Geophysical Research Abstracts
Vol. 12, EGU2010-3871, 2010
EGU General Assembly 2010

Determining the impacts of climate change and catchment development on future water availability in Tasmania, Australia

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In a water-scarce country such as Australia, detailed, accurate and reliable assessments of current and future water availability are essential in order to adequately manage the limited water resource. This presentation describes a recently completed study which provided an assessment of current water availability in Tasmania, Australia, and also determined how this water availability would be impacted by climate change and proposed catchment development by the year 2030. The Tasmania Sustainable Yields Project (http://www.csiro.au/partnerships/TasSY.html) assessed current water availability through the application of rainfall-runoff models, river models, and recharge and groundwater models. These were calibrated to streamflow records and parameterised using estimates of current groundwater and surface water extractions and use. Having derived a credible estimate of current water availability, the impacts of future climate change on water availability were determined through deriving changes in rainfall and potential evapotranspiration from 15 IPCC AR4 global climate models. These changes in rainfall were then dynamically downscaled using the CSIRO-CCAM model over the relatively small study area (50,000 square km). A future climate sequence was derived by modifying the historical 84-year climate sequence based on these changes in rainfall and potential evapotranspiration. This future climate sequence was then run through the rainfall-runoff, river, recharge and groundwater models to give an estimate of water availability under future climate. To estimate the impacts of future catchment development on water availability, the models were modified and re-run to reflect projected increases in development. Specifically, outputs from the rainfall-runoff and recharge models were reduced over areas of projected future plantation forestry. Conversely, groundwater recharge was increased over areas of new irrigated agriculture and new extractions of water for irrigation were implemented in the groundwater and river models.

Results indicate that historical average water availability across the project area was 21,815 GL/year. Of this, 636 GL/year of surface water and 38 GL/year of groundwater are currently extracted for use. By 2030, rainfall is projected to decrease by an average of 3% over the project area. This decrease in rainfall and concurrent increase in potential evapotranspiration leads to a decrease in water availability of 5% by 2030. As a result of lower streamflows, under current cease-to-take rules, currently licensed extractions are projected to decrease by 3% (19 GL/year). This however is offset by an additional 120 GL/year of extractions for proposed new irrigated agriculture. These new extractions, along with the increase in commercial forest plantations lead to a reduction in total surface water of 1% in addition to the 5% reduction due to climate change. Results from this study are being used by the Tasmanian and Australian governments to guide the development of a sustainable irrigated agriculture industry in Tasmania. In part, this is necessary to offset the loss of irrigated agriculture from the southern Murray-Darling Basin where climate change induced reductions in rainfall are projected to be far worse.