Analysis of In-Situ Precipitation Measurement Across Four Sites Near the Ross Ice Shelf of Antarctica for Identification of Snowfall Events

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1. INTRODUCTION

The Antarctic precipitation measurement project, an NSF-funded collaborative effort between CU Boulder and the NSF National Center for Atmospheric Research, deployed sensors at four different sites across the Ross Ice shelf between November 2017 and November 2019. These sites are Williams Field (Willie),Alexander Tall Tower, Phoenix Airfield and Lorne. OTT Pluvio^2 precipitation gauges were installed at these sites along with other sensors such as a sonic ranging "snow depth" sensor and a GPS Interferometric (GPS-IR) sensor for measuring the snow height. Additional instrumentation for wind speed and temperature measurement, field cameras, an ETI Optical Particle Detector (OPD), and a Parsivel laser disdrometer were also available.

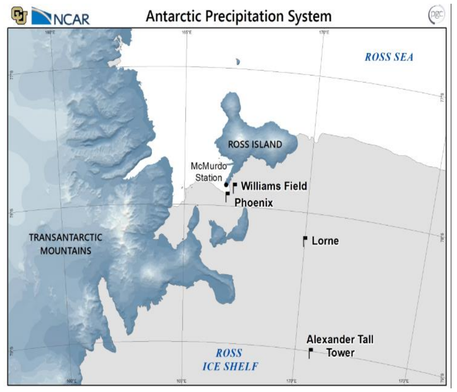


Figure 1. Locations of Antarctic Precipitation System

2. ANALYSIS OF SNOWFALL EVENTS

- This study was developed to assess snow accumulation events focused on a few months of early 2019 (Feb-April), which is during the summer and early fall in Antarctica.
- For establishing accumulation events, first OPD (measuring the presence and concentration of snow particles) count data was compared to the Pluvio^2 data on monthly basis for recognizing events where Pluvio^2 data coincided with an increase in OPD count data followed by time series plots of the monthly precipitation data, snow depth data and wind speed.

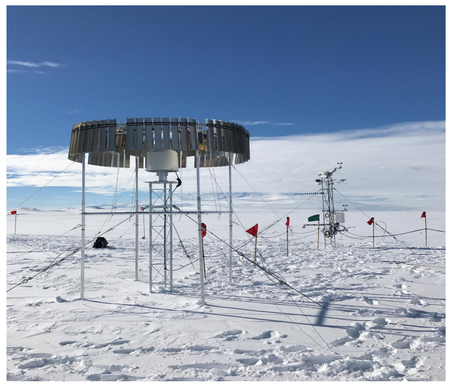


Figure 2. Willie Site with OTT Pluvio^2 precipitation gauge installed inside windshield

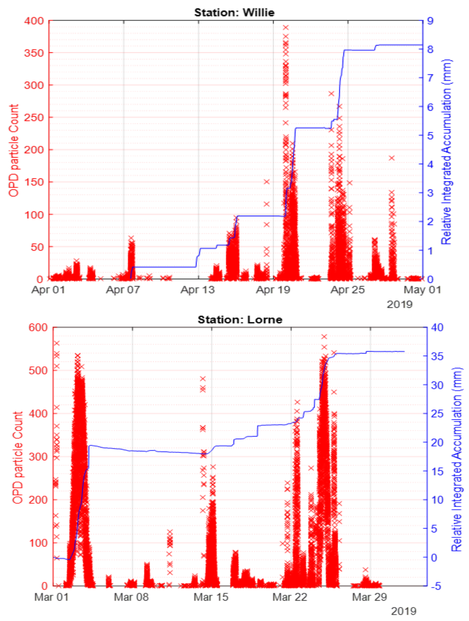


Figure 3. OPD count data compared with OTT Pluvio^2 accumulation data for two different months in two different sites

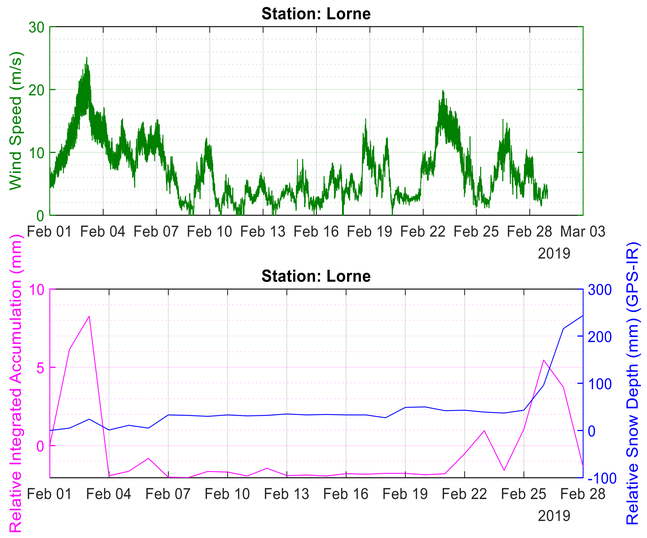


Figure 4. Time Series Plotting of Wind speed, monthly precipitation and snow depth data from both sonic sensor and GPS-IR sensor for sites Willie and Lorne

