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Reliable automated high-bandwidth data transfers for distributed unmanned instrument clusters in the Arctic.

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Remote science instruments benefit from data links that provide instrument status information without requiring in-person site visits, allowing scientists to confirm operation without having to physically visit the potentially hostile environment where the instrument is located.

There is a growing demand to also relay back actual science data in (near) real-time. This requires reliable high-bandwidth links in areas with, usually, no terrestrial communications or power infrastructure.

A comprehensive system utilizing local wireless distribution over IEEE 802.11 (WLAN) and commercially available broadband satellite communications, with Iridium fallback, has been in continuous operation at Imnavait Creek (Alaska) since September 2010.

We present the design challenges and technologies employed that result in a disruption-tolerant data transfer capability for multiple instruments located in an area of about 4km2 on the Alaskan tundra, supporting total data rates in excess of 40 megabytes per day.

The science data at this site are recorded using Campbell Scientific dataloggers. This company is well-established in the scientific community and is known for reliable low-power operations. However, the PakBus communications protocol used internally by these loggers suffers from inherent throughput limitations when used over high-latency communications links, making the direct download of large (multi-megabyte per day) data sets over a satellite link impossible.

We present a generic store-and-forward solution that utilizes a Python implementation of the PakBus protocol to retrieve 10-Hz carbon flux and wind data from multiple dataloggers and forwards these data over a satellite link without latency-related transfer rate losses.