Geophysical Research Abstracts
Vol. 18, EGU2016-427, 2016
EGU General Assembly 2016

Debris-covered glaciers extend the lifespan of water supplies in the European Alps

Pierre Lardeux, Neil Glasser, Tom Holt, and Bryn Hubbard
Aberystwyth University, DGES, Centre for Glaciology, United Kingdom (pfl4@aber.ac.uk)

Debris-covered glaciers have a slower melting rate than clean-ice glaciers due to the insulating effect of their debris layer. In the European Alps, debris-covered glaciers have received little attention due to their small contribution to sea-level rise. However, glaciers provide water supplies for the five main watersheds draining the European Alps (Danube, Rhine, Rhone, Po and Adige, in order of size), an area inhabited by more than 145 million people (20% of Europe's population). It is unclear what volume of ice (and so quantity of potential meltwater) is affected by a debris layer, and what the effect of this layer is for water resources in the Alps.

Combining the Randolph Glacier Inventory (RGI) and online imagery services, we calculated that more than 40% of ice volume in the Alps is influenced by debris cover. In this presentation, we will show the different elements leading to this number, including our evaluation of the RGI, the volume calculation method and what percentage of ice is actually covered (0.6 to 99% of glacier surface area). Our analysis has allowed a comprehensive understanding of the debris-covered glaciers in each watershed by revealing their distribution (i.e. where they will extend water supply lifespan), and hypsometry and equilibrium line altitude (how sensitive they are to climate change). The prolonged lifespan of water supply is visible at the scale of an individual debris-covered glacier: comparing the evolution of Glacier Noir and Glacier Blanc (France) over the last 150 years indicates that Glacier Noir (debris covered) has retained 2.5 times more ice than Glacier Blanc (clean-ice) under the same climatic conditions.

The number of debris-covered glaciers will increase as the >1°C rise in temperature in the European Alps since the start of the 20th Century increases the instability of rock faces and scree slopes. The evolution of these glaciers is therefore likely to have a major impact on human populations. This work shows that Alpine debris-covered glaciers are the main glaciological actor in Europe's water supply and can significantly extend the lifespan of this water resources even in the face of climate change.