Geophysical Research Abstracts
Vol. 16, EGU2014-14115, 2014
EGU General Assembly 2014

Effects of light absorbing impurities on the glacier albedo in the Tibetan Plateau: a case study of Zhadang glacier

Shichang Kang (1,2), Bin Qu (2), and Jing Ming (3)

(1) State Key Laboratory of Cryospheric Sciences, Chinese Academy of Sciences (CAS), Lanzhou 730000, China, (2) Key Laboratory of Tibetan Environment Changes and Surface Processes, Institute of Tibetan Plateau Research, CAS, Beijing 100101, China, (3) National Climate Center, China Meteorological Administration, Beijing 100081, China

Light absorbing aerosols, such as black carbon (BC, or element carbon) and mineral dust, can deposit and accumulate on glacier surface through dry and wet deposition, hence reducing the surface albedo and resulting in more solar radiation absorption, thus accelerates the melting of glaciers. Glaciers in the Tibetan Plateau (TP) can be affected by BC and dust from the surrounding areas. To investigate effects of BC and dust on the glacier albedo, we collected surface firn/ice samples in July and fresh snow samples in August, 2012, and measured albedo in Zhadang glacier (southern Tibetan Plateau). Concentrations of BC (DRI method) (80.9 - 472.6 ppbm) and dust (33.6 - 1891.9 ppmm) are much higher in firn/ice than these of BC (40.8 - 59.4 ppbm) and dust (3.4 - 8.2 ppmm) in fresh snow, indicating that BC and dust can accumulate when snow starts melt. Both BC and dust concentrations in snow reduced while albedo increased when elevation increased. Snow ice aerosol radiative (SNICAR) model were used to quantify the contribution rate of BC and dust to the snow albedo reduction. BC and dust in fresh snow contributed 47.7% and 13.6% for the reduction of glacier albedo, respectively, meanwhile other factors (snow particle size, moisture content changes) contributed 38.7%, suggesting BC was a major factor for snow melting in Zhadang glacier. However, the contribution of dust to albedo reduction could be as high as 71% when the glacier experienced strong melting when the surface coverage was almost entirely dirty bare ice. The radiative forcing (RF) caused by dust could reach 33.9 Wm–2, while that caused by BC was only 4.5 Wm–2, indicating that dust, rather than BC, was the most dominant factor on the melting of glacier during the intensive melting season.