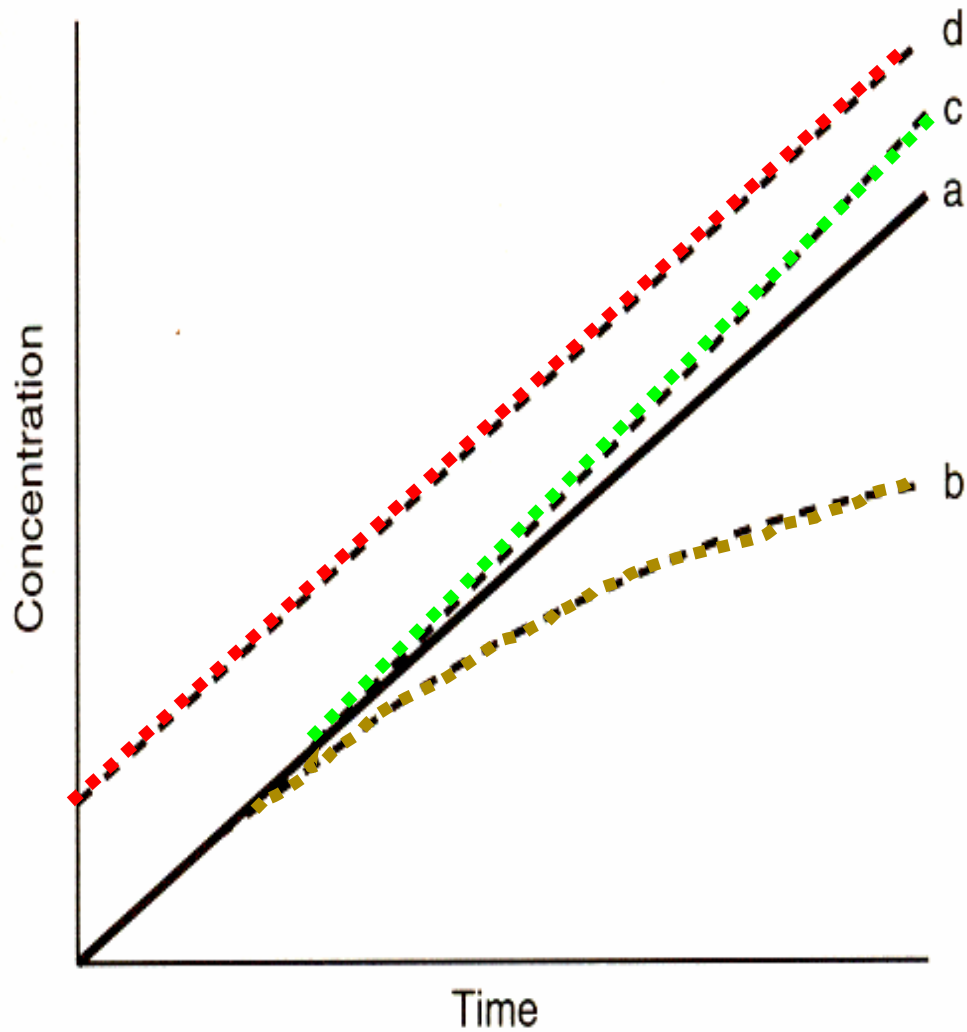
If enclosure dimension, deployment period and measurement protocol are appropriate, a linear model may be adopted. This method assumes a constant exchange rate over the period of observation

$$\text{Flux}_{\text{CH}_4} = \frac{V}{A} \frac{dC}{dt}$$



Verifying the model: qualitative examination of a scatter plot of actual vs. predicted concentration over time is often the most effective mean.

→ This should be used to both identify and screen observations objectively that do not meet model expectation (site disturbance, improperly sealed enclosure, sample handling, storage or analytical difficulties, enclosure dimensions or deployment time not suited to exchange rate measured.

