WSOK – a weather station on a kite or tethered balloon

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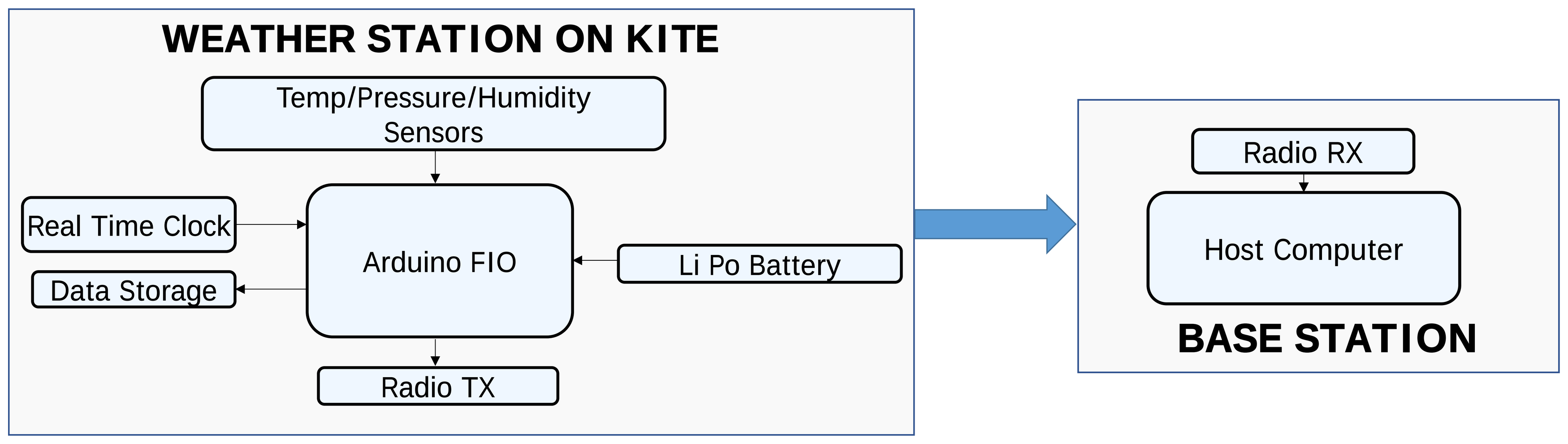
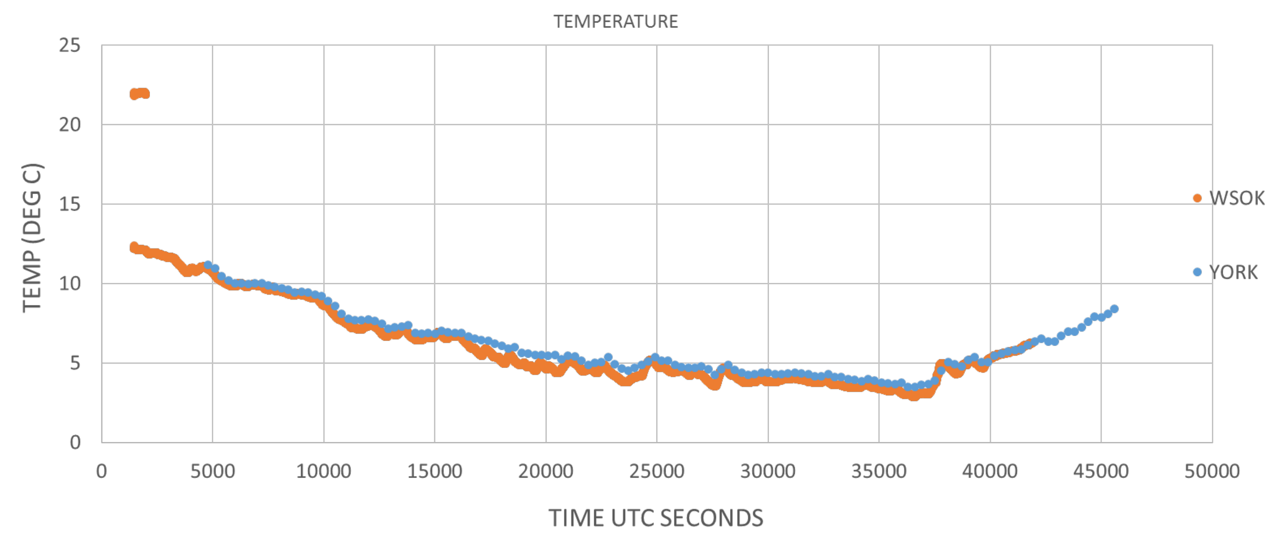
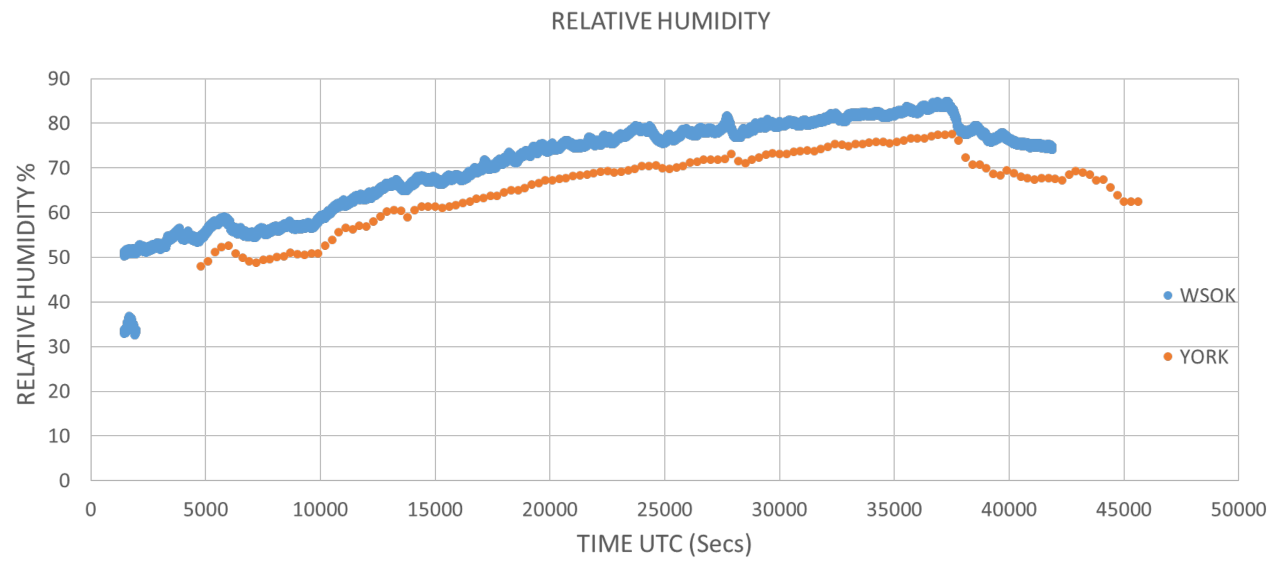
- Profiling of temperature, humidity and winds through the atmospheric boundary layer up to heights of order 1 km can be done in many ways but a simple, inexpensive, light weight package for rapid deployment has enormous potential for field projects. Lidar wind profilers and radiometers for temperature and humidity profiles are costly, as are ground stations for radiosonde packages, so the development of a simple, easy to deploy WSOK, based on an Arduino or Raspberry Pi device seemed worthwhile.

