HASP Monthly Status Report - January 2014

Balloons over Volcanoes Team

January 30, 2014

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1 Synopsis

- Balloons over Volcanoes team was accepted into the HASP program on January 15
- We ordered a robust seismic data logger to provide a reliable recording system
- We are in the process of obtaining acoustic data from an infrasound array in New Mexico and we are developing the capability of real time acoustic velocity model generation
- Atmospheric scientists we contacted have raised additional scientific questions to be addressed during the HASP experiment
- We received funding for equipment and travel

2 Activity Summary

The Balloons over Volcanoes team was notified of their acceptance into the HASP program on January 15 and received reviews of the payload plan on January 28. The team then discussed equipment acquisition and development. After consulting with experts on infrasound instrumentation, we concluded that it would be best to purchase a lightweight commercial data logger known to operate for long durations in the field rather than develop an unproven Arduino logger/digitizer. After contacting several companies with quotes, the team ordered an Omnirecs DataCube (see Appendix for specifications). Omnirecs engineers confirmed that the internal GPS will maintain a fix above 18,000 m, making this small, lightweight data logger an ideal match for this mission. We also decided to use very low amplitude analog infrasound microphones (Marcillo et al. (2012)) previously deployed at an experimental volcanology initiative. The team expects that the DataCube will arrive in mid February. Team member Jake Anderson plans to continue development of the Arduino data logger/sensor combination as part of his doctorate work regardless of its utility for the HASP.

After being notified of the team's acceptance into the HASP program, outside advisor Kyle Jones agreed to provide data from a ground infrasound array based in Socorro, New Mexico. We expect to receive these data by the end of January. Since the Socorro infrasound array is located along the anticipated balloon flight path, signals recorded on this network will allow the team to anticipate the number and amplitude of events likely to be present during the experiment. The team is also beginning to utilize recently developed open source software to examine sound profiles in the troposphere and stratosphere (Bowman and Lees (2013)) to quantify conditions during the HASP flight.

We contacted the Department of Earth, Marine and Atmospheric Sciences at North Carolina State University for thoughts on additional scientific questions that could be addressed by the HASP experiment. Scientists expressed enthusiasm for the initiative and suggested that ambient noise sources (especially the ratio of upgoing to downgoing sound waves) will be of particular interest.

The team applied for an internal grant through the Department of Geosciences at UNC Chapel Hill, and the grant was awarded on January 28th. We expect this grant to cover instrumentation and travel during the HASP experiment.

3 Issues Encountered

Since equipment development has not begun, no significant problems have arisen thus far.

4 Milestones Achieved

The team is delighted to have been accepted into the HASP program. Concerns about the aggressive timeline for Arduino data logger development have been ameliorated through the selection of a robust data acquisition system. The team looks forward to beginning development on the payload after addressing reviewer concerns given on the Student Payload Summary.

5 Team

The student team consists of Daniel C. Bowman and Ashley Foguel (University of North Carolina at Chapel Hill), Jacob F. Anderson (Boise State University) and Aaron Curtis (New Mexico Tech). Jonathan M. Lees (UNC Chapel Hill) serves as Faculty Advisor. Paul Norman and Kyle Jones are outside advisors.

References

Bowman, D. C. and Lees, J. M. (2013). *rNOMADS: An interface to the NOAA Operational Model Archive and Distribution System*. R package version 1.2.0.

Marcillo, O., Johnson, J. B., and Hart, D. (2012). Implementation, characterization, and evaluation of an inexpensive low-power low-noise infrasound sensor based on a micromachined differential pressure transducer and a mechanical filter. *Journal of Atmospheric and Oceanic Technology*, 29:1275–1284.

6 Appendix

Omnirecs

in touch with science

Omnirecs

in touch with science

Specifications

Physical

Input channels	3
Size	10 x 10 x 8.3 cm^3
Weight	1 kg with 2 D cells
Temperature	-40 - 60 °C
Waterproof	1 m water 48 h

Power

Batteries	2 D-cells alkaline Power
max. Run time	up to 14 days (cycled GPS)
external power	5 - 24 V

A/D

Input impedance	100 kOhm
Gain	1, 2, 4, 8,16, 32, 64
Full scale input	4.1 Vpp @ gain 1
Sample rate	800 (1ch-mode), 400, 200, 100, 50 sps
ADC resolution	typically 21.5 bit @100 sps

Data storage

Storage type	SDHC card
Capacity	up to 32 Gbyte
type of recording	continuous recording

Time base

GPS	GPS built in
Stability/accuracy	typically< 10ms over 20 days without processing <0.01 ms after resampling

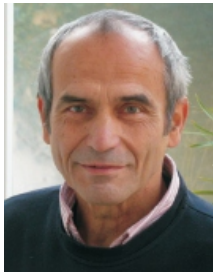
Interface

Type	USB 2.0 control, data down load, firmware upload

DATA-CUBE^3

the ultra-compact recorder which opens the horizon to a new experiment style !

www.omnirecs.de

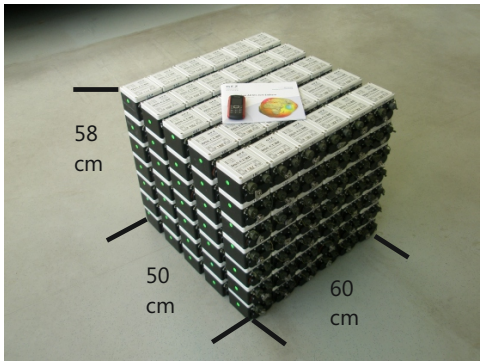


Dr. Albrecht Schulze

DATA-CUBE^3
is produced and distributed by Omnirecs a recently formed spin off from the GFZ.It was developed at GFZPotsdam. Omnirecs is led by A. Schulze, the former head of the Geophysical Instrument Pool Potsdam (GIPP).Thus a lot of experience both in the construction of geophysical recorders as well as the requirements of field experiments is concentrated at Omnirecs.

DATA-CUBE^3
meets the following demands:

- extreme low power consumption
- ultra-compact size
- accurate time base
- easy to handle in the field



630 seismic channels on 50x60x58 cm !!

Omnirecs
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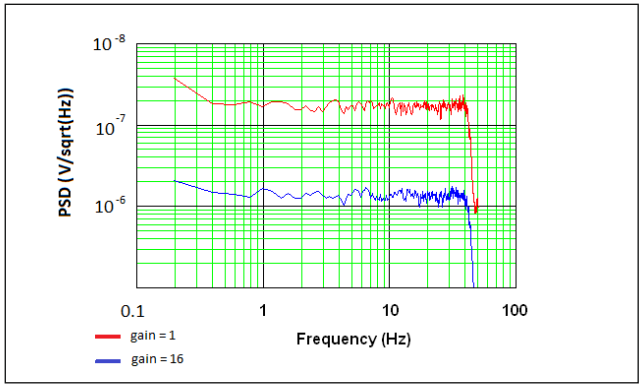

Input-referred noise (V/sqrt(Hz)) of **DATA-CUBE^3** for gain 1 and 16 (input short-circuited, 100 sps)

Data retrieval is carried out via the USB port (typical transfer rate: 7 MB/s). Subsequently, the data can be transformed into miniSEED and/or SEGY. The required software will be delivered together with the **DATA-CUBE^3**.

Thus **DATA-CUBE^3** is the ideal recorder for following tasks:

- Baseline measurements
- Time lapse investigations
- Active seismics (reflection and wide-angle/ refraction)
- Local and regional seismology
- Seismic projects in areas difficult to access
- Appropiate for measurements which require high time accuracy