

# Monitoring pressure, humidity and temperature with Arduino: Bari-01 set-up

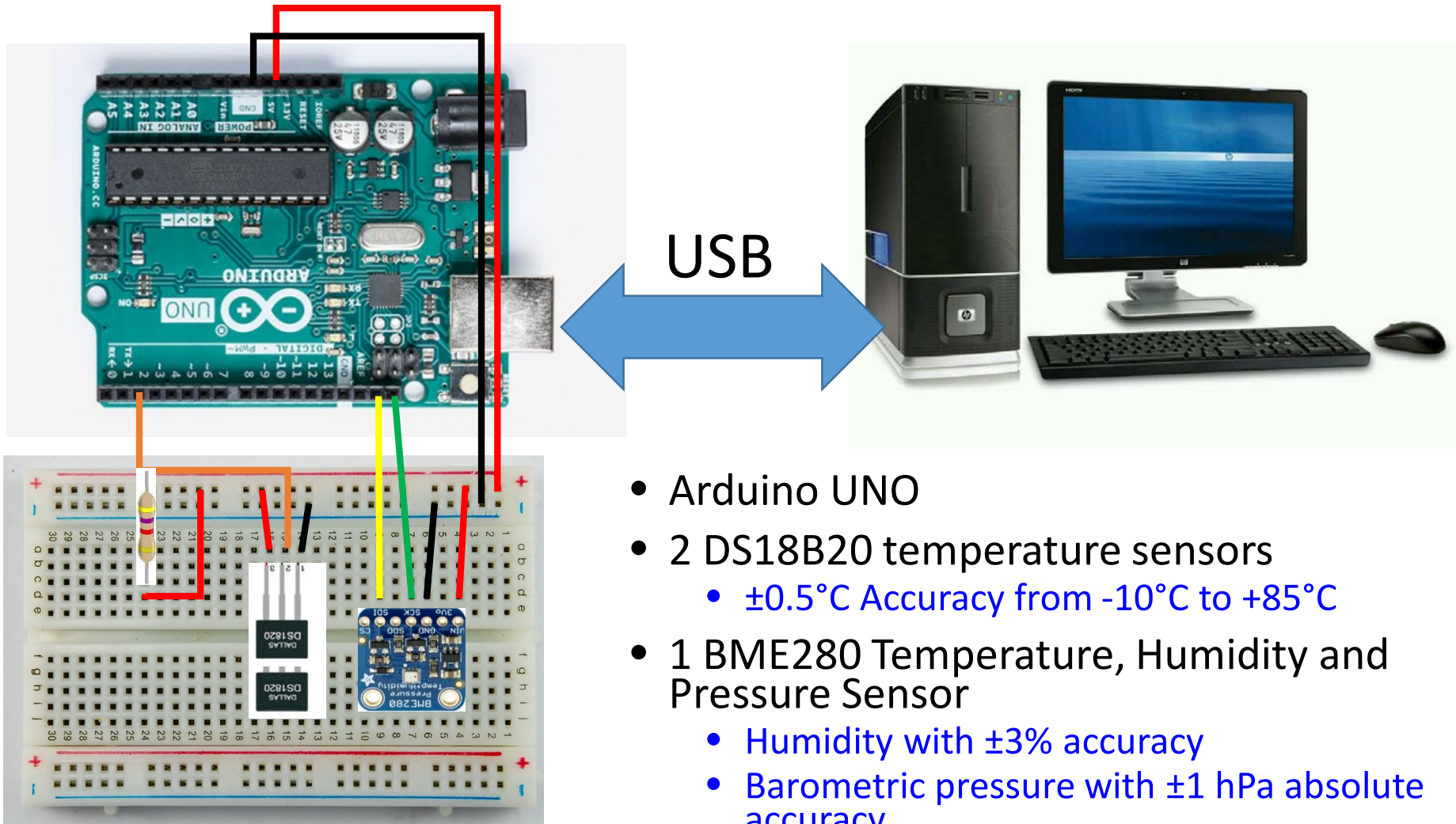
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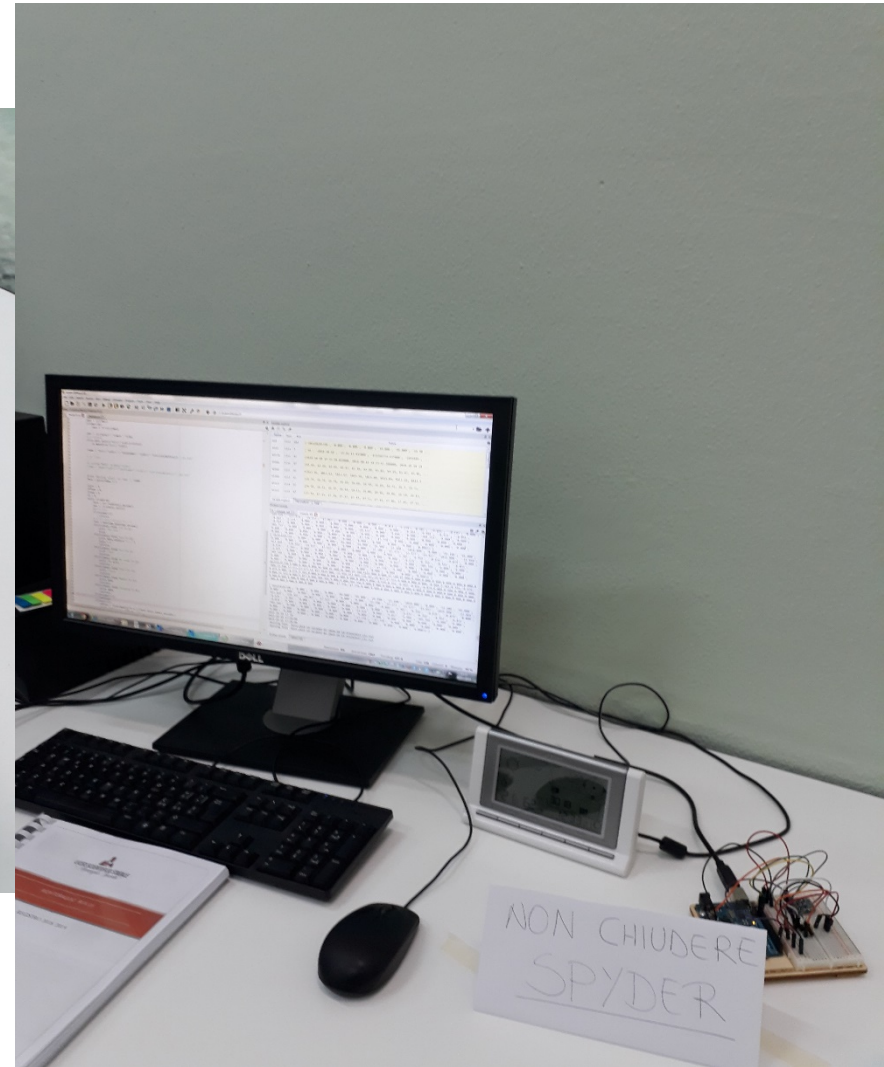
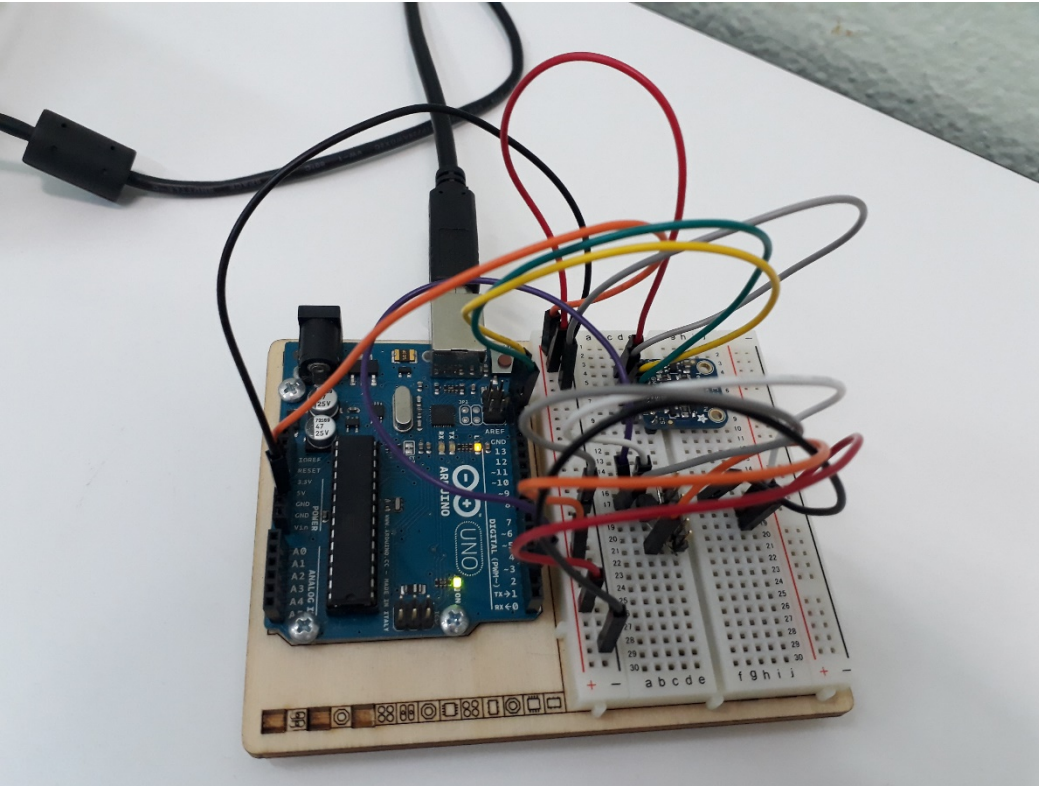
Roma Jan 14, 2019

