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Computing spatially distributed reference evapotranspiration using forecast fields from a meteorological model

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A component often missing from distributed hydrological modeling applications is a suitable estimate of the potential evapotranspiration. This paper describes a methodology applied to routinely compute the FAO-56 reference crop evapotranspiration (ET_0) at a spatial resolution of roughly 12 km over all of South Africa and parts of the neighboring states at hourly intervals. The ET_0 estimates are produced on a 0.11 degree grid. The experimental ET_0 product presented in this paper has a primary focus as forcing data for a distributed hydrological model, which will be used to compute distributed estimates of soil moisture. However, there are many other potential uses in Hydrology, Agriculture and Disaster Management. The input data required for computing ET_0 are obtained from meteorological model forecasts and a solar radiation product derived from Meteosat data. Each day, hourly forecast fields of temperature, humidity and wind speed, the variables required by the FAO-56 Penman-Monteith algorithm, are obtained from the meteorological model. The meteorological forecasts of are used in conjunction with the solar radiation estimates to compute ET_0 at each of the model grid points. We compare the ET_0 estimates computed using observed meteorological data at a network of weather stations to those computed using the model forecast fields. The results show that the evapotranspiration computed using the model fields is strongly correlated and unbiased relative to the independent values computed at the weather station locations. We conclude that the model forecasts are therefore suitable for producing an estimate of ET_0 in the absence of observed station data.