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Newhall Model for Assessment of Agricultural Drought Event Probability under Present and Changed Climatic Conditions

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Agricultural drought might be described in terms of soil moisture regimes providing the existence of a tool that is convenient and relatively simple to use. Therefore the Newhall simulation model (NSM) was evaluated and applied in this study. The main input for NSM is potencial evapotranspiration value for specified soil layers. This key value was obtained from implenented FAO – Crop Water Balance Model (FAO irrigation and drainage paper No. 56) while using results of Complex Soil Survey in Czech Republic (1970´s) dividing soil types into 21 classes based on 394 soil pits. The FAO model was improved further by aplication of Thornton´s snowpack model. For validation purposes of this method we used three highly productive and in agricultural landscapes of central Europe quite common soil types: deep chernozem, sandy chernozem and fluvisoil. All data for this validation were obtained from lysimeters

of Federal Office and Research Centre for Agriculture in Vienna, Austria. It has been found that under the present climate only a fraction of the territory is situated within the "high" risk area with aridic or xeric events probability over given threshold. All high drought risk areas are confined within two well known dry regions of the country i.e. south-east and north-west. In the next step the model was run with the climatic data corresponding to the conditions expected in 2015, 2035 and 2050 taking into account three GCMs (ECHAM, HadCM and NCAR) and assuming a B1-SRES emission scenario. In this case a gradual increase of the areas with high probability of drought was found. When the model was run with data accommodating to increase of greenhouse gases emissions according to A2-SRES, the shifts in the soil climate characteristics by the year 2050 were much more dramatic. It is obvious that more than 5% of area of the Czech Republic would be faced with relatively frequent aridic or xeric events accompanied also with higher probability of less severe drought spells. Such extreme soil conditions have not been recorded up to now at the territory. As the shift of the soil climate regimes is closely related to crop yields, forest productivity or fire danger, river flow or reservoir levels etc., a significant increase of drought related economic and social-economic losses will likely rise.

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