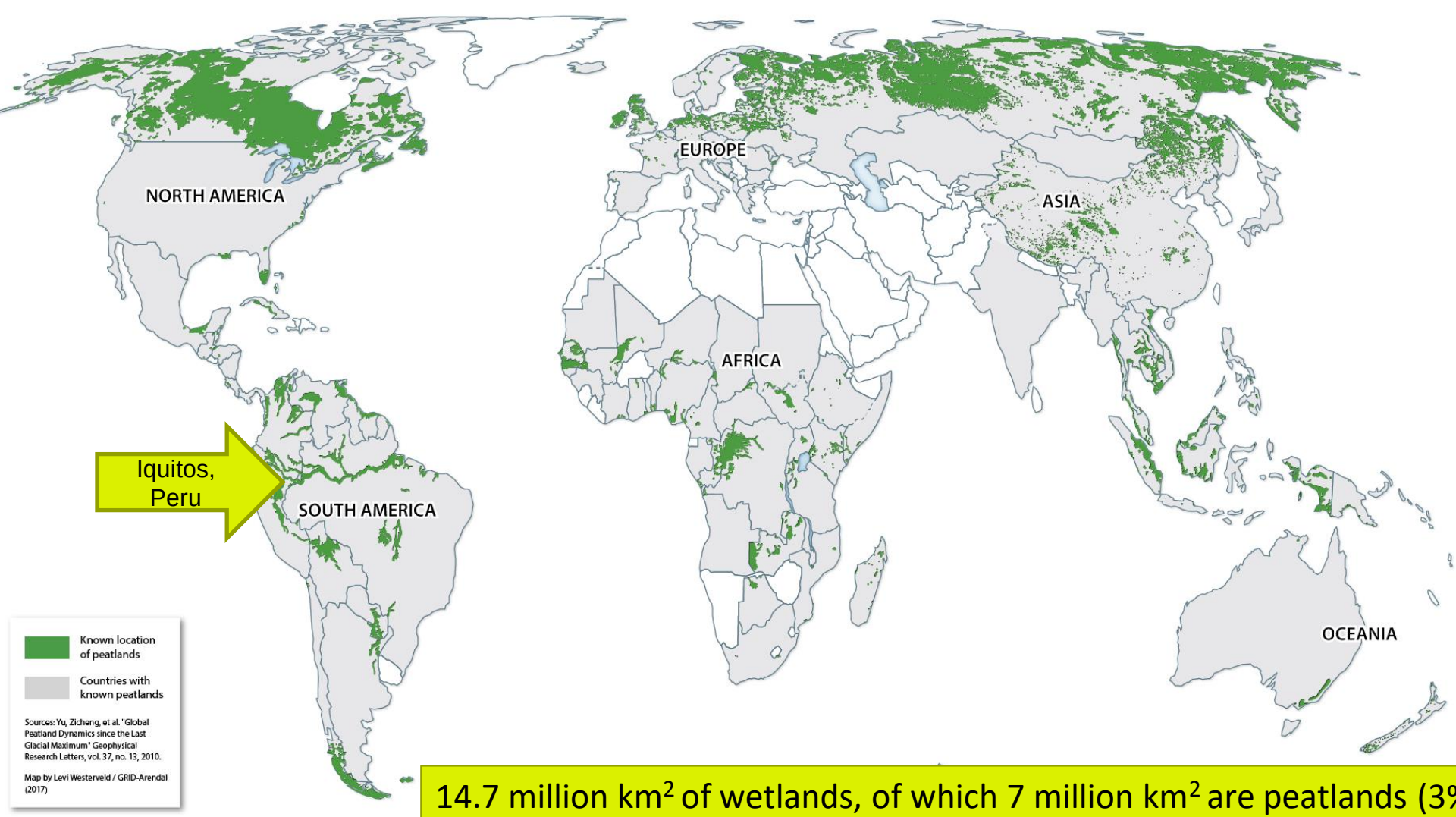
CARBON FLUXES OF AN AMAZONIAN PALM PEATLAND

Angela Lafuente[1], Daniel Tyler Roman[2], Jhon Rengifo[3], Fenghui Yuan[4], Erik Lilleskov[5], Rod Chimner[1], Lizardo Fachin[3], Jeffrey Wood[6], Daniel Ricciuto[7], Hinsby Cadillo-Quiroz[8], Randall Kolka[9], Craig Wayson[2], Kristell Hergoualc'h [10], Timothy Griffis[4].

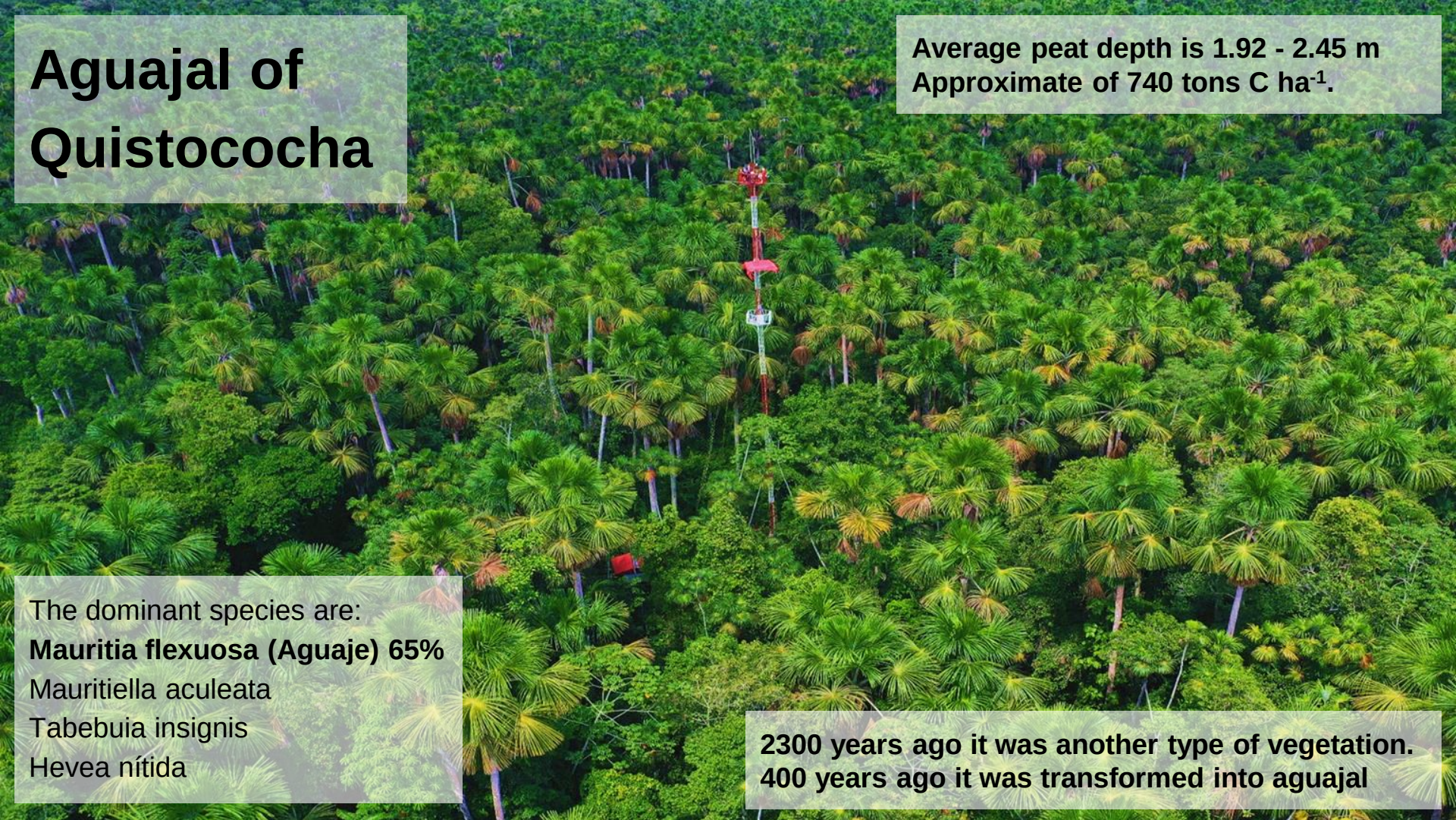
[1] Michigan Technological University, Houghton, Michigan, USA;
[2] USDA Forest Service, International Programs, Washington, D.C., USA;
[3] Instituto de Investigaciones de la Amazonia Peruana, Iquitos, Peru;
[4] Department of Soil, Water, and Climate, University of Minnesota, Saint Paul, MN, USA;
[5] USDA Forest Service, Northern Research Station, Houghton, Michigan, USA;
[6] School of Natural Resources, University of Missouri, Columbia, MO, USA;
[7] Oak Ridge National Lab, TN, USA;
[8] Arizona State University, Tempe, AZ, USA;
[9] USDA Forest Service, Northern Research Station Grand Rapids, MN, USA;
[10] Center for International Forestry Research, Jalan CIFOR, Situ Gede, Sindang Barang, Bogor 16115, Indonesia