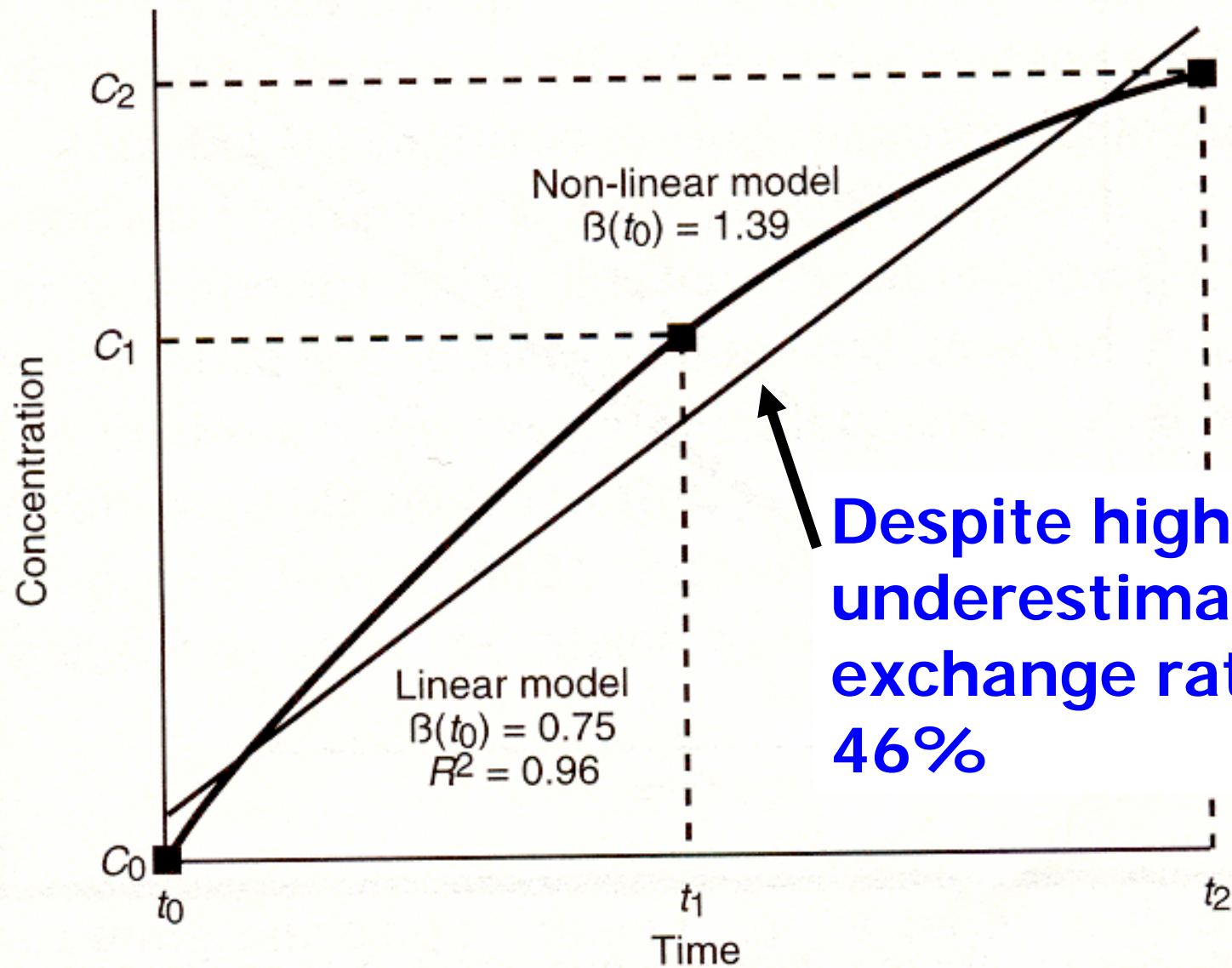


Elevated conc. from disturbance

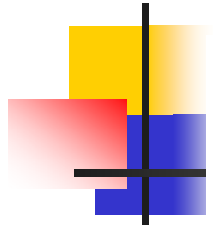
Increasing rate due to increase in soil temp.

