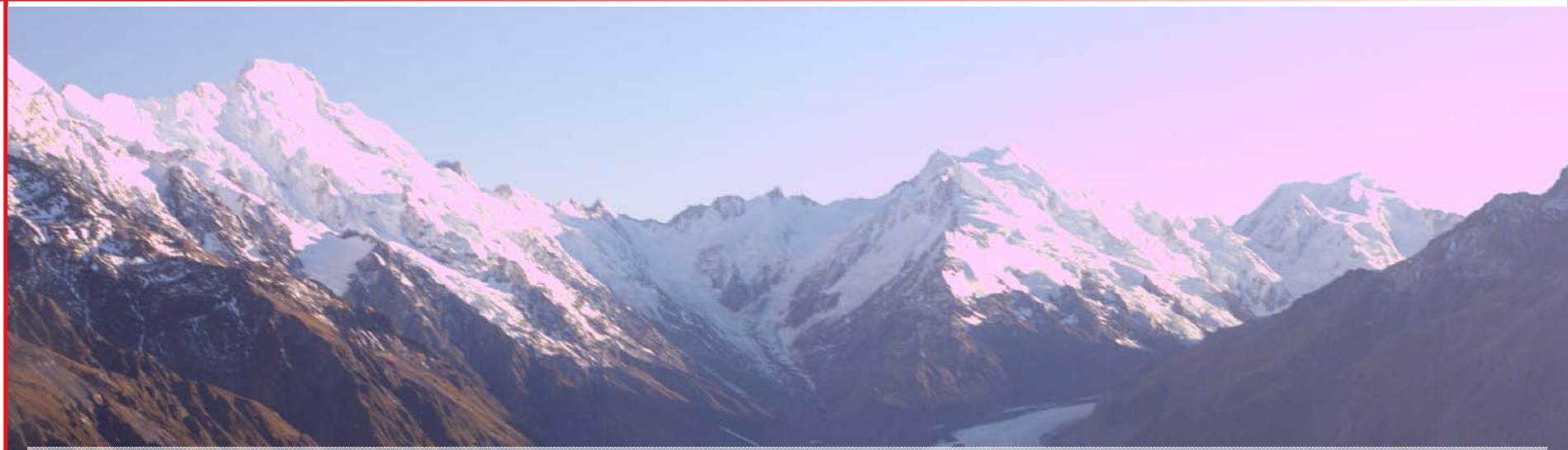

A NEW DIGITAL TERRAIN MODEL FOR THE TASMAN GLACIER, NEW ZEALAND, USING DIGITAL PHOTOGRAMMETRY TECHNIQUES

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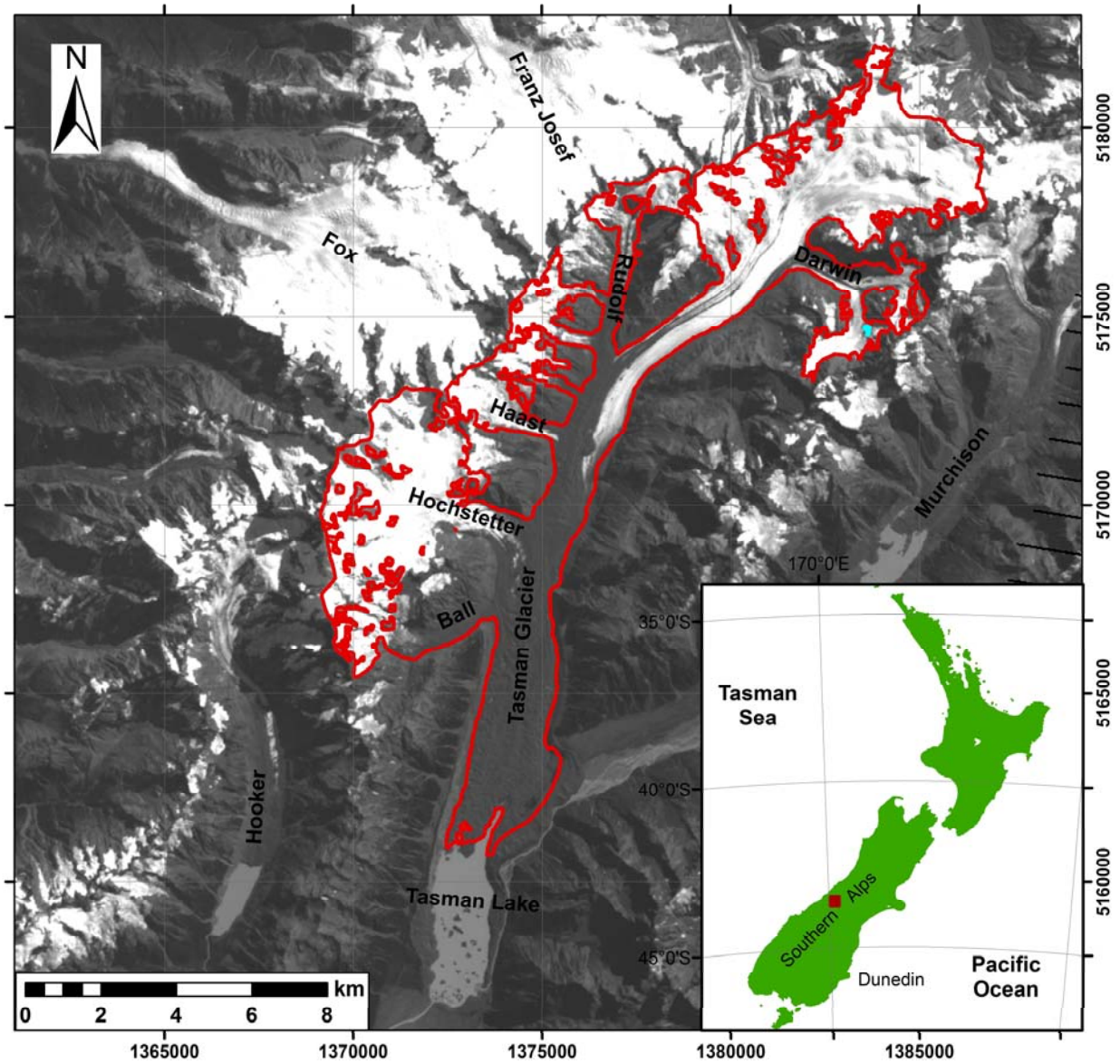
MOUNTAIN CARTOGRAPHY WORKSHOP 2012

Tongariro National Park, New Zealand | 1-5 September 2012

INTRODUCTION

Tasman Glacier



-100 km^2 glacier area (including tributary glaciers)

