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Climate change, adaptation and sustainability of Western US ski areas in the 21st century and a comparison with ski areas in the Alps

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We evaluate how climate change resulting from increased greenhouse gas (GHG) emissions may affect snow coverage for two case studies: Aspen Mountain and Park City Mountain in the years 2030, 2075, and 2100. Snow coverage was evaluated using the Snowmelt Runoff Model. We evaluated climate changes using MAGICC/SCENGEN and the output from five General Circulation Models (GCMs). We bracketed potential climate changes by using the relatively low, mid-range, and high GHG emissions scenarios: B1, A1B, and A1FI. To obtain higher resolution climate change estimates, we spatially downscaled projections using a regional climate model (RCM, MM5), and a statistical downscaling model (SDSM).

By 2030, temperatures are estimated to increase 1.8 to 2.5°C at Aspen Mountain and Park City Mountain, for all GCMs and emission scenarios. The length of the ski season is estimated to decrease by approximately 1 to 1.5 weeks at both ski areas, and the snowline is estimated at 2275 m. In 2100, temperatures are projected to increase 2.9 to 9.4°C at Aspen Mountain and 4.2 to 8.9°C at Park City Mountain. The snowline is estimated at 2800 to 2900 m at both ski areas for the A1B and B1 scenarios, and 3100 to 3200m for the A1FI scenario.

Here we address questions of adaptation and sustainability of ski areas in the face of these challenges. We address snowmaking, water availability, low-flow scenarios for streams draining ski areas, location of base areas, need for expansion to higher elevation areas, and other adaptation measures. We compare and contrast results for the western US with current conditions in the European Alps.