14.7 million km^2 of wetlands, of which 7 million km^2 are peatlands (3%

Aguajal of Quistococha

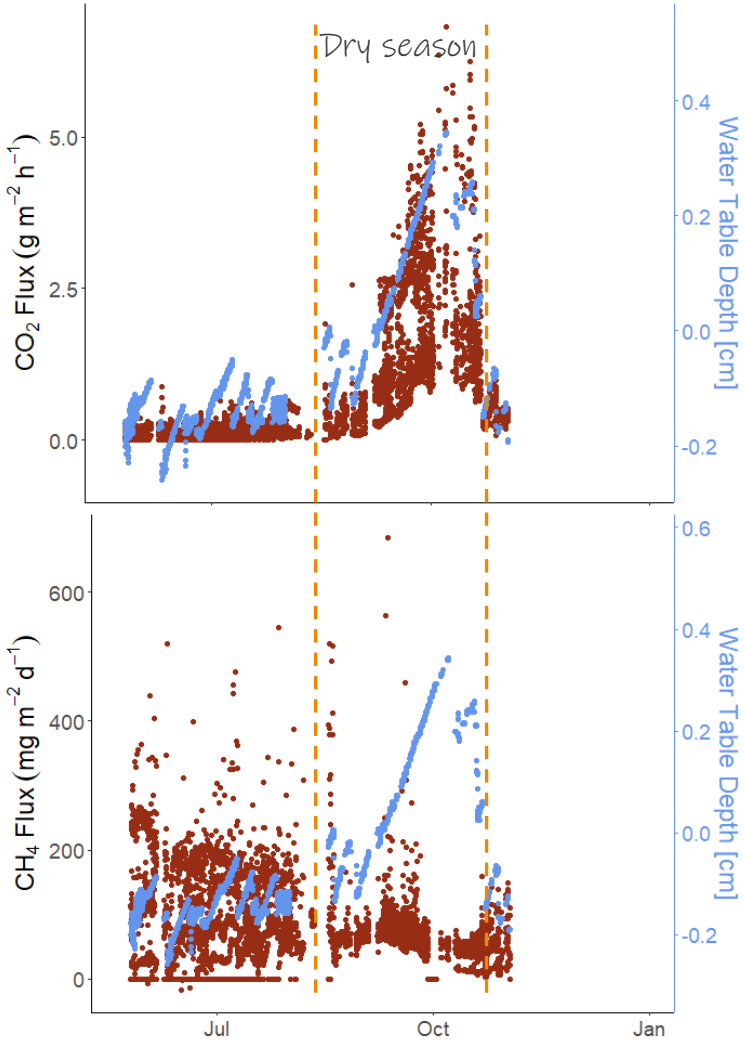
Average peat depth is 1.92 - 2.45 m
Approximate of 740 tons C ha^{-1}.



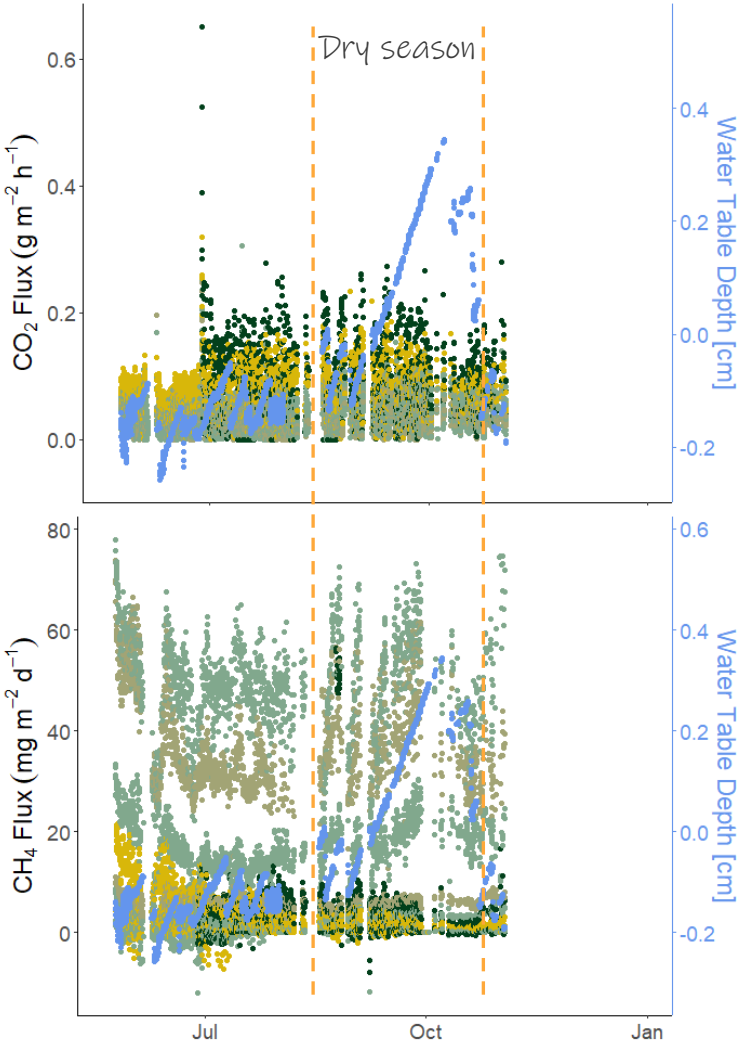
The dominant species are:
Mauritia flexuosa (Aguaje) 65%
Mauritiella aculeata
Tabebuia insignis
Hevea nítida

2300 years ago it was another type of vegetation.
400 years ago it was transformed into aguajal

LI-8100 + LI-7810 + LI-8150 system linked to
6 automated **soil chambers** + **10 stem chambers**

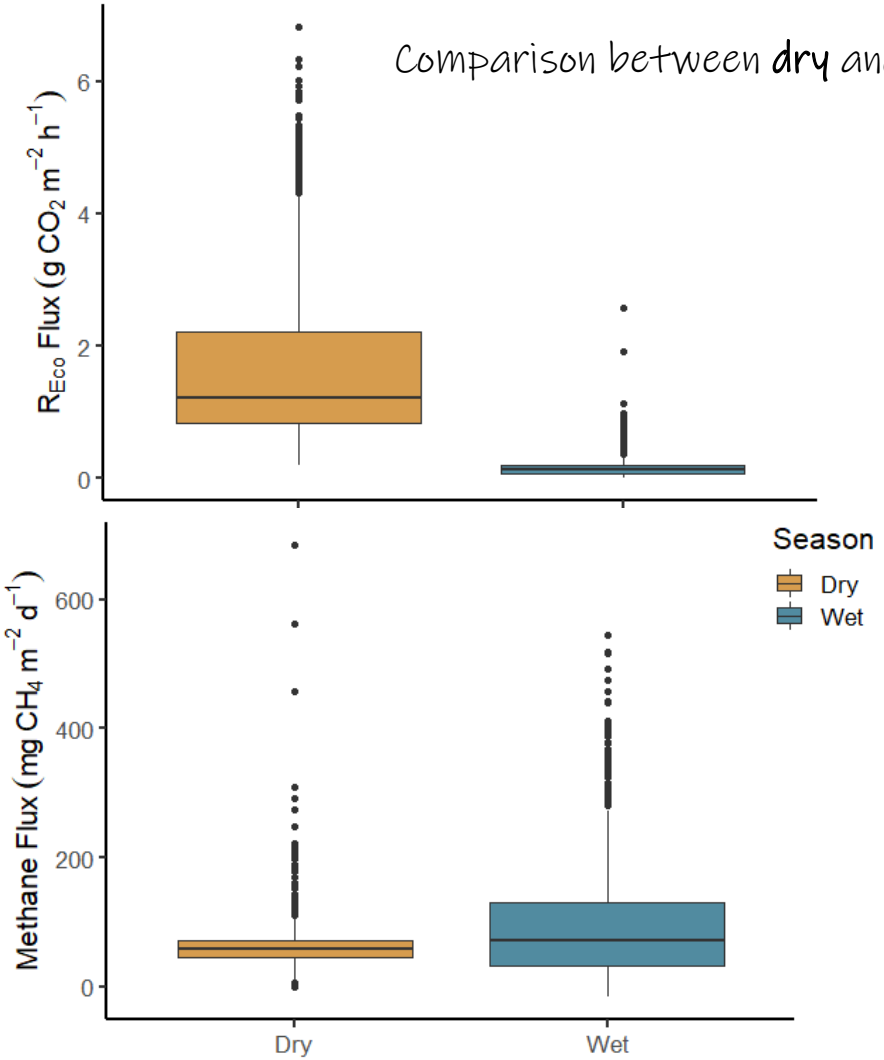


Observed variation on **Carbon fluxes** measured by the automated **soil chambers** during the study period **(June-November 2022).**



