Geophysical Research Abstracts
Vol. 13, EGU2011-7054, 2011
EGU General Assembly 2011

The impact of climate change on water demand of snowmaking

Robert Steiger
University Innsbruck, Institute of Geography, Innsbruck, Austria (robert.steiger@uibk.ac.at)

Climate change is likely to have a significant impact on the skiing tourism industry, as snowfalls will become less frequent and snowmelt will increase with rising temperatures. Extraordinary warm winters at the end of the 1980s led to a widespread diffusion of snowmaking, a technology used to reduce the dependency on natural snow and its annual variability and thus to reduce the business risks. Meanwhile most of the ski areas have installed snowmaking facilities. While Italy and Austria have the highest share of ski slopes equipped with snowmaking in the Alps (75 % and 66 % respectively), France (20 %) and Southern Germany (17 %) have the lowest share. There is a clear trend for large investments in new snowmaking facilities in regions still being largely dependent on natural snow. In regions where the diffusion of snowmaking is developed the most, the goal of ski lift companies is a 90-100 % snowmaking coverage of their entire skiing terrain. This means that a further on-going massive intensification of snowmaking and thus water demand and energy consumption can be expected for the upcoming decade. Furthermore, climate change will increase the demand for technically produced snow thus additionally increasing the water demand.
While the potential impacts of climate change on skiing tourism have attracted the attention of a number of studies, ecological problems related to an increased snow production have so far largely been neglected. This study seeks to assess the impact of climate change on the water demand of snowmaking facilities. The ski season simulation model "SkiSim 2.0" is used to calculate the required technically produced snow volumes at three study areas located in Tyrol (Austria) and South Tyrol (Italy), representing humid (690 mm, Nov-Apr), average (491 mm) and dry (202 mm) conditions. Climate change signals of the regional climate model REMO driven by two emission scenarios (B1 and A1B) are downscaled to the climate stations using a stochastic weather generator ("LARS-WG"). SkiSim 2.0 results are produced for each decade from the 2020s to the 2080s.
The modelled required snow volumes stay within a 10 % error range at all three study sites compared to real data of the ski areas. As snowmaking practices can differ quite significantly between ski areas (due to different capacities or accepted snowmaking costs) this error range produced by a degree-day model is satisfying, marking the model as appropriate for an application with snow-related climate change issues.
The required snow volume at the average humid station is 68 % higher than at the humid station and 638 % higher at the dry station. Model projections until the 2080s show that required snow volumes at the humid and average stations do not reach the values of the dry station of the baseline climate. Thus potential occurring water conflicts at these two stations can be regarded as solvable, considering that conflicts of water usage is currently no issue in the ski area at the dry station. But an increase of water demand of 39 % in the 2030s, 131 % in the 2050s and 193 % in the 2080s at the dry station is likely to provoke water conflicts with the potential of considerably impacting the ecological balance of the area.