

Extraction of End-Of-Summer Snowlines from ASTER images for Southern Alps

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**Presented at SIRC 2004 – The 16th Annual Colloquium of the Spatial Information Research Centre
University of Otago, Dunedin, New Zealand
November 29th-30th 2004**

ABSTRACT

Glacier fluctuations have been recognized as one of the clearest signals of climate variability and change. A change in climate characteristics directly alters the glacier mass balance. The End-Of-Summer-Snowlines (EOSS) provide an index of the glacier mass balance indicative of a positive or negative glacier mass balance.

The current study's aim is to evaluate if ASTER (Advanced Spaceborne Thermal Emission and reflection Radiometer) images can be used to complement End Of Summer Snowlines (EOSS) information acquired over the Southern Alps of New Zealand or, indeed, if they can be used as a cost effective substitute for mass balance determination. The Global Land Ice Measurements from Space (GLIMS) program is a project designed to monitor the world's glaciers using remote sensing.

The study presented here describes two main tasks: extraction of individual boundaries and the EOSS for index glaciers in New Zealand. We used ASTER images for the end of summer season from 2001-2003. There are several issues involved with the satellite data collection, such as relatively short temporal time window, high percentage of cloud cover within the image and potential for early unseasonal snowfall. Twelve usable images (Aster 1B level) were orthorectified to remove geometric distortions resulting from remote sensing and to align x and y axes of the image with the east and north axes of the map projection. The average geometric accuracy ranged from 11.2 to 21.2 meters. The areas covered by snow and ice were extracted utilizing the Normalized Difference Snow Index (NDSI). A Principal Component Analysis (PCA) was applied on the snow and ice images to reduce the redundant information by decorrelating the original spectral bands. The supervised spectral classification was performed by selecting representative or training pixels for each class, i.e. unshaded & shaded snow & ice. The images were classified using the minimum distance classification method. The EOSS were digitised on-screen and projected onto the Digital Elevation Model to obtain altitude information. The resulting mean elevations of EOSS for individual index glaciers were compared to the altitude values computed by Chinn et al. (2003).

REFERENCES

Chinn, T.J., C. Heydenrych and M.J. Salinger (2003) Glacier Snowline Survey 2003. NIWA Client Report AKL2003- 023, 29p. National Institute of Water and Atmosphere, Auckland.