A geostatistical framework to consolidate over a decade of mass balance measurements on Brewster Glacier, Southern Alps, New Zealand

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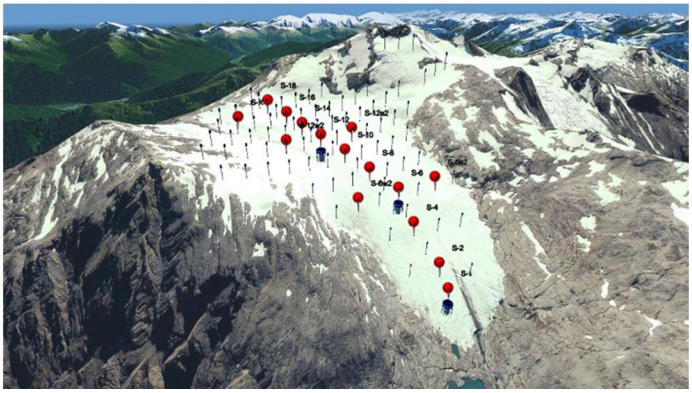

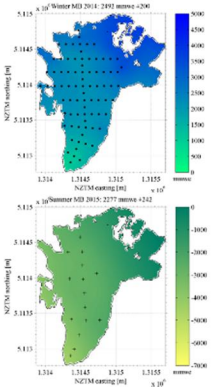

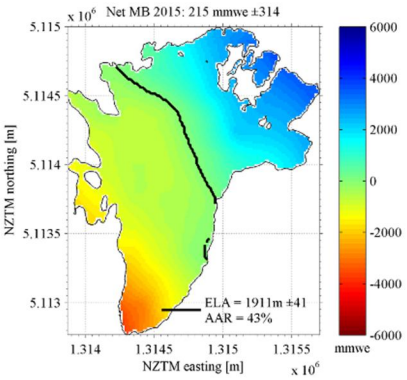

Abstract: We report on the consolidation of the glaciological measurements used to reconstruct mass balance on Brewster Glacier over the period 2005-2015. To help reconcile differences in historical data acquisition, which has influenced the spatial density of data obtained, we re-analyzed all the observational data and propose a new, geostatistical method to calculate mass balance. The method evolved from our hypothesis that the spatial structure of winter and summer balances on Brewster Glacier for any individual mass balance year should contain sufficient similarity to other years to allow spatially distributed indices to be developed for each quantity. This hypothesis was tested using a regression and geo-statistical analysis of the entire mass balance record using elevation gradient as a primary co-factor. The spatial co-variance of both measured winter and summer balances with elevation enabled co-kriging to be used to develop the indices for the entire surface of Brewster Glacier. Regression analysis revealed the newly derived indices are more powerful in revealing the spatial structure of winter and summer balance than elevation, and could thus be used as alternative predictors to spatialize the glaciological measurements. The method also enabled a mass balance index to be resolved that permitted to revisit years with net balance measurements in consistence with those with seasonal observations. The average glacier-wide surface winter, summer and annual balances are 2484, -2586, and -102 mm w.e., respectively, suggesting that the glacier has been losing mass over the observational period. Changes in summer balance appear to explain most of the variability in annual balance, supported by the strong and significant correlation ($R2 = 0.87$, p-value < 0.001) between annual and summer balance. The uncertainty of these estimates, as well as additional information about equilibrium line altitude, accumulation area ratio and mass balance gradients are assessed.

12:00 noon, Thursday, 7 April 2016
L1 Lecture Theatre
School of Surveying
310 Castle Street

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