

Master internship opportunity:

The effect of short-term transient temperature change on leaf respiration.

Mimicking chamber-side effects, as seen in chamber measurements on peat meadow grassland.



To research climate change and greenhouse gas budgets, one of the approaches is to use chamber measurements. In this method you put chambers over a plant and soil surface. During the closure of this chamber the change in concentration of greenhouse gas(es) is measured. After 2-3 minutes the chamber is being opened or lifted, so the environmental conditions can be equalized again.

For several reasons we want to keep the measurement time short (2-3 minutes). One reason is that we do not want to risk headspace saturation, for example. Other reason is that the chamber itself can act as a little greenhouse under certain circumstances: Air temperature can rise several degrees in few minutes. Of course we do not want our method to influence the measurements.

Therefore we want to better understand what the effect is of short-term temperature rise (2-3 minutes) to plant behavior and gas exchange. We use 2-3 min for our chamber measurements, but in literature (especially measurement on different 'slower' ecosystems) you can find measurement of 10 minutes or even longer. And we already find air temperature increase of very often 4-6 degrees, but with periods of up till +25 degrees during these 2-3 minutes of chamber close only.

Within this temperature range we want to conduct experimental research about the effect of short-term, transient air temperature changes on leaf respiration. Preferably we make a 3D plot of a range of T-increase vs a range of 'measurement' duration. We hope to catch stomata closure and capture Plant specific reaction to T effects. Stomata closure could be made visible with leaf inprints as well, to verify your findings.

Some interesting questions:

- 1 Can we expect that metabolism and gas exchange is affected by short-term air temperature increase? What temperature rise, during 2-3minutes, and what length of time period, is needed to create change in leaf respiration?
- 2 What is the max air temperature the plant tolerates (under these short-term transient air temperature changes) and how does the plant behaves next? And what does this mean in terms of gas exchange?
- 3 Can we see stomata closure during this short-term air temperature increase, and what is the relation with temperature and/or is this related with the duration of this temperature change?

Since our department mainly does GHG measurements on peatlands, both in nature reserves as in grassland peat meadows (Perennial ryegrass (*Lolium perenne*)), we want to look at peat related vegetation for this chamber heating effect. For vegetation in peat areas you can think of *Carex* species (sedge), common reed (*Phragmites australis*) and other marsh plants. These plant species each react differently to temperature changes, certainly in comparison to *Lolium perenne* (ryegrass). It makes sense to start with *Carex* specie for its flat leafs. We will use a Licor 6400 to zoom in on leaf respiration and locally adjustments of temperature. This device has requirements regarding the leafs for the measurements, wherefore *Carex* is the best fit among the peat-vegetation. Dependent of your internship duration(and or co-workers) we could also look into other plant species as well.

This experiment lends itself to being carried out fairly independently, but can be expanded with other field work if desired, for example to get a better picture of peat meadows, and the methodology. You can largely organize and carry out the experiment yourself at the greenhouses on the campus.

Are you interested or do you have questions? Reach out to us!

Supervisors:

Noortje Janssen (noortje.janssen3@ru.nl) and

Eric Visser (eric.visser@ru.nl)