Good linear response

Leak, improper chamber dimension or sampling time



Despite high R^2 , it underestimates exchange rate by 46%



- → should apply statistic test (simple t -test is acceptable) for the significance of slope parameter
- → rate should reported only when significant correlation was found



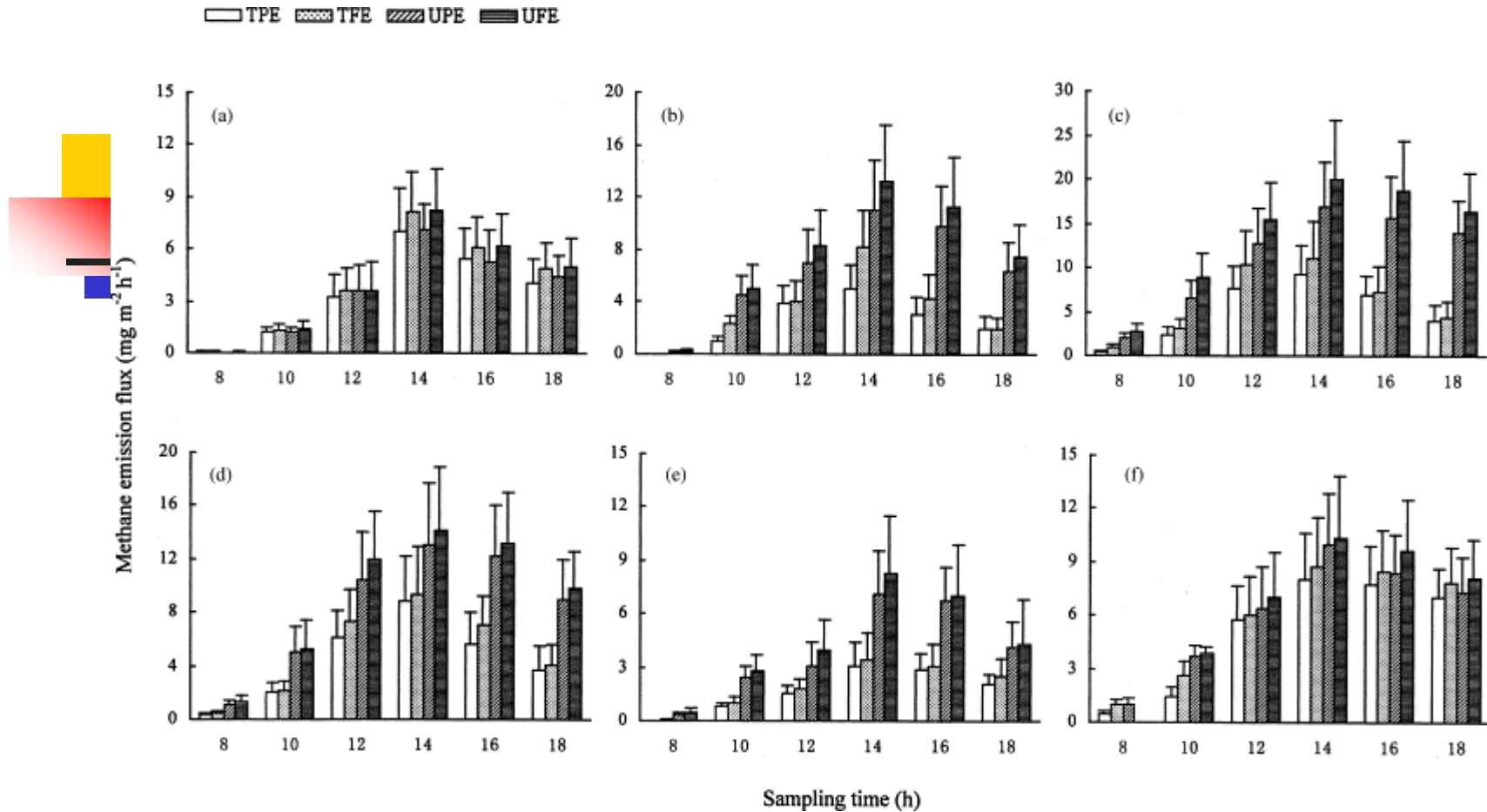
More—other sources of errors

- Overall precision is dependent upon pooled precision of all parameters involved in calculation.
- ➔ chamber volume:basal area ratio, a 1 cm error in the measurement of height for enclosures 20 or 50 cm tall corresponds to a 5 or 2% error in flux estimate.
- ➔ 1% error in concentration results from a 3°C error in the estimate of air temperature or a 1 kPa (7.6 mmHg) error in the estimate of total pressure.