# Set-up (Oct 2018)



- Arduino UNO
- 2 DS18B20 temperature sensors
  - $\pm 0.5^{\circ}\text{C}$  Accuracy from  $-10^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$
- 1 BME280 Temperature, Humidity and Pressure Sensor
  - Humidity with  $\pm 3\%$  accuracy
  - Barometric pressure with  $\pm 1$  hPa absolute accuracy
  - Temperature with  $\pm 1.0^{\circ}\text{C}$  accuracy

# Set-up (Oct 2018)



# Software and codes – Windows OS

- Arduino
  - <https://www.arduino.cc/en/Main/Software>
- Anaconda (python, pyserial, ...)
  - <https://www.anaconda.com/download/>
  - pyserial installed with conda run
    - `conda install -c anaconda pyserial`
- User codes
  - Arduino sketch to read the sensors and to send the data to PC through Serial port (USB)
  - python code to get the data on the serial port and to write data file
  - Plot data with a python code using matplotlib

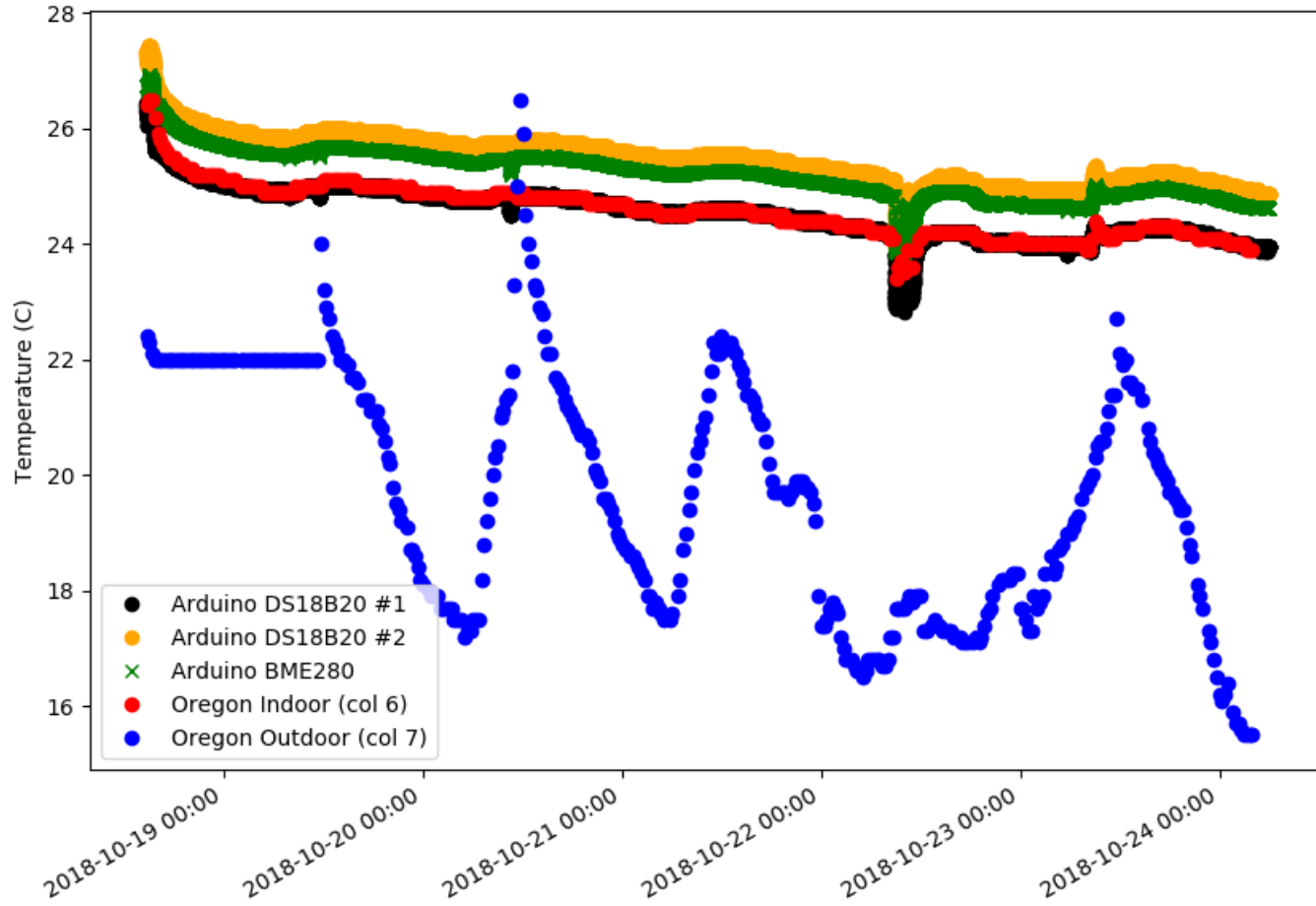
# Timestamp

- Arduino does not have any DateTime functionality
  - Only time from board began running the current program
    - millis() function returns the number of milliseconds
      - This number will overflow (go back to zero), after approximately 50 days
    - micros() function returns the number of microseconds
      - This number will overflow (go back to zero), after approximately 70 minutes
- We use the PC timestamp when reading the data through the serial port
  - We use the UTC time
  - A time difference between Arduino time with millis() and the PC time is also calculated

