Geophysical Research Abstracts
Vol. 17, EGU2015-9560-1, 2015
EGU General Assembly 2015

Probabilistic models for assessment of extreme temperatures and relative humidity in Lithuania

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Extreme temperatures are fairly common natural phenomenon in Lithuania. They have mainly negative effects both on the environment and humans. Thus there are important to perform probabilistic and statistical analyzes of possibly extreme temperature values and their time-dependant changes. This is especially important in areas where technical objects (sensitive to the extreme temperatures) are foreseen to be constructed.
In order to estimate the frequencies and consequences of possible extreme temperatures, the probabilistic analysis of the event occurrence and its uncertainty has been performed: statistical data have been collected and analyzed. The probabilistic analysis of extreme temperatures in Lithuanian territory is based on historical data taken from Lithuanian Hydrometeorology Service, Dūkštas Meteorological Station, Lithuanian Energy Institute and Ignalina NNP Environmental Protection Department of Environmental Monitoring Service.
The main objective of performed work was the probabilistic assessment of occurrence and impact of extreme temperature and relative humidity occurring in whole Lithuania and specifically in Dūkštas region where Ignalina Nuclear Power Plant is closed for decommissioning. In addition, the other purpose of this work was to analyze the changes of extreme temperatures. The probabilistic analysis of extreme temperatures increase in Lithuanian territory was based on more than 50 years historical data. The probabilistic assessment was focused on the application and comparison of Gumbel, Weibull and Generalized Value (GEV) distributions, enabling to select a distribution, which has the best fit for data of extreme temperatures.
In order to assess the likelihood of extreme temperatures different probabilistic models were applied to evaluate the probability of exeedance of different extreme temperatures. According to the statistics and the relationship between return period and probabilities of temperatures the return period for 30°C temperature approximately is 1 year, for 32°C is 2 years and for 34°C is 7 years (applying all distributions under consideration). Return period for 36°C temperature is 29 (Gumbel), 63 (Weibull) and 66 (GEV) years. Using these models the maximum which might be exceeded was also calculated. This expected maximum annual temperature over 50 years is 36,7 °C (Gumbel), 35,83 °C (Weibull) and 35,81 °C (GEV). The analysis of temperatures from dry and wet thermometers in Dūkštas region enabled to analyse the relative humidity. According to the records the lowest relative humidity is 30%, while the average relative humidity is 84% during the considered ten years period.