- Our initial system is based on the Sparkfun variant of the Arduino Fio system with the MEMS sensor package, based on a Bosch Sensortec BME 280 Integrated Environmental Unit measuring Temperature, Humidity and Pressure. In a small enclosure (140g, 2cm x 4cm x 5 cm) with data storage, radio communication, batteries etc. but with weight to a minimal level to be easily lifted by a helium filled tethered pilot balloon, a suitable, stable sled or box kite or possibly added to other packages being lifted by a larger tethered balloon or an Allsopp Helikite (http://www.allsopp.co.uk/). The latter could be the most appealing for launch and recovery in high winds (15 m/s) at sea and for profiling to heights of order 500m, but we like small simple kites.



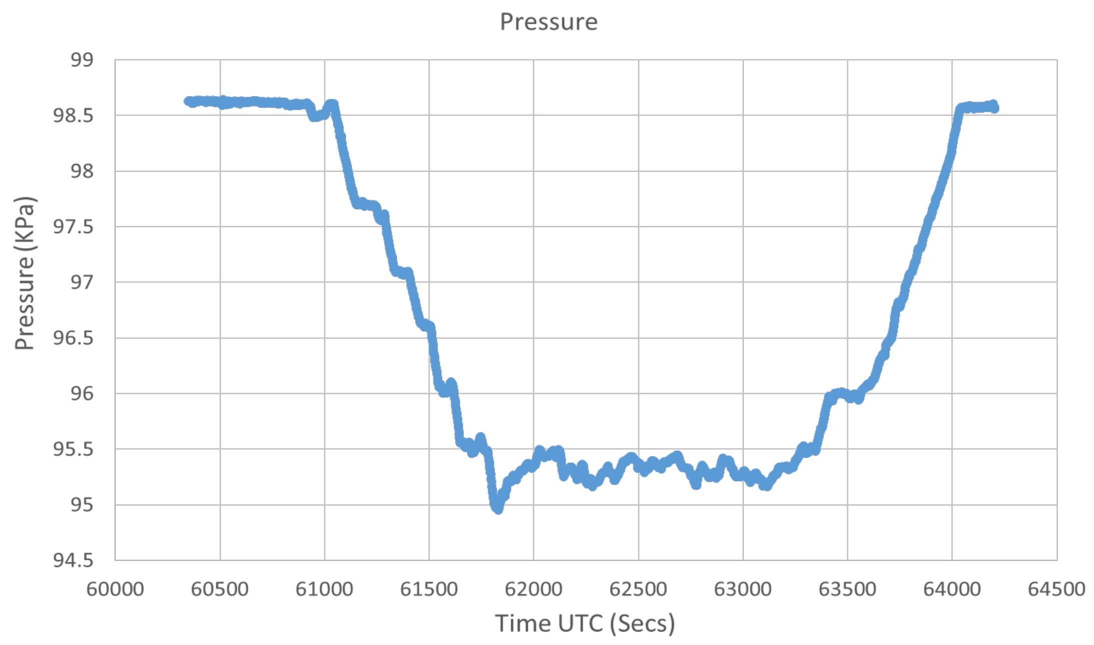
Wind speeds at kite level were about 7 m/s, Surface (10 m) values 5.5m/s.

