



SKOV & LANDSKAB

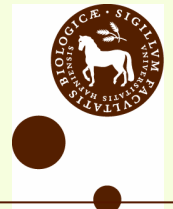
Temperature measurements in throughfall samples

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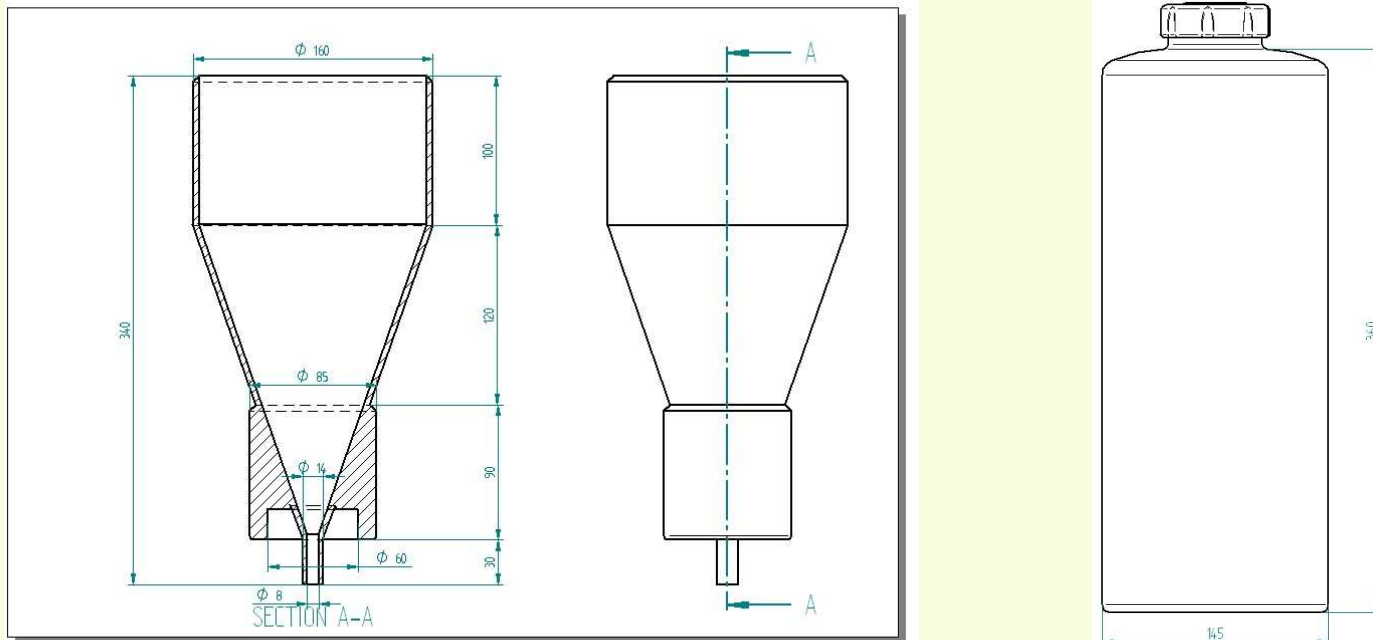


Throughfall samplers in the Level II plots – pictures from TNO comparison 2001

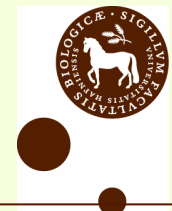




Current comparison of throughfall samplers in FUTMON - One step forward in a harmonisation

