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Flux calculations using the IHF mass balance method with shuttles

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ROTHAMSTED RESEARCH

BBSRC bioscience for the future

Lawes Agricultural Trust

Data required

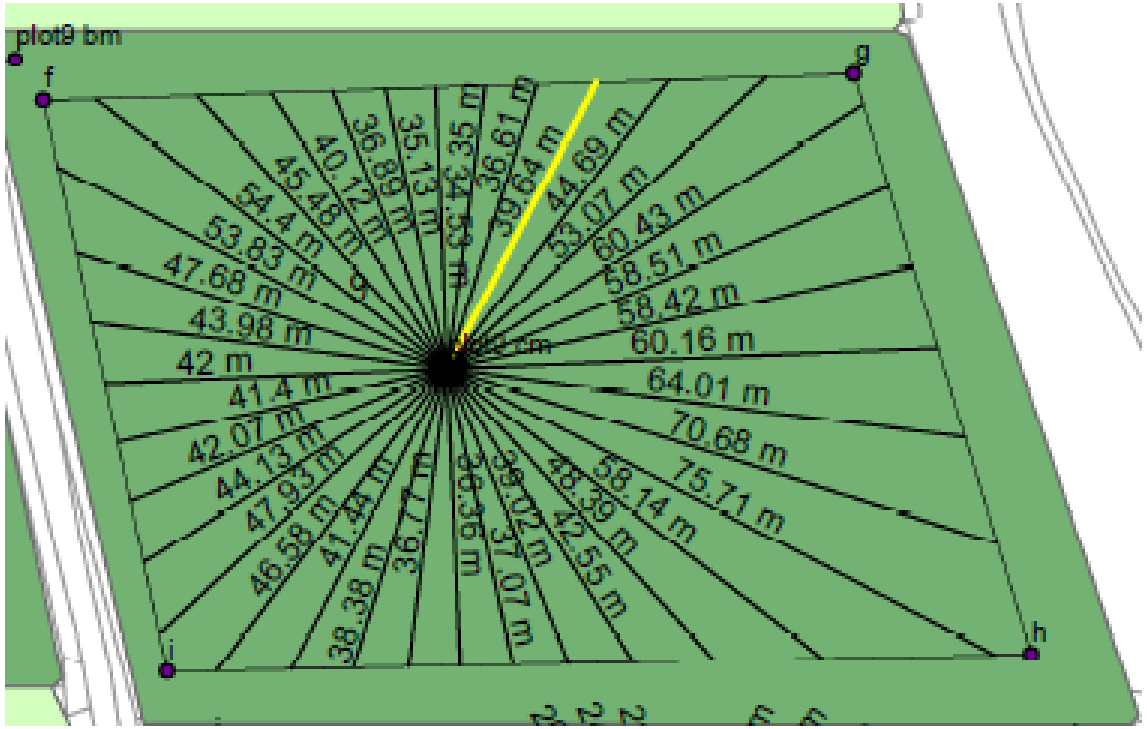
$$\text{Flux from treated area} = (IHF_{dw} - IHF_{uw}) / x$$

- Heights of shuttles on main and background mast
- Duration of sampling period
- Fetch length for sampling period
- Amount of ammonia collected in the shuttle
- ‘Blank’ value for shuttle

Fetch length

- Need to be weighted average according to changing wind direction
- Calculate fetch length for each 5-min period
- Requires wind direction

See spreadsheet example



Ammonia collected per shuttle

- Volume of water used to extract (e.g. 40 ml), V_e
- Lab concentration of extract (e.g. 20 ug ml^{-1}), C_s
- Average lab concentration of 'blank' shuttles, C_b

Mass collected, M (ug):

$$\boldsymbol{M = (C_s - C_b) \times V_e}$$

Horizontal flux per shuttle

- Mass of NH_3-N collected, M (from previous)
- Effective cross-sectional sampling area of shuttle, A (m^2)

From Leuning paper A = 2.42 x 10^{-5} m^2

(Actual area of orifice in baseplate = 3.85 x 10^{-5} m^2)

