Supporting Information for "Evaluation of sub-hourly MRMS quantitative precipitation estimates in mountainous terrain using machine learning"

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Contents of this file

1. Figures S1 to S2
2. Tables S1 to S3

Introduction This Supporting Information document includes figures and tables describing the multi-sensor correction method, single-output model experiment, and hyperparameters tuned.

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March 1, 2024, 9:15pm

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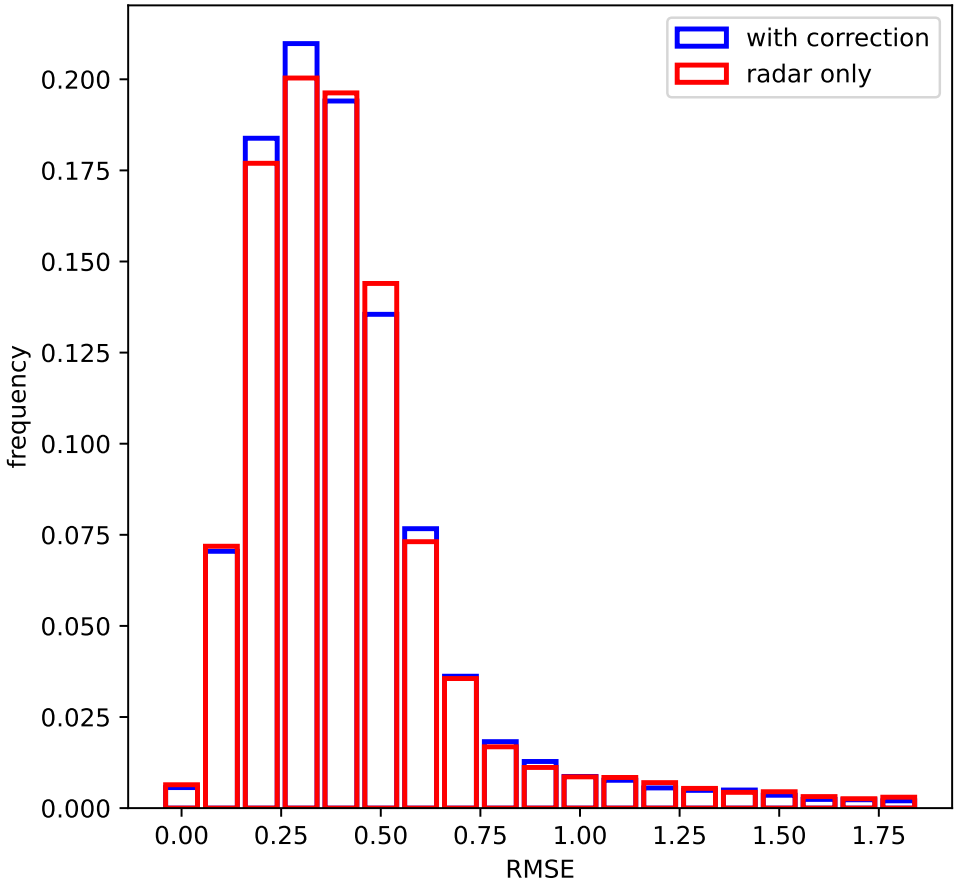

Figure S1. Distribution of RMSE for radar-only 15-minute intensity and multi-sensor corrected 15-minute intensity.