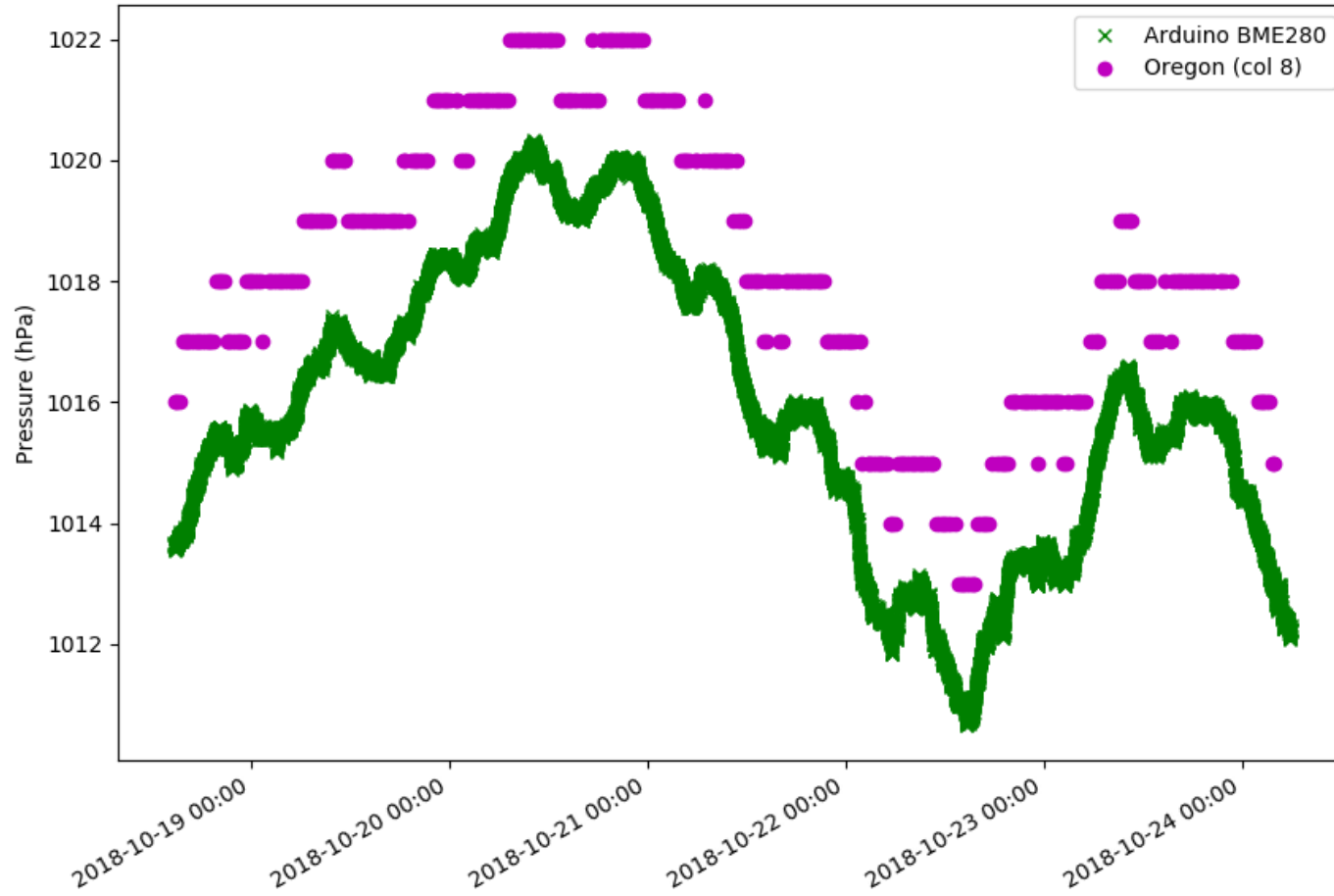
# Plotting data

- A python code is used to read the data from file and to plot them
- The data taken from Arduino set-up are compared with the ones taken from weather Oregon station
  - Data file C:\vws\data\dbase.csv
    - Data taken every 5 minutes
    - Note that time in dbase.csv is the local one
      - We convert it in UTC
- In the current Arduino set-up we have only the temperature sensors in the lab
  - The comparison with the weather station is only for the Indoor temperature data