-30% of the ice volume of NZ

-One of the most studied glaciers in NZ and SH

-Debris covered in the lower area

-Calving terminus

-Slightly negative mass balance index

-Current topography available is derived from a 1986 aerial survey

Chinn (2001), Dykes et al. (2011), Willsman et al. (2010), Quincey & Glasser (2009)

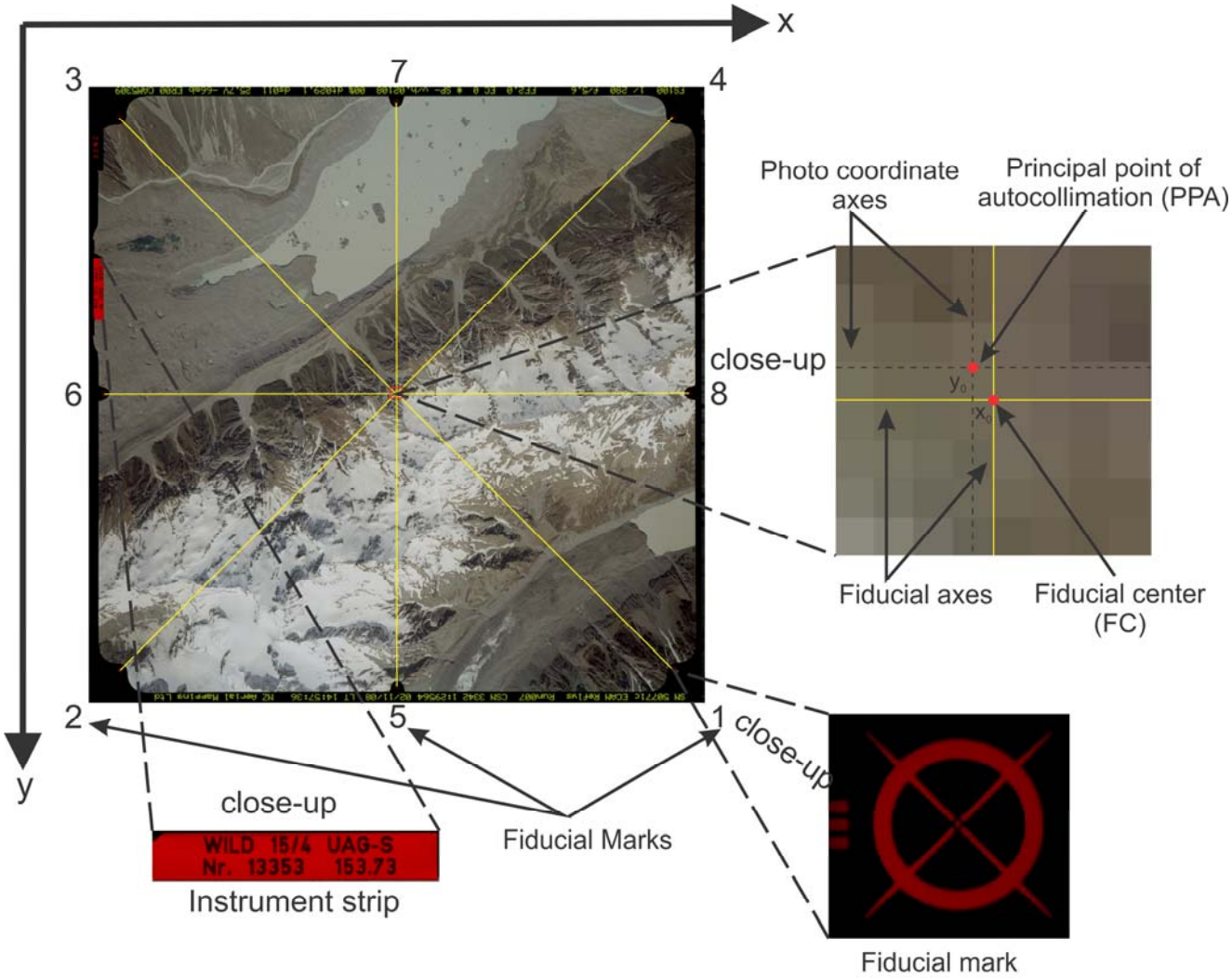
DATA AND METHODS

- 2008 aerials photographs (digital format)
- Differential GPS Trimble R4
- Trimble Business Center v2.5
- Leica Photogrammetry Suite 2011 (LPS)
- ArcGIS 10

Survey code	Nominal scale	Survey date	Camera model	Nominal ground resolution (m)
50686c	1:40,000	08/02/2008	Leica RC30	0.56
SN8895	1:50,000	01/02/1986	Zeiss RMK	0.70

