POLAR CLIMATE AND WEATHER STATION: THE NEXT GENERATION SURFACE METEOROLOGICAL OBSERVING SYSTEM (A STATUS REPORT)

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https://madisoncollege.edu/antarctic-meteorology-project

1. OVERVIEW

The surface meteorology of the Antarctic continent is primarily observed via automatic weather stations (AWS) due to the limited staffed stations - most of which are only found along the coast. Today there are several networks of AWS across Antarctica, managed by different national Antarctic programs and groups. With both the weather and climate characterization of the Antarctic surface relying on this observing network, the University of Wisconsin-Madison (UW-Madison) segment of the network contains nearly 60 stations. There is a need for these stations to fulfill a dual role: to capture a critical climate record along with day-to-day weather observations. Additionally, all AWS hardware systems must to be able to run well in the Antarctic environment. The observations are used for research, weather forecasting, and education. A new project has been initiated at Madison Area Technical College and UW-Madison to develop a next generation polar climate and weather station (PCWS) system (Lazzara et al., 2018). In addition, information from the current AWS networks inform this effort (See Norton et al., 2018). This project, with students involved at every stage, aims to develop a modern polar-centric automated observing system within reasonable means. While development is still on-going, this presentation outlines the status of the project today, lessons learned, successes, as well as future plans. The planned sensor systems, communication methods, and other capabilities in development will also be reviewed. Outlined in this presentation will be an overview of the challenges encountered during the project and learning opportunities, especially for undergraduate students working on the project.

2. PLANNED SYSTEM

The primary focus of this effort is a newly constructed electronics control and logging system (See figures 1 and 2). Our efforts have led to the development of several

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prototypes. The sensor systems that will be a part of the PCWS are much like those found on existing AWS systems used across the Antarctic. Temperature (multi-level), pressure, wind, relative humidity, snow depth, and 4-component radiation will all be standard sensors on the new system. Testing will be done on an acoustic disdrometer. The project will continue to use a standard tower/mounting system as well as a power system (batteries and solar panels) like those already in use on the continent.

3. STATUS

The electronics effort has seen two versions created, and a third is currently in revision. Currently in progress are programming of communications to the Iridium modems and recording of the observations on board the system. Most equipment for 10 full stations has been acquired. Testing of the basic sensors has been accomplished.

Figure 1. A workstation area with the electronics core for the PCWS to the right of the laptop computer.

4. LESSONS LEARNED AND SUCCESSES

The largest success, beyond the progress on the physical system, is the inclusion of students in the project. With over 8 students significantly involved in the project, they have all had the opportunity to explore a science, technology, engineering, and mathematics (STEM) topic. Some have reached new heights in their educational training. Others have discovered their calling in a STEM area. While most will not be in Antarctic work for their careers, some are now pursuing higher education with a goal to be the next generation of Antarctic scientists.

Lessons learned are centered around the challenges of conducting an MRI project at a two-year community technical college. Clear and transparent communications between the MRI team and support areas of the college have proven to be critical in overcoming any problems that have been encountered. Without aid from the support areas at Madison College, this project would not be as successful.

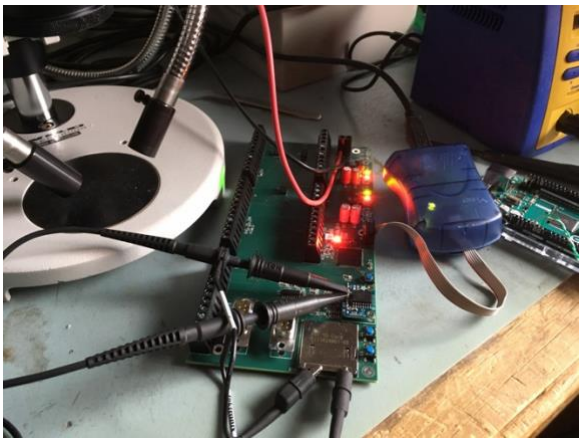

Figure 2. A close up of the electronics core as it is being tested for the new PCWS system. The onboard LEDs offer information on the status of the system.

5. FUTURE PLANS

Beyond the continued effort to complete a “final” version of the electronics core, final acquisition of the components for 10 stations will be completed. Programming of the following remaining sensors will be worked on: acoustic depth gauge (snow depth), disdrometer and 4-component radiometer. Testing of the final systems will be done in our -85°C freezer, including long duration testing in the coming year. Final integration is planned, including outdoor testing at Madison College and a review/test installation of the whole system by an electronical construction class. User level

documentation is in progress and will round out the project.

6. ACKNOWLEDGEMENTS

This material is based upon work supported by the National Science Foundation, Directorate for Geosciences, Office of Polar Programs, under Grant PLR-1625904.

6. REFERENCES

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