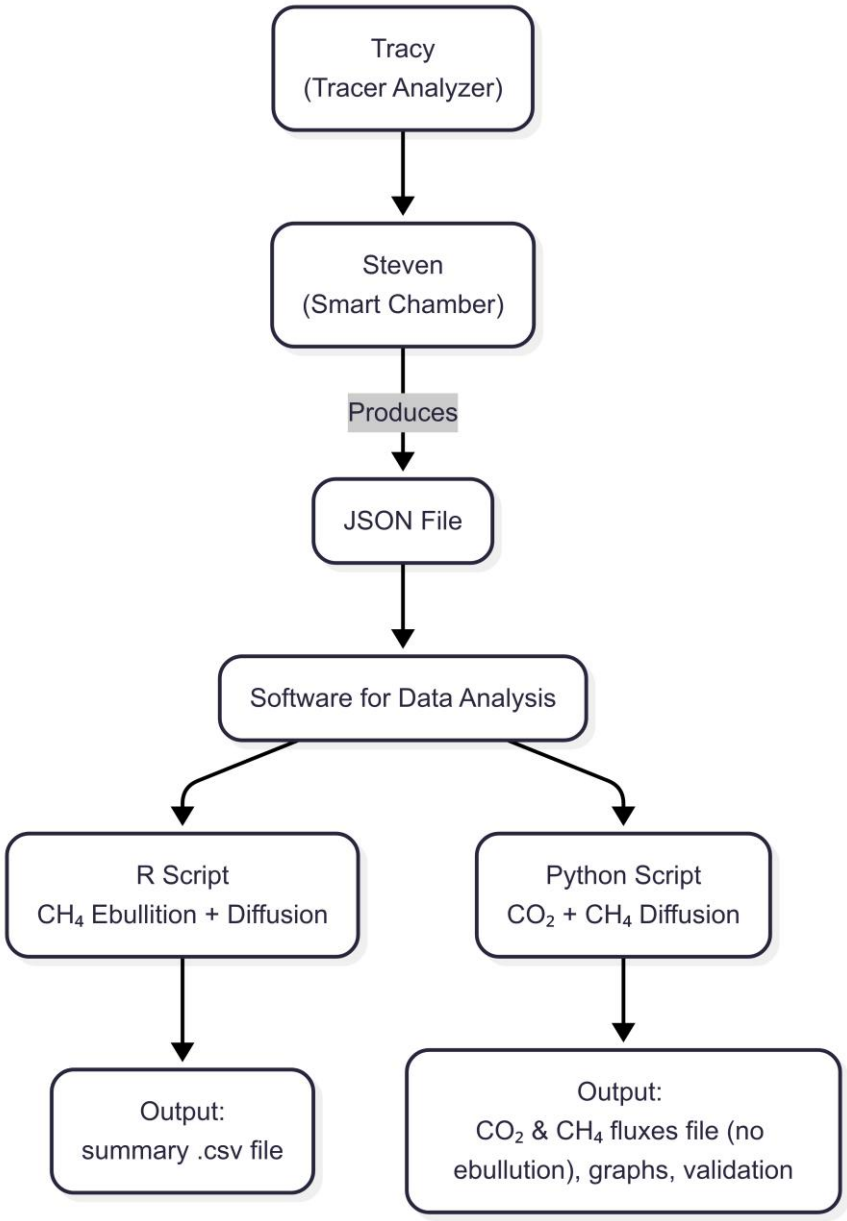
GHG Flux Analysis
Project Update & Next Steps

Current Status

We've built two parallel pipelines for analyzing greenhouse gas (GHG) emissions (CH_4 and CO_2) from smart chamber data files (in JSON format). The workflow is visualized in the accompanying diagram.



🔗 Repository Access

📁 You can find the full working R and python scripts here:

👉 GitHub Repository Link – https://github.com/natdefalco/GHG_emission

(A README with instructions is included)

R Pipeline – Status: ☑ Working

• Built around the aquaGHG and goFlux packages.
• Focused on CH_4 flux analysis, with both diffusion and ebullition separation.
• Uses:
  - automaticflux() for fully automated, reproducible flux estimation
  - flux.separator() to distinguish between bubbling (ebullition) and diffusion
  - flux.plot() and flux2pdf() for automated diagnostic visualizations
• Current output includes:
  - .csv file with fluxes per measurement
  - .pdf with plot diagnostics (AICc, MAE, RMSE, flux model type, etc.)

📦 Packages used:

• aquaGHG: wrapper for high-level CH_4 flux analysis with optional ebullition/diffusion separation.
• goFlux: base library for linear and non-linear flux fitting from chamber measurements.

Python Pipeline – Status: ☑ Operational (for CH_4 + CO_2 Diffusion)

• Supports CH_4 and CO_2 diffusion flux estimation
• Based on custom regression and physical gas law conversion
• Allows validation against device-reported fluxes (e.g., Smart Chamber outputs)
• Includes:
  - Plotting of raw time series and regressions
  - Basic statistical summaries

📌 Limitation: Currently does not separate CH_4 ebullition from diffusion.

What Still Needs to Be Done?

Task	Priority	Platform
Run CH_4 pipeline in R	✅ Done	R
Extend R code to process CO_2	🔶 High	R
Add validation plots (vs. device)	🔶 High	R
Enhance graph export (CH_4 + CO_2)	🔶 High	R

Summary

- The R pipeline is reproducible and field-ready for CH_4 ebullition + diffusion analysis.
- The Python pipeline is fast and useful for validation and CO_2.
- Our next steps should focus on:

  - Completing the R-based CO_2 and validation
  - Finalizing documentation
  - Improving Python's graphical outputs