Observed variation on **Carbon fluxes** measured at 50 cm height (and 90 cm only on *Mauritia flexuosa*) by the automated **stem** chambers colour-coded by tree species during the study period **(June-November 2022).**

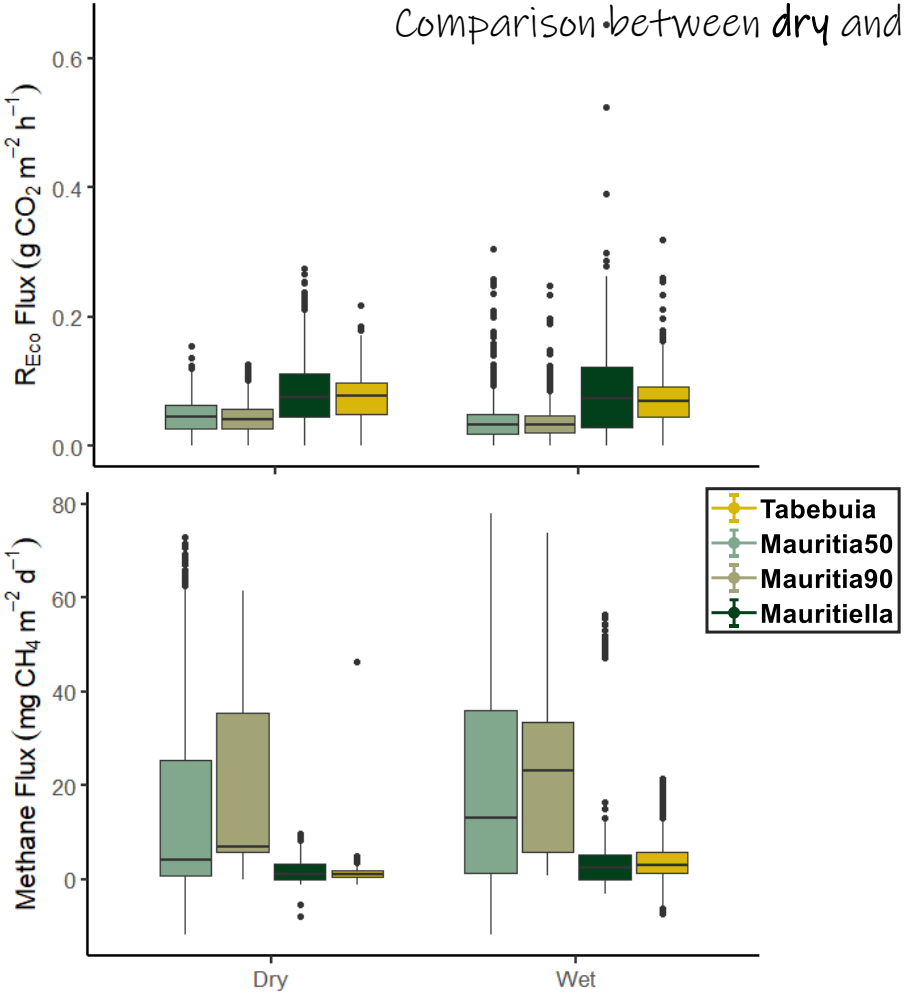
Comparison between **dry** and **wet** season on average **C fluxes**



Averaged **CO_2 fluxes** from soil are higher in the dry than in the wet season.

Averaged **CH_4 fluxes** from soil are higher in the wet than in the dry season.

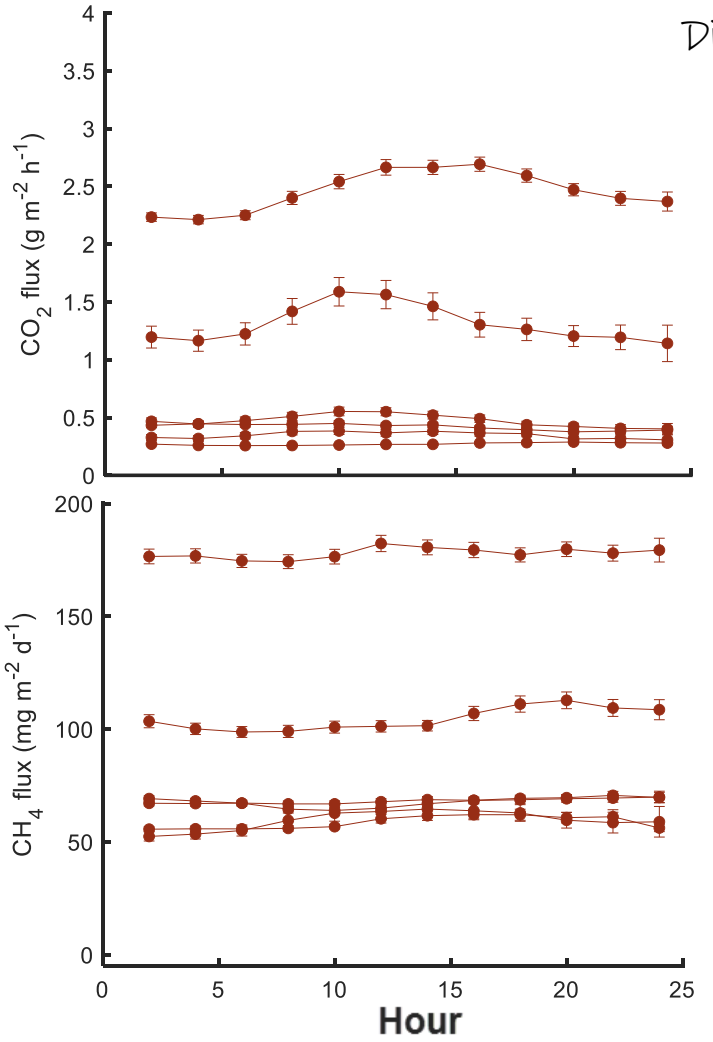
Comparison between dry and wet season on average C fluxes



Averaged **CO_2 fluxes** are higher in *Mauritiella armata* and *Tabebuia insignis* than in *Mauritia flexuosa* both in the dry and wet seasons.

Averaged **CH_4 fluxes** are higher in *Mauritia flexuosa* than in in *Mauritiella armata* and *Tabebuia insignis both in the dry and wet seasons.*

