



Contribution ID: 214 Contribution code: ACI-5

Type: Oral Presentation

Temperature-forced runoff changes in arid areas of central asia inferred from ^{10}Be exposure ages of river terraces

Wednesday, 23 October 2024 11:00 (20 minutes)

Understanding the hydrological changes on context of global warming is of special significance for the security and sustainable development in vast arid areas of Central Asia. The sustainability of river runoff, as the major freshwater source in arid Central Asia, is of special concerns because millions of people suffer from water stress. However, our understanding of the freshwater mechanisms in arid Central Asia has been limited by the paucity of long-term records and the inconsistency of available information. Here, we reconstructed the first and longest record of freshwater supply in Central Asia by river terrace ^{10}Be exposure ages in Tarim Basin. These exposure ages, integrating with the chronological data of the river terraces and the ^{10}Be exposure ages of the moraines across Central Asia, provide a deep insight into the hydrology dynamics of Central Asia. The results show that the river terraces are developed through erosion and incision of the alluvial deposits by high river power, and thus the ^{10}Be exposure ages indicate the periods with high river power. The high river runoff corresponded to alpine glacier expansions in Central Asia, indicating that meltwater is the dominant source of the freshwater in Central Asia. The high river runoff displayed a close link to low temperatures on both orbital and millennial time scales during the past 280 ka, indicating that the low temperature, rather than increased precipitation or meltwater associated with global warming, drove the freshwater supply in Central Asia. All these lines of evidence suggest that both the river discharges and alpine glaciers as water reservoirs would decrease in the future with global warming in arid Central Asia, implying an increasing water crisis with global warming in the future.

Student Submission

No

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Session Classification: Applications of Cosmogenic Isotopes

Track Classification: Applications of Cosmogenic Isotopes