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Agricultural risks from changing snowmelt

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Abstract

Snowpack stores cold-season precipitation to meet warm-season water demand. Climate change threatens to disturb this balance by altering the fraction of precipitation falling as snow and the timing of snowmelt, which may have profound effects on food production in basins where irrigated agriculture relies heavily on snowmelt runoff. Here, we analyse global patterns of snowmelt and agricultural water uses to identify regions and crops that are most dependent on snowmelt water resources. We find hotspots primarily in high-mountain Asia (the Tibetan Plateau), Central Asia, western Russia, western US and the southern Andes. Using projections of sub-annual runoff under warming scenarios, we identify the basins most at risk from changing snowmelt patterns, where up to 40% of irrigation demand must be met by new alternative water supplies under a 4 °C warming scenario. Our results highlight basins and crops where adaptation of water management and agricultural systems may be especially critical in a changing climate.