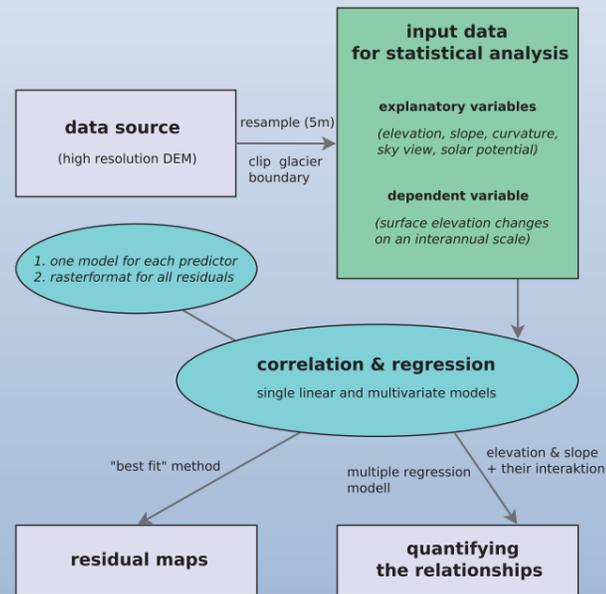


Introduction

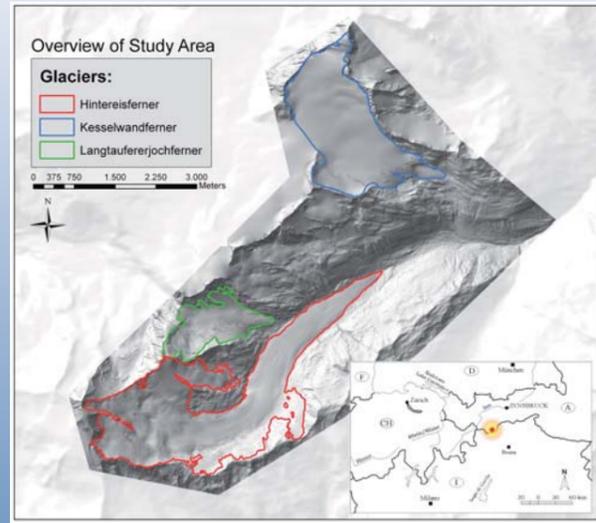
ALS data provides the rastersets which contain the topographic predictor variables (*elevation, slope, curvature, sky view and solar potential*) for the regression analysis. The dependent variable, *surface elevation changes (Δz)*, is calculated by subtracting two digital elevation models from two different dates.



Based on the correlation matrix, the predictors for the multiple regression model are selected. A coefficient preferably near 1 indicates the current variable as useful for fitting the model. Correlations between the predictors itself have to be checked for multicollinearity or redundancy. Red marked are those which are used within the multiple model, the green marked point out the interaktion variables which are transformed to an interaktion term. Yellow are the redundand ones.

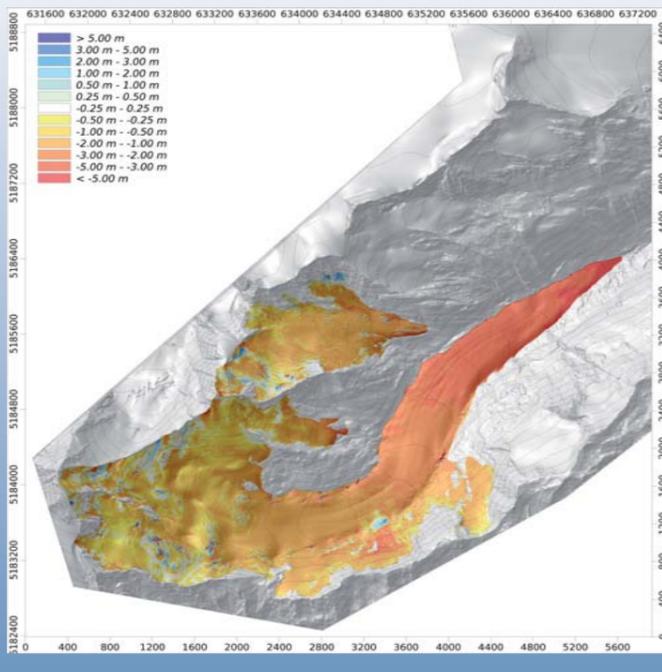
coefficients	Δz	elevation	slope	sky view	curvature	solar potential
Δz	1	0.76	0.36	0.05	-0.18	0.07
elevation	0.76	1	0.57	0.08	-0.02	0.15
slope	0.36	0.57	1	-0.37	0.12	-0.29
sky view	0.05	0.08	-0.37	1	0.30	0.52
curvature	-0.18	-0.02	0.12	0.30	1	0.07
solar potential	0.07	0.15	-0.29	0.52	0.07	1

Study area



The Hintereisferner (HEF) is a typical alpine valley glacier with an area of ca. 7.49 km² (2008) located in the Ötztaler Alps (Tyrol). Its characteristic long tongue is north/northeast exposed and is in the lower part about 200 m thick.

