Sensitivity experiment of local temperature prediction accuracy

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Renewable energy such as solar and wind powers is an promising power source for preventing the global warming due to fossil fuel, on which about 80% of current power sources in Japan depends.
We need to predict the power generation to efficiently operate the system including a battery. Therefore, we eventually have to predict the atmospheric conditions like solar insolation, wind direction and speed, etc.
However the suppliers or who plan to do business regarding to the prediction of atmospheric conditions do not always know what is necessary for their business. What kinds of variables are useful? How long do the variables have to be accumulated? How accurate prediction are expected?
As the first step, we focus on temperatures that are considered the easiest to predict in this study, while we are planning to investigate a method to predict solar insolation and wind speed in the future.
I investigated the sensitivity of prediction accuracy of temperature to the number of explanatory variables.
We tested the three cases below: 1) only temperature itself
2) temperature and solar insolation
3) temperature, solar insolation, and wind direction.
The results showed that the prediction accuracy peaked when forecasting
the average temperature 0.5 to 1 hour ahead from 7 days of time series data using a model trained 8 years of data.
The root mean squared error of temperature prediction in the case (1), was 0.60℃, 0.58℃ and 0.57℃ in the cases (2) an (3), respectively.
Increasing the number of the physical quantities used as explanatory variables improved the accuracy of temperature prediction.

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