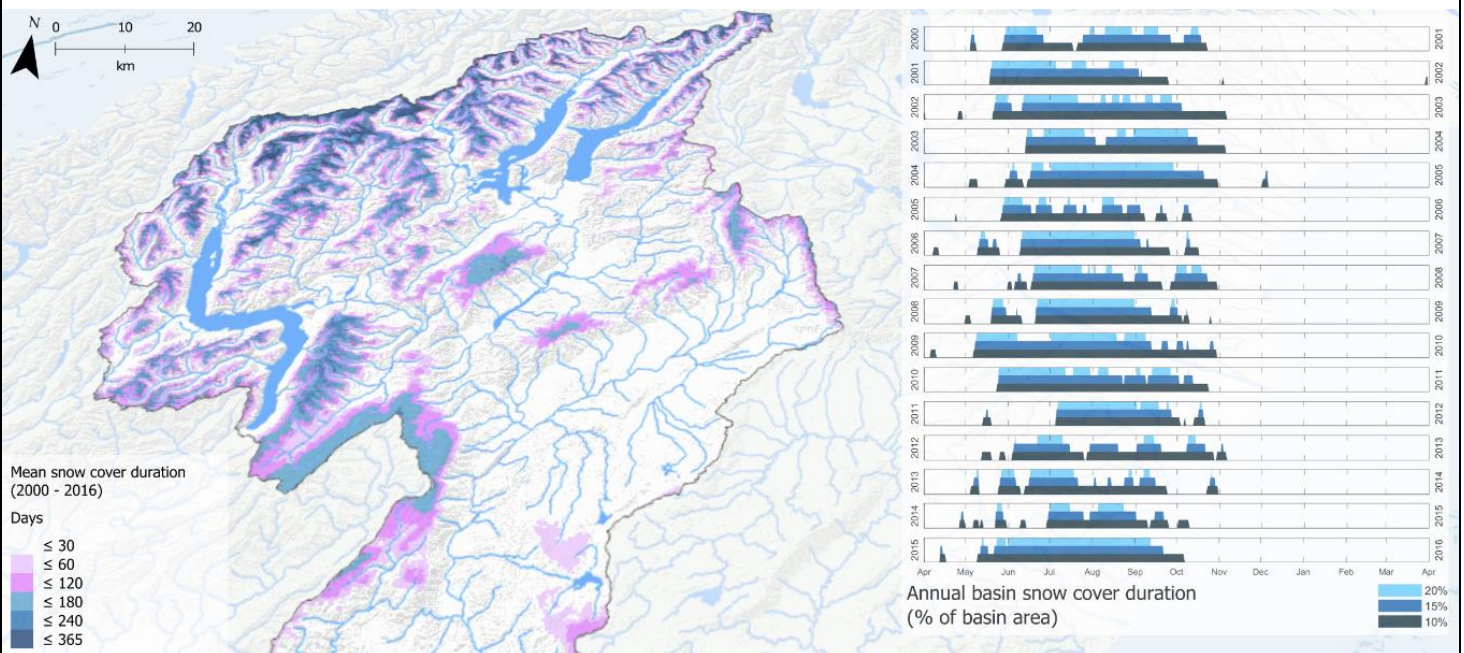


Should you buy a ski pass this winter?

Characterising seasonal snow variability in the Clutha Catchment with remotely sensed data

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Abstract:

Seasonal snow observations in New Zealand are under-represented in the context of the global cryosphere. In turn, our understanding of spatio-temporal variability of seasonal snow, and ability to constrain and contextualise snow models has been limited for New Zealand. Remote sensing, combined with geospatial analysis, provides a valuable tool for addressing such gaps in observational records. Here, these shortcomings are addressed by exploiting a 16-year time series of MODIS satellite imagery to map daily snow-covered area and produce a regional scale snow cover climatology for New Zealand's largest catchment, the Clutha. Substantial temporal variability in snow-covered area (SCA) and snowline elevation (SLE) was detected throughout the timeseries. In contrast to other regions globally, no significant temporal trend was observed in either of these metrics. Spatialised principal components analysis identified six distinct spatial modes, characterising 77% of the observed variability in snow cover duration (SCD). The spatial structure of principal components highlights the influence of variable winter synoptic scale circulation, as characterised by HYSPLIT trajectory analysis, on seasonal snow cover. Sensitivity of SCD to climate variability was further assessed via regression between SCD, temperature and precipitation anomalies for individual mountain ranges. Overall, SCD was found to be more sensitive to variability in temperature than precipitation, and sensitivity to both varied spatially across the catchment. Temperature sensitivity decreased with distance from the main divide, while precipitation sensitivity was greatest for ranges between 40 and 60 km east of the divide. These findings provide valuable insight into the variability of seasonal snow in New Zealand and controlling processes. Furthermore, without a substantial change to synoptic scale weather patterns, interannual climate variability is likely to remain more influential than longer-term climate change on the extent and duration of seasonal snow within the Clutha Catchment in the near-future.