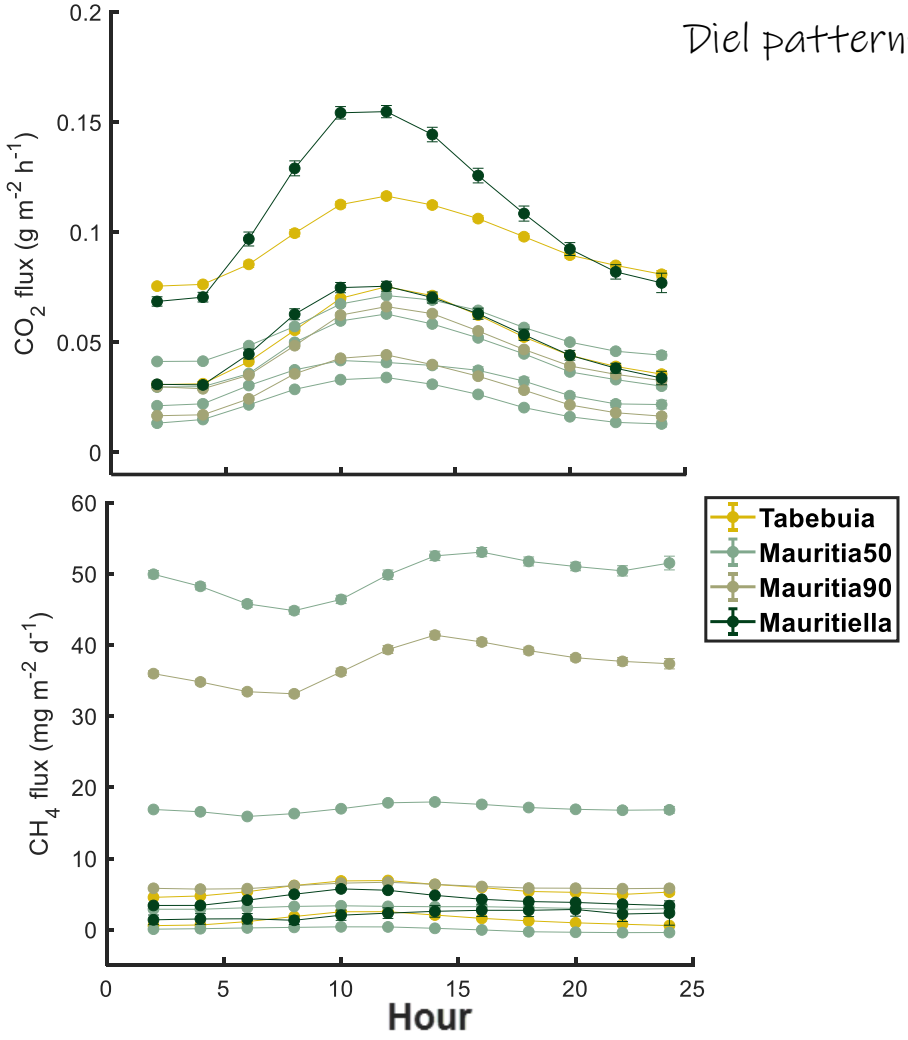
Diel patterns on soil C fluxes



Two of the soil auto-chambers show a diel patter on **CO_2 fluxes**.

We do not observe a diel patter on **CH_4 fluxes** from soils**.**

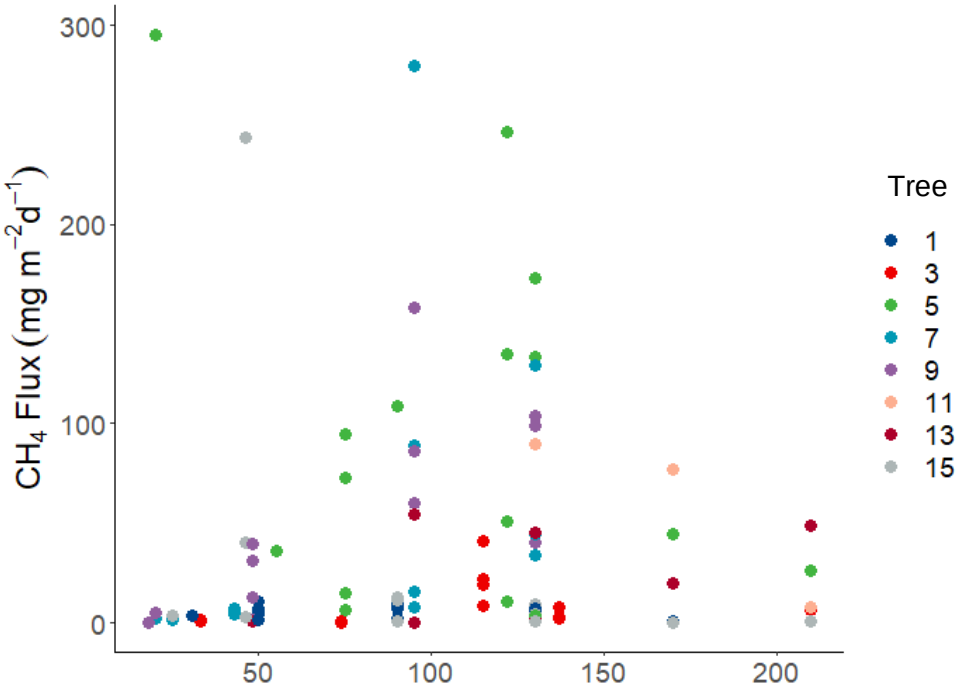
Diel patterns on stem C fluxes



We observe a diel pattern on stem **CO_2 fluxes.**

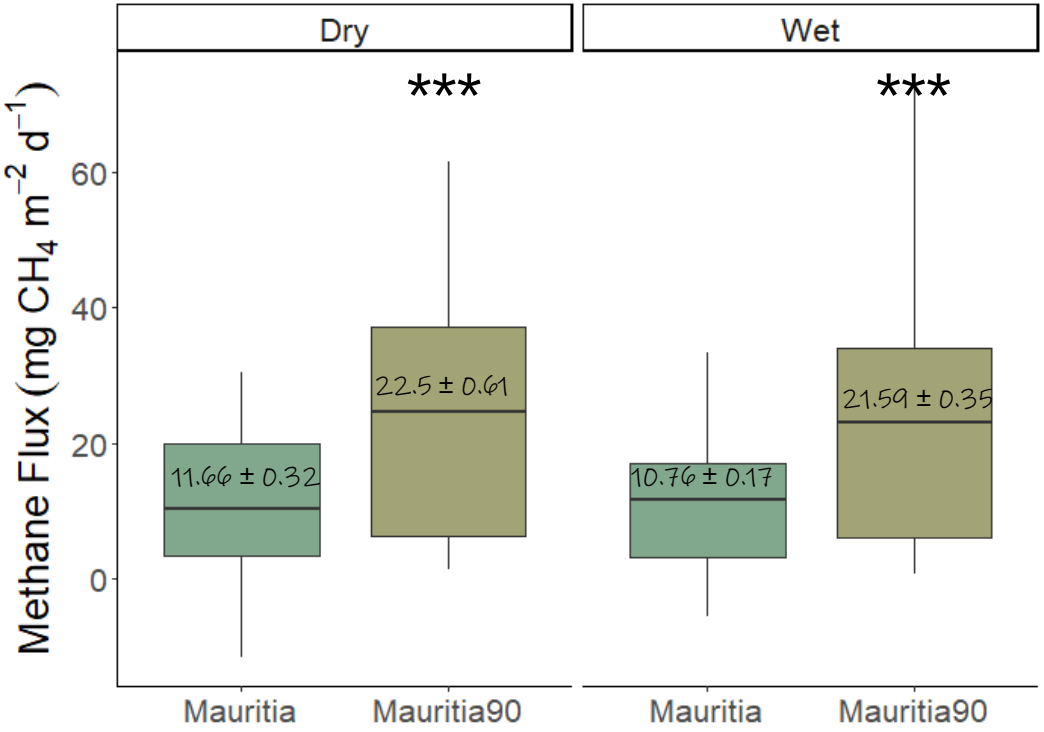
We do not observe a diel pattern on stem **CH_4 fluxes.**

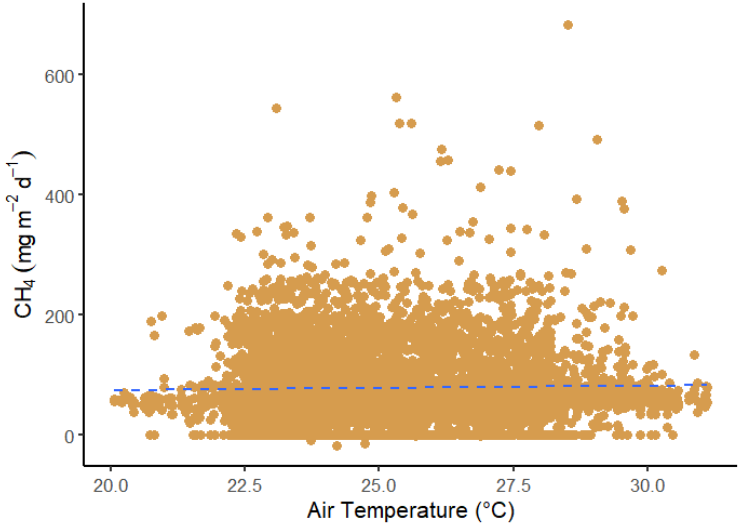
Manual measurements done on ***Mauritia flexuosa*** **stem** with a Picaro GasScouter show that **CH_4 fluxes peak at 90cm** height and then rapidly decrease after 130 cm from the soil surface.



