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Water-soluble organic carbon in snow and ice in Mt. Yulong and its implications for glacier melt

Hewen Niu, Yuanqing He, and Shichang Kang

Cold and Arid Regions Environment and Engineering Research Institute, Chinese Academy of Sciences, State Key Laboratory of Cryospheric Science, Lanzhou, China (niuhw@lzb.ac.cn)

Melting of the high-elevation glaciers can be accelerated by the deposition of airborne organic carbon and mineral dust as it leads to significant reductions of the surface albedo of snow and ice. Organic carbon deposited in snow and ice is of great significance to global carbon cycles, snow photochemistry, and air-snow exchange processes. In this work, various snow and ice samples were collected at the high elevated site of the Mt. Yulong in southeastern Tibetan Plateau in 2015, these samples were analyzed for water-soluble organic carbon (WSOC), total organic nitrogen (TON), and water-soluble inorganic ions (WSIs) to elucidate the chemical species and compositions of snow and ice in Mt. Yulong region. The result indicated that ice meltwater with the lowest WSOC content (0.39 mg L-1), while surface snow with the highest WSOC content (0.91 mg L-1) among various types of snow and ice samples. There was obvious spatial and temporal trend of WSOC and WSIs in snow and ice samples, the WSOC content in snow from the east slope was notably higher than those from the west slope of the Mt. Yulong, and the seasonal variation was consistent between WSOC and WSIs in surface snow and rainwater. WSOC and TN concentrations in various snow samples were decreased in a sequence of fresh snow, snow meltwater, snow pit, surface snow. The photolysis of WSOC and snow quick-melt effect resulted in this interest phenomenon. Field observation and statistic calculation indicated that the surface snow with high WSOC and TN ratios in the melt season, the ratios were 0.79 and 0.19 mg L-1 d-1, respectively. While in winter season, the ratios of WSOC and TON were remarkably lower and with the values of 0.20 mg L-1 d-1 and 0.08 mg L-1 d-1, respectively. Decrease of the WSOC and TON content was due to snow quick melt, moreover, deposition of these light-absorbing impurities in snow and ice can accelerate snow melt and even glacier retreat.

Keywords: Water-soluble organic carbon; Total organic nitrogen; snow quick melt; Mt. Yulong.