

Instrumentation of a tall tower at Princess Elisabeth station to study the vertical energy exchange during blowing snow events in Antarctica

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Blowing snow sublimation is one of the most uncertain components of the Antarctic Ice Sheet surface mass balance, and its modeling is particularly challenging. The few existing models that incorporate blowing snow processes show discrepancies exceeding a factor of two, and the turbulent energy exchange during these events is still poorly understood and quantified. Therefore, accurate observations are required to refine current parametrizations and better represent energy exchanges during blowing snow events. However, observations of blowing snow and associated surface heat fluxes over the Antarctic Ice Sheet are scarce and limited to surface-level measurements, overlooking the three-dimensional structure of blowing snow.

To address this gap, we present here a new Antarctic measurement infrastructure installed at Princess Elisabeth station, Dronning Maud Land, designed to investigate boundary layer processes with a particular focus on surface and low atmosphere energy exchanges associated to blowing snow. The setup consists of a 30-meter tall tower equipped with vertically distributed sensors measuring wind speed, temperature, humidity, all four radiation components, high-frequency wind components and water vapor to calculate turbulent heat exchange, along with various instruments for measuring drifting and blowing snow. The sensors are arranged across five atmospheric layers and were installed on an antenna mast next to our surface station established during the 2021-22 austral summer season. The instrumentation was arranged over two field campaigns: an initial test deployment of CSAT3 ultra-sonic anemometers was done in the 2023-24 summer season, and the final setup was completed during the 2024-25 summer season. Next campaigns are planned to obtain the data in near-real time in our data center.