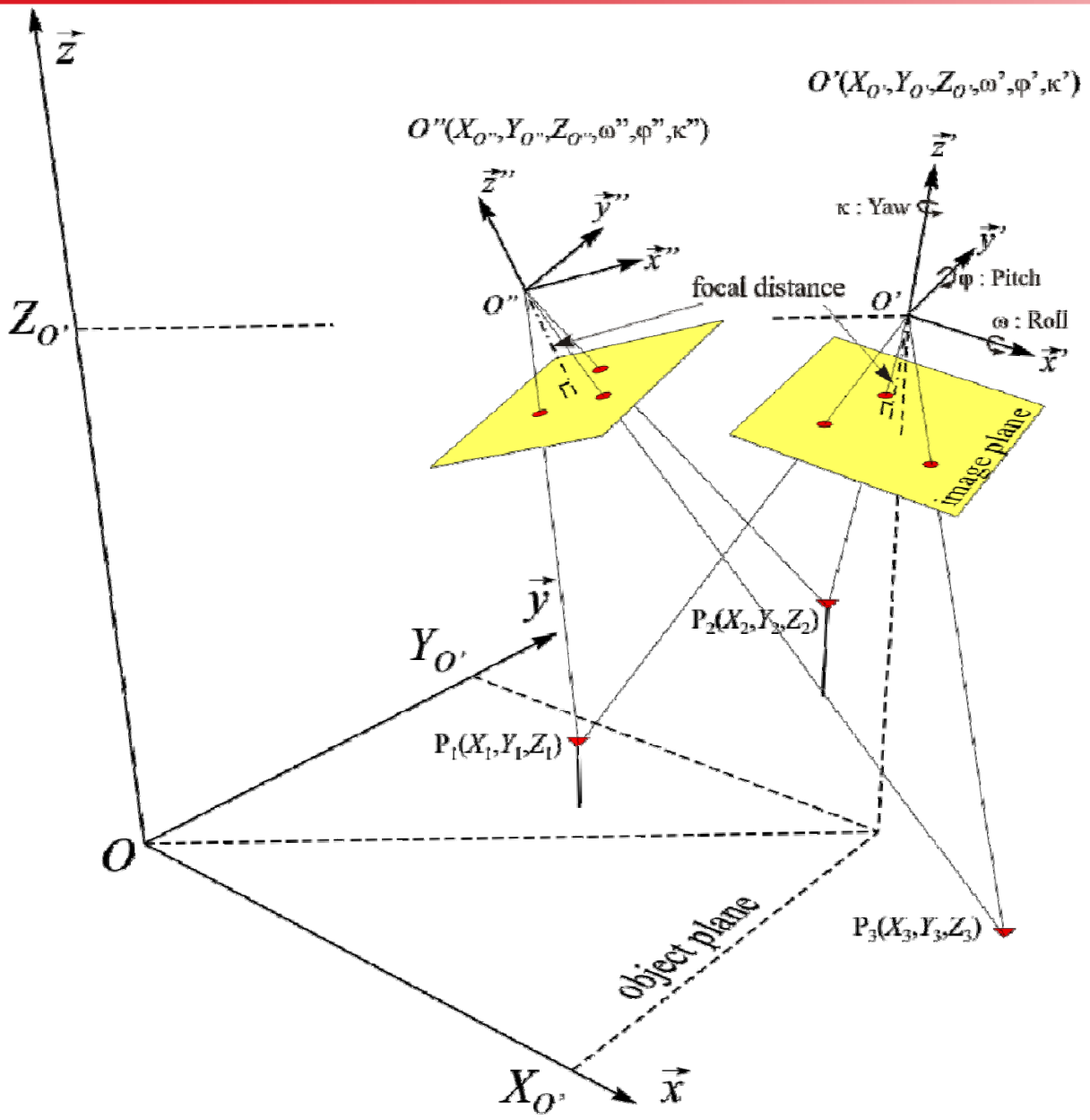
DATA AND METHODS

Interior Orientation



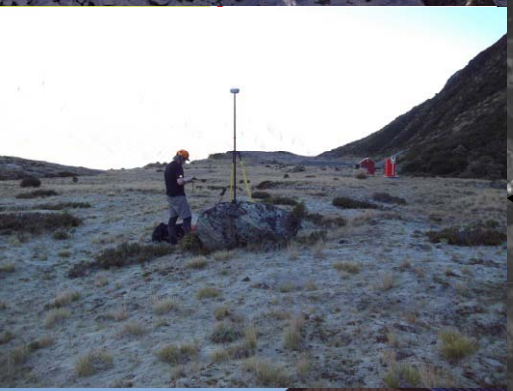
DATA AND METHODS

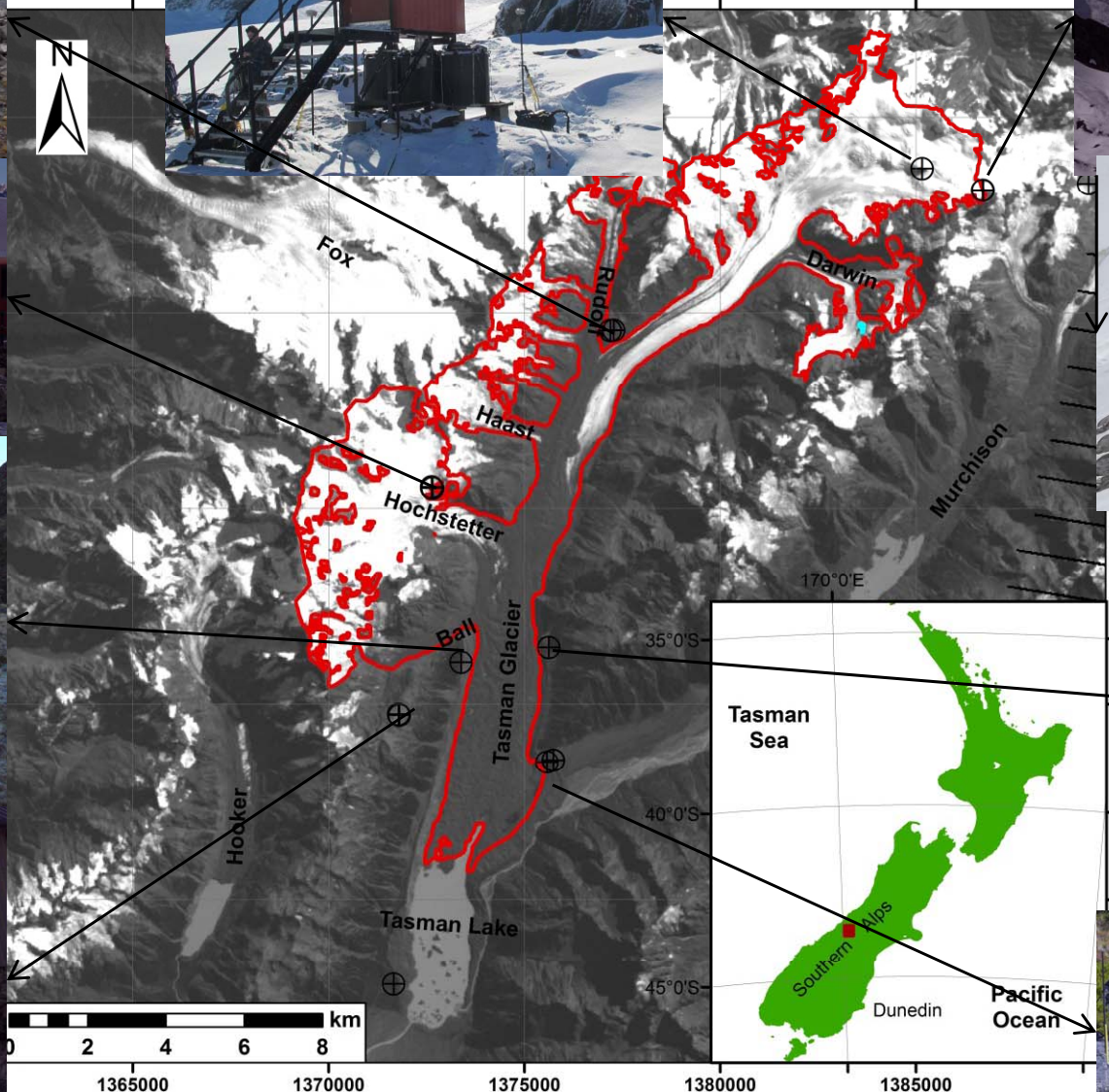
Exterior Orientation

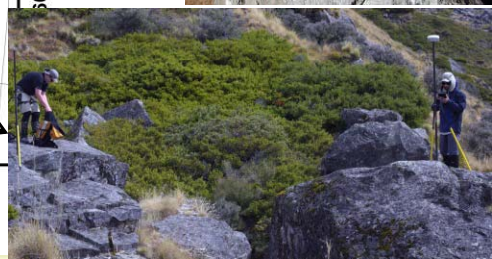


DATA AND METHODS

Differential GPS Surveys 2011-12

