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Simple calibration method for the estimation of daily solar global radiation from maximum and minimum temperatures

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Solar radiation (Rs) is one of the most important parameters affecting the evapotranspiration processes. In the past, many empirical methodologies have been developed for the estimation of Rs. The models usually require historical meteorological measurements at a specific site. This paper proposes a new prediction method for the estimation of the daily solar radiation Rs based on the Hargreaves and Samani (1982) equation. Introducing a variable adjustment coefficient (Kr) a site specific calibrating procedure is developed. Testing and validation was carried out on experimental data of 18 different meteorological stations covering a time period of 14 years between 1990 and 2003. The stations are located in the Piedmont area of North-West Italy at an elevation between 170 m and 2700 m; they are supposed to be representative for the area. The analysis is structured following two successive steps. Firstly, the calibration procedure is addressed with an extensive error analysis. A clear relation between the elevation of the measurement site and the coefficient Kr is established. This correlation equation enables the prediction of site specific values of Kr ranging between 0.16 and 0.23. As compared to the classically used constant value of Kr=0.16, the site specific value of Kr improved considerably the calculation of the solar global radiation Rs. The second step concerns the validation procedure which gave satisfying results with a squared correlation coefficient $R2>0.7$ calculated between measured and predicted global radiation values. Compared with the empirical self-calibrated prediction method of Allen (1997), the new prediction method improves the results on Rs. Even though these results are satisfying, the method still suffers from the fact that the ad-

justment coefficient Kr is a dimensional fitting parameter. Obviously, the use of a non-dimensional adjustment coefficient would be more appropriate. Such non-dimensional prediction model is actually in the process of being developed. Successful testing of this later method would possibly allow for transporting the methodology to climate regions different from those used for the present study.