Other considerations

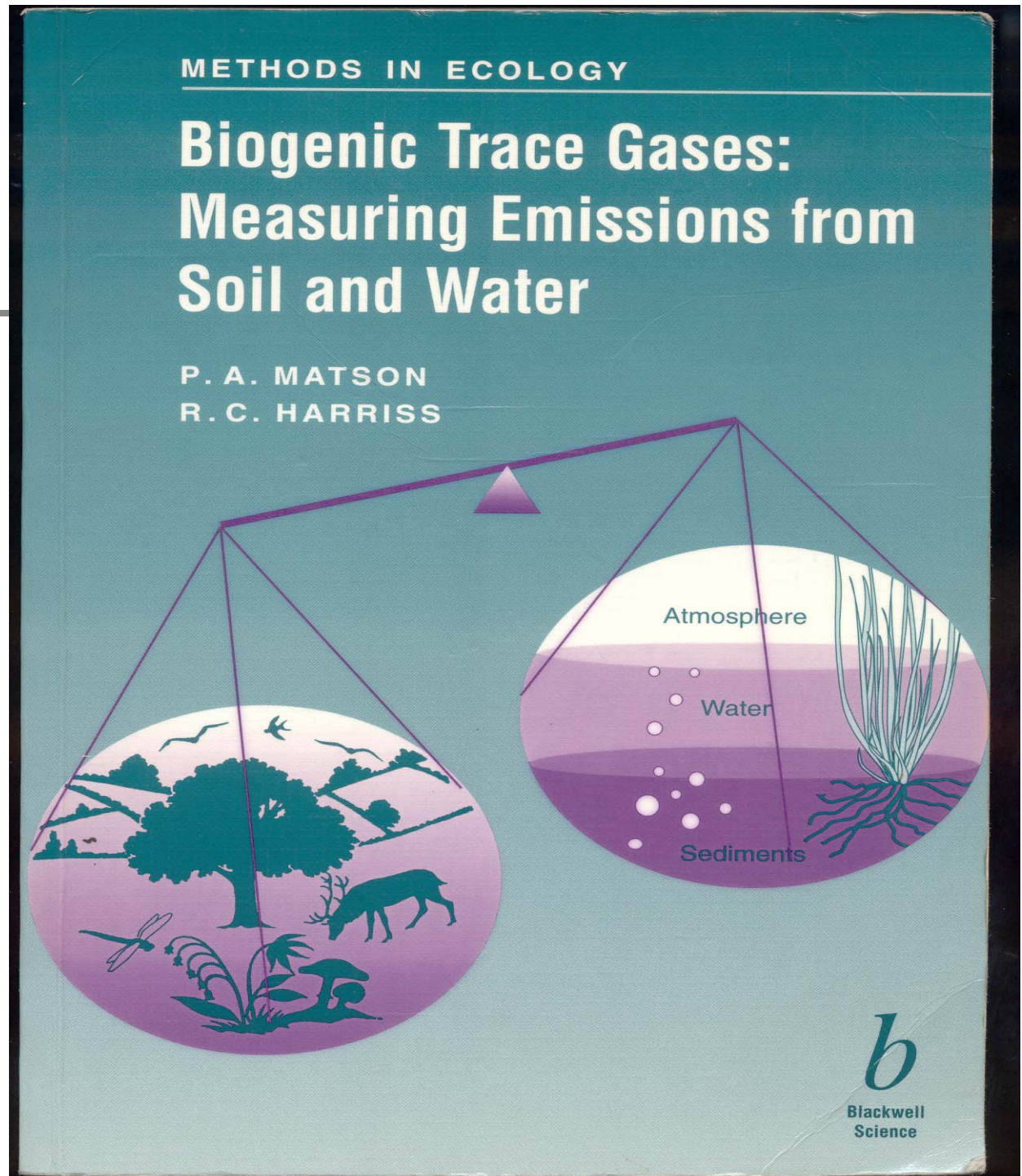
- Spatial and temporal variations
- Sampling points