# Temperature results

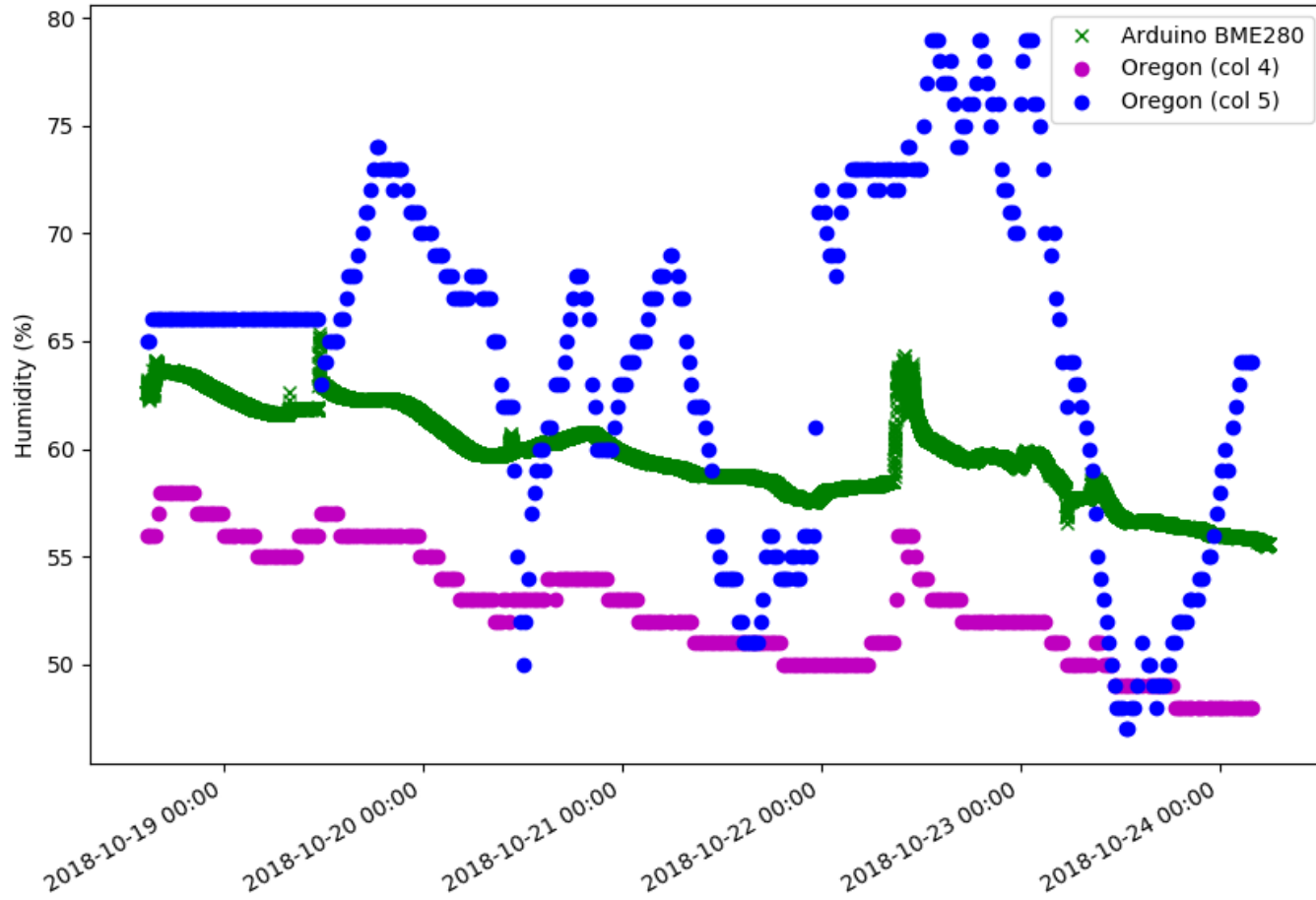


# Pressure results

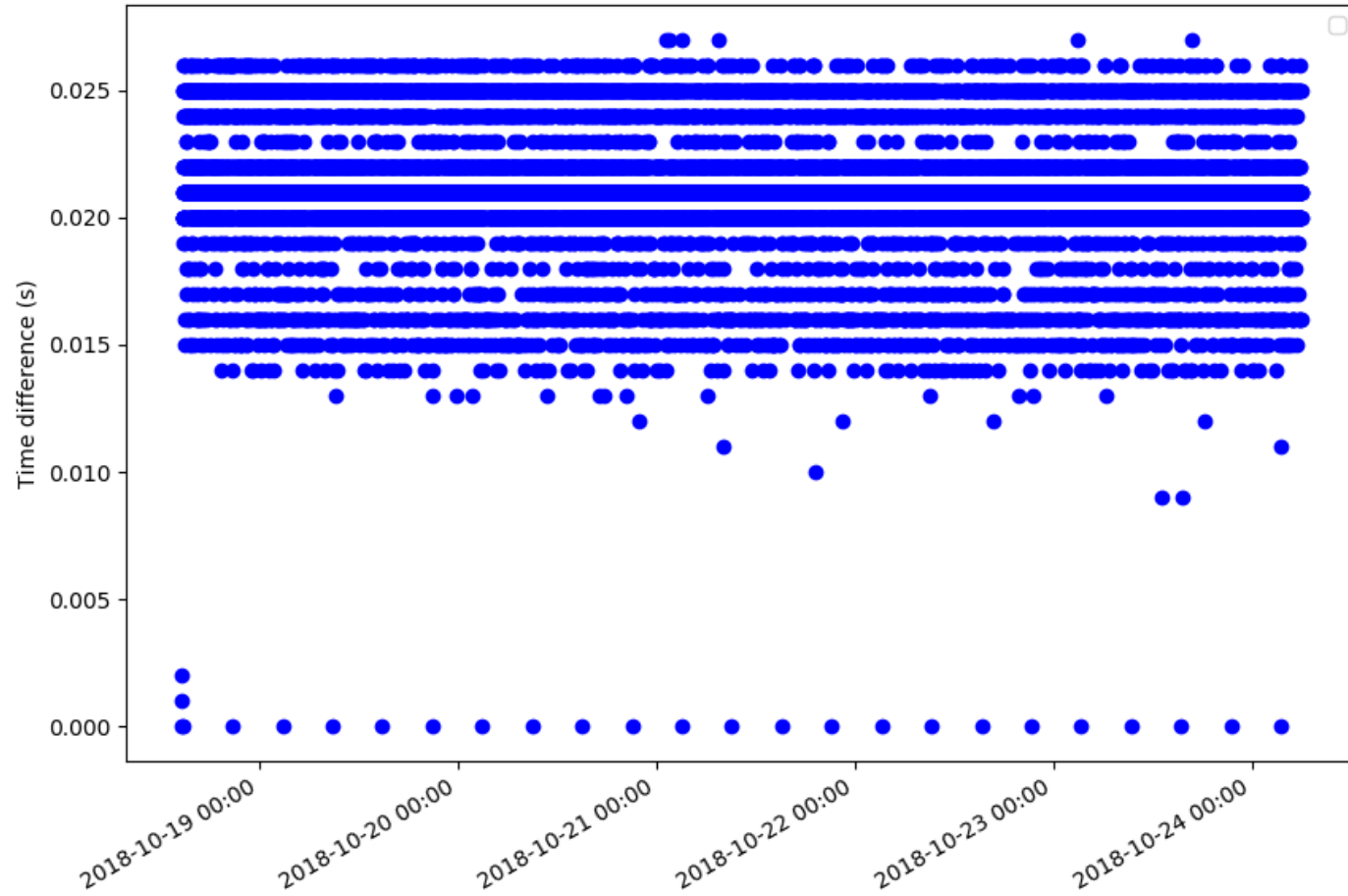




# Humidity results



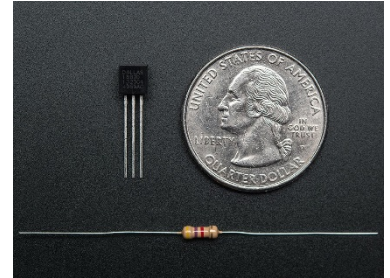
# PC-Arduino Time step difference



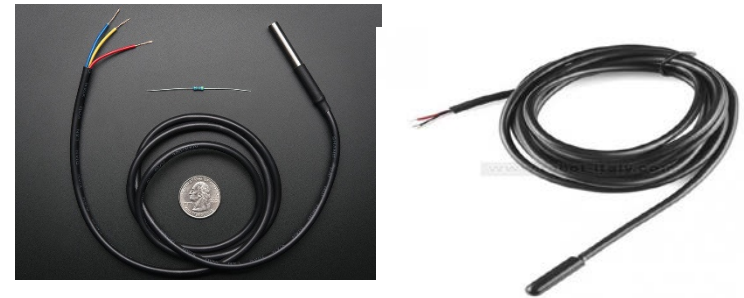
# Temperature sensor DS18B20

- The DS18B20 digital temperature sensor is cheap but it could have some problem when the cable is too long
  - It uses the 1-Wire protocol
- A I2C to 1-Wire bridge allows to work with long cable
- The module MIKROE-1892 by MikroElektronika uses the DS2482-800 module, an 8 channels 1-wire to I2C bridge device
  - The test is still on going