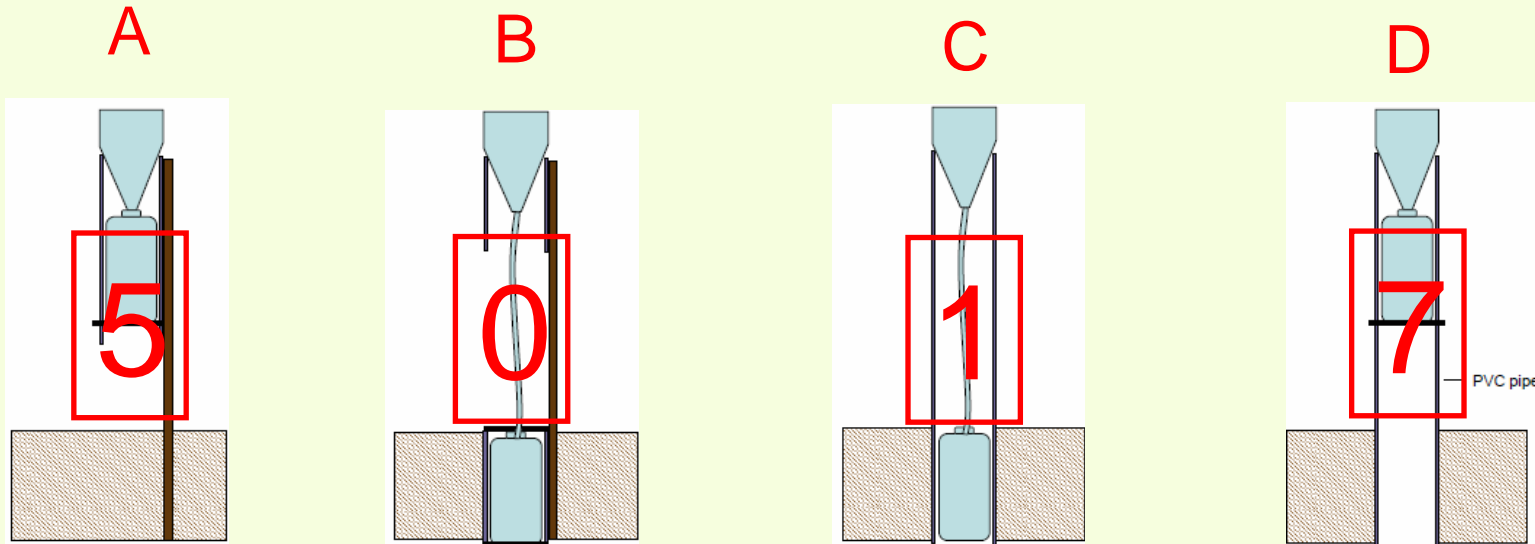


These have been mounted according to national standards!





Comparison of throughfall samplers in FUTMON



16 out of 17 sample bottles are hanging freely in the air

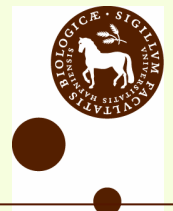
Does it matter for quality how we install?





Samples to be kept dark and cold – Why?

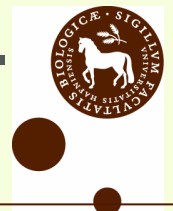
- to avoid algal growth and uptake of nitrogen by their growth
- to slow down microbial or chemical degradation of the sample
- to avoid transformations of nitrogen compounds, that is especially nitrification transforming ammonium to nitrate – especially a problem in agricultural areas





Nitrification

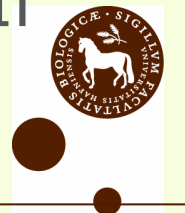
- Nitrification is a two-step process. Bacteria known as *Nitrosomonas* convert ammonium to nitrite. Next, bacteria called *Nitrobacter* finish the conversion of nitrite to nitrate. The reactions are generally coupled and proceed rapidly to the nitrate form.
- These bacteria known as “nitrifiers” are strict “aerobes,” meaning they must have free dissolved oxygen to perform their work. Nitrification occurs only under aerobic conditions at dissolved oxygen levels of 1.0 mg/L or more.





Nitrification in water samples

- A sufficient population of nitrifying bacteria must be present in order to nitrify. These bacteria are attached growth organisms, meaning that they must attach themselves to the surface of an object. It is believed that nitrifiers may attach to the sides of the container, to particles in the sample and perhaps to algae particles.
- Nitrification stops at a pH below 6.0.
- High temperatures promote and increase nitrification - as the temperature increases, the nitrification rate increases to a certain degree. If nitrification is lost, it will not resume until the temperature increases to well over 10°C.

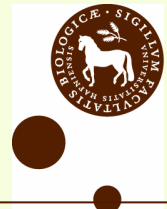




The dependence of nitrifiers on temperature

Gerardi (2002): Temperature and nitrification

Temperature	Effect upon nitrification
> 45°C	Nitrification ceases
28-32°C	Optimal temperature range
16°C	Approx. 50% of nitrification rate at 30°C
10°C	Significant reduction in rate, approx. 20% of nitrification rate at 30°C
< 5°C	Nitrification ceases





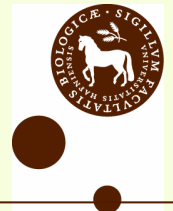
Temperature in samplers hanging free in the air $>$ $<$ in soil pit