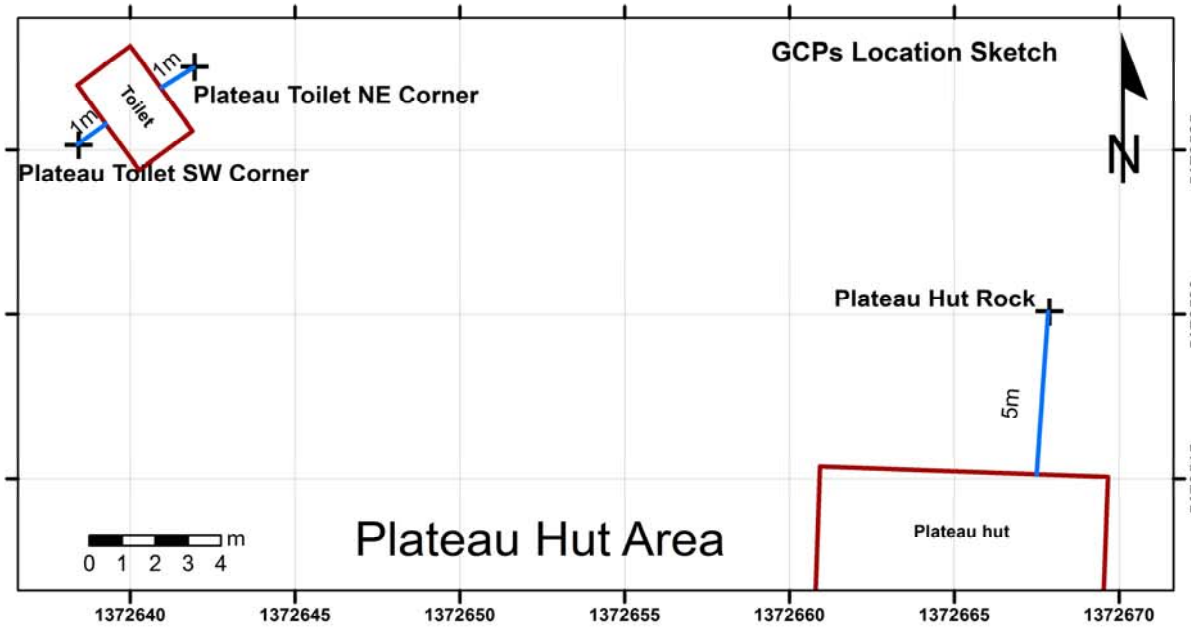


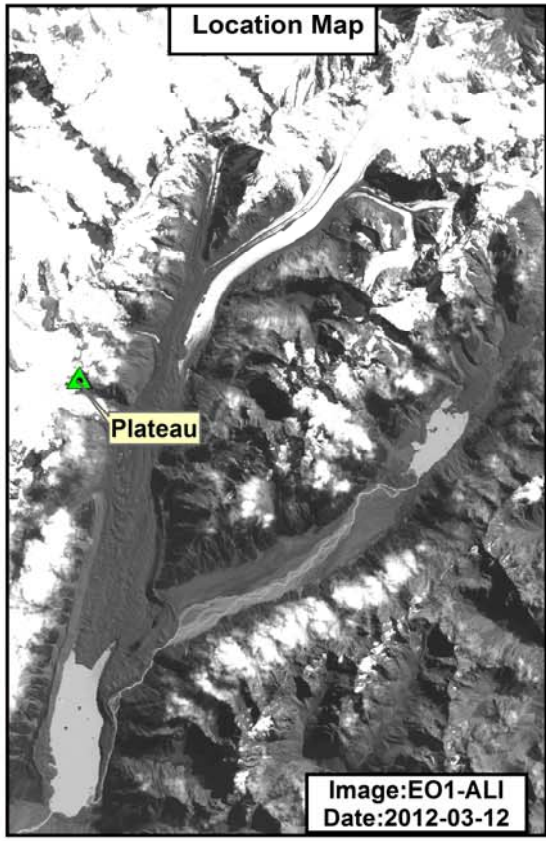


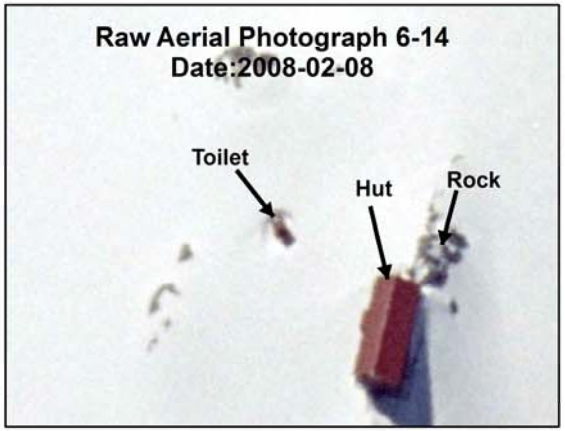


DATA AND METHODS

Ground Control Point selection







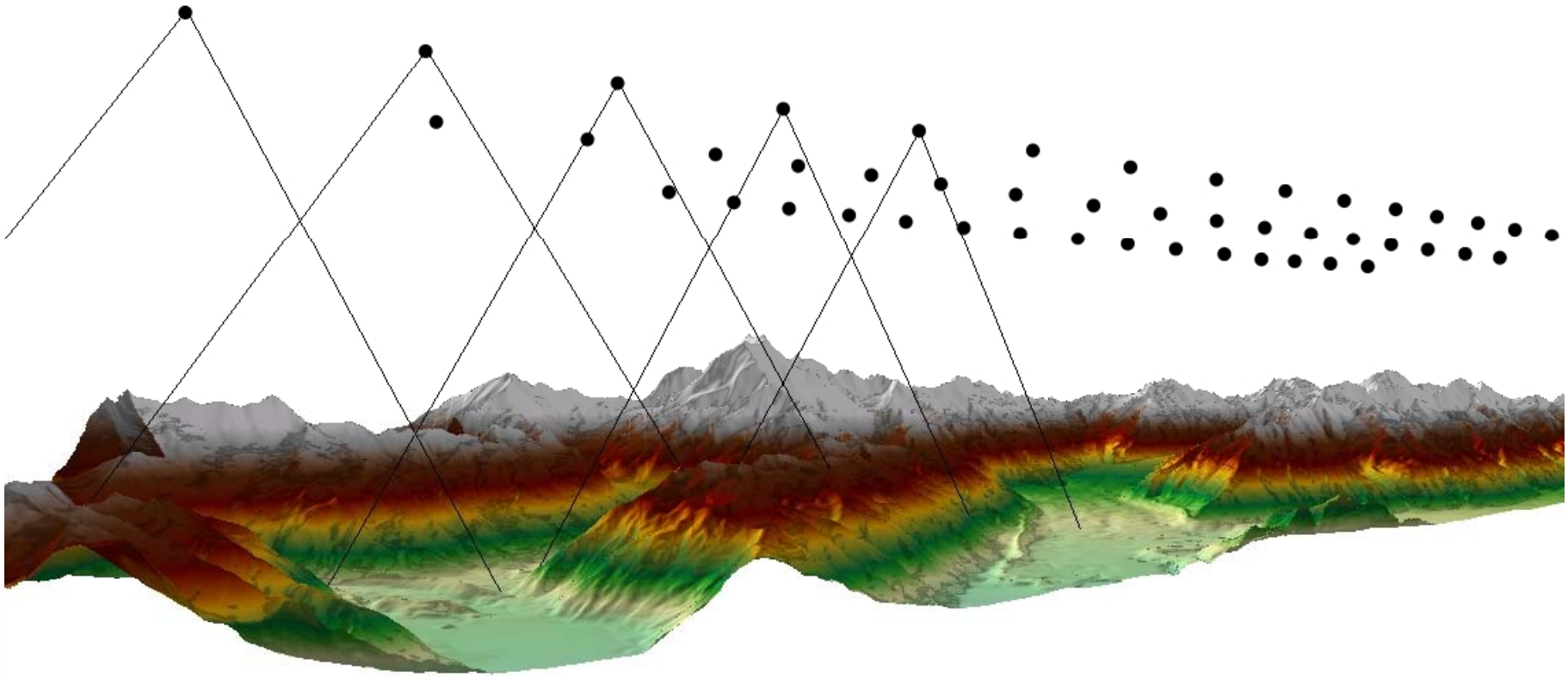
GCPs Table Values

Name	Easting	Northing	Elevation_Geoid	Height_Ellipsoid	Latitude	Longitude
Plateau Toilet NE Corner	1372641.961	5170527.507	2196.73	2210.258	S43°35'00.73244"	E170°11'01.96016"
Plateau Toilet SW Corner	1372638.446	5170525.139	2197.227	2210.755	S43°35'00.80523"	E170°11'01.80003"
Plateau Hut Rock	1372667.899	5170520.077	2204.775	2218.302	S43°35'01.00145"	E170°11'03.10416"

