EMS Annual Meeting Abstracts
Vol. 10, EMS2013-235, 2013
13th EMS / 11th ECAM

Using meteorological grid data to forecast change of energy wood moisture content

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Energy wood (harvesting residues and small diameter stem wood) is one of the most rapidly growing renewable energy sources in Europe. The drying season in northern countries is relatively short, while demand for good quality energy wood is high. It is therefore important to reduce transportation costs and CO_2 emissions by transporting the energy wood in as dry a state as possible.

In this work, we have developed a forecast model to predict the moisture content of energy wood piles, and to select the optimal time to transport dry biomass from forest storage to heating plants. The model uses an optimized linear regression model based on observations at Mekrijärvi Research Station of the University of Eastern Finland. The weight of eight energy wood piles was continuously monitored during the drying process, and used as a measure of wood moisture content.

The model was found to depend most strongly on potential evaporation, estimated with the Penman-Monteith equation, and precipitation. Precipitation data and other weather parameters needed for the Penman-Monteith equation were obtained from a nearby meteorological weather station and the Finnish Meteorological Institute's (FMI) gridded weather data. This data set consists of weather observations (e.g. temperature, humidity, precipitation), which have been interpolated to a 10km x 10km grid by the Kriging interpolation method. The grid data is used for agricultural and road weather applications.

Our first results are promising; however, future challenges include incorporating the effects of different conditions in storage areas, such as shade from the surrounding forest or storage pile properties such as height, form and structure. Furthermore, while this paper draws on historical data to estimate current moisture levels, in the future it may be possible to draw on numerical weather prediction models to produce required input data for moisture change forecasts.