$>$ $<$

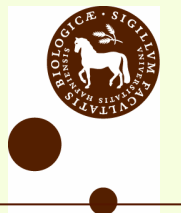
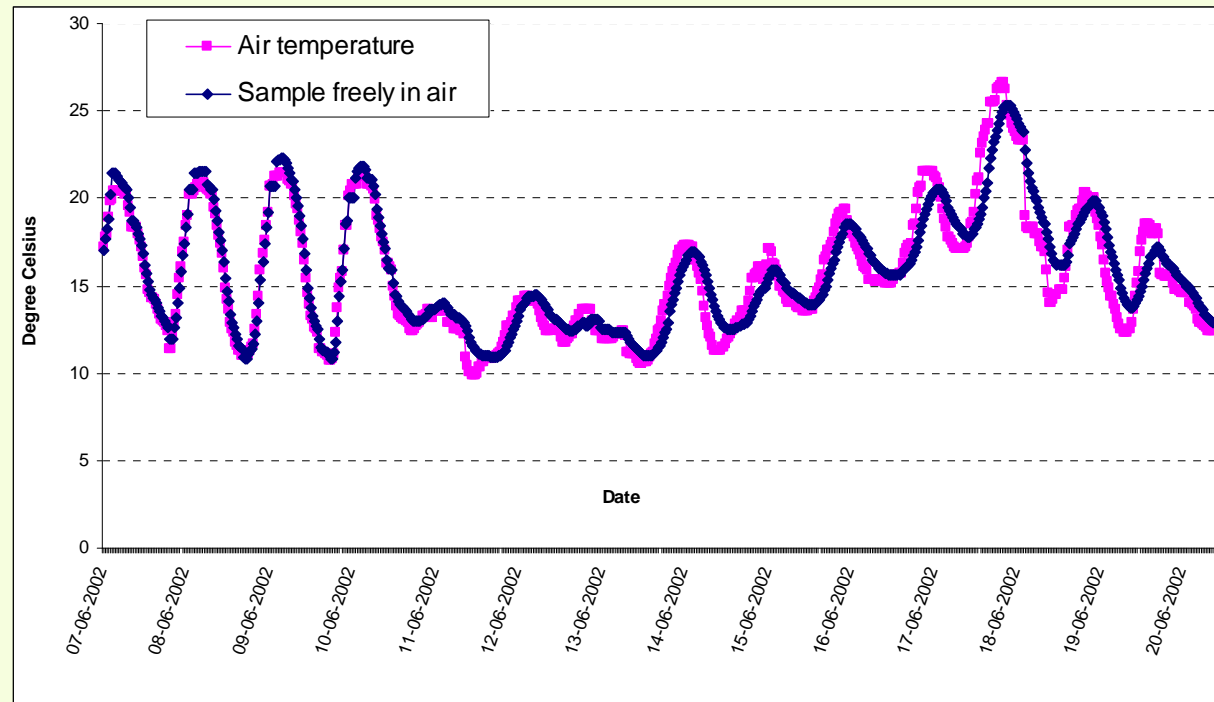


Compared at the same location



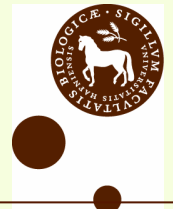
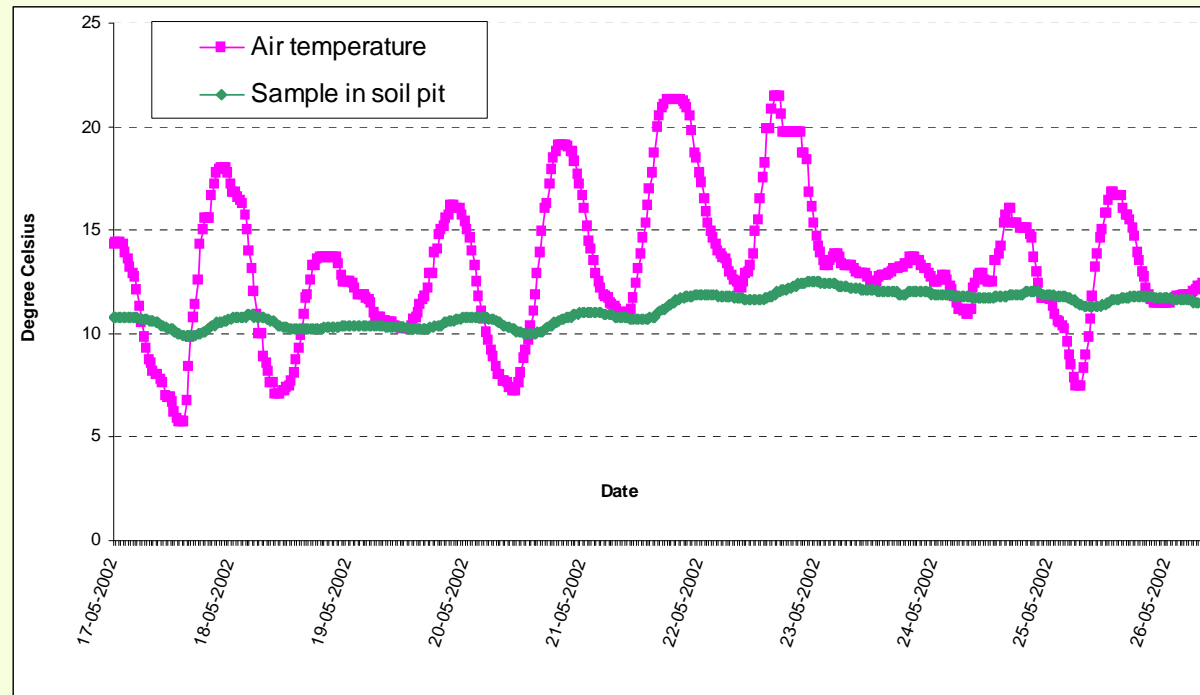