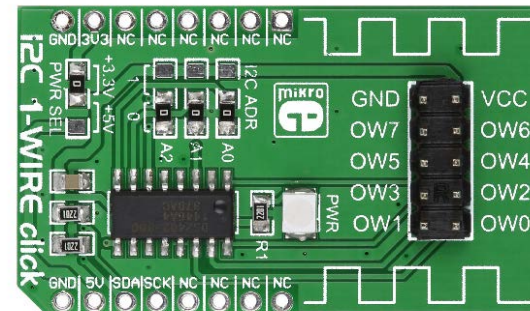
DS18B20 (≈ 1-2€)



Waterproof DS18B20 (≈ 5-10€)



MIKROE-1892 (≈ 25-30€)



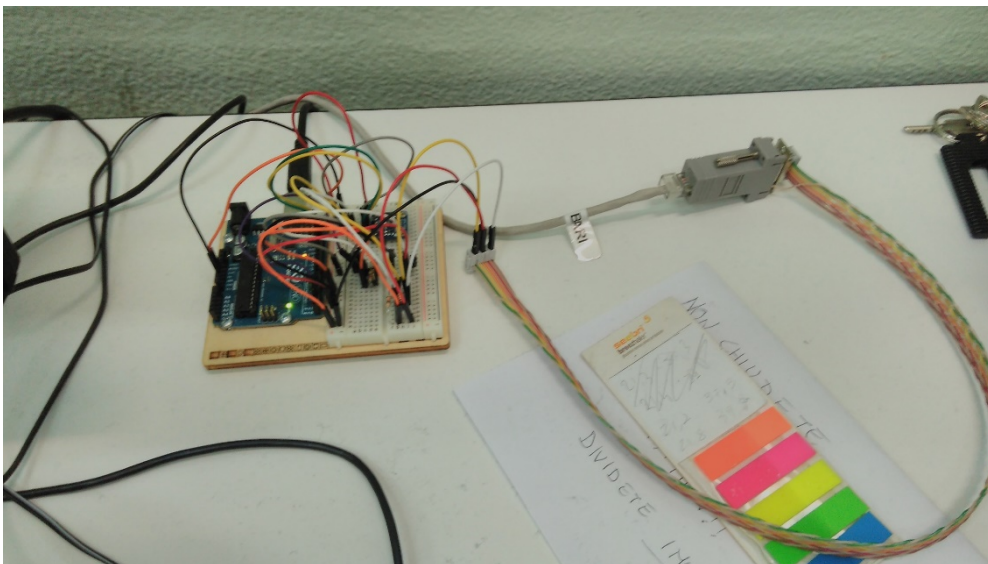
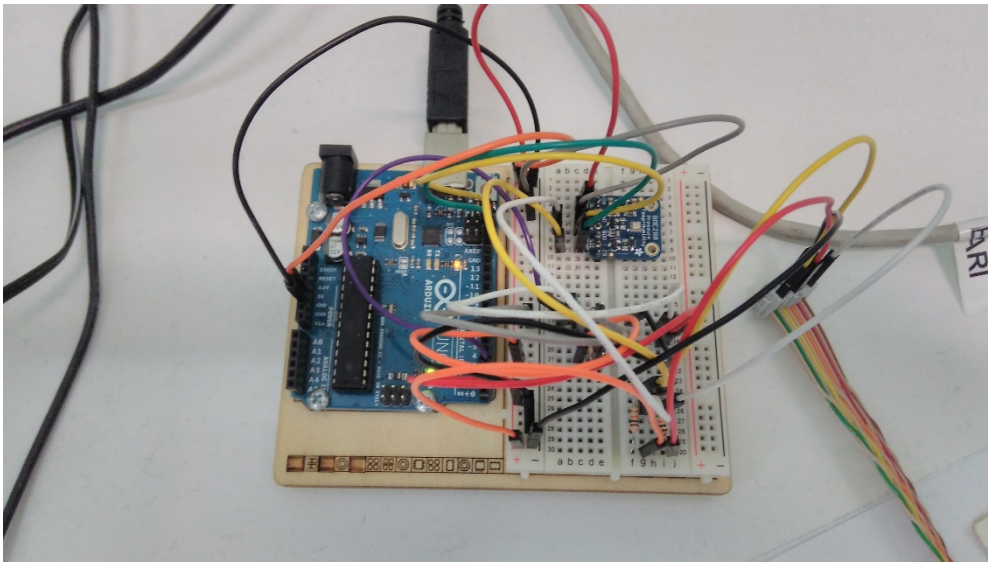
# Set-up upgrade Jan 2019

- The AM2315 has been added to the set-up to monitor the external temperature
  - This is an I2C-interface temperature & humidity sensor in a nice enclosed style
  - It is not rated as 'weatherproof', but this sensor would do much better for sensing where there might be wind
- The I2C protocol works fine with long cable
  - A standard Ethernet cable with RJ45 plugs is used

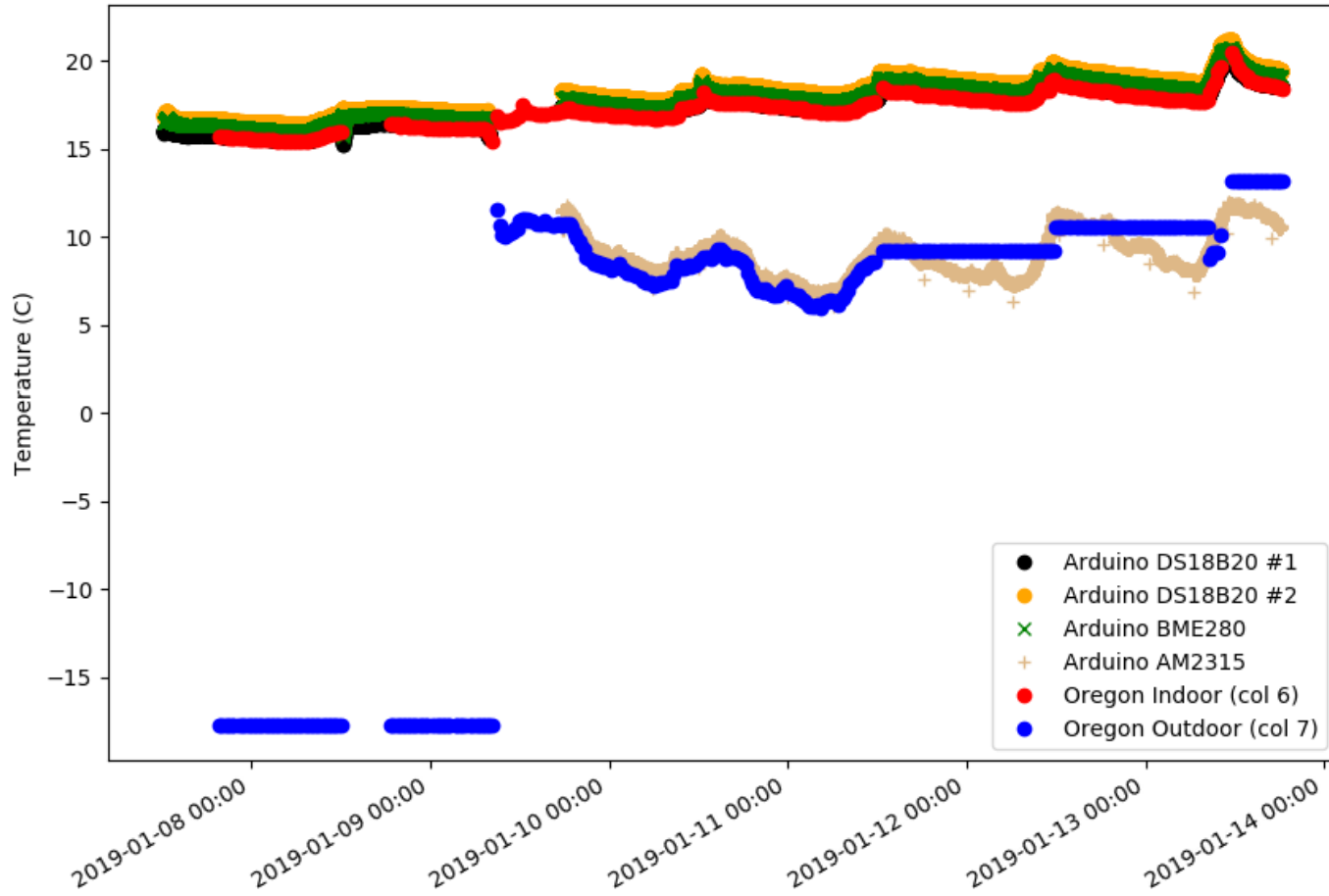
AM2315 (≈ 40€)



