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Exploring the use of WRF-3DVar for Estimating reference evapotranspiration in semi arid regions

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Evapotranspiration is an important process in hydrology and is central to the analysis of water balances and water resource management. Significant water losses can occur in large drainage basins under semi arid climate conditions, moreover with the lack of measured data, the exact losses are hard to quantify. Since direct measurements for evapotranspiration are difficult to obtain it is common to estimate the process by using evapotranspiration models such as the Priestley-Taylor model, Shuttleworth -Wallace model and the FAO Penmann-Monteith. However these models depend on several atmospheric variables such as atmospheric pressure, wind speed, air temperature, net radiation and relative humidity. Some of these variables are also difficult to acquire from in-situ measurements; in addition these measurements provide local information which need to be interpolated to cover larger catchment areas over long time scales.

Mesoscale Numerical Weather Prediction (NWP) modelling has become more accessible to the hydrometeorological community in recent years and is frequently used for modelling precipitation at the catchment scale. However these NWPs can also provide the atmospheric variables needed for evapotranspiration estimation at finer resolutions than can be attained from in situ measurements, offering a practical water resource tool. Moreover there is evidence that assimilation of real time observations can help improve the accuracy of mesoscale weather modelling which in turn would improve the overall evapotranspiration estimate.

This study explores the effect of data assimilation in the Weather Research and Forecasting (WRF) model to derive evapotranspiration estimates for the Tigris water basin, Iraq. Two types of traditional observations, SYNOP and SOUND are assimilated by WRF-3DVAR.which contain surface and upper-level measurements of pressure, temperature, humidity and wind. The downscaled weather variables are used to determine evapostranspiration estimates and compared with observed evapostranspiration data measured by Class A evaporation pan.