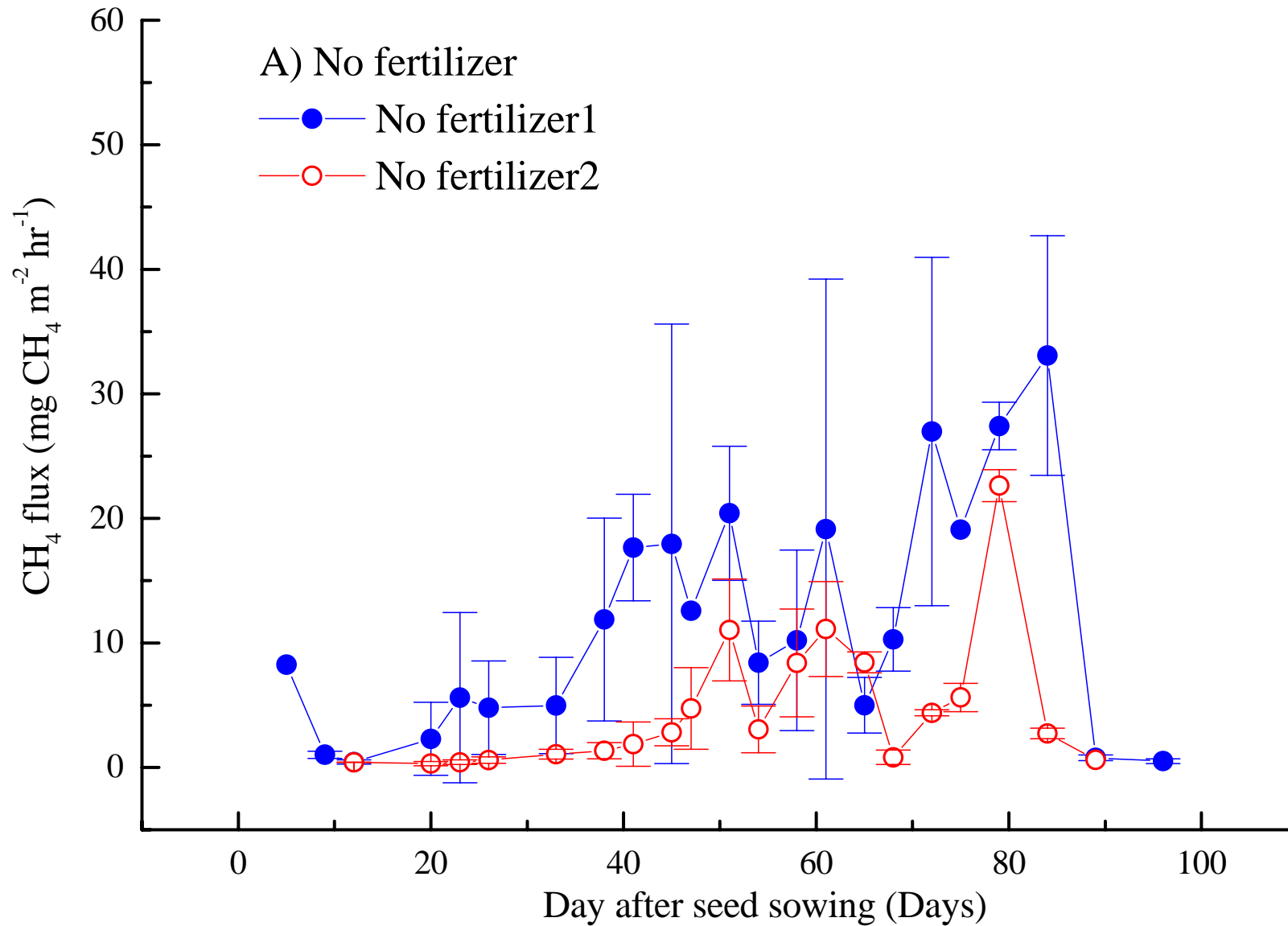
- Diurnal variations in methane emission flux ($\text{mg m}^{-2} \text{h}^{-1}$) during different growth stages of rice: (a) initial tillering stage; (b) full tillering stage; (c) young panicle differentiation stage; (d) booting stage; (e) complete heading stage; (f) ripening stage. TPE, rice–duck complex ecosystem in the plot experiment; TFE, rice–duck complex ecosystem in the field experiment; UPE, conventional rice field in the plot experiment; UFE, conventional rice field in the filed experiment. Huang at al., 2004



