

Time Lapse Photography From Arctic Buoys

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Introduction

We have equipped buoys deployed throughout the Arctic with inexpensive cameras. These imaging systems need to be simple, reliable and low power. To that end, we use off-the-shelf webcams connected to an ARM-based single board computer, which also handles data collection from the science instruments and communications. Images are taken at a rate of every 20-minutes during the summer and hourly at other times. They are transmitted over an Iridium satellite link and assembled into long running movies. We have captured a number of interesting events, observed the ice dynamics throughout the year and visits by polar bears. Each of the systems have been deployed for periods of up to a year and over 80,000 images have been received. The cameras have proved to be a great outreach tool and are routinely watched by number of people on our websites.

Data Transport Network

The Data Transport Network is a system for designing robust field instrumentation that integrates the collection of scientific data, system health monitoring, data processing and the distribution of real-time results over unstable and bandwidth limited networks. The system is built around a set of message servers that provide a store and forward mechanism for buffering data, a publish and subscribe interface for accessing the data feeds and a software framework for coordinating the programs in the system. It has been in operation at field sites throughout the world since 1999.

More Information

obuoy.datatransport.org usna.datatransport.org
www.o-buoy.org www.datatransport.org

Acknowledgments

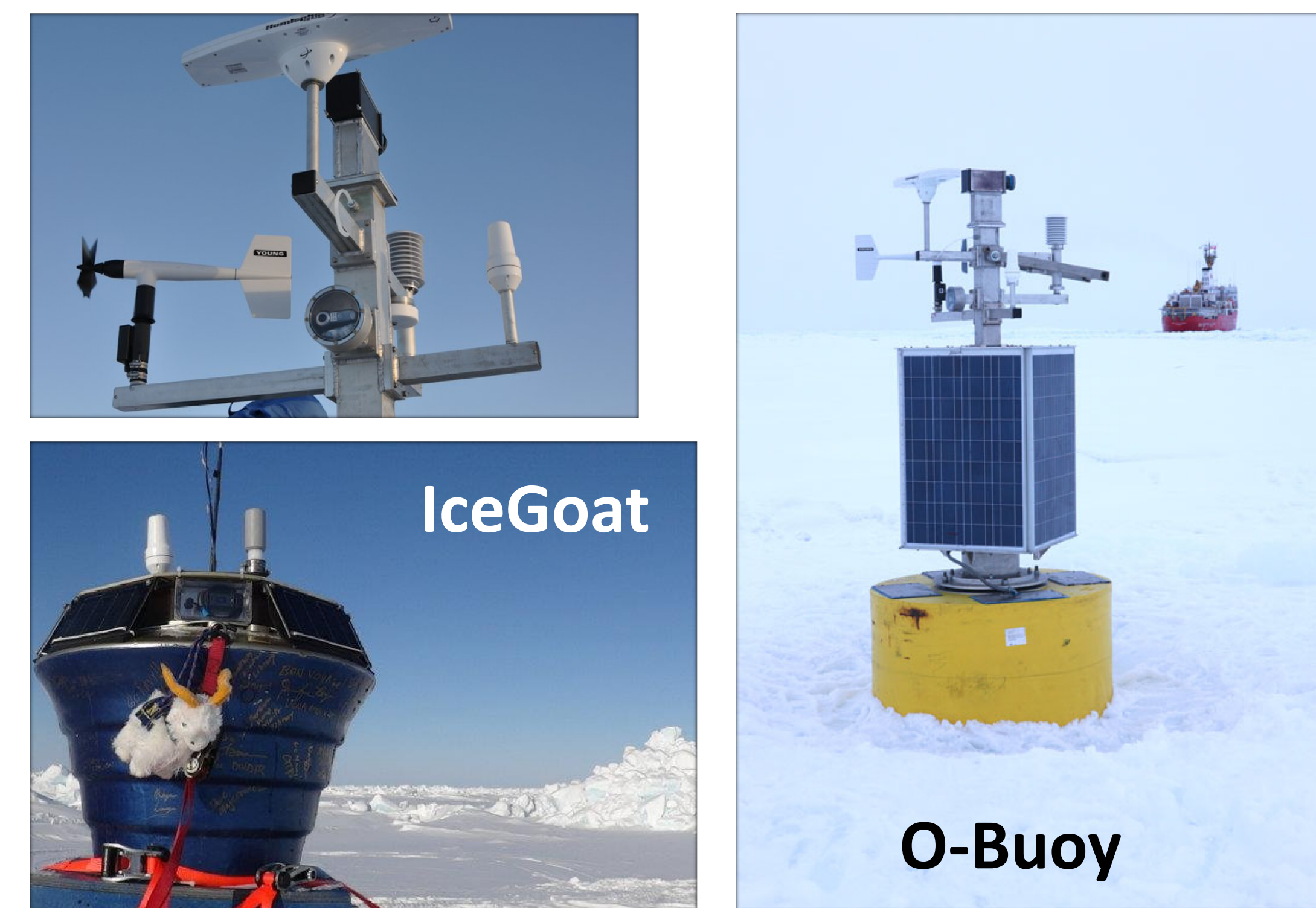
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1 The Buoys

