



Lake reservoir management under transient climate change in the Italian Alps

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Global warming is affecting the climate of mountain areas in temperate regions and the water resource distribution therein. Within the European Alps thermal shift since the 1980s, albeit synchronous with global warming, seems at least twice as much as the global climate signal, leading to substantially unchanged precipitation, but with a marked decrease of snowfall, and modification of the hydrological cycle therein. Southern, i.e. Italian, Alps display considerable sensitivity to climate change according to recent studies. Expected hydrological changes within Alpine catchments include modified average in channel discharge, as well as modified incidence of extreme events, either low flows or flood flows, thus impacting water management strategies in the lowlands, as needed for agricultural, flood mitigation and environmental purposes. As a case study of modified water resources management within the Italian Alps we investigate how to re-operate the multipurpose Lake Iseo, fed by the Oglio (≈ 1800 km²) Alpine watershed, to cope with the changing climate. We downscale future precipitation and temperature (A2 storyline) from some GCMs available within the IPCC's data base chosen for the purpose based upon previous studies. We then feed the downscaled fields to a minimal hydrological model to build future hydrological scenarios. We use traditional control approaches and reinforcement learning techniques to design the optimal operation under the future hydrological scenarios. We comment upon modified hydrological regimes and its fallout upon optimal strategies. The uncertainty and significance of the projected variables as given by use of more models is also addressed.

Key words: climate change; Alpine watersheds; water resources management