Measuring seasonal snowpack with drone photogrammetry

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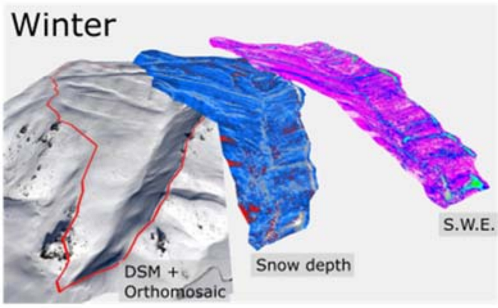

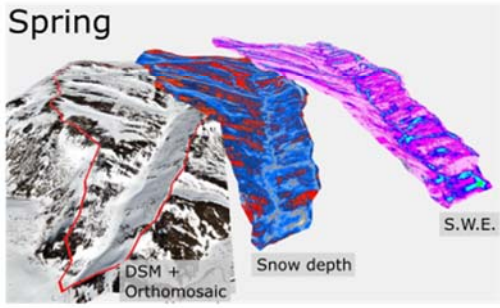

Abstract: Seasonal snow is highly variable in time and space. In New Zealand, persistent seasonal snow cover is largely confined to remote alpine areas, making ongoing in-situ measurement and characterisation of seasonal snow challenging. The remote sensing age has seen significant progress in mapping of seasonal snow from space, yet satellite remote sensing approaches suffer from compromises in spatial and/or temporal resolution. Snow depth, which is beneficial for accurately determining snow water equivalent (S.W.E.) cannot be retrieved from optical satellite imagery. The potential of a remotely piloted aircraft system (RPAS) photogrammetry to address some of these limitations has been explored in a study basin located in the Pisa Range, Central Otago. The Trimble UX5 RPAS platform was flown on three missions during the 2016 autumn-winter-spring period. Imagery was captured by a Sony NEX 5R mirrorless digital camera, fitted with a 15 mm Voigtländer wide angle lens. Photogrammetric processing of captured imagery, constrained by a ground control (GCP) network surveyed with RTK GPS, provided RGB ortho-mosaics and digital surface models (DSM) at 0.05 and 0.15 m spatial resolution respectively. The data acquired in autumn, when the study area was largely snow-free, provides a reference DSM, and subtracting this from winter (02/08/2016) and spring (10/09/2016) DSMs provides maps of snow depth for each epoch at 0.15 m spatial resolution. A vertical accuracy of ±~0.09 m (95% confidence level) was achieved for RPAS measured snow depths for both epochs. RPAS derived snow depth for the spring mission was validated against a reference dataset collected by in situ snow probe measurements. Accuracy assessment and validation revealed the influence of geo-location uncertainty and vegetation-snowpack interactions on snow depth uncertainty and bias. While highlighting some of the limitations that accompany RPAS photogrammetry for surface and volume change analysis, this study demonstrates a repeatable means to produce accurate, very high resolution and spatially continuous maps of snow depth for an entire hydrological basin. Insights into seasonal snow processes may now be provided at an unprecedented level of detail, contributing to improved understanding of controls on the spatial and temporal distribution of seasonal snow.

12:00 noon, Thursday, 11 May 2017
L1 Lecture Theatre
School of Surveying
310 Castle Street

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Te Kura Kairūri

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