3. DISCUSSIONS

- The disdrometer was installed at the height of the opening of the precipitation gauge and captured snow particle count and size for better distinguishing between precipitating and blowing snow.
- The OPD count data and particle count data from the disdrometer were compared at sites where the data were available (Tall tower and Phoenix), to distinguish the precipitation events (which would correspond to increase in both OPD count, and particle count data) from blowing snow as the OPD is installed much closer to the ground and can assess both blowing and precipitating snow
- With each individual event of snow accumulation determined using the Pluvio^2 and snow depth data, the events were validated by calculating density, as the density of freshly falling snow is mostly within the range of 50-100 kg/m^3, and this distinguishes fresh precipitating snow from the snow which was already there.

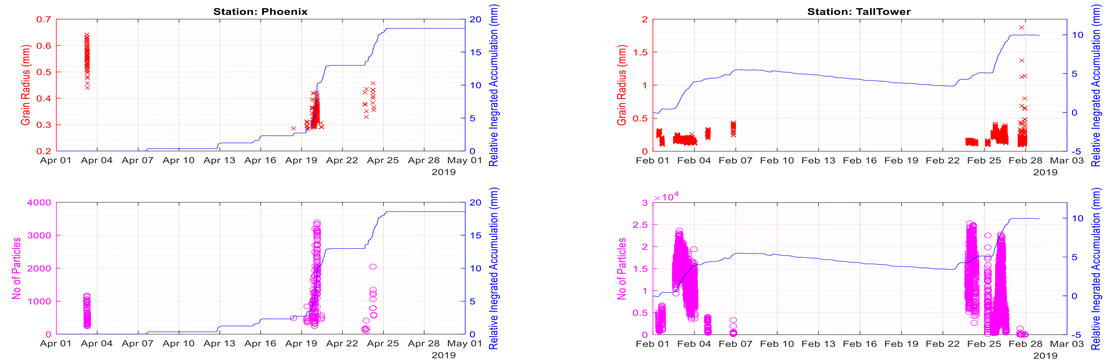


Figure 5 . Disdrometer particle count and particle size data for Phoenix and TallTower sites for two different months

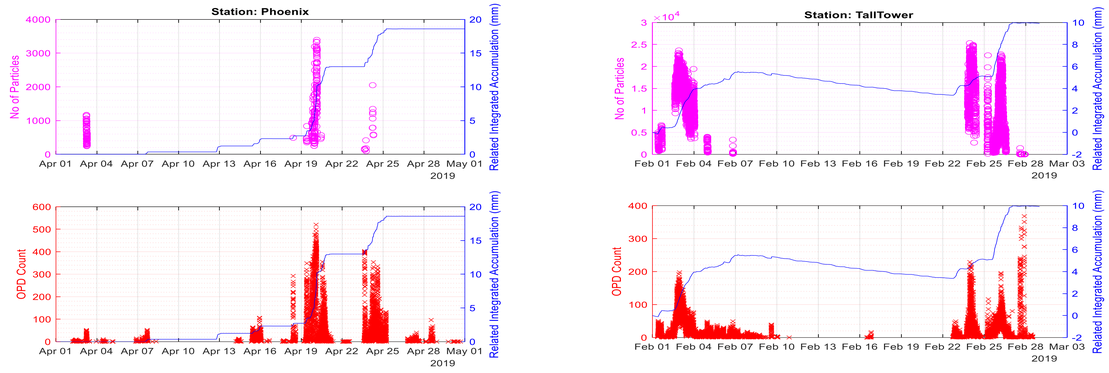


Figure 6. Particle count data and OPD count data compared at sites Phoenix and TallTower for two different months

4. CONCLUSION

This study contributed to identifying individual snow accumulation events through various in-situ measurements conducted at different sites of northwestern Antarctica during early 2019.

5. ACKNOWLEDGEMENT

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