Geophysical Research Abstracts, Vol. 7, 08740, 2005
SRef-ID: 1607-7962/gra/EGU05-A-08740

Uncertainty in the global solar radiation data, its propagation in crop models and consequences for the spatial analysis

M. Trnka(1), J. Eitzinger (2), P. Kapler (1), Z. Zalud (1), H. Formayer(2), M. Dubrovsky (3), D. Semeradova (1)

(1) Institute for Landscape Ecology, Mendel University of Agriculture and Forestry Brno (MUAF), Czech Republic (mirek_trnka@yahoo.com), (2) Institute of Meteorology, University of Natural Resources and Applied Life Sciences (BOKU), Vienna, Austria (josef.eitzinger@boku.ac.at), (3) Institute of Atmospheric Physics, Czech Academy of Sciences, (IAF), Prague, Czech Republic

The results of the recently published studies suggest that the estimated R_G values are loaded with an error, which might compromise the precision of the subsequent crop model applications. Such error would then translate in the analyses based on the crop models as e.g. crop yield forecasting or climate change impact studies. Therefore a detailed analysis of the error propagation was made using two crop models i.e. CERES-Barley and CERES-Wheat. Database of meteorological data originating from 8 stations in Austria and Czech Republic was used in order to carry out the analysis. It has been found that even application of the method based on sunshine duration hours that yield the lowest bias in $R_G$estimates significantly influences number of key crop model outputs. It has been also noted that in 5-6 seasons out 100 cases of deviation greater than $\pm$10 % are to be expected whilst the chance of occurrence of even greater error ($\pm$25 %) is not negligible. The precision of the yield estimates and other crop model outputs is lower yet acceptable and mean bias error in range of 2.0-4.1 % when estimates based on the diurnal temperature range and cloud cover are used. In this case yield deviations over $\pm$10 % occurred in about 20 % cases (depending on the crop) whilst the probability of significant yield departure ($\pm$25 %) doubled of that found for the previous method. The method based on the diurnal temperature range and precipitation sum yielded similar results. However in case of these estimates the increase of the systematic bias of yield of winter wheat and considerably higher number of sea-

sons with yield departures over ± 25 % was noticed. Utilisation of the methods based on the diurnal temperature range only for the purposes of seasonal yield forecasting or climate change impact assessment is questionable as the probability of significant yield departure is very high (as well as the systematic error). The behavior of the error propagation in the crop yields during climate change impact studies introduced by selected methods of $R_G$estimates was then tested at two selected sites (Hradec Králové – CR; Graz – Austria). These tests uncovered similar behavior to that found under present climatic conditions with clear exacerbation during some seasons thus introducing proportionately larger bias into the climate change impact estimates. It is clear that uncertainties in the global radiation estimates will be preserved and might even propagate further when the data are used in the spatial analysis. Therefore we tried to estimate consequences of such bias on a selected case study.

Results of the presented work should in our view act as an incentive to the further research aimed at development of more precise and widely applicable methods of estimating daily $R_G$based more on the underlying physical principles. In the mean time more detailed study (both in terms of methods included as well as spatial resolution) following the work of Supit and van Kappel (1998) should follow on the European as well as global scale. Overall decrease of the existing uncertainties in the R_G estimates would result into increase of the reliability of subsequent applications that use R_G as input variable especially when reliable spatialized dataset are required.

Acknowledgement: This study was conducted with support of Grant Agency of the Czech Republic project no. 521/03/D059 in cooperation with Institute of Meteorology, University of Natural resources and Applied Life Sciences (BOKU). We thank the Central Institute for Meteorology and Geodynamics, Vienna, Austria for data support.