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Analysis of mountain hazards in the Qilian Mountain based on tree rings

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Mountain hazards, including landslides, rockfall and debris flows, are the most serious natural hazards in China, and affect almost 70% of all mountainous areas of China. An improved understanding of geomorphic processes and knowledge on past events are important tasks for the assessment of mountain hazards. Tree rings have on varied occasions proved to be a reliable tool for the acquisition of data on past events. Here we present a preliminary reconstruction of past mountain hazards in the Qilian Mountains, northeast Tibet Plateau, China. A total of 658 Qilian juniper (Sabina przewalskii Kom.) samples (selected from 327 trees) standing on or adjacent to a landslide body in the Qilian Mountains, as well as 672 Qinghai spruce (Picea crassifolia Kom.) samples (from 175 trees) growing on three adjacent debris-flow sites were collected to reconstruct past landslide and debris-flow histories. Based on the dating and interpretation of growth disturbances (GD) in the tree-ring series of sampled trees, we reconstruct past mountain hazards at the four sites. Results show that the first detectable landslide occurred as early as AD 1261, and then seven major reoccurrence years can be found in AD 1703, AD 1816, AD 1848, AD 1863, AD 1913, AD 1970, and AD 1982. At the three debris-flow sites, different events were identified at each of the sites, i.e. four events (AD 1872, AD 1878, AD 1880, AD 1884) at site 1, two events (AD 1811 and AD 1953) at site 2, and three events (AD 1866, AD 1885 and AD 1961) at site 3. Our research indicates that Chinese conifers indeed have a large potential to yield dates of past mountain hazard events with tree rings, and dendrogeomorhology should therefore be used in similar environments for a better understanding of past and potential future fluvial and mass-movements processes.