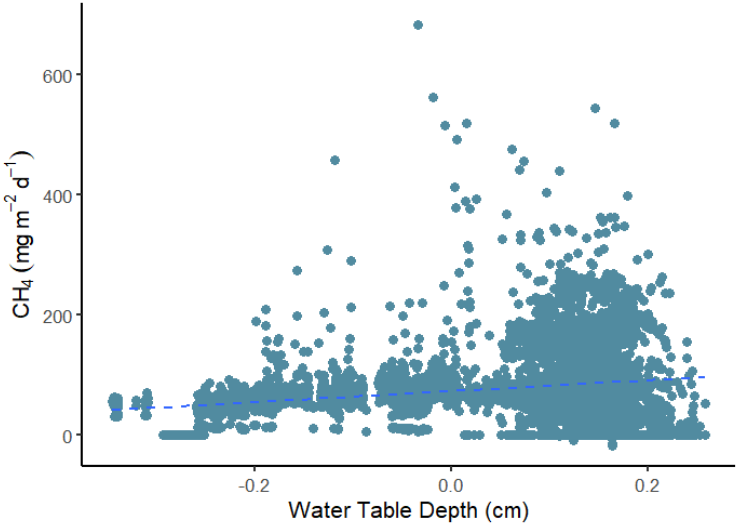
Measurements done with autochambers linked to LI-8100 + LI-7810 + LI-8150 at 2 heights on *Mauritia flexuosa* stems

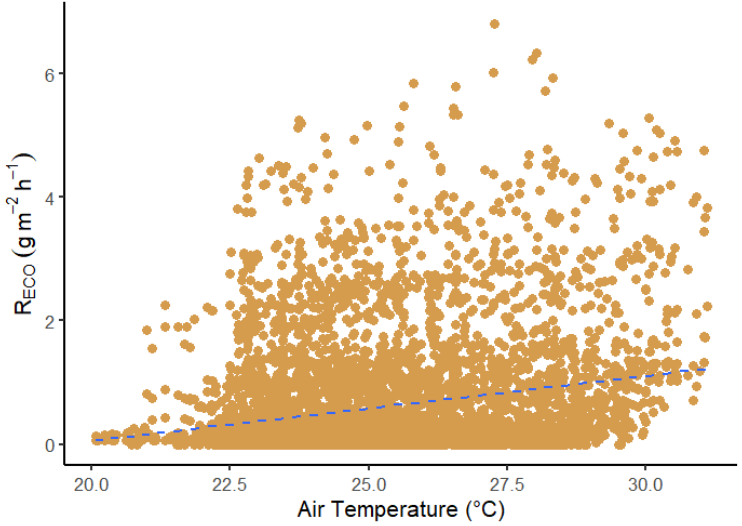
CH_4 fluxes are significantly **higher at 90 cm** from the soil surface both during the dry and wet season



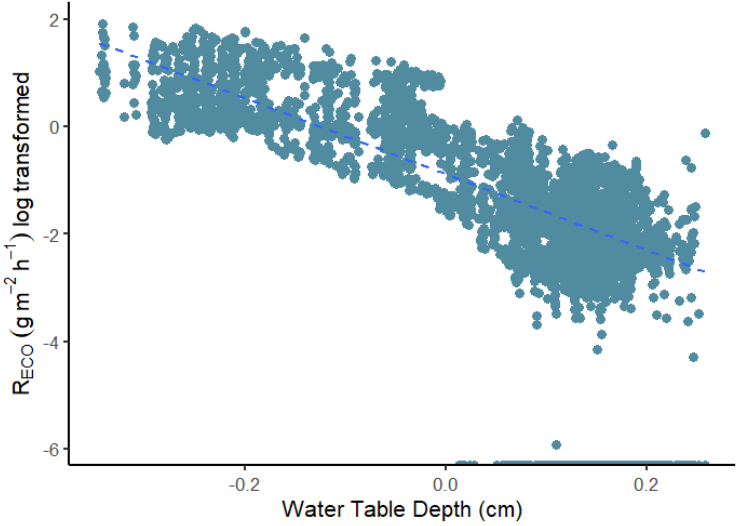


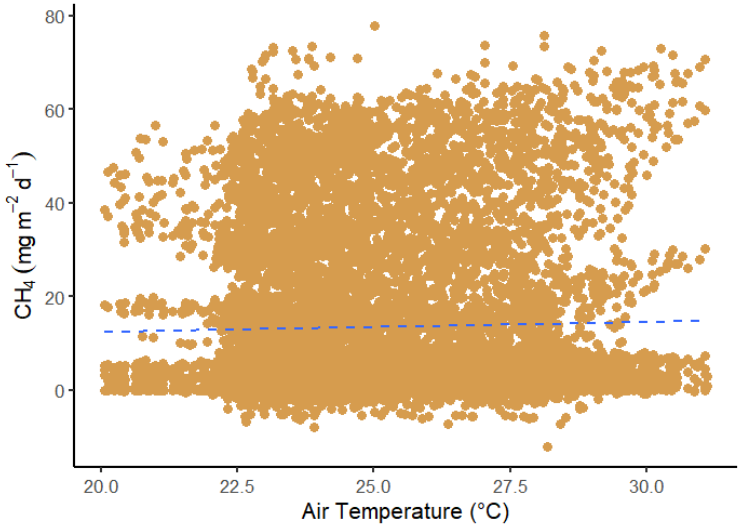
Soil CH_4 fluxes are positively correlated with temperature and water table depth



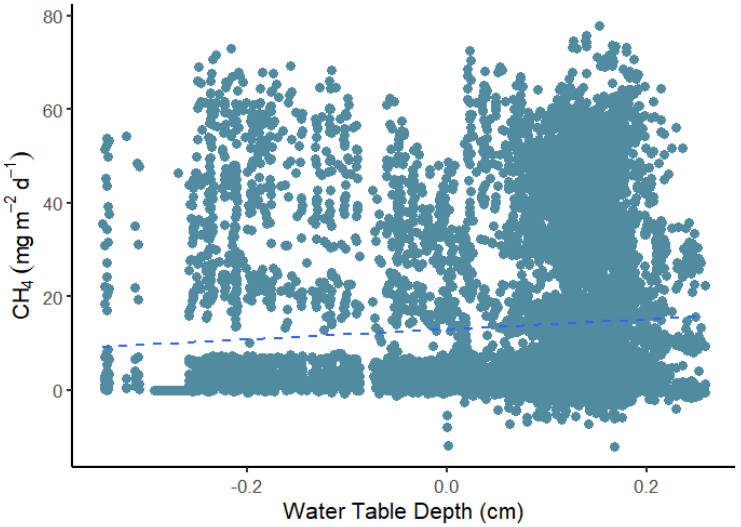


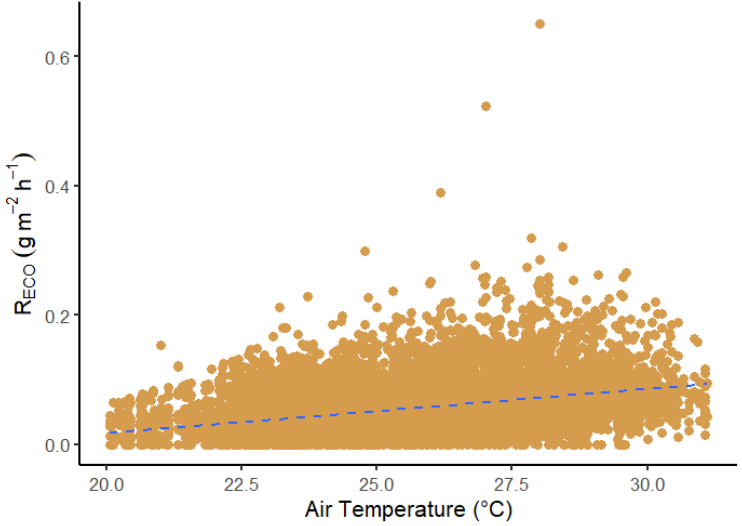
Soil CO_2 fluxes are positively correlated with temperature and negatively correlated with water table depth



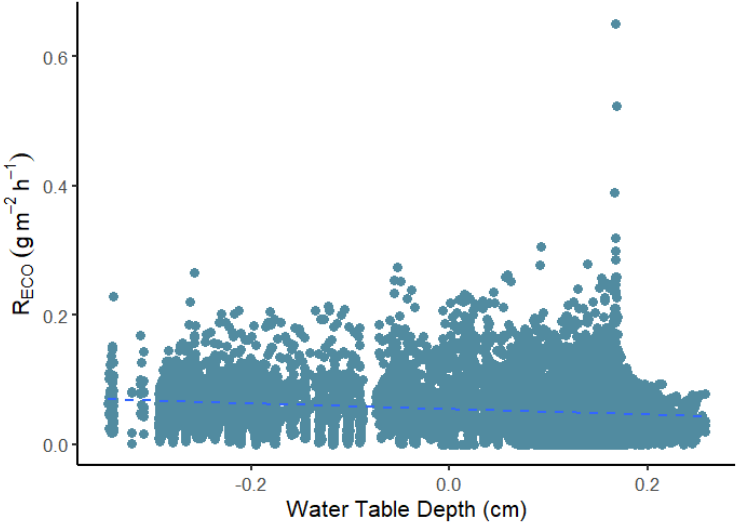


Stem CH_4 fluxes are positively correlated with temperature and water table depth

