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A use of global climate model output for site-specific assessment of climate change impacts on groundwater temperature

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Abstract Spatial mismatch of coarse resolution projections in Global Climate Models (GCMs) is a major constraint in site-specific climate impact predictions. The objectives of this study were to: (1) statistically downscale MRI monthly data at coarse resolution grid scale to station scale in the Sendai plain, Japan using transfer function method, and (2) estimate the potential range of groundwater temperature change in future from different GCM scenarios. Field observations of groundwater temperature and groundwater level were made in five observation wells. A water budget technique was applied to account for the changes of groundwater recharge in the future. A one-dimensional heat transport model was calibrated to the present day and used with the downscaled GCM results and potential recharge variations for predicting aquifer temperature change. The strongest effects were estimated that probably increase surface air temperature by 3.3°C and annual precipitation by 82 mm (7% from 1967 to 2006) during 2060–2099. The overall results show that the aquifer temperature, under the changed ground surface temperature and precipitation, will increase in a range of 1.1 to 2.6°C.

Key words climate change; groundwater temperature; downscaling; transfer function; Sendai plain