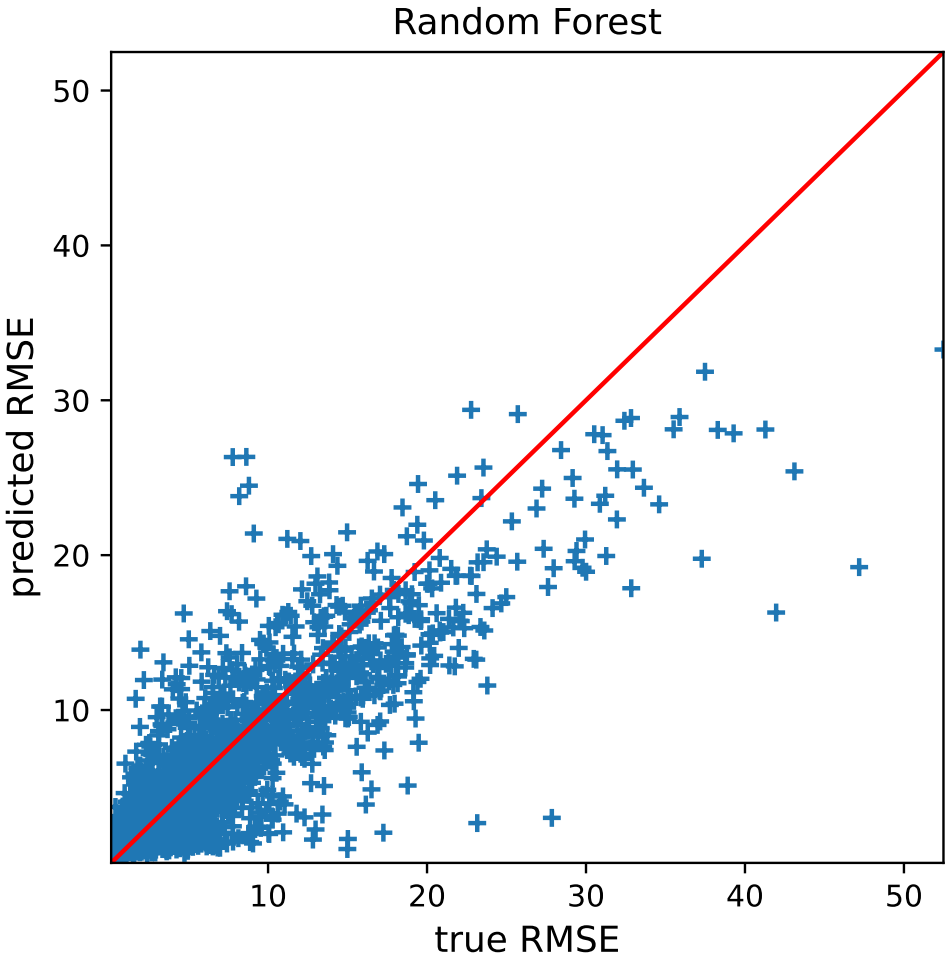

Figure S2. Spread of model RMSE predictions for the best performing model, a random forest regressor.

Table S1. Brief Model Descriptions for Single Output Experiment

Model	Description
Nearest Neighbors	Samples are classified based on proximity in feature space (Cover & Hart, 1967)
Decision Tree	A hierarchical series of questions to optimally split the classes based on feature values (Breiman et al., 1984)
Random Forest	Decision trees are fit to samples of features and predictions are averaged to improve performance and limit overfitting (Breiman, 2001)
Bagged Tree	A decision tree is trained on a sample of data and predictions are averaged (Breiman, 1996)
Multilayer Perceptron	Fully connected neural network with one or more hidden layer (Pedregosa et al., 2011)
AdaBoost	Decision trees are repeatedly fit to samples of dataset and classification is made based on a weighted average. Weights are increased with each iteration if the learner predicts correctly, and decreased otherwise (Freund & Schapire, 1996)
Logistic Regression	Estimates the probability of a class while minimizing log loss (Géron, 2021)
xgboost	Similar to gradient boosting with various optimizing features (Friedman, 2001)
Gradient Boosting	Decision trees are repeatedly fit to samples and classification is made based on an average. New learner fits to residual error of previous learner (Friedman, 2001)
Support vector	Determines the maximum distance between samples in feature space and assigns classes based on location relative to this distance (Géron, 2021)

Table S2. Model Comparison Test Results [a]

Model	**R2**	**MAE**	**MSE**
Nearest Neighbors	0.78	0.99	3.97
Decision Tree	0.69	1.15	5.53
Random Forest	0.8	0.96	3.54
Bagged Tree	0.78	1.2	3.94
Neural Net	0.69	1.44	5.51
AdaBoost	0.71	1.43	5.06
linear	0.8	0.97	3.61
xgboost	0.78	1.0	3.86
Gradient Boosting	0.68	1.3	5.69
SVR	0.76	1.03	4.22

[a] Acronyms: mean absolute error (MAE), mean squared error . (MSE), multilayer perceptron (MLP), support vector regressor (SVR)

Table S3. Hyperparameters Tuned and Values Used

Hyperparameter	**Range Tested**	$\alpha = 0.05$	$\alpha = 0.50$	$\alpha = 0.95$
`learning_rate`	0.01 - 0.91	0.17	0.26	0.056
`max_depth`	2 - 4	2	4	2
`min_samples_leaf`	1 - 19	4	17	1
`min_samples_split`	2 - 19	19	18	2
`n_estimators`	50 - 250	153	221	196
`random_state`	0 - 999	387	219	637