**More Details
can be found
in:**



Emission Factor → mg CH₄/m₂/day





Paddy field emission

Treatment	CH₄ flux g m⁻²	mg/m²/day
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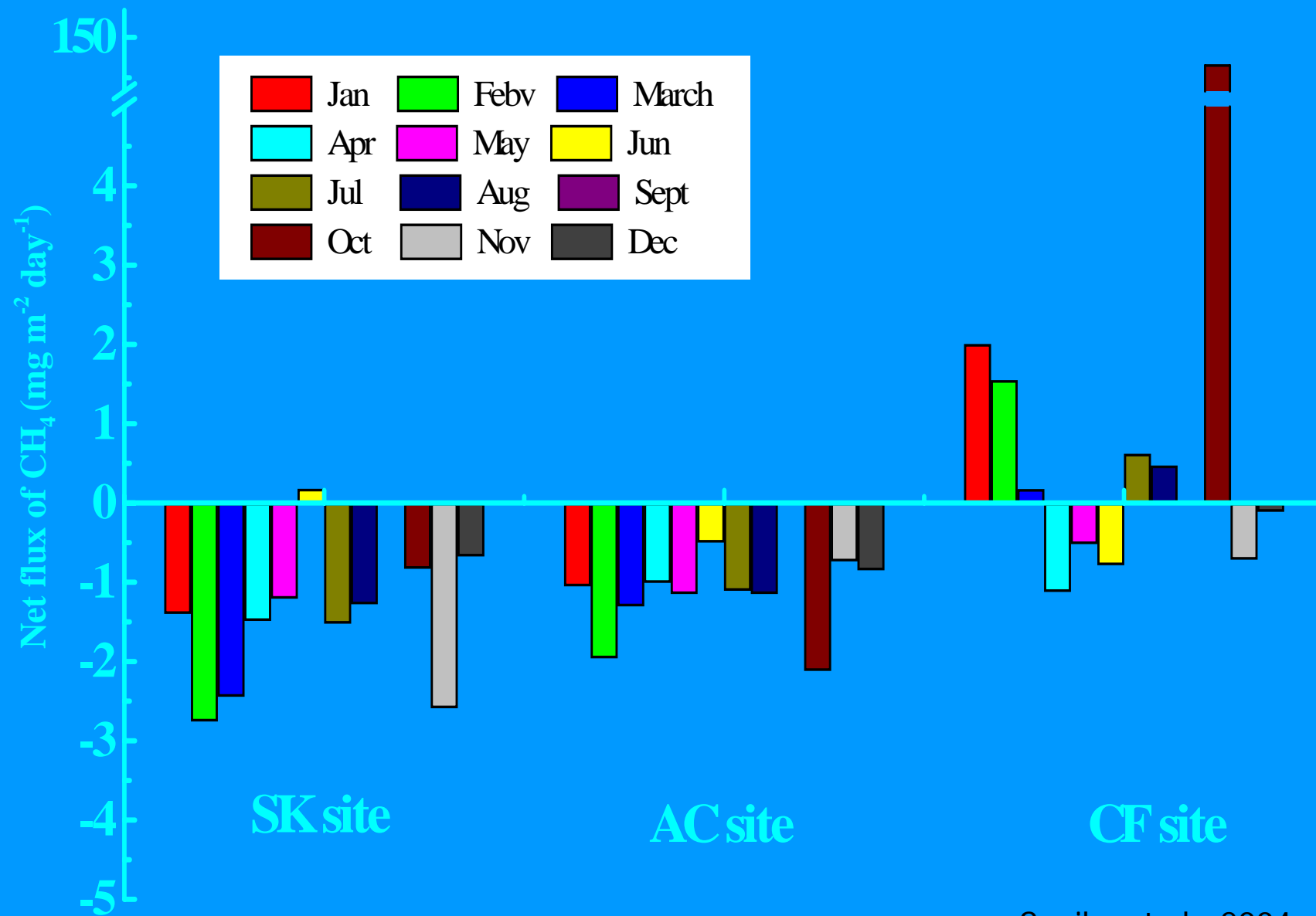
Control	18.5	154
Chem.	11.0	92
Manure	13.8	115