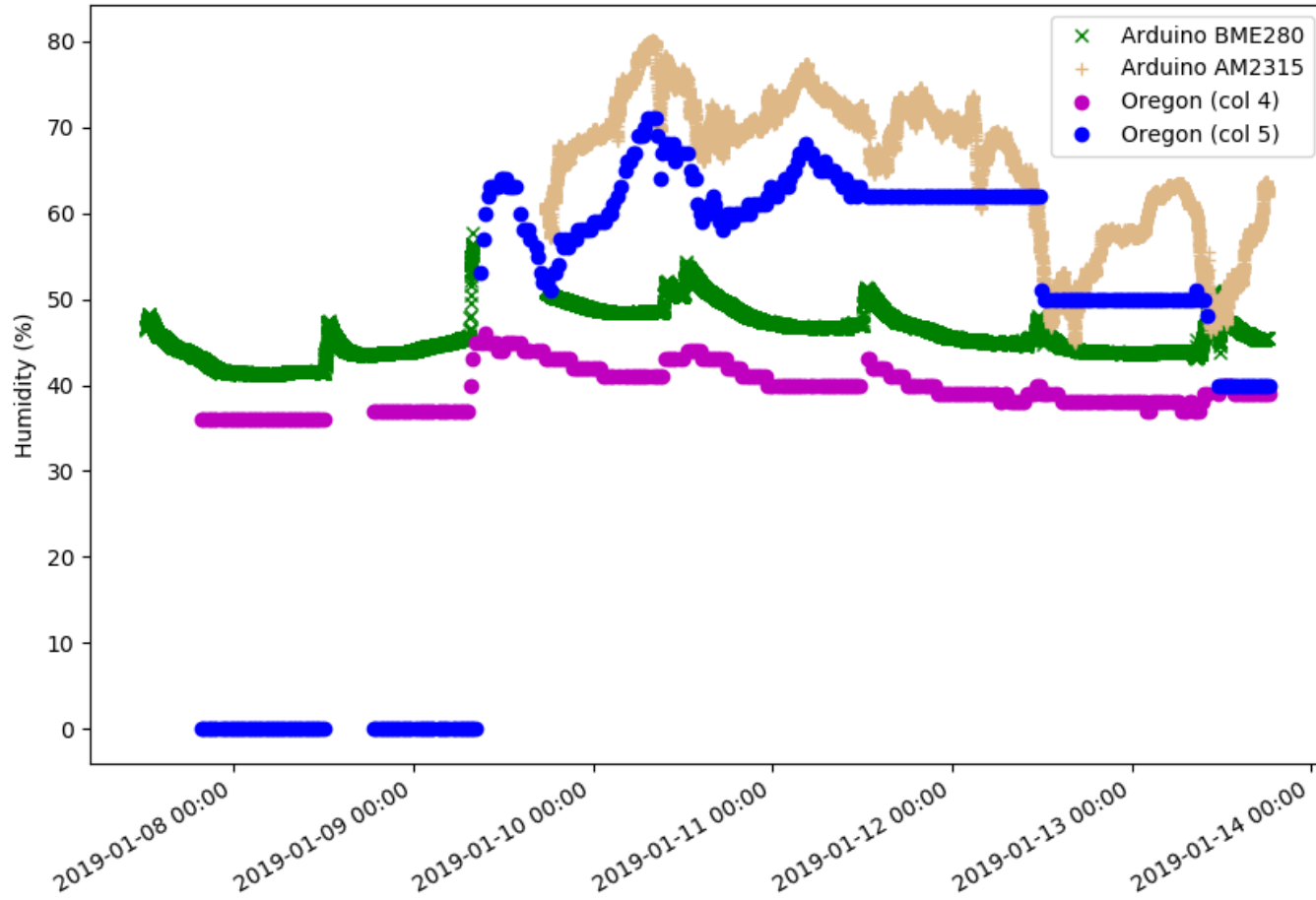
# Current set-up



# Temperature



# Humidity

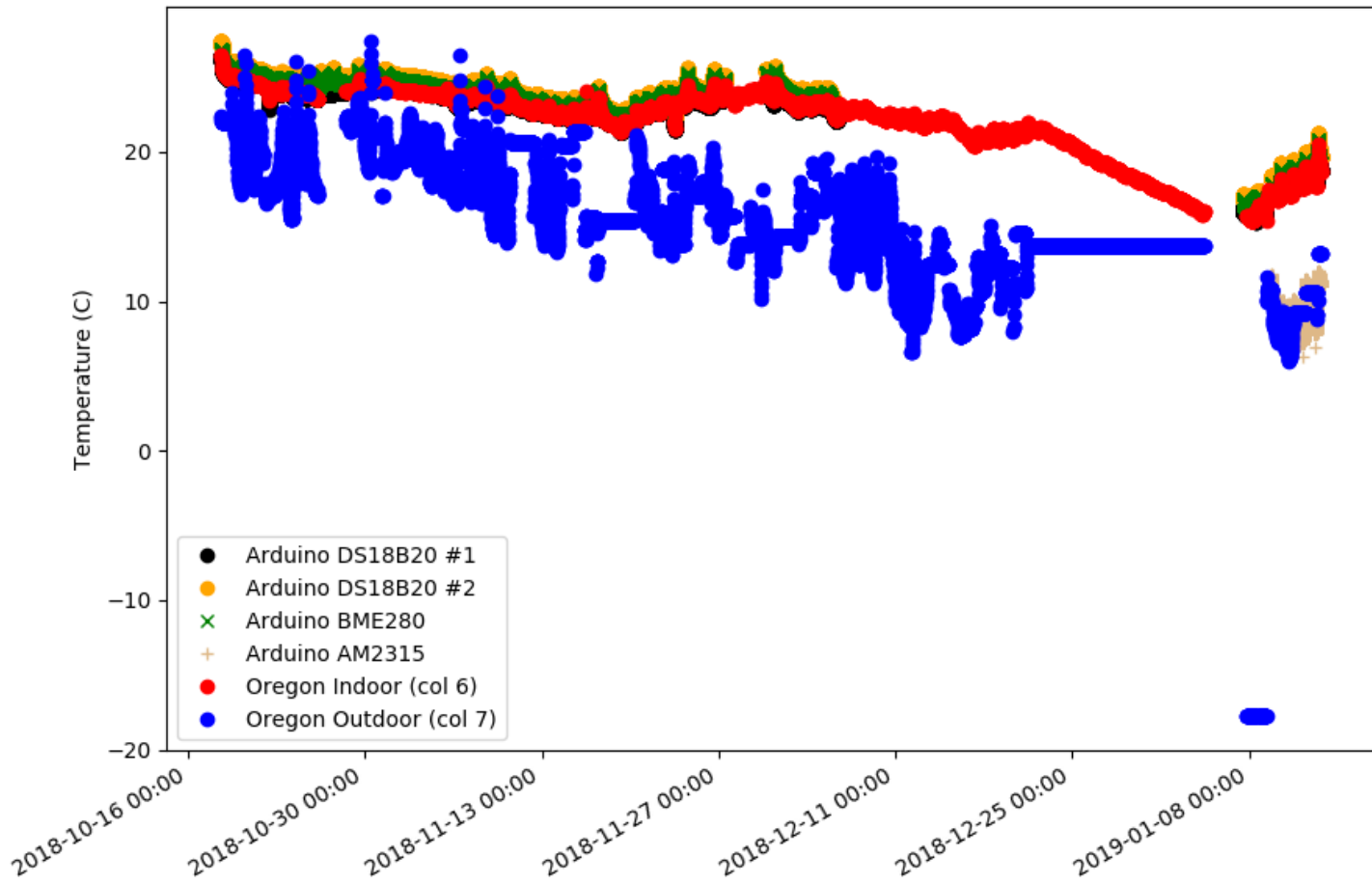


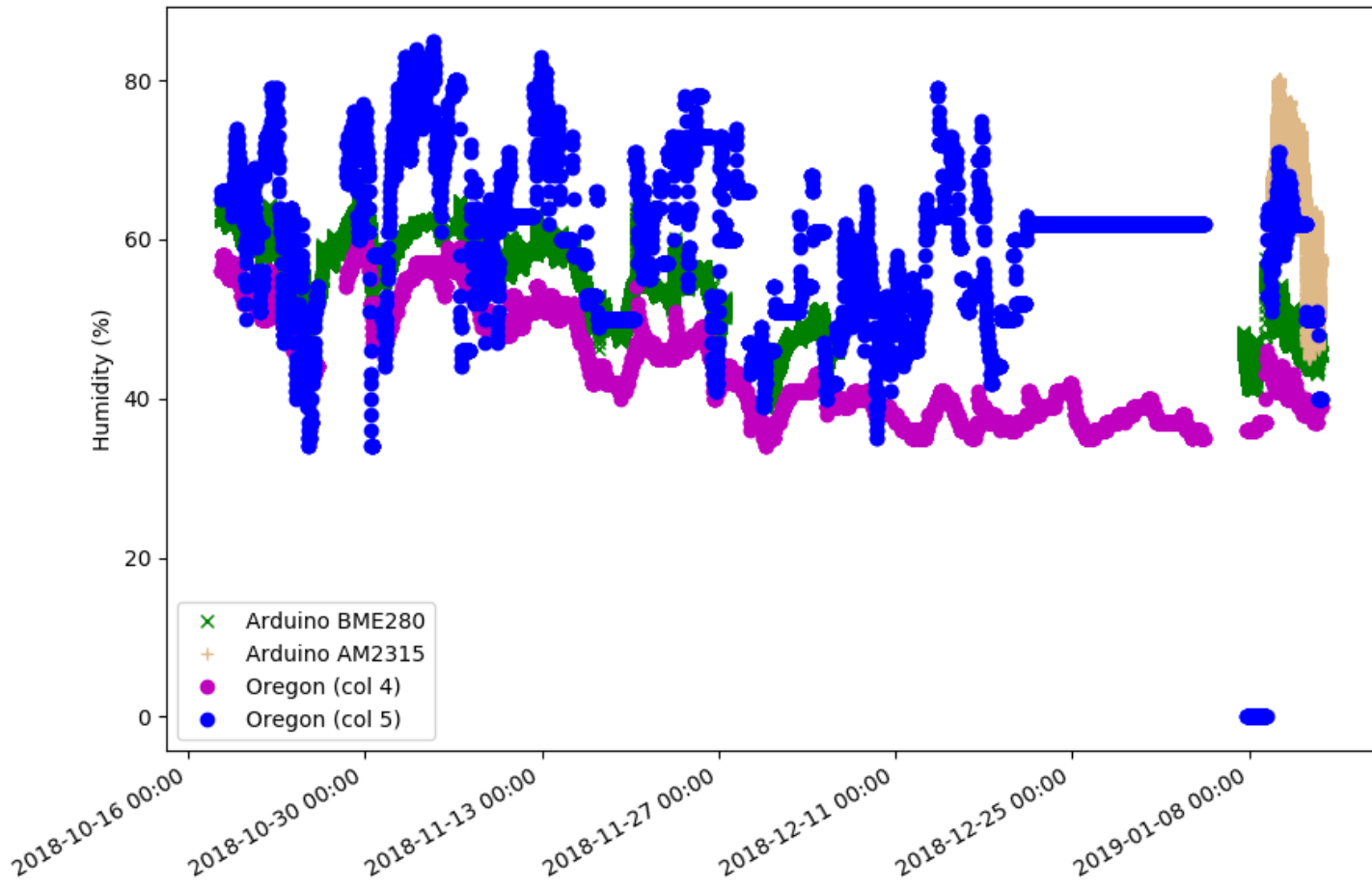
# Conclusions

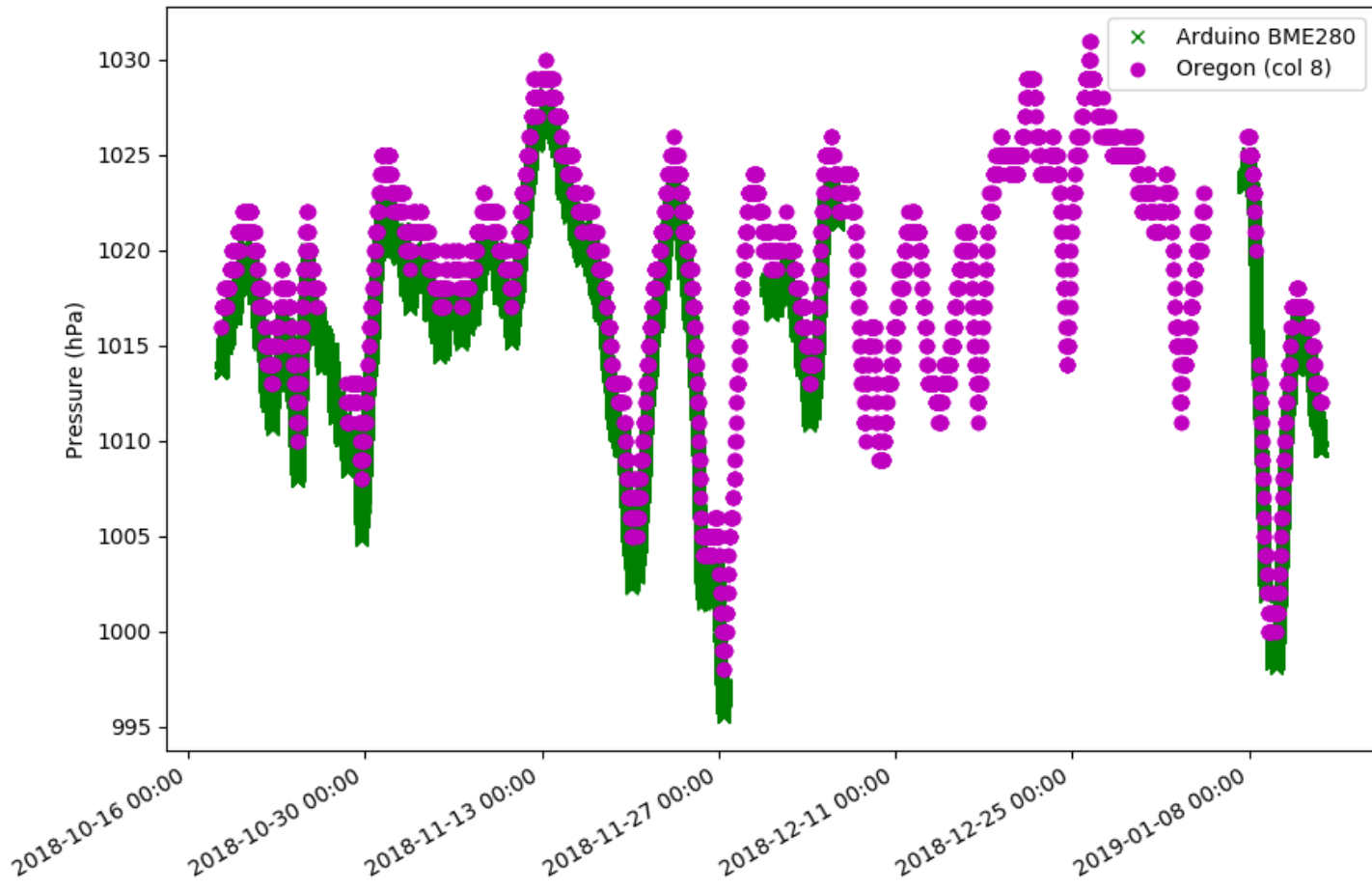
- Arduino set-up to monitor temperature, pressure and humidity is running in BARI-01
