

Estimation and Forecasting Potential Evapotranspiration Using Air Temperature Data

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Objective

Can we leverage the troves of data gathered by networks of weather stations for machine-learning based prediction and forecasting of reference ETo?

Statistical models that use only air temperature and clear-sky radiation estimates (based on location) have been used successfully before (Hargreaves & Semani, 1985). But, these needed local calibration.

We seek a generalizable global model. Here we show the first steps.

Approach

Temperature forecast

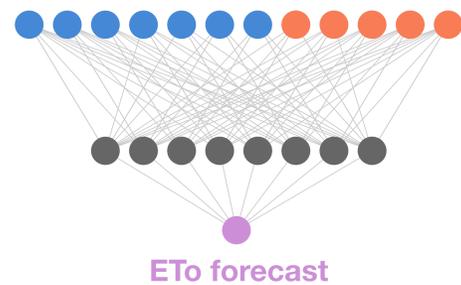


Location based data

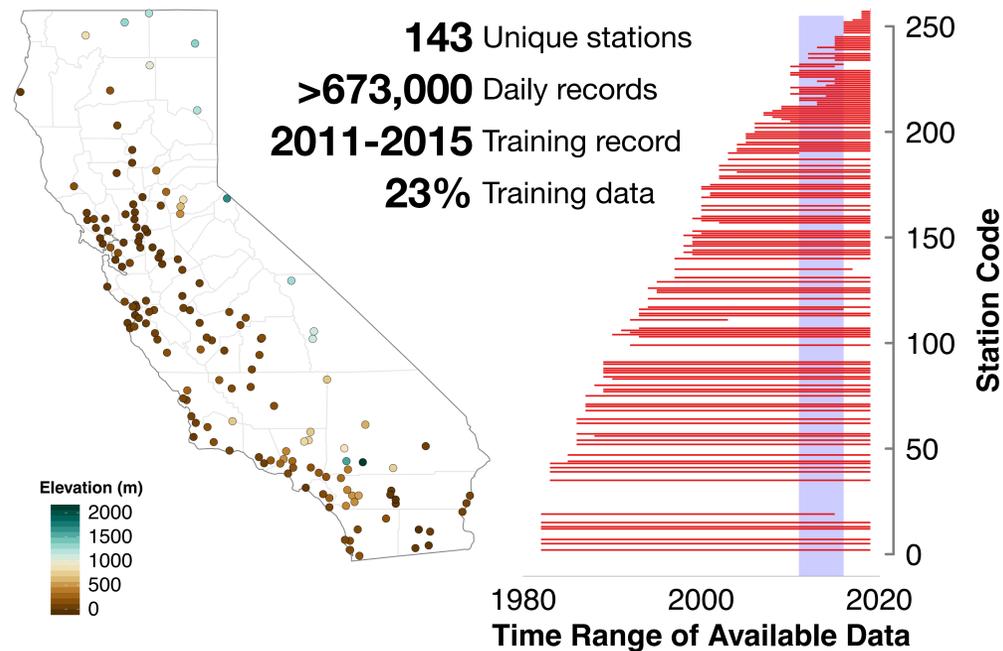


Temperature statistics of current and previous day. Data for training comes from historical data. Trained model can use weather forecast temperature to predict ETo.

Clear-sky radiation is estimated based on latitude and elevation of the target area at hourly step, and daily radiation statistics and daylight length are calculated

