Statement for the Arctic Observing Summit, 2020

**Advances in Autonomous Sea Ice Mass Balance Observation**

Cameron J. Planck, Thayer School of Engineering at Dartmouth

Recently, significant progress has been made towards developing a mature and reliable system for autonomous sea ice mass balance observation. The latest instrument, termed "SIMB3", is the third iteration of the venerable CRREL (Seasonal) Ice Mass Balance Buoy and a product of Dartmouth College (Planck et al., 2019; Polashenski et al., 2011). Redesigned from the ground up, the primary goal of the SIMB3 project was to: i.) improve instrument reliability, ii.) reduce instrument cost, and iii.) improve instrument availability. Success in each of these areas enables more science by i) decreasing post deployment failures and increasing survivability through the melt season ii) permitting more SIMB3's to be deployed for a given budget, and iii.) ensuring the SIMB3 technology is available to researchers in a timely manner.

The SIMB3 instrument is equipped with a standard suite of sensors which enable it to directly and independently measure sea snow/ice surface and bottom position (via ice-facing acoustic rangefinders). Auxiliary sensors for air temperature and barometric pressure, vertical temperature profile from the air, through the snow/ice, and into the ocean (2 cm resolution), and GPS location are also included. Data transmission at user defined intervals (usually one hour) is achieved anywhere in the world via the Iridium satellite network. SIMB3 is battery operated with an operational lifespan of up to two years. To make the SIMB3 technology available for academic and industrial use, a partnership with a private company devoted to manufacturing SIMB3 has been established. See: *www.cryosphereinnovation.com.*

Currently, every transmission from an SIMB3 starts as a 275-byte binary file. A software backend then decodes the data, creates a CSV file, and hosts it to a web-accessible server for access by the end user. While the CSV datafile is the primary way researchers access SIMB3 outputs, data is also added to a hosted database that is accessible programmatically. This feature permits SIMB3 data to be easily processed, moved, or manipulated by any program that can interface with MySQLi (Python, C, PHP, Javascript). The latency total time from transmission to web is 5 minutes, making the SIMB3 a near real-time device.

As the SIMB3 program has matured, innovation focus has shifted from device to data. Getting the data into the hands of researchers quickly and in useful form is high objective, and therefore leads to the following pertinent questions: *How do we optimize our data hosting framework to be maximally accessible, standardized, and efficient? What form should the data be in for maximum efficacy? Should these data be integrated in a larger data framework, and if so, which one?* The principal purpose of this statement is to create discussion and solicit responses to these questions from the wide audience of stakeholders at the AOS Summit.

The near-real-time capability, fully customizable backend, and relative infancy of the SIMB3 program makes the system ripe for early stage development input. Of particular interest is feedback from the modeling community as to standards and format of data which make SIMB3 outputs most suitable for use in simulations (if any). On a broader scale, parties who have worked with (S)IMB data in the past are welcomed to comment on format, quality, and availability, as well as provide opinions on future direction for the program.

## References

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