  - The PC timestamp seems to be enough without requiring external hardware
  - On the other hands, a DS1307 Real Time Clock module can be added to the set-up to keep track of Arduino time
- External sensor set-up to be defined soon
- HV power supply



backup





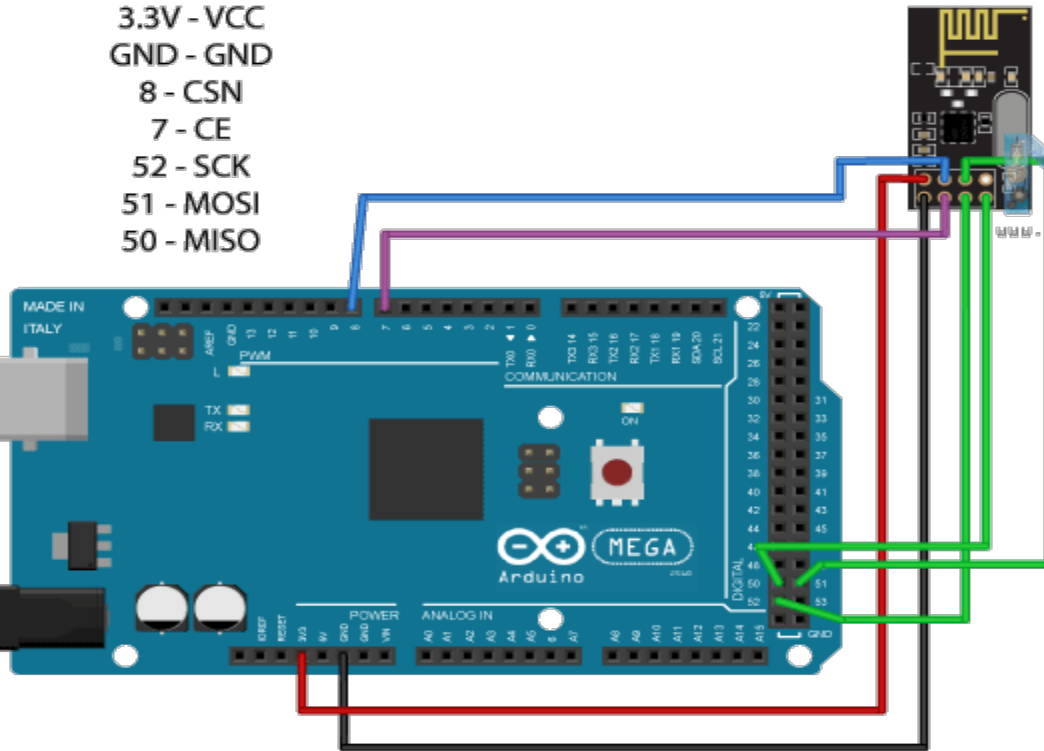


# RF option

- nRF24L01 2.4 GHz wireless RF Transceiver Module