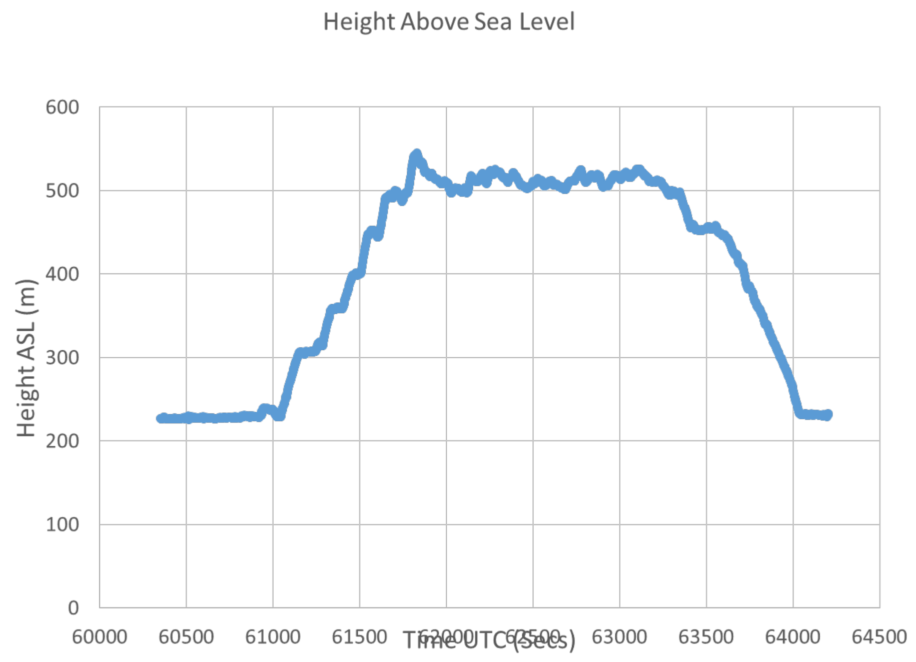


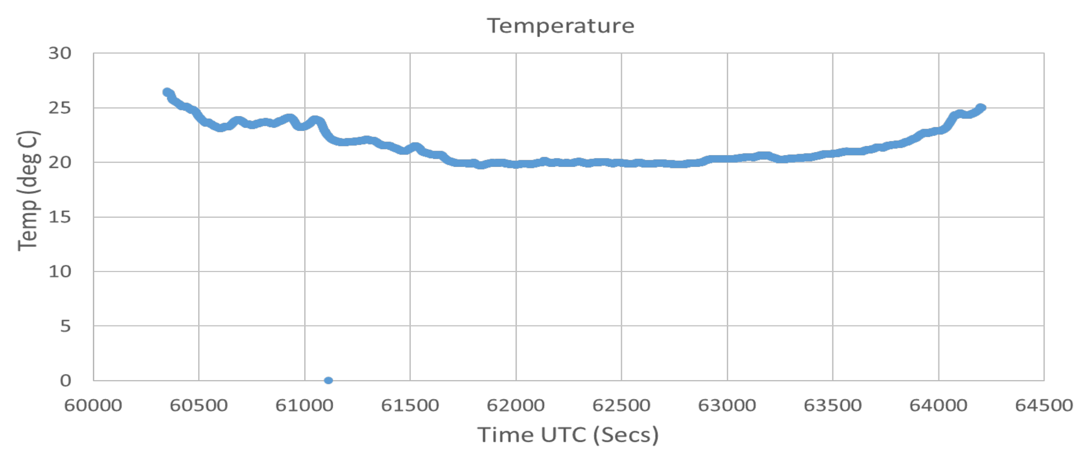


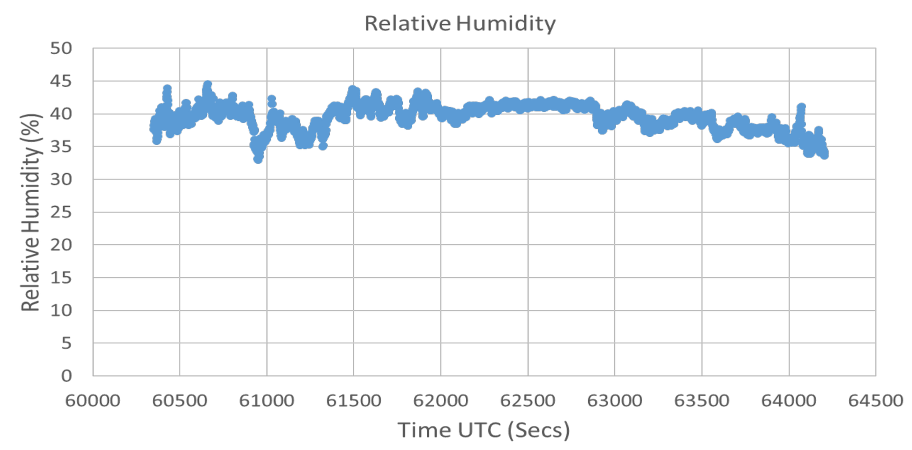
Initial tests – about 12 hours compared to York EMOS weather station (5 min averaged values). WSOK package was taped to the EMOS mast at a comparable, 2m height above ground.

We need to check both RH sensors









Egbert profile test on balloon, 3000s, surface to 300m (a short test was also done with a kite). Note 3 degree temperature drop, consistent with DALR.

Before May 2018, the last time we flew these simple (TALA) sled kites was in Askervein 1983. (www.yorku.ca/pat/research/Askervein/). Wind speeds were determined with line tension measurements and calibration with tower measurements. The UK BRE group flew 5 kites side by side and continuously measured winds up to 500m (see profile). The Canadian group flew profiles above the hilltop.
Then we measured line tension on the ground, but if we measure at the kite and record data together with temperature, humidity, pressure, GPS location and images we can produce an effective, relatively inexpensive, Weather Station on a Kite (WSOK). The mass of the package will increase, but we can build a slightly bigger kite. One shown is only about 0.21 m^2