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Analysis of Numerical Weather Predictions of Reference Evapotranspiration and Precipitation

Theodor Bughici (1), Naftali Lazarovitch (1), Erick Fredj (3), and Eran Tas (2)

(1) Ben-Gurion University of the Negev, French Associates Institute for Agriculture and Biotechnology of Drylands,Jacob Blaustein Institutes for Desert Research, Sede Boqer Campus, 84990, Israel, (2) The Hebrew University of Jerusalem, The R.H. Smith Faculty of Agriculture, Food and Environment, Rehovot, 76100 Israel, (3) Lev Academic Center, School of Engineering and Computer Science, Jerusalem, 91160, Israel

This study attempts to improve the forecast skill of the evapotranspiration (ET_0) and Precipitation for the purpose of crop irrigation management over Israel using the Weather Research and Forecasting (WRF) Model. Optimized crop irrigation, in term of timing and quantities, decreases water and agrochemicals demand. Crop water demands depend on evapotranspiration and precipitation. The common method for computing reference evapotranspiration, for agricultural needs, ET_0, is according to the FAO Penman-Monteith equation. The weather variables required for ET_0 calculation (air temperature, relative humidity, wind speed and solar irradiance) are estimated by the WRF model. The WRF Model with two-way interacting domains at horizontal resolutions of 27, 9 and 3 km is used in the study. The model prediction was performed in an hourly time resolution and a 3 km spatial resolution, with forecast lead-time of up to four days. The WRF prediction of these variables have been compared against measurements from 29 meteorological stations across Israel for the year 2013. The studied area is small but with strong climatic gradient, diverse topography and variety of synoptic conditions. The forecast skill that was used for forecast validation takes into account the prediction bias, mean absolute error and root mean squared error. The forecast skill of the variables was almost robust to lead time, except for precipitation. The forecast skill was tested across stations with respect to topography and geographic location and for all stations with respect to seasonality and synoptic weather system determined by employing a semi-objective synoptic systems classification to the forecasted days. It was noticeable that forecast skill of some of the variables was deteriorated by seasonality and topography. However, larger impacts in the ET_0 skill scores on the forecasted day are achieved by a synoptic based forecast. These results set the basis for increasing the robustness of ET_0 to synoptic effects and for more precise crop irrigation over Israel.