DATA AND METHODS

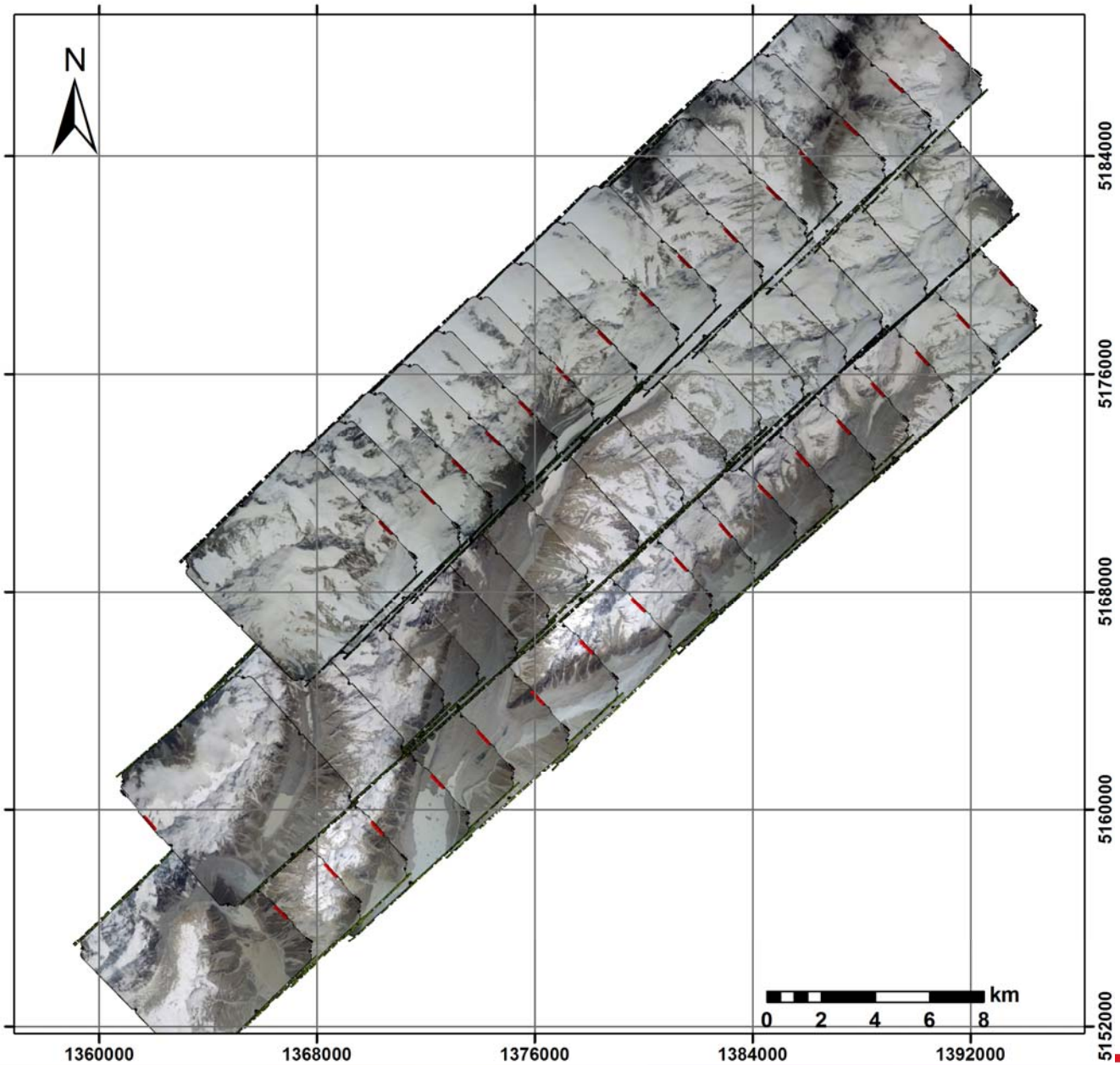
Aerial Triangulation

X, Y, Z and Omega, Phi, Kappa

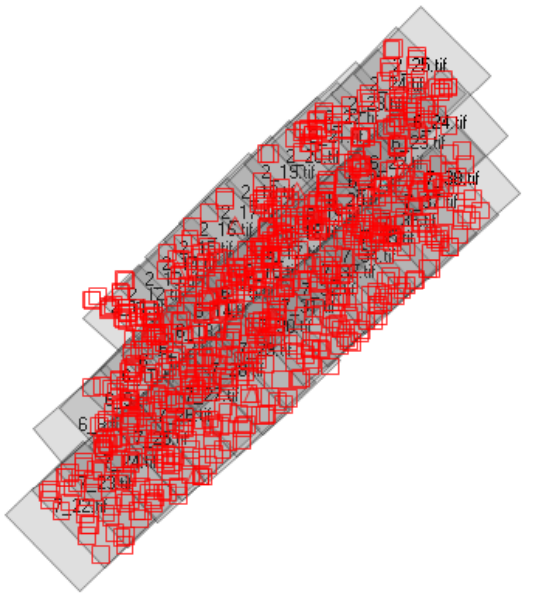


DATA AND METHODS

Aerial Triangulation 2008

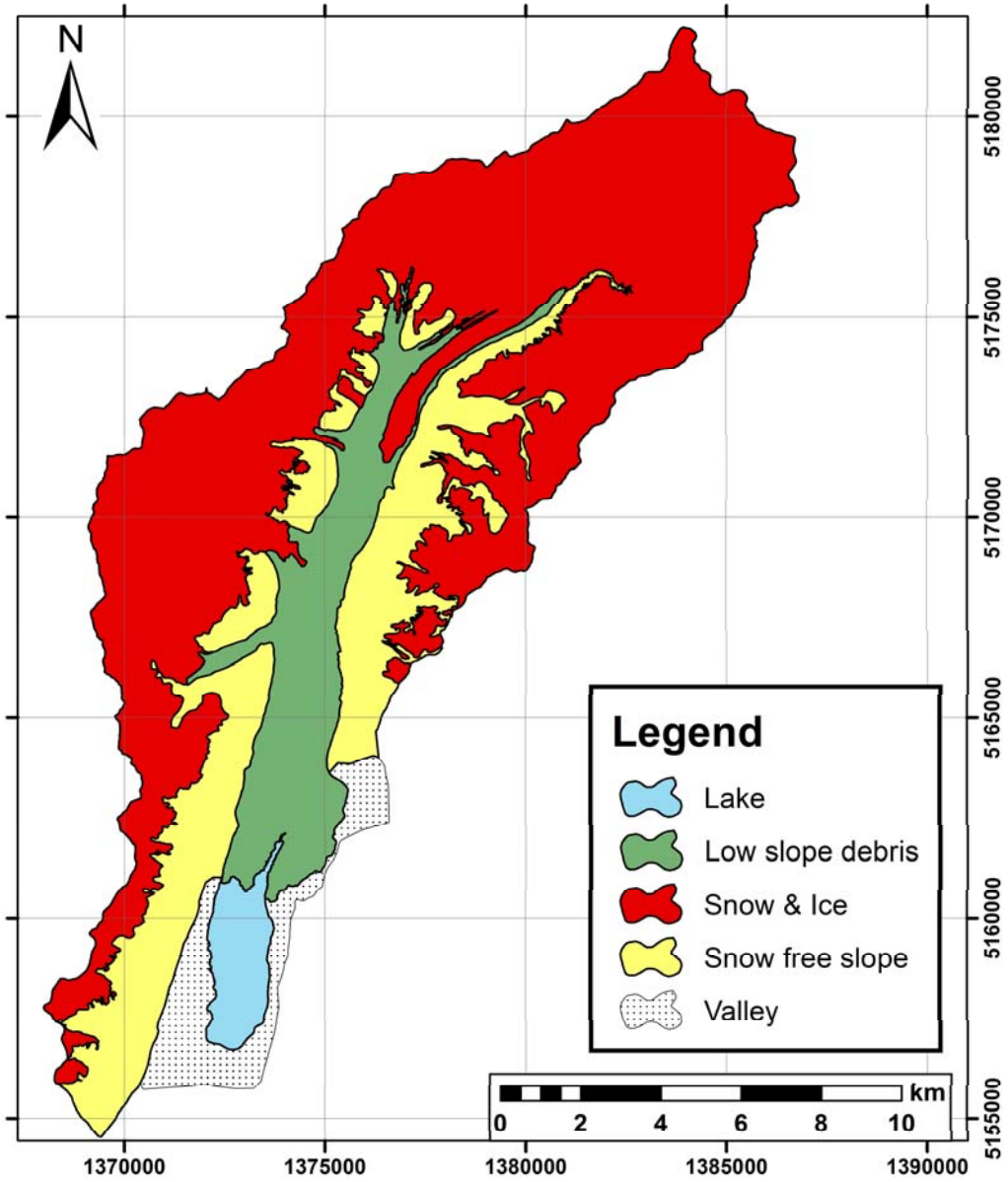


49 aerial photographs
10 full GCPs
5 Vertical GCPs
750 tie points
Total image unit-weight
RMSE 0.39 pixel



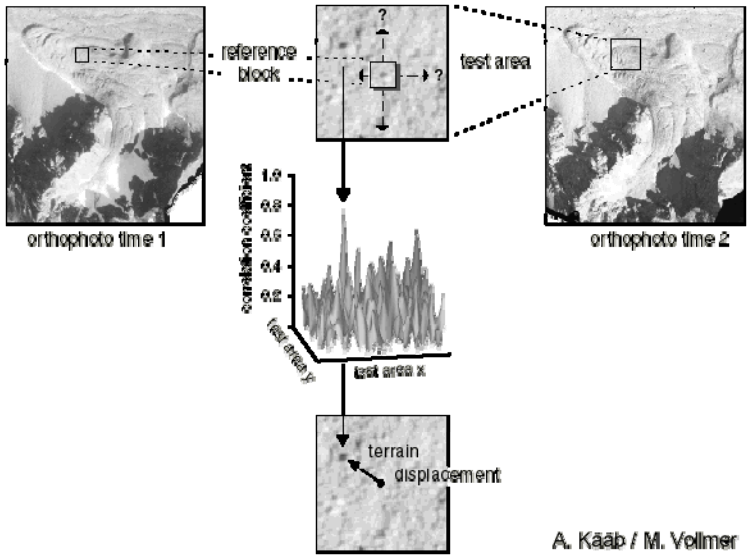
DATA AND METHODS

Photogrammetric DTM computation



-Enhanced automatic terrain extraction module (eATE)