Temperature in sampler hanging free in the air





Temperature in sampler in soil pit





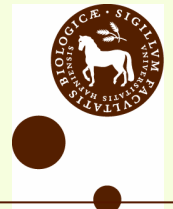
Conclusion:



We should cool samples – Sampler in soil pit is a solution, but:

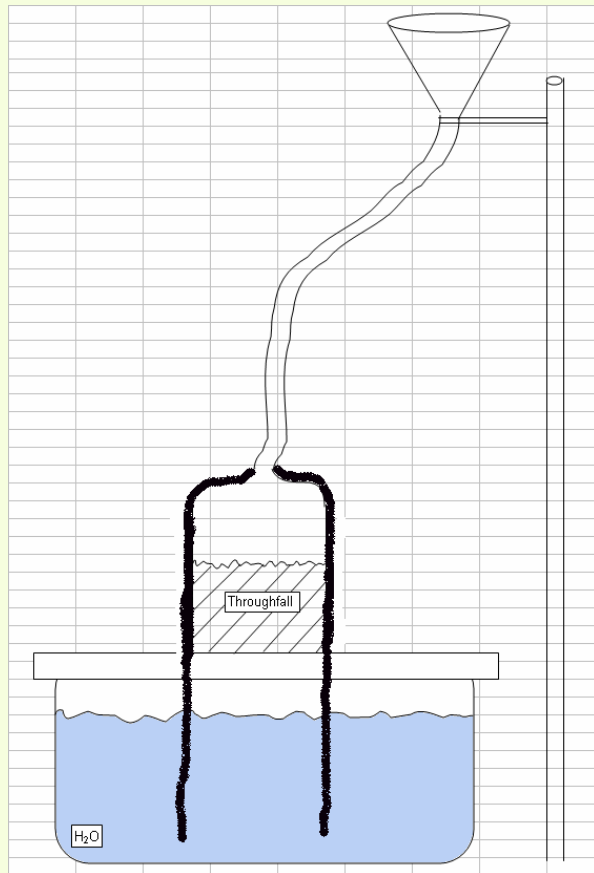
Countries do not want to dig soil pits!

