

# **Observing the Antarctic Atmosphere with the SUMO UAS: From the Ross Sea to the Dry Valleys**

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The Small Unmanned Meteorological Observer (SUMO) unmanned aerial system (UAS) has been used for four major field campaigns in the Antarctic to study the temporal evolution of the atmospheric boundary layer. These campaigns have occurred in four very different geographic locations and during both the austral summer and winter. As a result, a wide range of boundary layer conditions have been sampled. In January 2014 and September 2016 two SUMO campaigns, one in summer and the other in late winter, observed the atmospheric boundary layer over a permanent ice shelf. The January 2014 campaign took place over the flat Ross Ice Shelf, approximately 100 km south southeast of McMurdo Station with no terrain features within 50 km of the field site. The September 2016 campaign occurred closer to McMurdo Station in area of complex terrain with local terrain features rising 500 to over 3000 m above the surrounding ice shelf within 30 km of the observation site. In January 2017 the SUMO was used as part of a larger project studying ecological conditions in the Dry Valleys west of McMurdo Sound. SUMO flights as part of this project occurred in a 5 km wide ice and snow free valley bound by ridges rising 1000 m above the valley floor. In April and May 2017, the SUMO was launched from sea ice stations in the Ross Sea during the Polynas and Ice Production in the Ross Sea (PIPERS) research cruise. Taken together these SUMO flights capture a range of boundary layer conditions including strongly stable, very shallow boundary layers, shallow wind-mixed boundary layers, and deep convective boundary layers. Analysis of the forcing for these different boundary layer conditions will be presented. Challenges and lessons learned during these UAS flights will also be discussed.