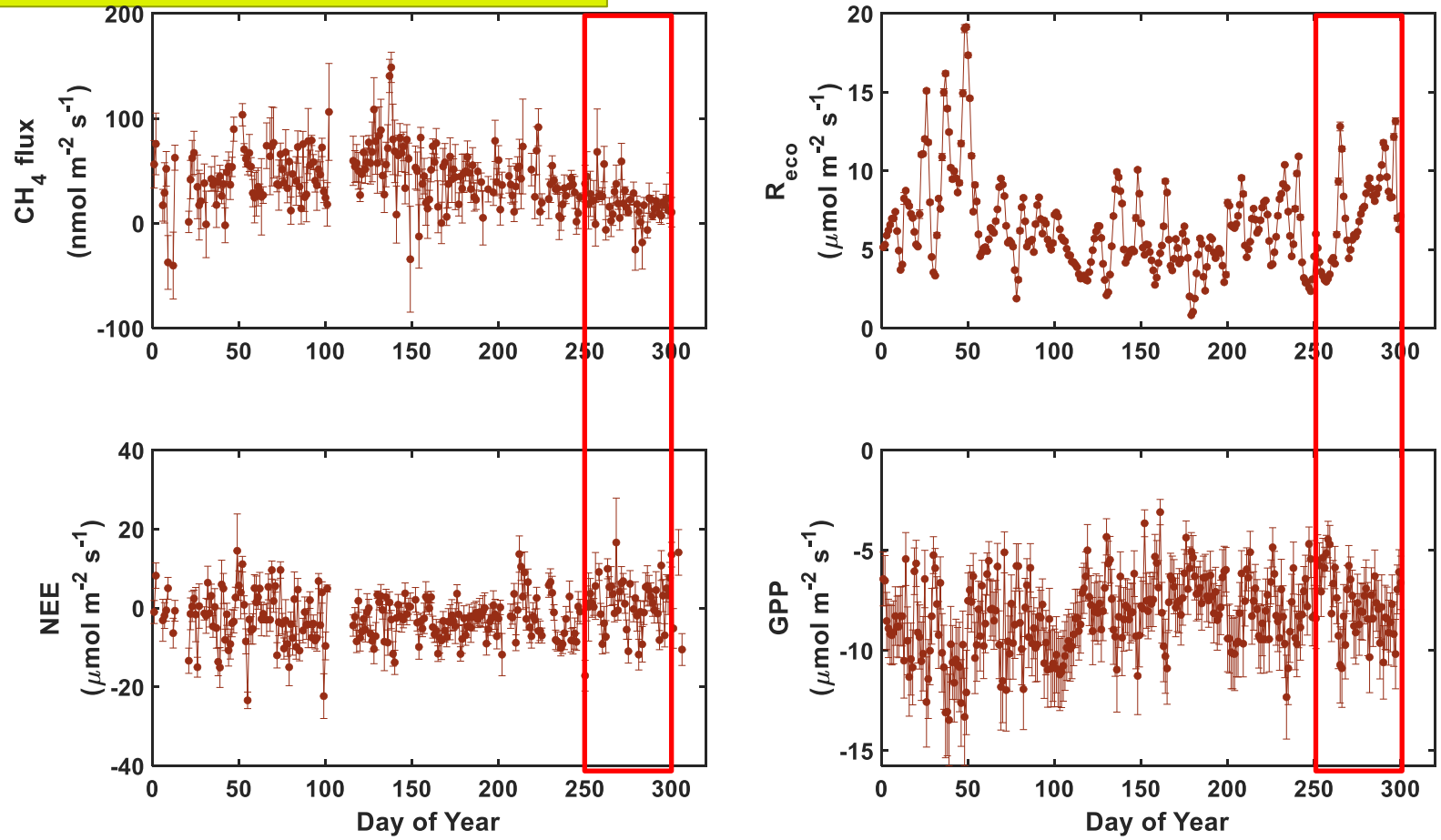




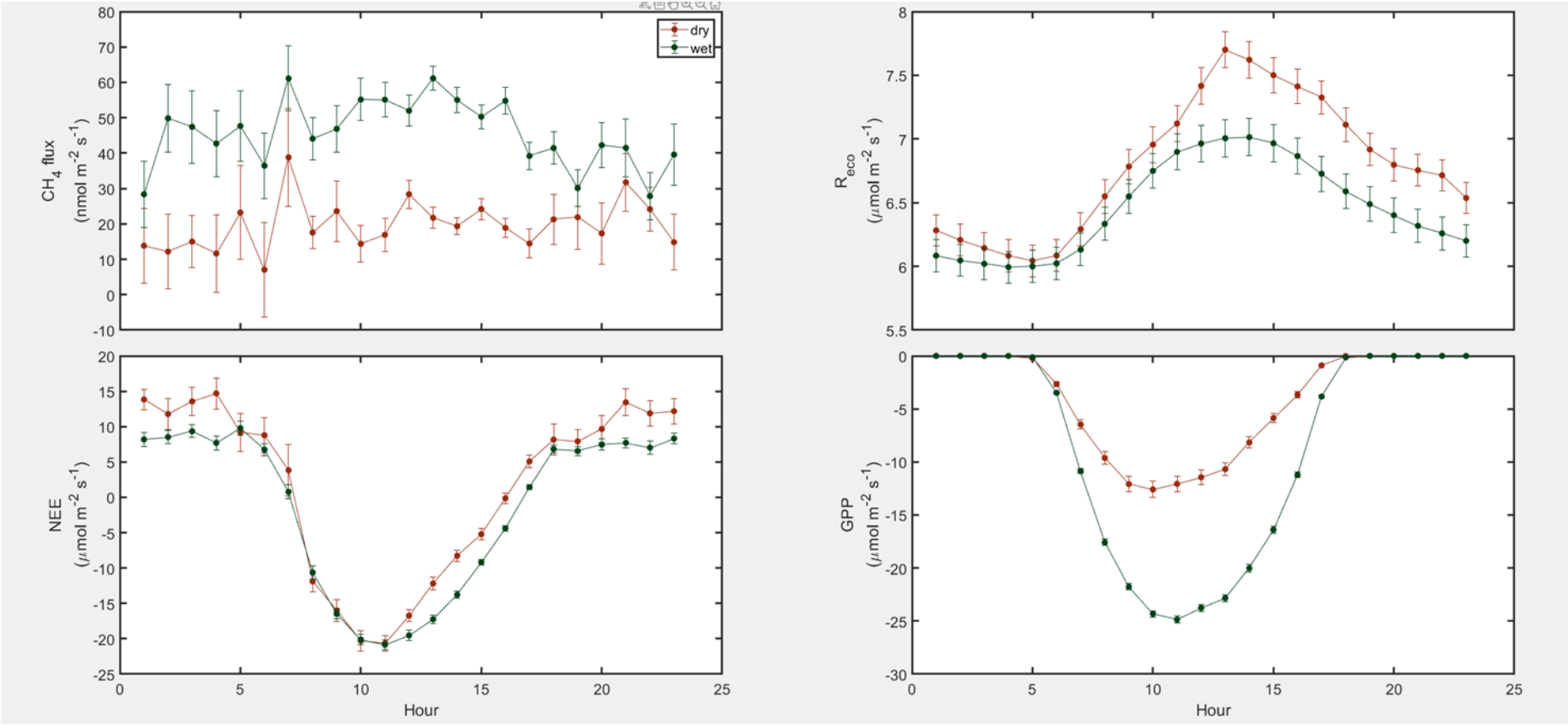
Stem CO_2 fluxes are positively correlated with temperature and negatively correlated with water table depth