We might then need another way to cool samples in the field

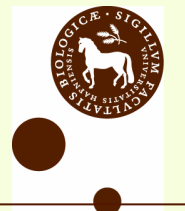




Temperature in sampler cooled by water evaporation - development

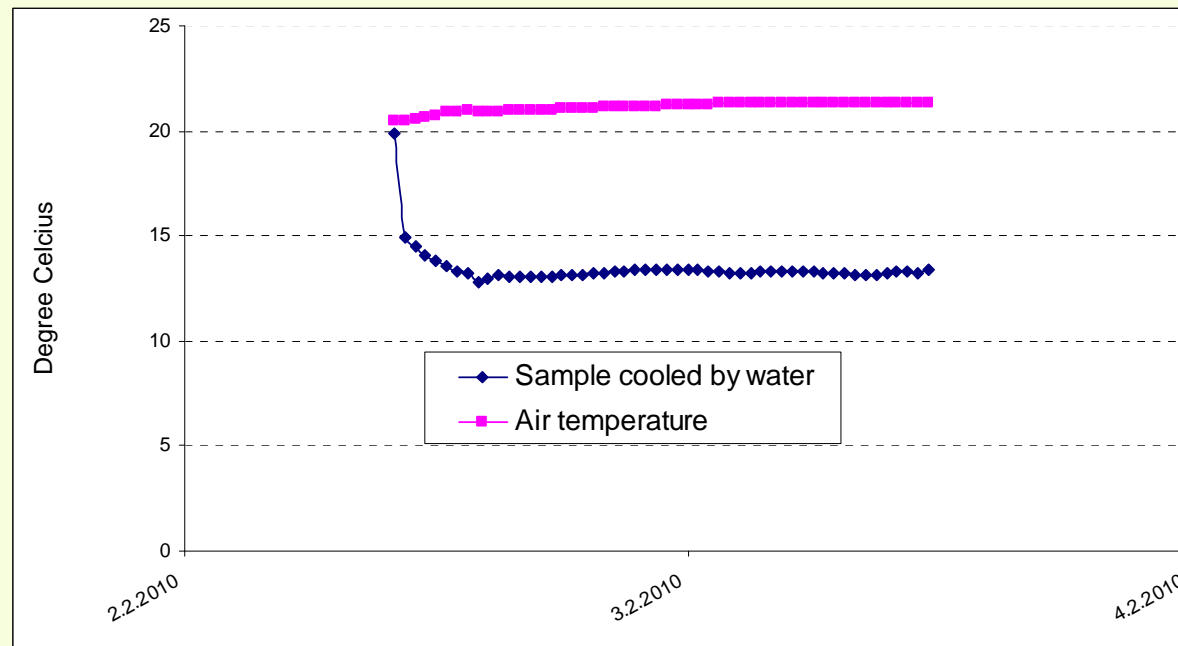
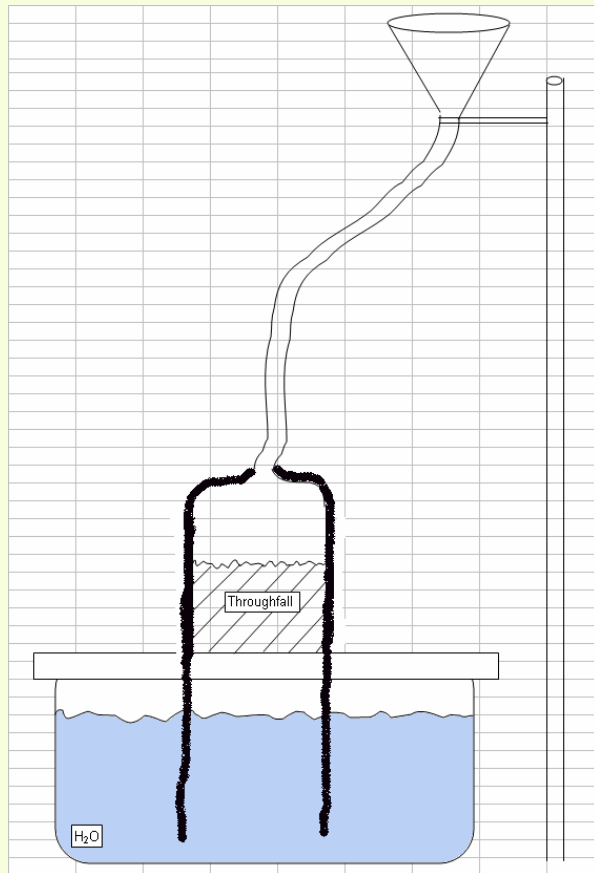


- A self-cooling system where evaporation of water from a cloth, soaked in water and wrapped around the sample flask, will cool the sample
- Non-destructable – you do not need to dig soil pits. You can place the system above ground
- Maybe not feasible in Mediterranean areas with high temperatures and little precipitation?





Temperature in sampler cooled by water - a test in the laboratory



Cooled by 8-9 degrees

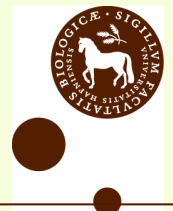
Any other ways to cool, be welcome to share knowledge





Future throughfall comparison experiment in Denmark

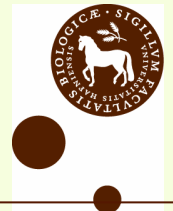
- Use of the Slovenian throughfall samplers
- 1 sampler hanging free in the air (as most are in FUTMON), 1 sampler in a soil pit, and 1 sampler cooled by water
- All three samplers placed as close as possible to each other in the forest
- 10 replications – a total of 30 samplers
- Running for 4 months during the summer 2010 – measuring fortnightly
- Temperature is measured in 3x3 samplers and in the air
- Nitrogen compounds alone will be measured (nitrate, ammonium and organic nitrogen)





Alike experiments in other countries?

- Any other temperature experiments in throughfall samples performed? - please contact us!
- If you should be interested in taking part in this kind of experiment and publishing it afterwards - please contact us!
- My mail address: kiha@life.ku.dk



Silver fir

Cypress

Sitka spruce

Oak

Norway spruce

Beech

Noble fir

Larch

Grand fir

Douglas fir

Contorta pine

Mountain pine

Thank you for your attention!