FluxLite-3 high altitude balloon experiment

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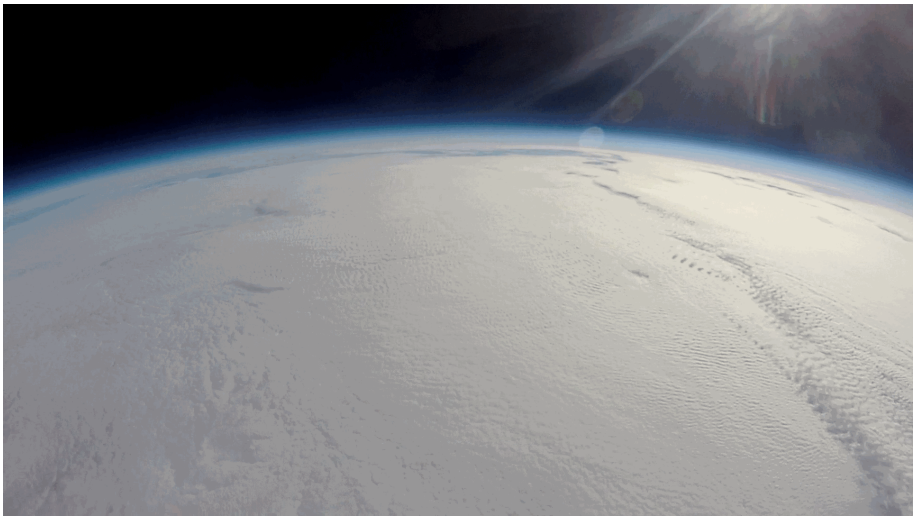
The Fluxlite-3 experiment is an outreach project aimed at high-school students. They are offered to use data gathered from a cosmic ray particle detector attached to a high altitude balloon flown to the stratosphere. This was the third attempt, and to date the most successful.

As the main payload was a particle (muon) detector and a small logger circuit built by KTH (Royal Institute of Technology, Stockholm, Sweden) and Vetenskapens Hus (Science centre in Stockholm, Sweden). To retrieve it we used an APRS transmitter (GPS and radio, transmitting its position to an amateur-radio network). As a secondary retrieval device and real-time data transmitter we used a heavily modified version of the Windsond system from Sparv Embedded AB. Everything was secured in styrofoam boxes and hung from the envelope via a parachute that passively deployed as the balloon burst.

The Windsond device was attached to the bottom of the payload with a quarter wave whip antenna pointing down and a horizontal virtual ground plane. A corresponding whip antenna and a directional yagi antenna was used on the ground station for optimal range.

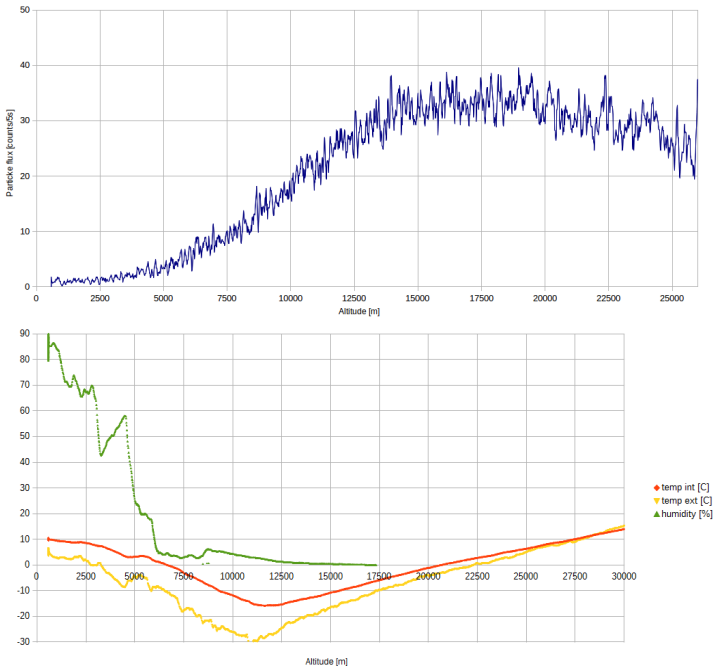
Sparv Embedded had modified the sonde with high altitude compliant components and custom firmware to allow external sensor input (from the particle detector) and on board data logging. All sensor data (time, position, climate data etc.) was transmitted to the chase vehicle and linked over a 3G modem back to Stockholm where visitors and students could follow the mission in real time.

The mission began early in the morning on October 10, driving from Stockholm to Sälen. Filling with hydrogen went smoothly and all sub-systems (detector, APRS-logger, Windsond and cameras) were initialized as the launch approached. At 11:29 local time the balloon was launched and began rising at an average rate of 3 m/s. At just below an altitude of 35 km the balloon burst and began falling back. It approached alarmingly close to a few small lakes but touched down in a newly felled forest patch.



The flight was not without its problems ranging from weather limitations to vacuum breaches. Unfortunately the pressure vessel enclosing the detector leaked, so particle data above 25 km was unusable. Minor issues included camera batteries running out, thus not capturing the balloon bursting (one camera died 5 minutes prior) or the landing. The battery of the sonde was not suited for this type of mission, however it performed well above expectations as it passed through the tropopause and temperatures close to -30°C. The battery finally died at 30 km, so we were unable to use it to locate the payload after landing.

Upon retrieval, the data from all sub-systems were secured and analysed. The particle data was complicated to extract due to the pressure breach and possibly corrupted data. All Windsond sensors behaved well. Temperature, pressure and relative humidity was saved and could be clearly correlated to the ballon's passage through cloud and atmospheric layers.



Muon flux (above) and temperature/humidity (below) against altitude