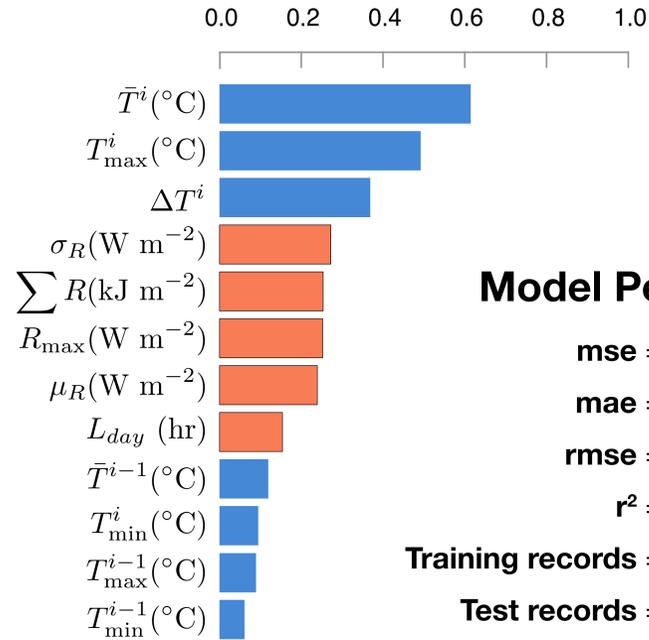


Data Source for Training & Testing



Training and Testing of Model

Feature Importance

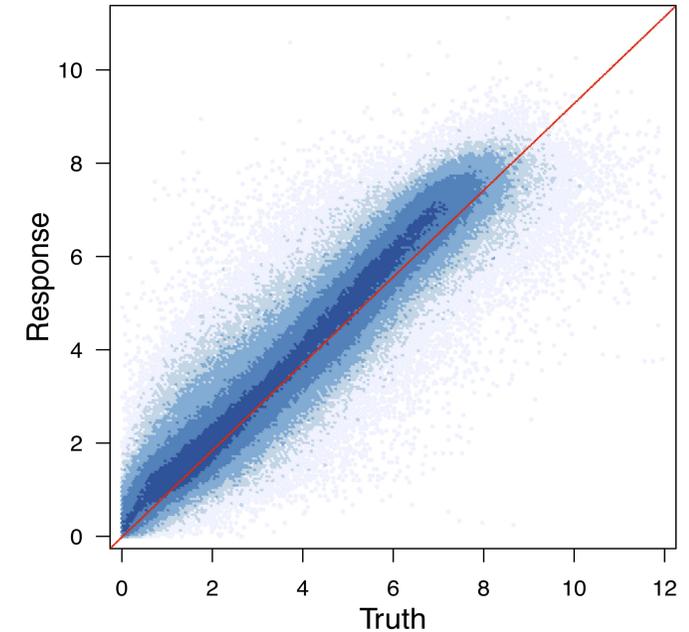


Model Performance

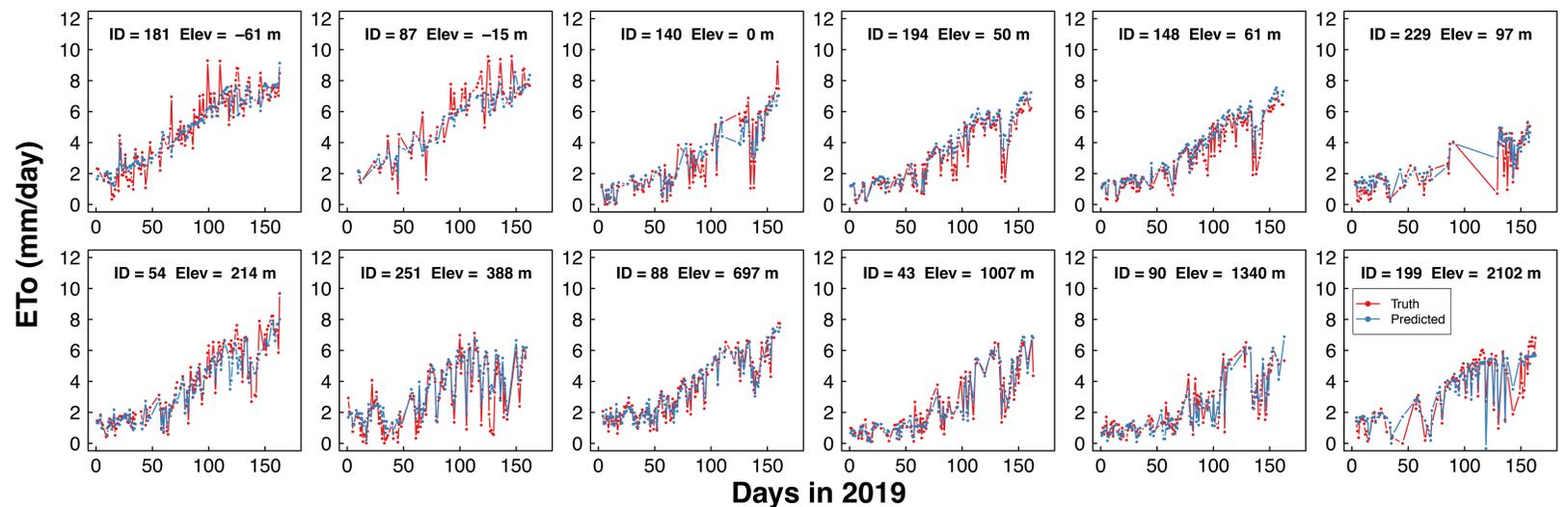
mse = 0.471 mm
mae = 0.481 mm
rmse = 0.686 mm
r² = 0.901

Training records = 153,000
Test records = 520,000

Reference ET (mm/day)



Example Cases



Lessons and Conclusions

ML model shows promising potential of forecasting of ETo. The ability of the same model to perform well over wide range of elevations and unusually low ETo levels in May 2019 is remarkable.

The approach has promising potential of eliminating the need for expensive weather stations everywhere ETo estimate is needed. It leverages historical records that remain unused.

Although the data needed to further expand this model is abundant, most state data repositories are hidden behind pay-walls or institutional restrictions.