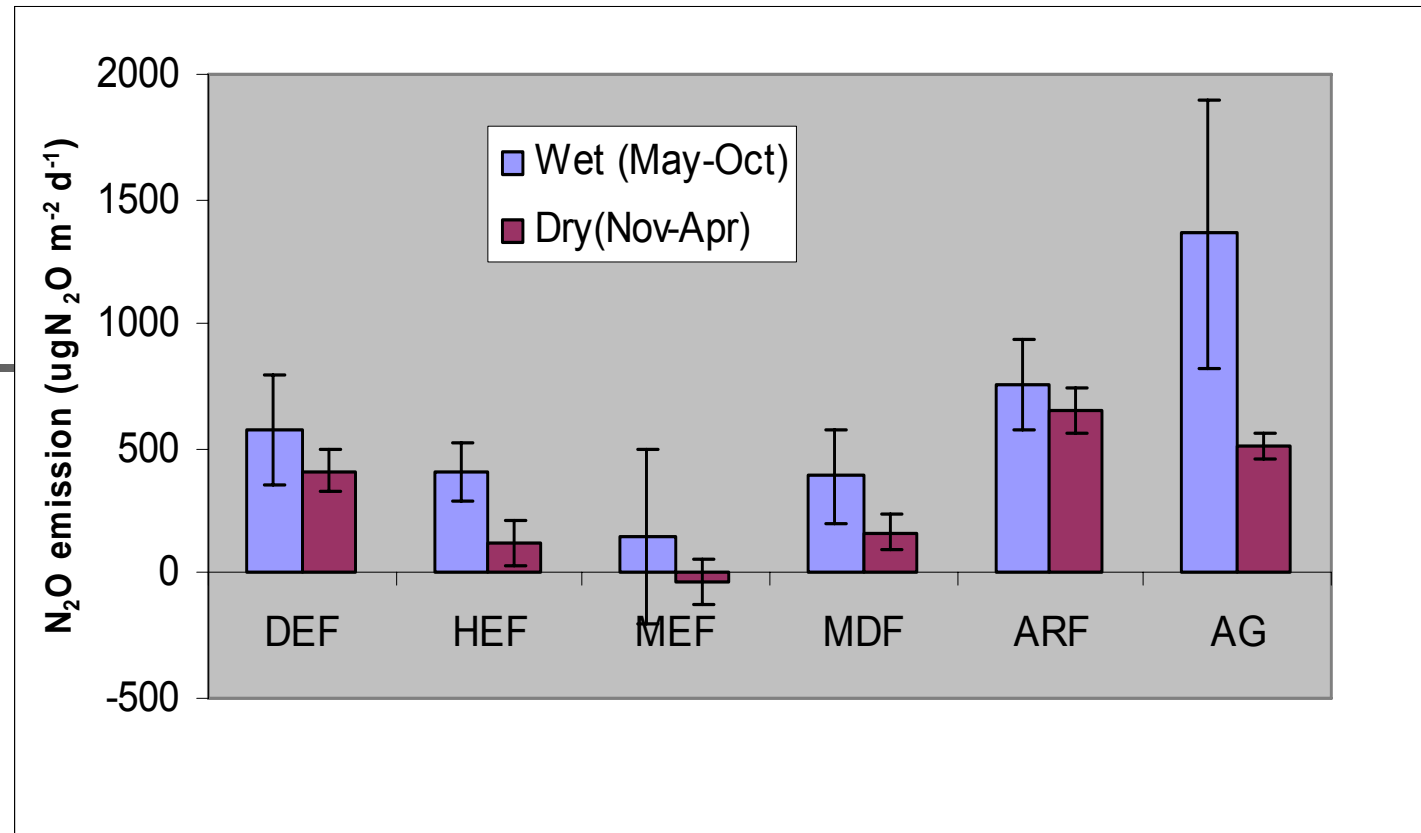


Forest emission factor

- Measurement for one year
- Convert to mg/are/day or any suitable format

Net Methane flux ($\text{mg m}^{-2} \text{ day}^{-1}$)





The monthly average (\pm SD)
($\mu\text{g N}_2\text{O m}^{-2} \text{ day}^{-1}$)

DEF	491 ± 321
HEF	261.9 ± 268
MEF	46 ± 456
MDF	276 ± 321
ARF	627 ± 346
AG	829 ± 851



The End