The buoys are ice-tethered observation platforms, moving along with the ice flows in the ocean currents. O-Buoy is a chemical sensing buoy designed for measurements of ozone, CO2 and bromine. IceGoat is a Naval Academy buoy with cameras and weather sensors. The IceKids are small, portable, surface deployed systems.



2 Data Processing

Images are transferred via Iridium satellite modems using the Data Transport Network. On the server, a set of Python programs query a database to find the closest telemetry (GPS and attitude) and create annotation overlays on the image. Once a day, the images are stitched into a movie using ffmpeg, generating webm, ogg and mp4 format videos suitable for streaming to modern browsers supporting HTML5 video playback.



3 Polar Bear Sightings

Buoys deployed in the Beaufort Sea can have occasional visits by polar bears. We have managed to capture images of the bears twice.



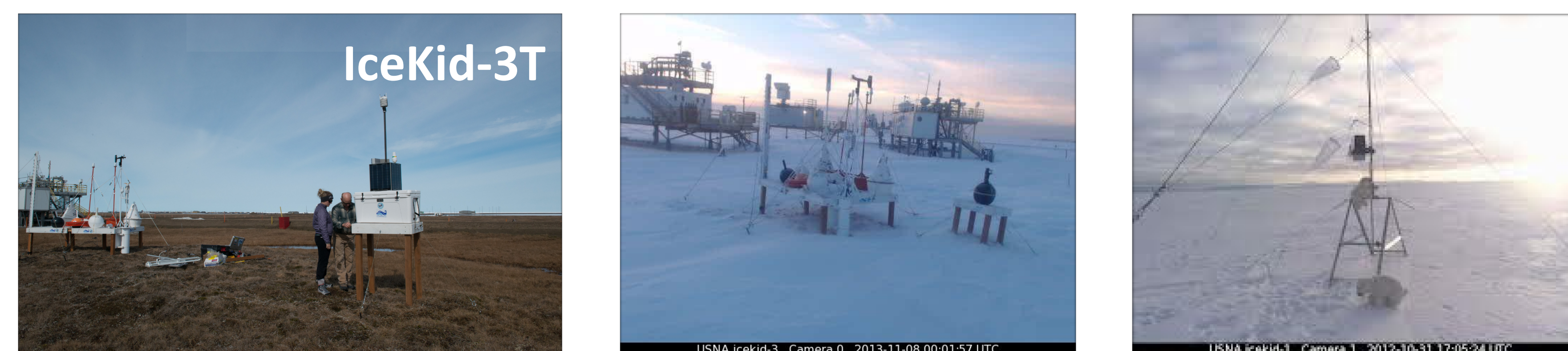
OBUoy-7



IceLander-2

4 Experiment Monitoring

One common application is to use the cameras to monitor other experiments. In Barrow, Alaska, USNA IceKid-3T is collecting images of other buoys as part of the Arctic Observing eXperiment (AOX). In Antarctica, IceKid-1 monitored experiments near McMurdo and Pine Island Glacier.



5 Observations Of Sea Ice

The cameras provide a view of the sea state and ice dynamics over the year. O-Buoy 7 captured a particularly interesting sequence as the flow it was one broke up and the buoy entered open water for about a week. Then on Sep. 27, the ice began to reform and within an hour large ice formations began to appear.

