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Is supraglacial debris actually playing a role in driving the Karakoram Anomaly?

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The glacier evolution in the Karakoram differs from most other glaciated regions and it came to be known as the "Karakoram Anomaly" (Hewitt, 2005). The analysis of area and mass changes for the last decade (Gardelle et al., 2012, 2013; Minora et al., 2013) depicted a situation of general stability, in contrast to glacier retreat worldwide. This study investigated the possible causes of these observations. In particular, we focus on the effects of supraglacial debris on glacier melt. Continuous clast-thick supraglacial debris insulates the ice underneath (from Østrem, 1959), if a "critical value" of thickness is exceeded (Mattson et al., 1993).
Our study area is the Central Karakoram National Park (CKNP, an extensive protected area in the Pakistani Karakoram). It is 12,000 km2 wide, with more than 700 glaciers, mostly debris-covered.
Based on Landsat 7 thermal band imagery and an empirical relationship between surface temperature and debris thickness (Mihalcea et al. 2008), we calculated supraglacial debris thickness distribution. The overall mean thickness turns out to be 5.6 cm which is probably more than the critical value (according to Reznichenko et al., 2010). In 2004, field data were collected on Baltoro glacier (the biggest glacier of CKNP), and the effect of ablation on ice-free and ice covered by debris was studied by setting up a stake network. From this field measurements the critical value was determined to be about 5 cm, lower than the mean thickness derived from remote sensing information.
Our results suggest recent (2001-2010) stable conditions for the CKNP glaciers (Minora et al., 2013) might be due to thick supraglacial debris coverage which decreases the ablation rates on large portions of the glacier tongues (among other possible causes).
As debris-covered glaciers represent the major glacier type in Karakoram (Smiraglia et al. 2007), the thick debris layer seems to play an important role in controlling the "Karakoram Anomaly".
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