Atmospheric dust record preserved in an ice core from Trambau Glacier, Nepal Himalaya

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Mineral dust affects climate through direct radiative forcing by scattering and absorbing solar radiation in the atmosphere and by accelerating snow and ice melting through reduced albedo when deposited on snow surfaces. The concentration and composition of dust deposited on glaciers reflect the surface conditions of the source regions and atmospheric conditions during transportation. Dust records in ice cores provide insights into historical atmospheric and land surface environments. However, ice cores drilled in high-altitude Himalayan glaciers are limited. To investigate historical variations in dust concentration in the Himalayas, we conducted ice core drilling at an elevation of 5862m on the Trambau Glacier in the Rolwaling region of the Nepal Himalaya. The ice core, covering 146 years (1874-2019), was dated using seasonal variations in NO3− and Ca2+. The 81-m ice core was divided into 1637 samples (~5 cm interval), and dust concentration (particle size ranging from 0.6 to 10.0 µm) was measured using the Coulter Counter Multisizer™ 3. The Trambau ice core exhibits a higher dust concentration than the other Himalayan ice cores, particularly with an abundance of small particles (<2 µm in diameter). This suggests that the dust concentration in the Trambau ice core are mainly controlled by the supply of small particles from relatively distant regions. Furthermore, the dust concentration shows periodic fluctuations with a 20-30-year cycle, consistent with the Atlantic Multi-decadal Oscillation (AMO). This suggests a connection between the environmental changes (precipitation, temperature, and land surface conditions) in the dust source regions and AMO.