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CryoSat-2 validation on land and sea ice in the western Ross Sea Region, Antarctica, based on near-surface remote sensing methods

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The SAR Interferometric Radar Altimeter system (SIRAL) onboard ESA's CryoSat is designed to yield improved accuracy on ice surface elevation over conventional radar altimeters. The aim of this study is to validate CryoSat-2 measurements on land and sea ice in the Pacific Sector of Antarctica by the application of independent near-surface remote sensing methods. Information on snow and ice characteristics, e.g. density and surface roughness, is collected simultaneously in order to better understand the interaction of the radar signal with sea and land ice.

The investigation area is located in the vicinity of New Zealand's Scott Base (77°51'S, 166°45'E, 14 m a.s.l.). Sea ice formation processes found here, close to the Ross Ice Shelf and McMurdo Ice Shelf, may be quite typical for Antarctica as a whole as about half of the Antarctic coastline is bordered by ice shelves. The outflow of very cold water from underneath the ice shelf favours the formation of frazil and platelet ice - important ingredients which need a better understanding in order to reliably measure and predict changes in Antarctic sea ice coverage. For land ice, this area is also quite favourable with respect to the investigation of snow/ice-microwave interaction, because a large variety of common snow or ice surface classes can be found within a reasonable short distance from Scott Base.

The field work was conducted over two field seasons (2008 and 2009). The remote sensing instruments used include a helicopter borne electromagnetic inductivity device ("HEM bird") for sea ice thickness, a ground penetrating radar system to map internal snow layers as well as snow depth on sea ice, and a laser profiler and high resolution optical camera. The laser profiler and camera was operated either from the ground or mounted on an unmanned aerial vehicle (UAV). For the planning of the field work and to obtain auxiliary information we used satellite data from Envisat and ALOS in various imaging modes and geometries. Information on snow properties was obtained from snow pit measurements and ice core drilling.

Main results are a sea ice thickness map for the McMurdo Sound, 3D information on snow in the percolation and dry snow zone, and information on surface roughness. We present first results from our measurements on land and sea ice properties and compare these results to satellite signatures from spaceborne sensors.