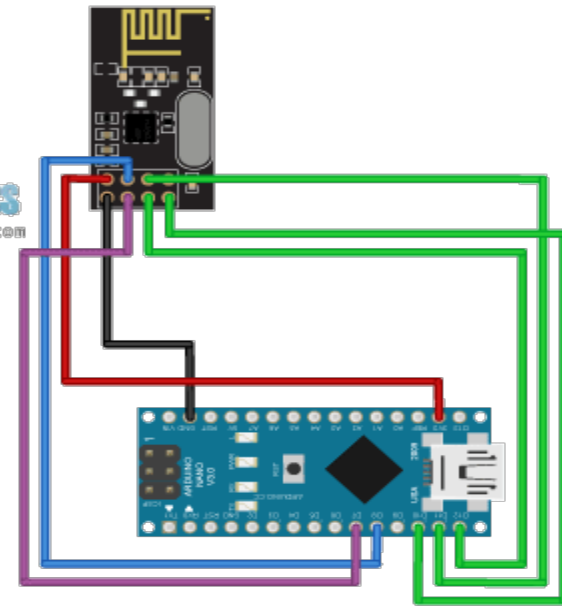
## Arduino Mega - NRF24L01

3.3V - VCC  
GND - GND  
8 - CSN  
7 - CE  
52 - SCK  
51 - MOSI  
50 - MISO



## Arduino Uno/ Nano - NRF24L01

3.3V - VCC  
GND - GND  
8 - CSN  
7 - CE  
13 - SCK  
11 - MOSI  
12 - MISO



# Wifi option

- Adafruit CC3000 WiFi Breakout with Onboard Antenna