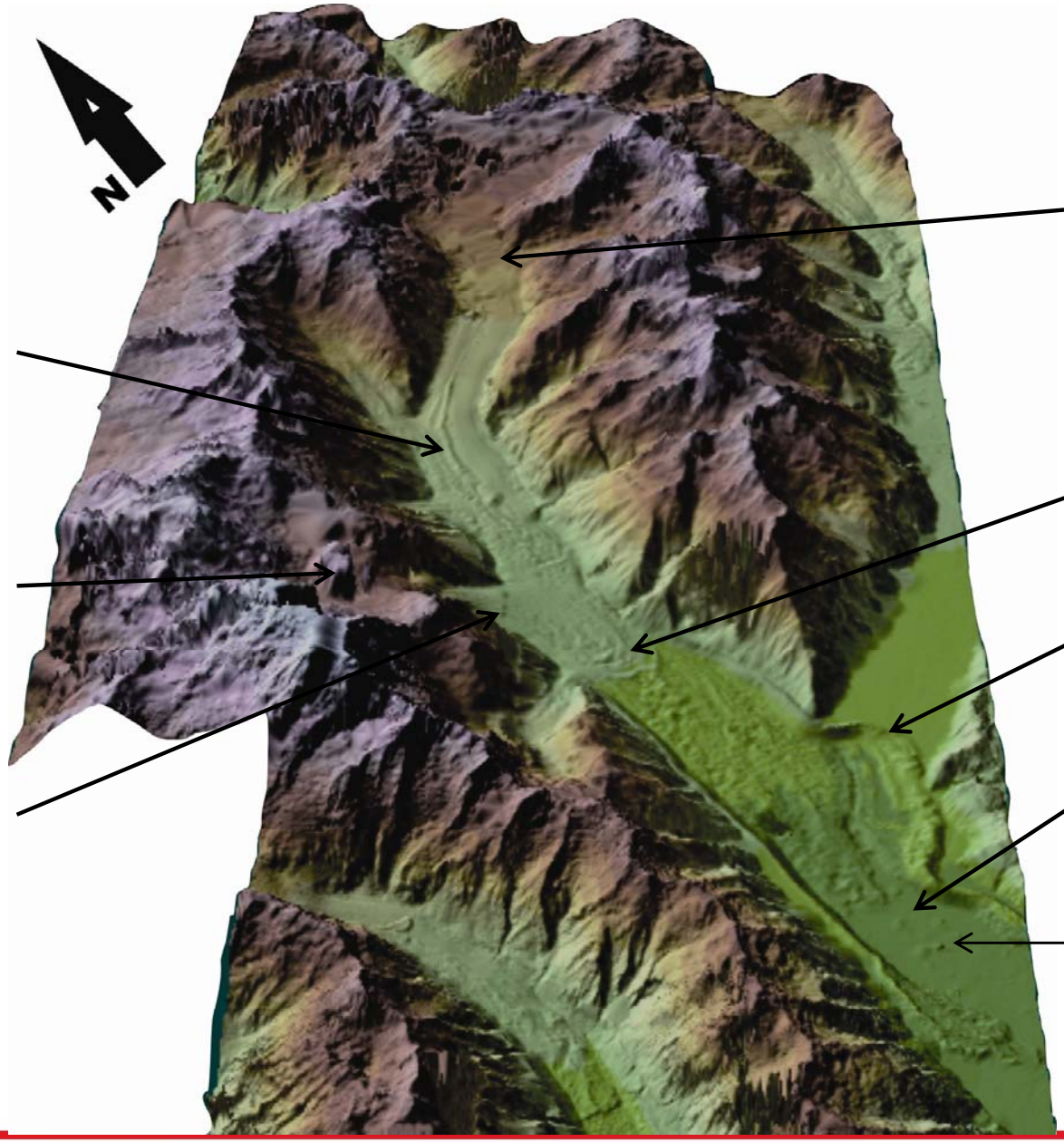
- Find conjugate points in stereo overlaps by means of cross-correlation



