Monitoring of air temperature, humidity, and CO_2 concentration

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Monitoring excercise; instructions

- Aim:
    - To learn to design, perform, and report a monitoring activity
- Physical quantities to be measured:
    - Air temperature and relative humidity
    - **Absolute humidity should be calculated**
    - Optional: CO_2 concentration
- Alternative 1: Using data loggers for monitoring:
    - Data logger EBI 20, that should be programmed by means of a PC
    - Monitoring of air temperature and humidity
    - You should use at leat two data loggers
- Alternative 2: Using a Grant squirrel multichanel data logger
    - Monitoring air and surface temperatures at 8 locations
    - The data logger is used together with a portable PC (available in the lab)
- Sampling duration:
    - At least 24 hours
- Groupwork:
    - One or two students in the group (monitoring of temperature and humidity)
    - Two students in the group (monitoring of temperature, humidity and CO_2 concentration)

Optional

- We will study air flow rates and CO_2 concentarions later in this course

- You could measure the air flow rates in the room in which you do the monitoring, however you need to learn how to measure

- You could compare the measured air flow rates to the design values in D2

- If you monitor also CO_2 concentrations, and know the number of persons present, you could do some further analysis of the ventilation in the room

Example of monitoring in an office room
* Think what kind of variation you could expect in temperature and humidity
* Constant values are not very interesting results

Memory capacity of the EBI 20 data loggers

- 8000 measured data (temperature and humidity takes two)

- The unit provides different recording modes
- The desired recording mode is set by the PC
  1. Endless measurement
  2. Immediate measurement until memory is full
  3. No measurement/start by pressing key
 4. Start/stop measurement

Comparison of the two EBI 20 data loggers

- The data loggers that you have, may show different values for temperature and humidity
  - You should correct for that difference, when you analyze your sampling data
- This is how you should do:
  - When you are starting your sampling, put the loggers first at the same location (at a table side by side) and let them be there for an hour
  - Use this data to correct the results so that your loggers show the same results at the same location

Grant squirrel multichannel data logger

- Each sensor has a long cabel
- Suggestions for measuring activities:
  - Do a comparison of the sensors, since this data logger is new and we do not yet have information about its characteristics.
  - Study operative temperature, since one of the sensors could be installed inside a globe thermometer.
  - Study the efficiency of the heat recovery of Building A by monitoring the temperatures in various locations in the air handling unit.