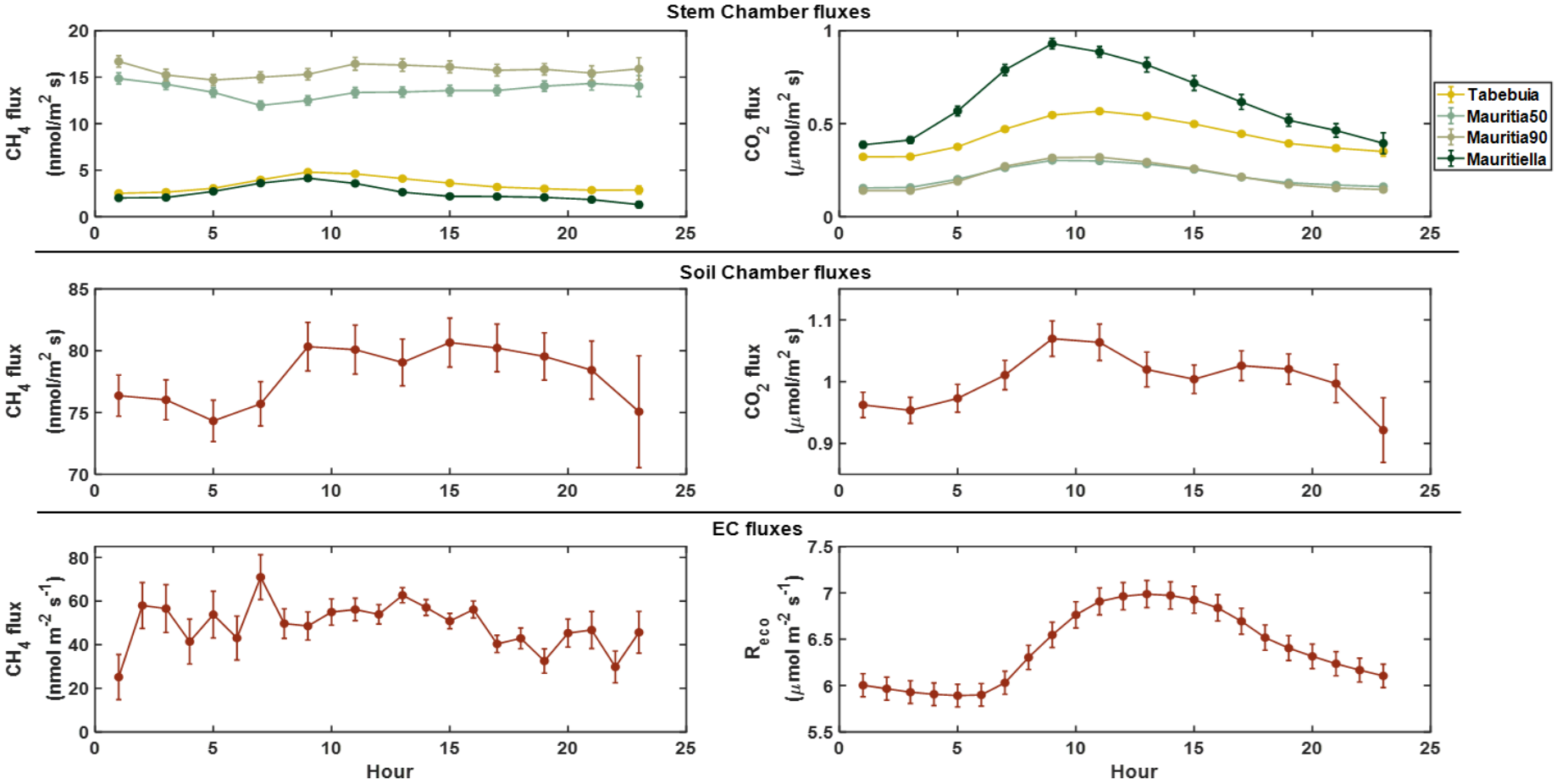
Eddy**C**ovariance **fluxes**. Marked in red is the dry season.



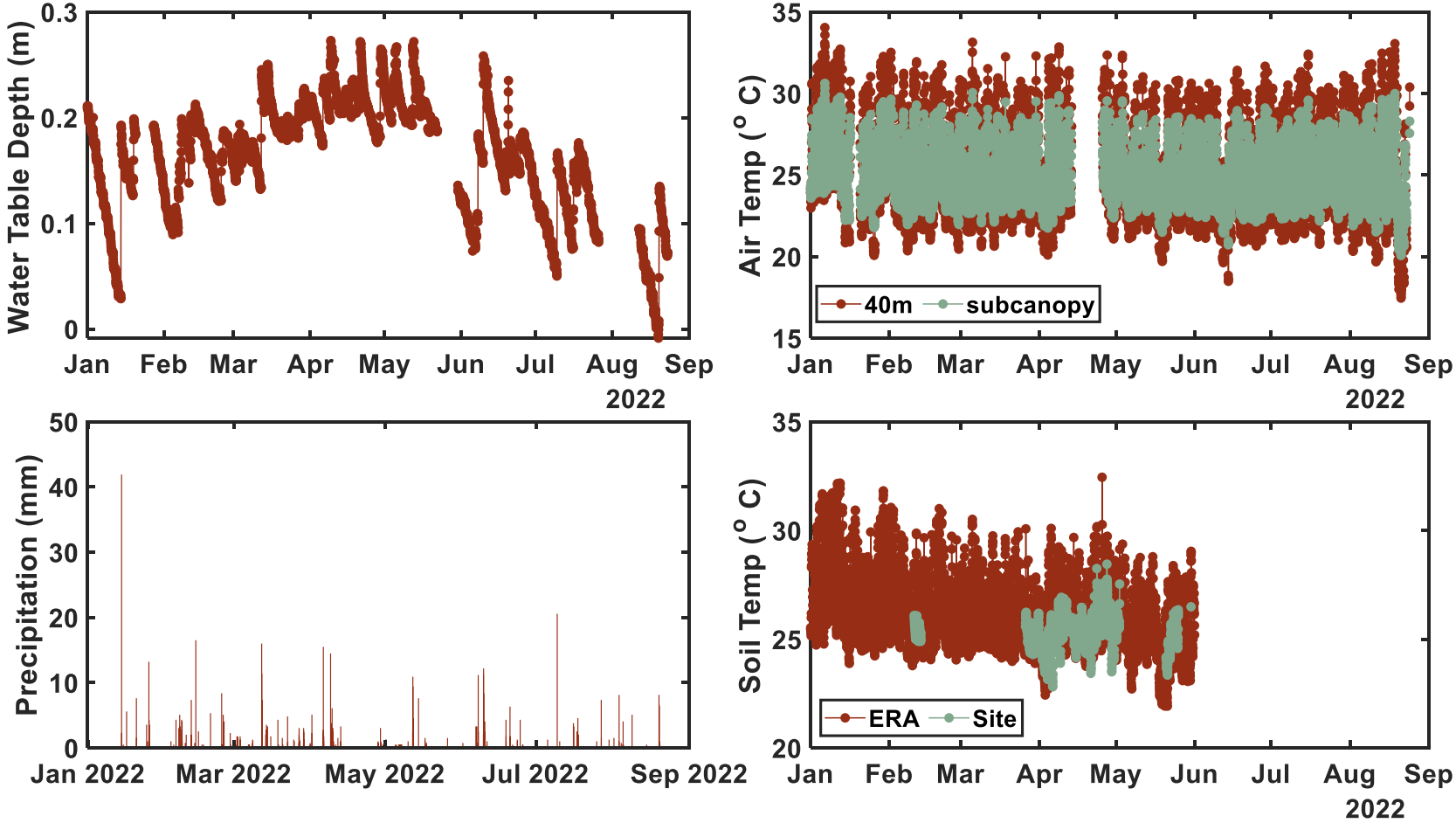
Eddy**C**ovariance flux **diel patterns** during the dry and wet seasons.



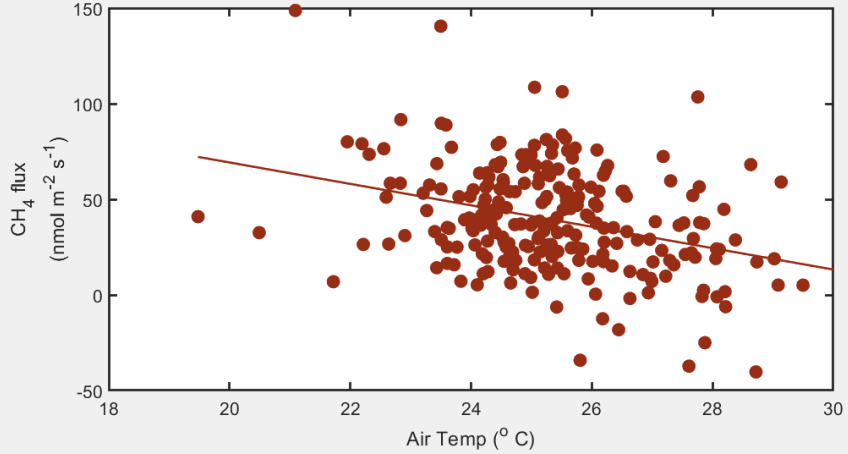
Eddy**C**ovariance and chamber **diel cycles** during the **wet season**. *Note different Y axis scales*

