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Microstructure Mapping of Firn

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The evolution of the microstructure is crucial for the understanding of many properties of snow, firn and ice. We recently developed a method to map as many visible microstructural features of ice as possible in microscopic resolution: grain boundaries, subgrain boundaries and any kind of visible inclusions. We applied the same method to firn. The result of the mapping is a digital mosaic image in microscopic resolution (1 pixel = 3.3 μm). Mapping is done under the microscope in reflection on carefully microtomed sections. Our method has been successfully applied on polar firn from Dronning Maudland, Antarctica. It works well for polar firn below about 5 m depth. It does not need any pore filler. Applying digital image analysis techniques the mosaic images provide grain and pore size data. Vertical sections contain stratigraphic information. Documented as well are subgrain boundaries or micro-bubbles. The images allow to compare microstructure with other parameters available in high resolution, e.g. derived from computer tomography or chemical parameters to study how microstructure is affected by impurities.