Measuring CO_2 concentarion
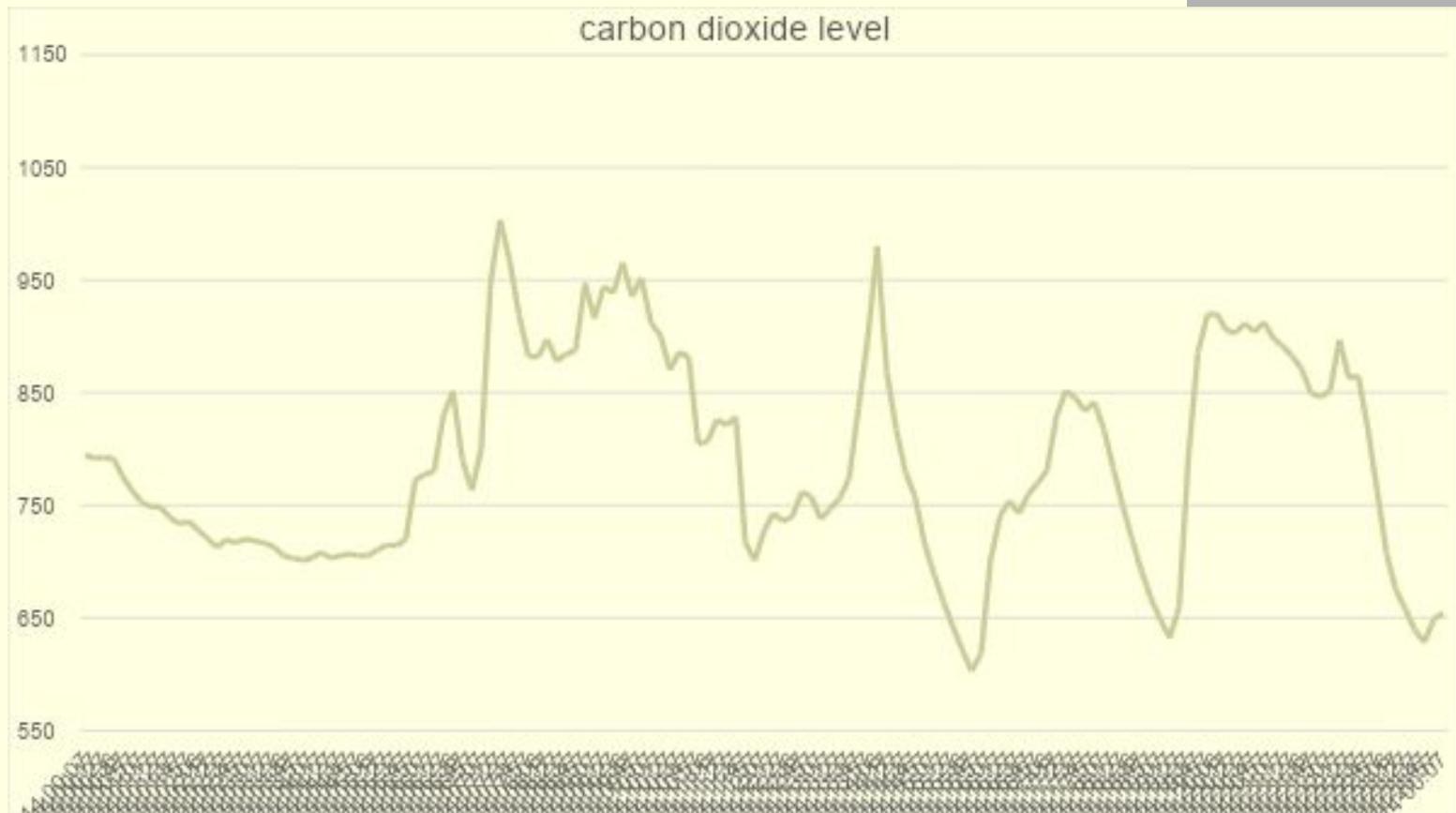
What are the resons for the variations?

Selecting the topics and reserving the instruments

- Tuesday 7th of February:
  - Each group tells, what and where they are going to monitor
- Reserving the data loggers:
  - Send an e-mail to the laboratory engineer keijo.piirainen@xamk.fi to reserve the loggers. Tell in the e-mail about which instruments you need, when you want to get the instruments and instructions to use them, and when you will return them.
  - Save the monitoring results to your own memory stick
- You need to do a PowerPoint file which has to be returned on the 19th of March in Moodle (detailed instructions for the report will be given later)

Oral presentations

- Presentations should be in a PowerPoint file
- Oral presentations are held on Tuesday the 21st of February
- The data should be shown in averages and in graphs (done with Excel)
- Absolute humidities should be calculated and shown together with the air temperature and relative humidity
- CO_2 concentrations should be shown
- Photos of the monitoring are desirable

Suggestions for monitoring

- Residence, indoor and outdoor conditions
- Residence, conditions in different rooms
- Residence, conditions at different heights
- Conditions inside a refrigerator or freezer
- Class room, conditions during the day, at different heights or at different locations in the room
- Something else that interests you? Swimming hall, gym, department store…
- Conditions inside a car

<u>When you put the data logger outside, make sure that it does not get wet (snow, rain…) or stolen.</u>

Start with these questions:

- With whom do you work?
- The aim of the measurements?
- When do you measure?
- Where do you measure?
- Which data loggers you are going to use?
- How many loggers do you need?
- For how long do you monitor? (at least 24 hours)
- How often do you store the data (s, min, h)?
- What kind of results do you expect to get?
- How would you analyze the results?
- Comparison of the reults to D2, standards etc.?