Geophysical Research Abstracts
Vol. 18, EGU2016-10643, 2016
EGU General Assembly 2016

Contemporary ice-elevation changes on central Chilean glaciers using SRTM1 and high-resolution DEMs

Sebastian Vivero and Shelley MacDonell
Centro de Estudios Avanzados en Zonas Áridas (CEAZA), Glaciology, La Serena, Chile (sebastian.vivero@ceaza.cl)

Glaciers located in central Chile have undergone significant retreat in recent decades. Whilst studies have evaluated area loss of several glaciers, there are no detailed studies of volume losses. This lack of information restricts not only estimations of current and future contributions to sea level rise, but also has limited the evaluation of freshwater resource availability in the region. Recently, the Chilean Water Directorate has supported the collection of field and remotely sensed data in the region which has enabled glacier changes to be evaluated in greater detail. This study aims to compare high-resolution laser scanning DEMs acquired by the Chilean Water Directorate in April 2015 with the recently released SRTM 1 arc-second DEM (∼30 m) acquired in February 2000 to calculate geodetic mass balance changes for three glaciers in a catchment in central Chile over a 15-year period. Detailed analysis of the SRTM and laser scanning DEMs, together with the glacier outlines enable the quantification of elevation and volume changes. Glacier outlines from February 2000 were obtained using the multispectral analysis of a Landsat TM image, whereas outlines from April 2015 were digitised from high resolution glacier orthophotomosaics. Additionally, we accounted for radar penetration into snow and/or ice by evaluating elevation differences between SRTM C-and X-bands, as well as mis-registration between SRTM DEM and the high-resolution DEMs. Over the period all glaciers show similar ice wastage in the order of 0.03 km^3 for the debris-covered and non-covered glaciers. However, whilst on the non-covered glaciers mass loss is largely related to elevation and the addition of surface sediment, on the debris-covered glacier, losses are related to the development of thermokarst features. By analysing the DEM in conjunction with Landsat images, we have detected changes in the sediment cover of the non-covered glaciers, which is likely to change the behaviour of the surface mass balance in coming years. This study shows the utility of collecting high-resolution DEM data in dynamic regions, such as the Andes, where access is often limited, and multiple surface changes happen simultaneously (such as the aggregation of sediment on the surface, the expansion of thermokarst features or the development of penitentes) which are difficult to record using traditional mass balance techniques.