Geophysical Research Abstracts
Vol. 14, EGU2012-1221, 2012
EGU General Assembly 2012

Climate Services for Thermoelectric Power in Europe and the U.S.

M.T.H. van Vliet (1), J.R. Yearsley (2), F. Ludwig (1), S. Vögele (3), D.P. Lettenmaier (2), and P. Kabat (1)

(1) Earth System Science and Climate Change, Wageningen University and Research Centre, P.O. Box 47, 6700 AA Wageningen, The Netherlands, (2) Department of Civil and Environmental Engineering, University of Washington, Seattle, WA 98195, USA, (3) Forschungszentrum Jülich, Institute of Energy and Climate Research–System Analyses and Technology Evaluation, D-52425 Jülich, Germany

Thermoelectric (nuclear and fossil fueled) power plants currently produce 91% of all electricity in the United States and 78% in Europe. These power plants directly depend on the availability and temperature of water resources for cooling. During recent warm, dry summers several thermoelectric power plants in Europe and the Southeastern U.S. were forced to reduce production due to cooling water scarcity. Due to climate change, periods with low flows in combination with high water temperatures could increase, causing significant reductions in cooling water availability during summer. To be able to anticipate and adapt to changes in cooling water availability, it is important for the electricity sector to have realistic projections of both daily water availability and water temperature under future climate.

As part of the EU FP7 ECLISE project, we developed climate services for the thermoelectric power sector in the U.S. and Europe. We used a newly developed physically-based hydrological and river water temperature modeling framework in combination with an electricity production model. Our modeling framework was forced with different socio-economic and climate change scenarios to quantify how climate change will affect daily water availability, river water temperature, and subsequently electricity production potential over the next 20-50 years. A total number of 96 existing nuclear and fossil fueled power plants (with different cooling systems) in the Southeast U.S. and in Europe were included in our analyses.

Our results show considerable decreases in summer average capacity of thermoelectric power plants in particular in Southern and Southeastern Europe, and the Southeastern U.S. In addition, probabilities of extreme (>90%) reductions in thermoelectric power production are projected to increase substantially. The thermoelectric power sector in Europe and the U.S. can use these results to develop improved climate adaptation strategies in order to assure future energy security.