

Precipitation Phase Shift Variations under a Warming Climate over the Qilian Mountain, China in the 21st Century

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摘要: Precipitation phase shift over the Qilian Mountain (QLM) profoundly impacts glacier surface mass balance, seasonal river runoff, and surface albedo. However, it remains unclear how these shifts manifest under global warming. Here, we examined the variations of rainfall and snowfall from 1961 to 2020 based on the ERA5-Land data and then projected the length of potential snowfall days (LPSD) during 2021-2100 using the simulations from the Coupled Model Intercomparison Project Phase 6 over the QLM. The result showed that the annual mean temperature increased at a rate of 0.25 °C/10a, resulting in the rainfall increasing and snowfall decreasing at 5.61 and -1.89mm/10a, respectively. However, the temperature faced a faster increase in 0.28 and 0.82 °C/10a under the SSP2-4.5 and SSP5-8.5 from 2020 to 2100. The LPSD would shorten dramatically with 0.28 and 8.84 days/10a, leading to the LPSD approximately decline of 35 and 74 days at the end of the 21st century relative to 2001-2020, respectively. Notably, the snowfall in summer decreased dramatically at a rate of -1.95 mm/10a, while the rainfall increased at 8.33 mm/10a from 1961 to 2020 over 4000 m.a.s.l. The LPSD would be absent in summer by mid-century under the SSP5-8.5 scenario, implying that snowfall would totally shift to rainfall in summer. This potential snowfall-rainfall shift would strongly threaten the sustainable usage of water resources in the oasis downstream of QLM.

关键词: Precipitation phase shift; Qilian Mountains; ERA5-Land; Length of potential snowfall day; CMIP6