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SnowPixel SAIL Field Campaign Report

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ARM

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Acronyms and Abbreviations

ARM	Atmospheric Radiation Measurement
SAIL	Surface Atmosphere Integrated Field Laboratory

Contents

Figures

1.0 Summary

Between March 20, 1000, 2022 and March 23 0700, 2022, the SnowPixel was deployed at the U.S. Department of Energy Atmospheric Radiation Measurement (ARM) user facility's Surface Atmosphere Integrated Field Laboratory (SAIL) site in Gothic, Colorado. These dates were chosen for deployment based on a forecasted 6" of snow at nearby Crested Butte mountain resort. The SnowPixel was mounted atop a shipping container ~3m above the ground as shown in Figure 1. The field conditions during deployment were primarily sunny and clear, with episodes of light intermittent snow. By the time SnowPixel was taken down, approximately ¼" of snow had fallen. Logistical and travel difficulties between the University of Utah and Gothic prevented any further attempts at field data collection in Gothic.

2.0 Results

The SnowPixel collected continuous data and operated at ambient temperatures ranging from -10° C to 0° C. Snow accumulation only totaled ~6 mm during this time, insufficient for measurement of snow water equivalent precipitation. However, useful atmospheric wind data was collected that was analyzed in the frequency domain. A Fast Fourier transform was performed on 20 minutes of SnowPixel atmospheric wind time-domain data to generate an energy spectrum for up to 10 Hz. The spectrum was compared to theoretical expectations of a -5/3 slope on a log-log plot that normally characterizes energy versus frequency through the inertial subrange, as shown in Figure 2. The spectrum is shown to well approximate the anticipated -5/3 Kolmogorov scaling through the inertial subrange. The shaded region represents the device noise floor and extends from the Nyquist frequency of 5 Hz to ~1 Hz. This result supports the capability of the SnowPixel to measure turbulent wind fluctuations.

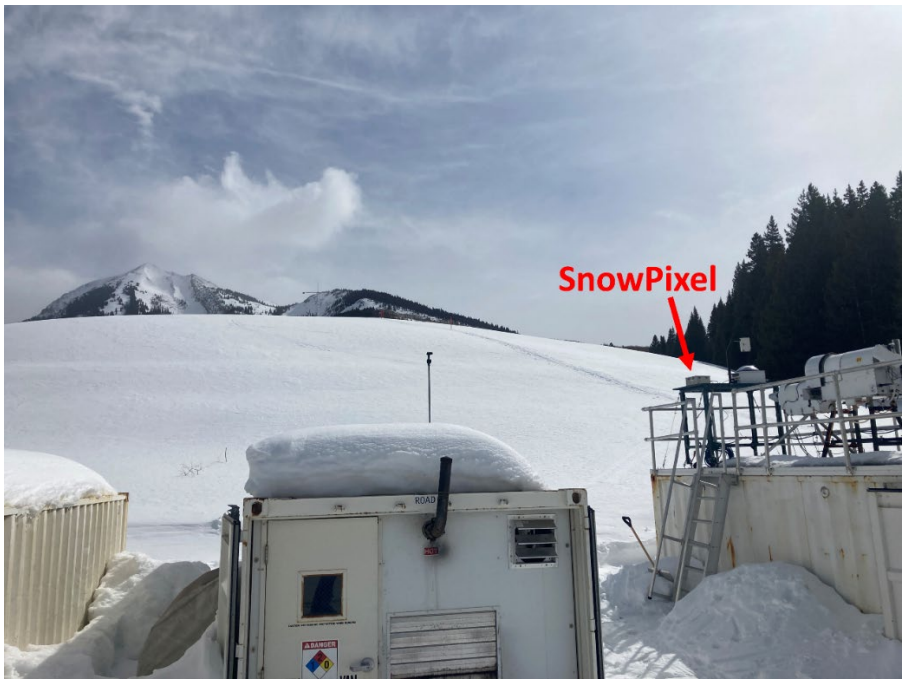

Figure 1. SnowPixel mounted atop shipping container at SAIL.

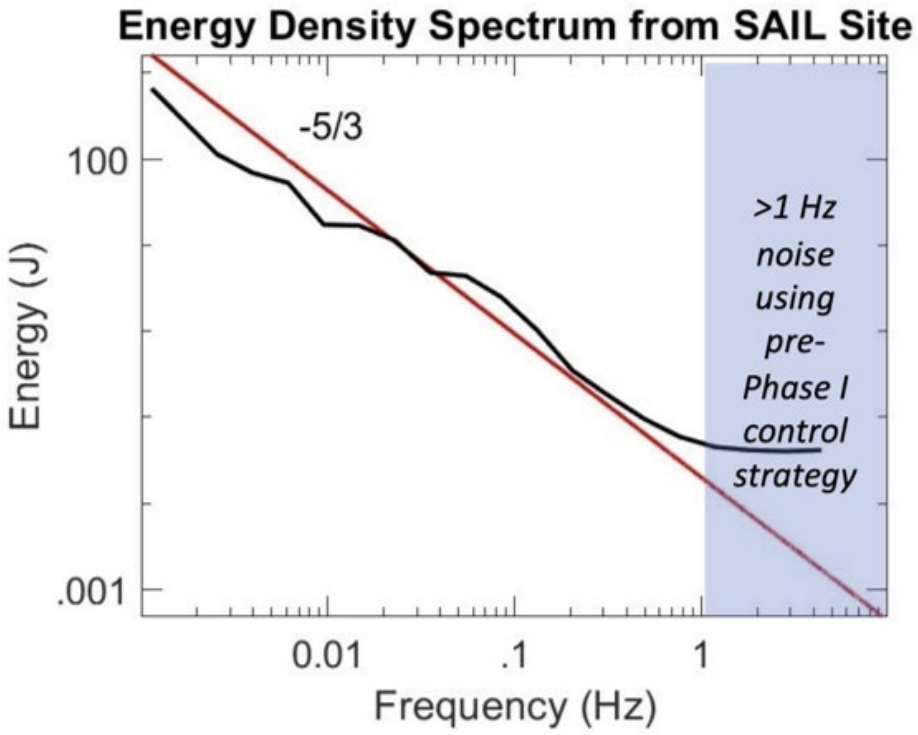

Figure 2. SnowPixel energy spectrum well-approximates Kolmogorov theory through the inertial subrange at SAIL.

3.0 Publications and References

Szczerbinski, R, TJ Garrett, E Pardyjak, DK Singh, T Morrison, and A Reaburn. 2022. Preliminary results of meteorological measurements using a novel high-density thermodynamic device. Conference and poster session presented at the annual ARM/ASR Principal Investigator Meeting, Rockville, Maryland.

Szczerbinski, R, TJ Garrett, E Pardyjak, DK Singh, T Morrison, and A Reaburn. 2023. Meteorological measurements using a novel high-density thermodynamic device. Conference and poster session presented at the annual ARM/ASR Principal Investigators Meeting, Rockville, Maryland.

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