Surface elevation changes



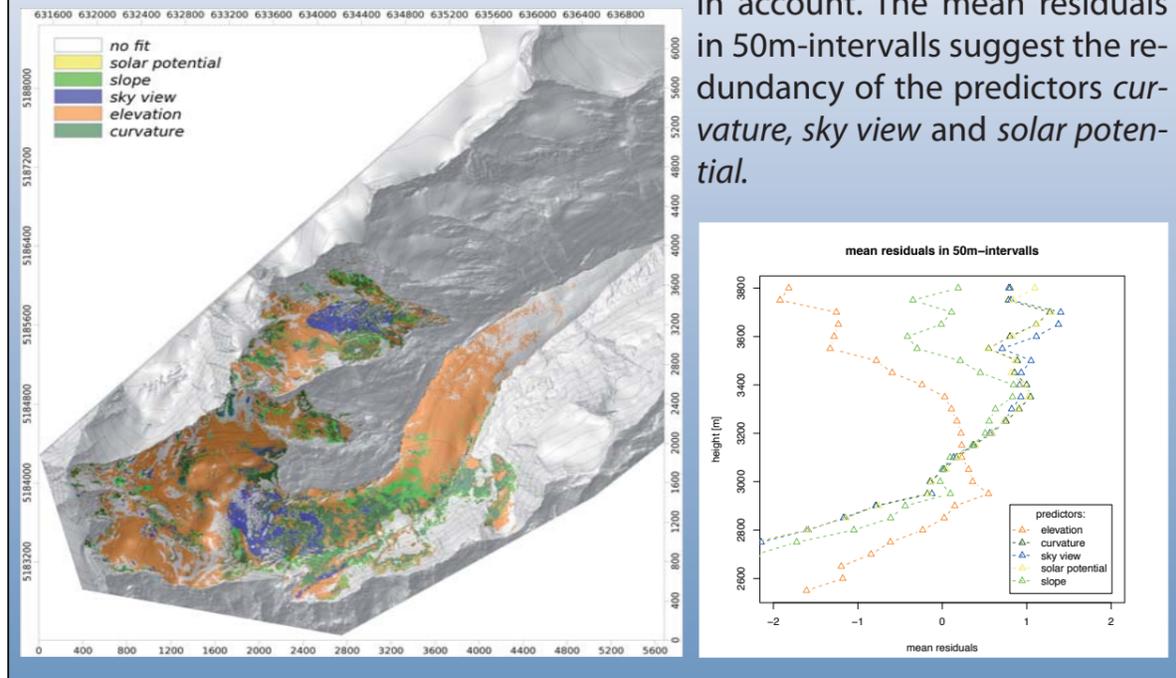
For a better understanding of the influence of topographic parameter on surface elevation changes, it is important to consider the corresponding delta z itself. The map shows the differences between fall 2007 and fall 2008.

Acknowledgements

The ALS flight campaigns and the related studies have been carried out within the framework of the EU Projekt OMEGA (Operational Monitoring of European Glacial Areas, project Nr.: EVK2-CT-2000-00069), the asap – Austrian Space Applications Programm ALS-X (project Nr.: 815527), the ACRP – Austrian Climate Research Programme C4AUSTRIA (project Nr.: A963633) and with financial support of the Tyrolean Science Foundation.

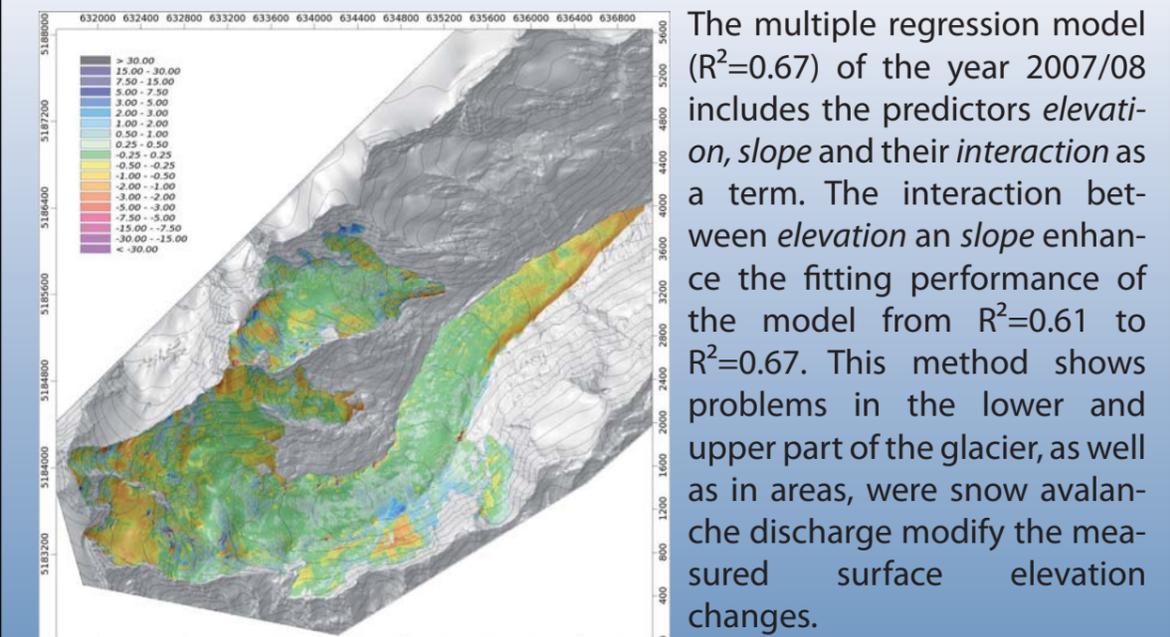
residual map - single linear model for each predictor

The residuals of each predictor from the regression modelling of the year 2007/08 are plotted into one map applying the rule of best fit value. In order to yield honest results, every residual value between - 0.5 and 0.5 is not taken in account.



The mean residuals in 50m-intervals suggest the redundancy of the predictors *curvature, sky view and solar potential*.

residual map - multiple linear model with interaction



The multiple regression model ($R^2=0.67$) of the year 2007/08 includes the predictors *elevation, slope* and their *interaction* as a term. The interaction between *elevation and slope* enhance the fitting performance of the model from $R^2=0.61$ to $R^2=0.67$. This method shows problems in the lower and upper part of the glacier, as well as in areas, where snow avalanche discharge modify the measured surface elevation changes.