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Exploring firn aquifers on the Muller Ice Shelf, Antarctica

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Over the last two decades, several ice shelves in the Antarctic Peninsula region have experienced significant volume loss or even total collapse driven by atmospheric, oceanic and hydrological processes. Of the three main drivers of ice shelf change, the role of liquid water on and within ice shelves is perhaps the least well defined, largely due to the paucity of field measurements. This study aims to characterise firn aquifers found within an ice shelf vulnerable to hydrological processes. To achieve this objective we use observations collected during two field seasons on the Müller Ice Shelf. The Müller Ice Shelf, the northernmost ice shelf on the western edge of the Antarctic Peninsula, presents a unique opportunity to accomplish our goal: both surface melt pools and subsurface refreezing are known to occur there, and the shelf straddles the -9ºC annual mean isotherm currently considered the limit of ice shelf viability. Measurements from the 2018/19 and 2019/20 field seasons include firn core stratigraphy, geophysical measurements and thermistor datasets, which when combined help to characterise the size and structure of water bodies found within the ice shelf. Whilst during the initial field campaign, no liquid water was observed at the surface, during the drilling of three firn cores liquid water was present at all sites at depths within 20 m of the surface. The prevalence of water and the characterization of the aquifers will provide a baseline for future dynamical studies using physically based models.