-5 custom strategies + default strategy

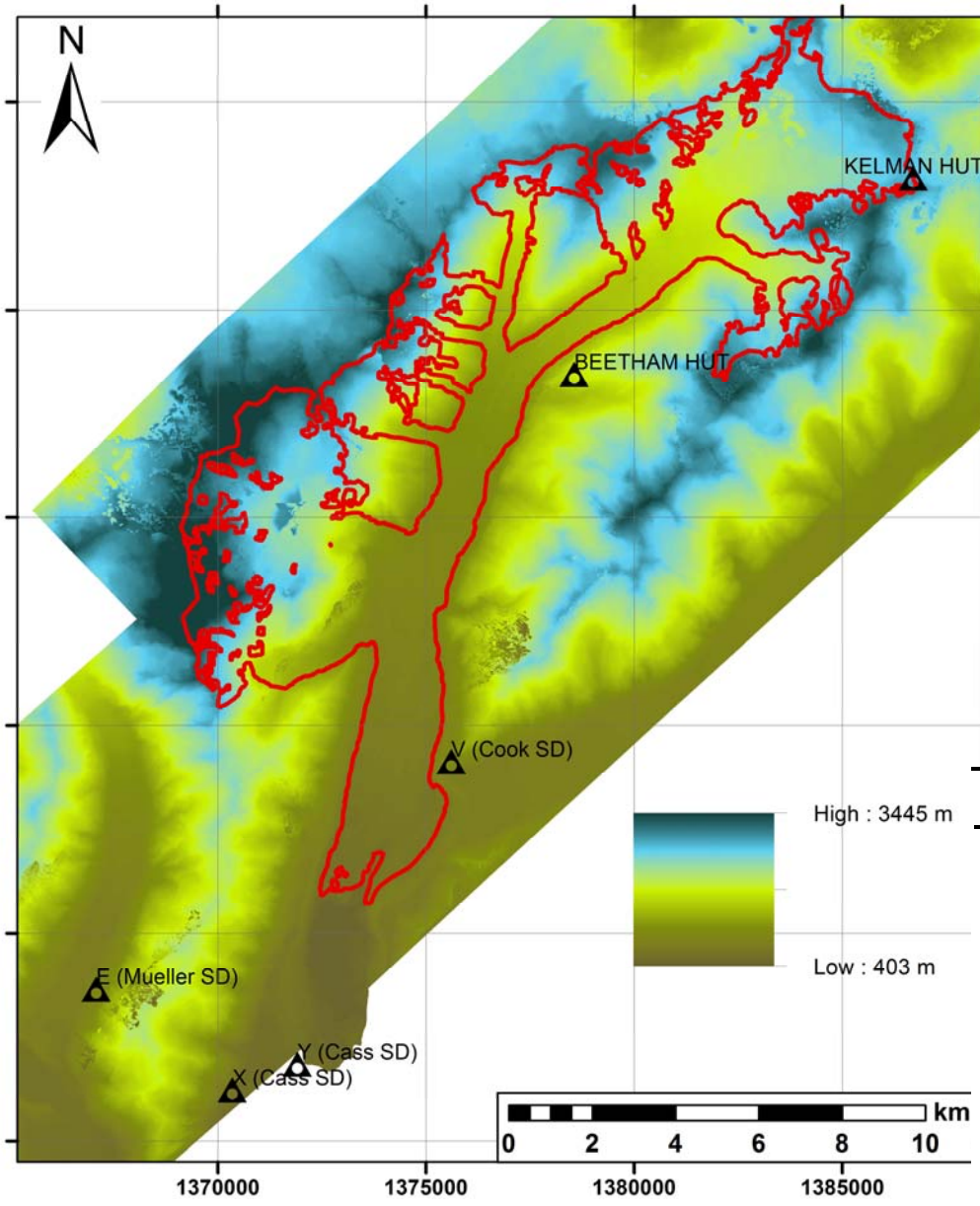
RESULTS

Perspective view of the Tasman Glacier DTM



RESULTS

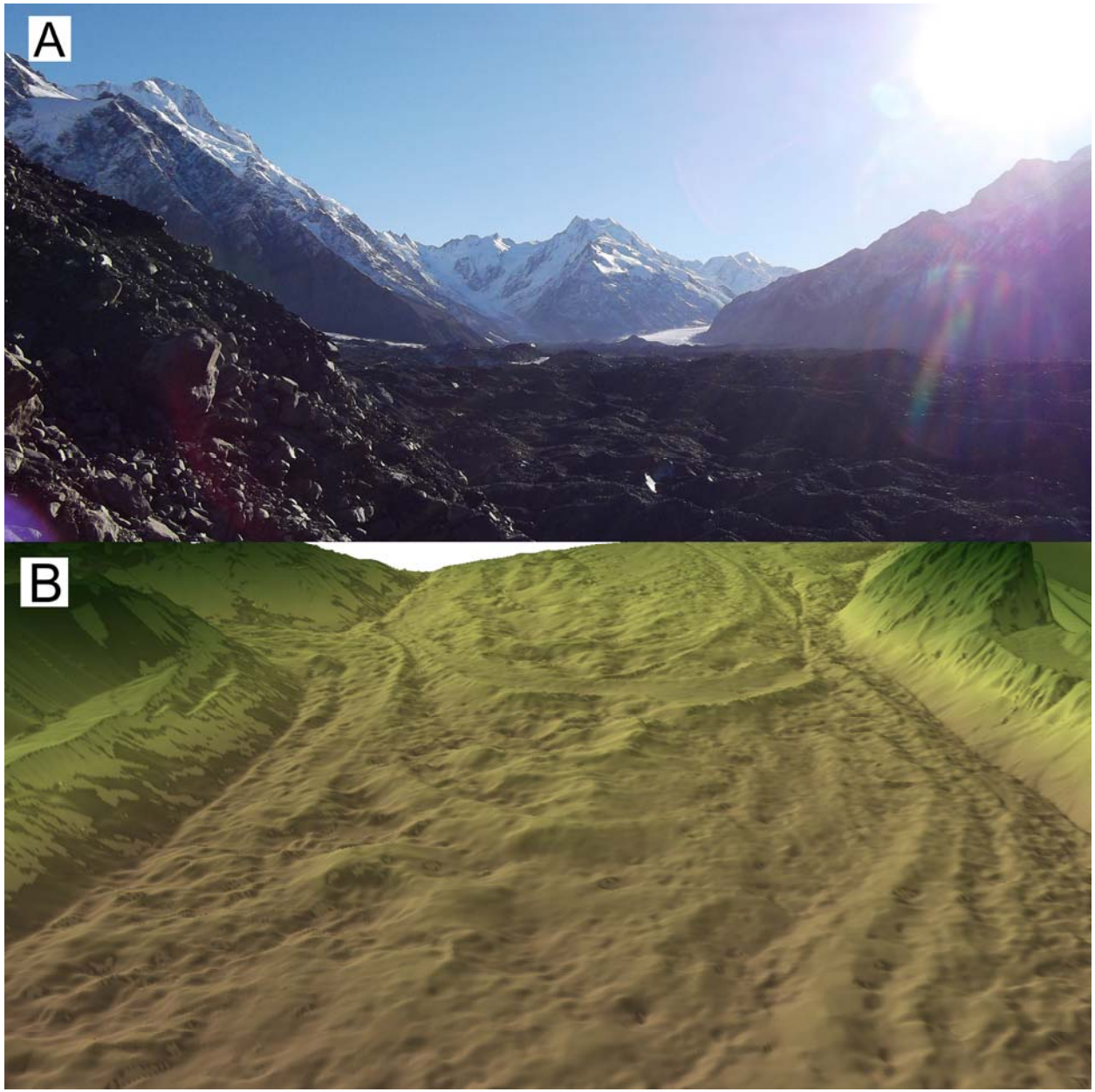
DTM Error



Leave-one-out cross validation method	RMSE (m)
x	0.68
y	0.92
z	2.05

Statistics	Values (m)
Root mean squared error (RMSE)	2.970
Mean error (ME)	-1.271
Mean absolute error (MAE)	2.250
Maximum absolute error (MaxAE)	5.841
Error standard deviation (S)	2.940

RESULTS



CONCLUSIONS AND FUTURE WORK

- *DTM quality*
  - Higher resolution than any other DTM available for this region
  - Improved vertical accuracy
  - However, this DTM has to be manually corrected and edited

- *Exploiting possible applications of the DTM and aerial block information*
  - Volume change and mass balance estimations
  - Topographical updating
  - Photogrammetry derived ground-control points
  - Better orthorectification of satellite imagery (dynamic environment)
  - Adjustment of coarse DEMs (e.g. ASTER DEMs) using this model as a reference.

THANKS, QUESTIONS?
GRACIAS, ¿PREGUNTAS?

- References

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- Acknowledgments