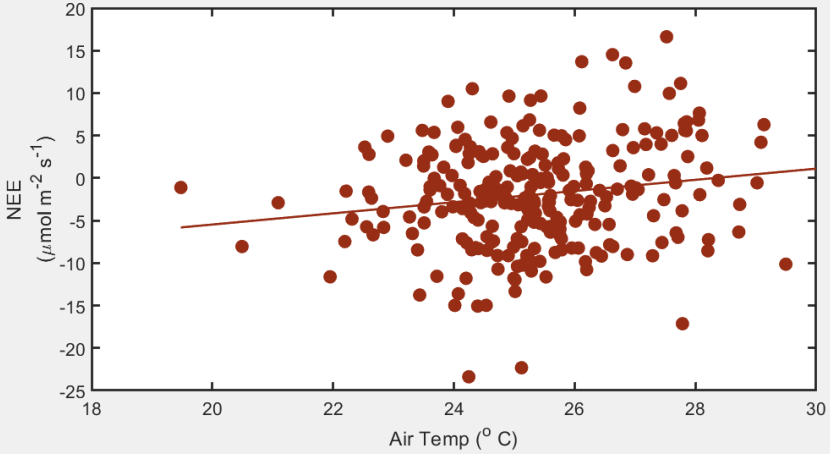


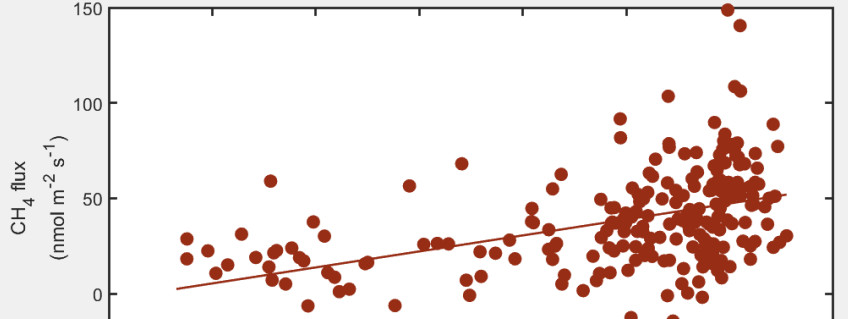
Environmental variables.

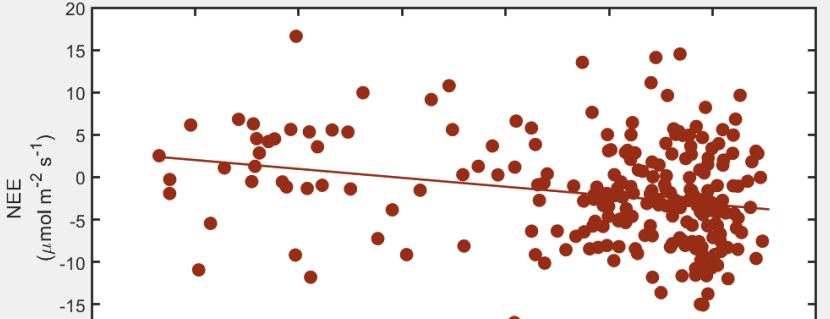


Eddy**C**ovariance fluxes vs Air Temperature & Water Table Position



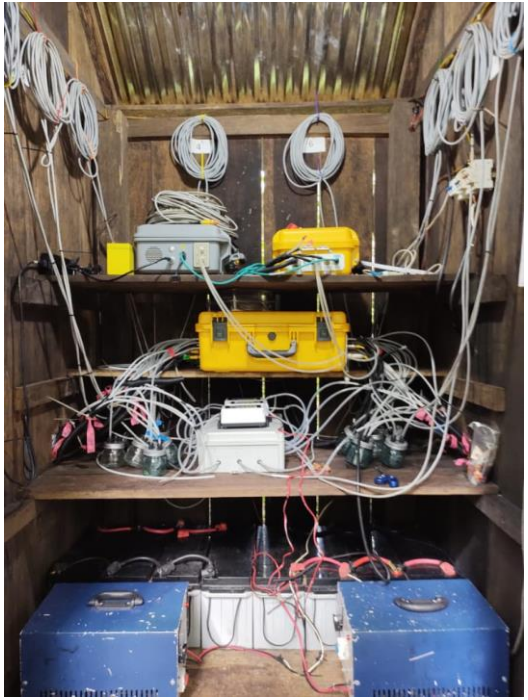






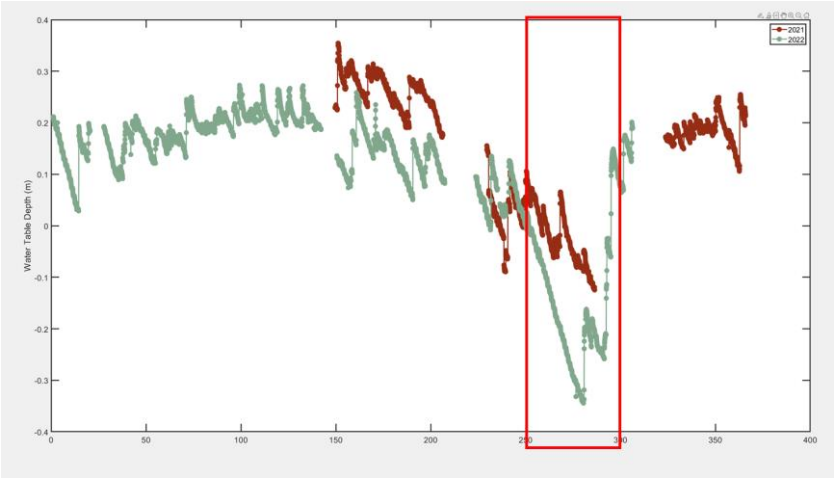
Conclusions

- Both EC and chamber fluxes show **correlation** with **Water Table position** and **air temperature**
  - 2022 dataset only contains ‘wet season’ so far for EC data
- **Diel pattern** similar for chambers and EC on **CO_2 fluxes**
- Neither shows particularly strong CH_4 diel pattern
- **CH4 fluxes** from **stems** are **significant** and **vary by species**

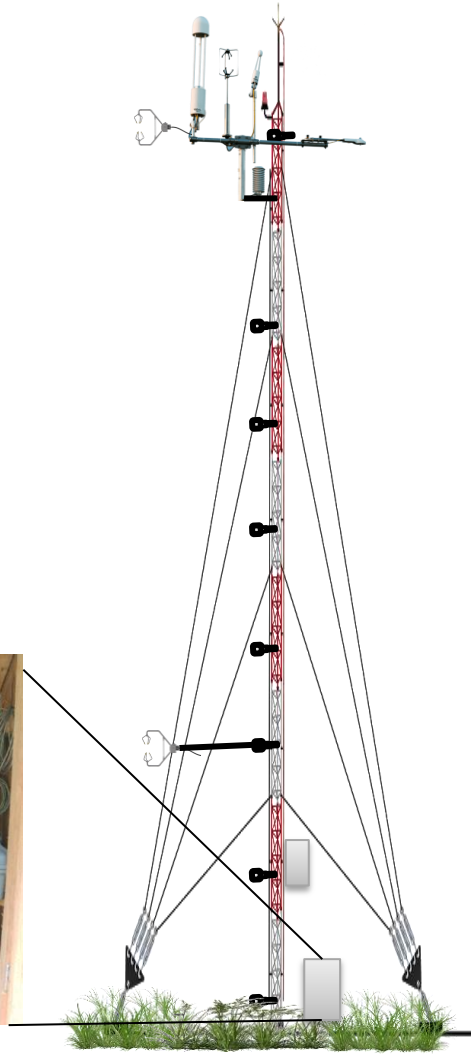


Next Steps…

- Addition of Profile system for Lagrangian canopy analyses
- Allometric data to scale stem flux data
- Continue investigating vertical distribution of stem fluxes
- Currently entering dry season… evaluate changes in fluxes



Profile System



Acknowledgments

Thanks to the AMP Tech Team for providing a loaner LI-7500 to keep the site in operation while our instrument was shipped back to the USA for repairs

Financial support:
Initial support for tower/site establishment provided in part by the United States Agency for International Development under award number USAID-USFS Participating Agency Program Agreement (PAPA) AID-EGEE-T-16-00001 in support of the Sustainable Wetlands Adaptation and Mitigation (SWAMP) program.

This study was supported by the Office of Biological and Environmental Research in the Department of Energy Office of Science (DE-SC0020167). Other financial supports include the Sustainable Wetlands Adaptation and Mitigation Program (SWAMP, Grant MTO-069018) by the United States of America