

ABSTRACT

This research is mainly focussed on solar radiation in the UK. It can be divided into four main areas; evaluation of models, analysis of the relations between temperature and solar radiation, critical analysis of the projected future data for the UK and the improvement to the UKCP09 Weather Generator (WG).

From the evaluations of models carried out, the Liu-Jordan model performs well for estimating the average hourly global and diffuse radiation. At the individual hourly level however, a number of problems were observed. Regarding clear-sky radiation models, for semi-arid climatic conditions Page model was found to be suitable and for humid climates Yang model is recommended. As for all-sky radiation models, the MRM and Yang model were selected. For the UK, the MRM was found to perform better than the Yang model.

Furthermore, a study was carried out to analyse the relationship between temperature and solar radiation. The development of temperature-based mathematical models to obtain mean-daily irradiation was established. A procedure to decompose daily to hourly temperatures was evaluated with respect to world-wide locations and its performance found to be satisfactory.

As part of the UKCP09/COPSE project, detailed analysis on the future projected data was carried out to critically evaluate sol-air temperature and the likely change that may occur in the key climatic variables, i.e. temperature, sunshine duration and solar irradiation. Drastic increase of sol-air temperatures and shifting trend of daylight illuminance were found. Furthermore, a sensitivity test was also carried out to analyse the effects of each input variables on sol-air temperature.

As a result of the present investigations and communications with the UKCP personnel a new version of WG was released with appropriate modifications. A comparison of the now old- and new WG data sets has been made. Improvements in ratio of diffuse to global radiation and sunshine datasets were found.