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Near-term forecasts of soil water states

Monday, 31 May 2021 18:45 (15 minutes)

Soil water content (aka soil moisture) influences many Earth surface processes, from surface runoff to ET to groundwater recharge. By combining pedotransfer functions (PTF's) (e.g., Vereecken, 1995; Vereecken et al., 2010; van Looy et al. 2017), digital soil models, and high-resolution weather forecasts, we can estimate future soil water states (content and storage), and then use them to solve practical problems like flood risk potential and irrigation needs. Especially where human wellbeing is concerned, errors in soil water state estimates need to be minimized. The questions we ask are: what is our current skill in forecasting soil water content and storage, and what is the role of soil hydraulic properties in reducing errors in these forecasts? To address these questions, we use data from the Texas Soil Observation Network (TxSON), which monitors soil water states and weather parameters from 40 sites, all located west of Austin, TX. Weather forecasts are available from the US National Weather Service (NWS) at time resolutions that vary between 1-12 hours, depending on forecast period, and initial soil hydraulic properties are obtained from PTF's using SoilGrids250m (Hengl et al., 2017). The monitored field site(s) are found on thin, calcareous soils formed on limestone parent material. Vegetation consists of oak trees, woody plants, and a mixture of short and mid-height grasses (Caldwell et al., 2019). Data are incorporated into HYDRUS-1D, where we fine tune soil properties across several months that includes wet and dry periods. We then forecast soil water states between May 2020 –February 2021, using HYDRUS-1D and 7-day weather forecasts obtained from the NWS's National Blend of Models (NBM). NBM provides highly-skilled weather forecasts, with data including probability of precipitation, temperature, wind speed and direction, dew point, etc. from which forecasts of ET—and soil water states—can be obtained. Forecasts of soil water content are compared sequentially to measurements from ground-based sensors. As simulations move forward in time, each 7 days long, multiple comparisons of observed and forecasted soil water states are determined as forecast lead time is reduced from 7 days to 0 days. Conducted over ~300 days, stacked results will indicate when errors in soil water forecasts drop below a specified threshold (e.g., +/- 0.03 m3/m3). Results will be presented in the form of ubRMSE and magnitude difference between observed and forecasted soil water content, as a function of forecast lead times.

Time Block Preference

Time Block B (14:00-17:00 CET)

References

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