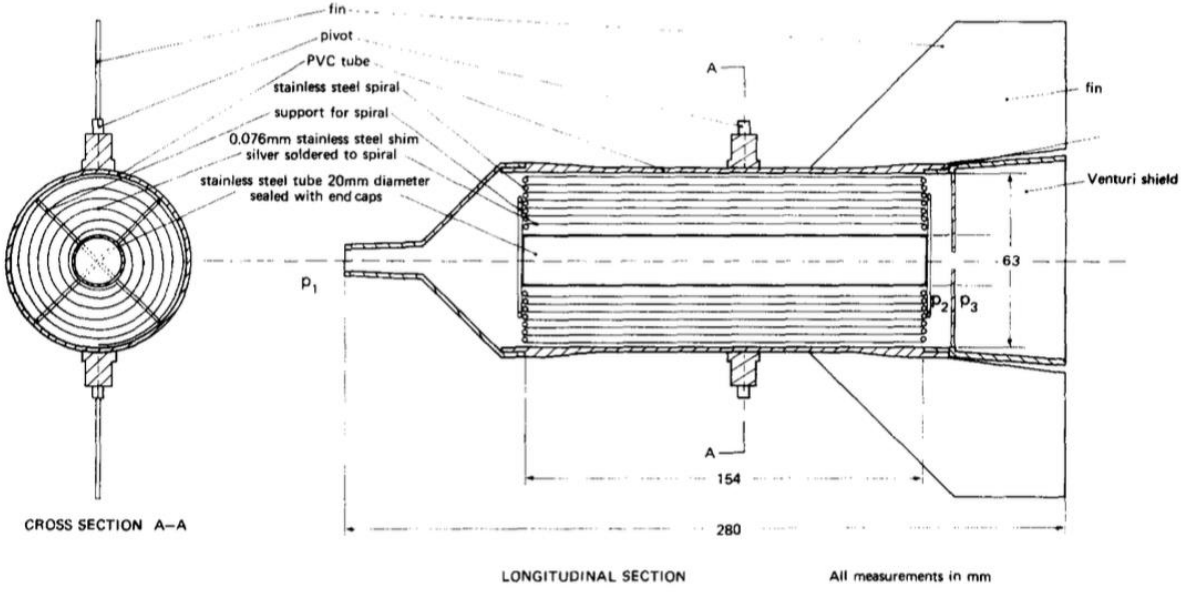


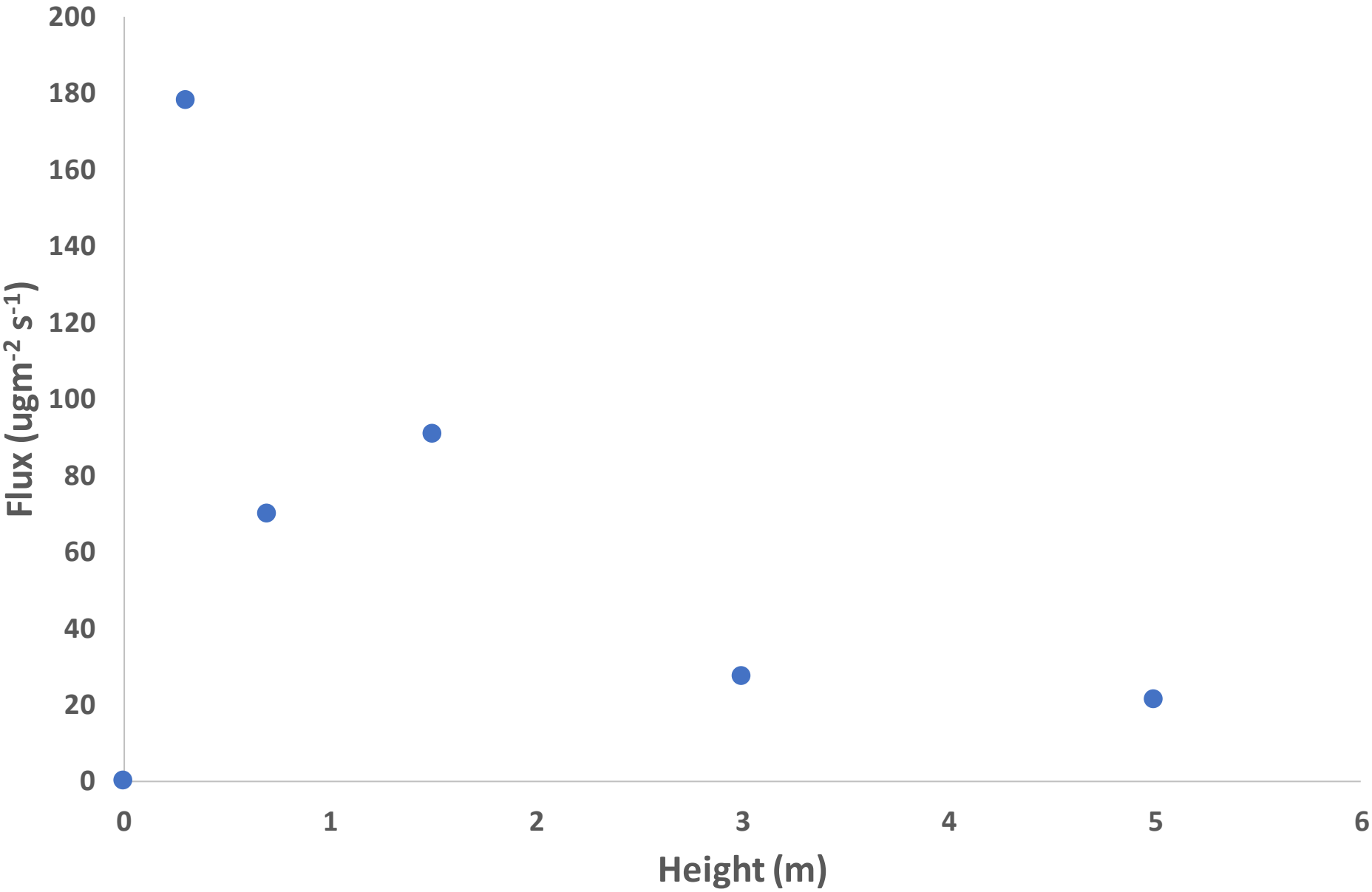
Fig. 1. Schematic diagram of ammonia sampler.

Horizontal flux per shuttle

- Mass of NH_3-N collected, M (from previous)
- Effective cross-sectional sampling area of shuttle, A (m^2)
- Sampling duration, t (s)

Horizontal flux, F (ug m^{-2} s^{-1}): $$\boldsymbol{F = M/At}$$

Integrated horizontal flux per mast



Integrated horizontal flux per mast