

<><> Time Stamp <><>

Code started: 07/10/2022 - 11:47:24

Total Run Time: 11.43 s

<><> Bore Information <><>

Bore ID: GW036872.1.1

Region: Coastal

Bore Coordinates: (-30.923963, 153.044423)

Agency: WaterNSW

Drilled Date: 01/08/1990

Bore Depth: 30.5 m

Drilled Depth: 30.5 m

Reference Elevation: nan m

Time Series Reference Elevation: nan m

Land Surface Elevation: nan m

Silo Grid Point Coordinates: (-30.9, 153.05)

<><> Model Output <><>

Averaged Period: 30 day(s)

Output: Average Standing Water Level (m) in 1 period(s) time

<><> Model Inputs <><>

Data Range: 01/05/2010 - 31/08/2021

Train Set Size: 80.0%

Test Set Size: 20.0%

Input Timesteps: Current period + 2 preceeding period(s)

Input Variables:

Average Standing Water Level (m)

Average Rainfall (mm)

Average Absolute Deep Drainage (below 6m) (mm)

Average Absolute Root Zone Soil Moisture (0-100cm) (%)

<><> Data Quality <><>

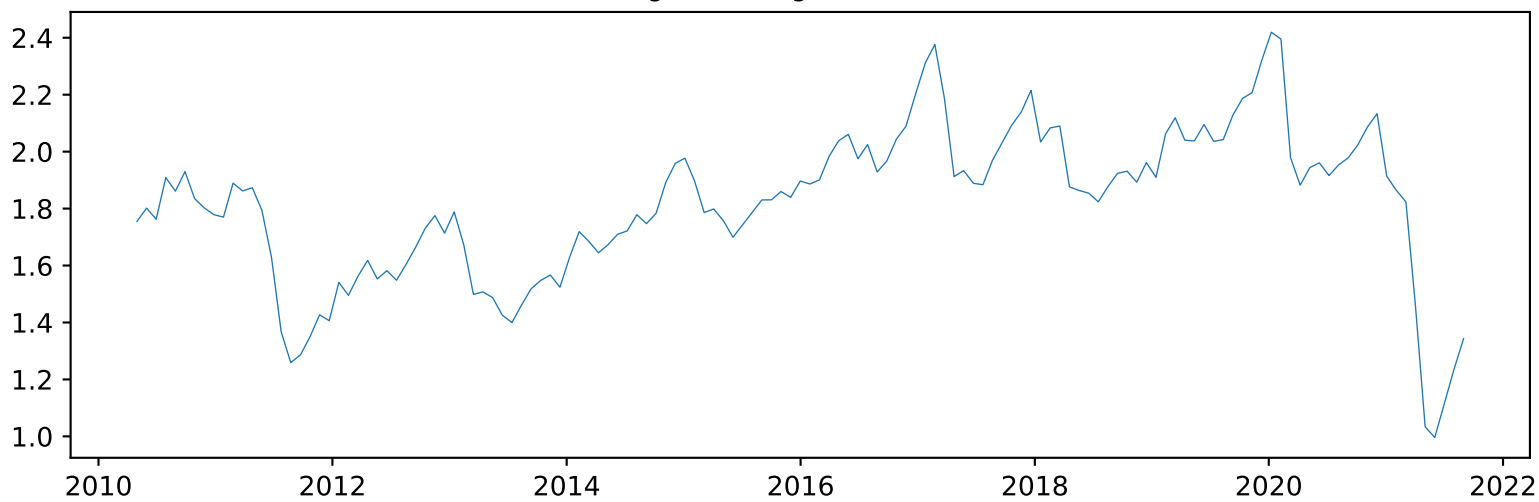
Interpolation Method: Spline

Quality Code: A, Number: 3434, Percentage: 82.33%

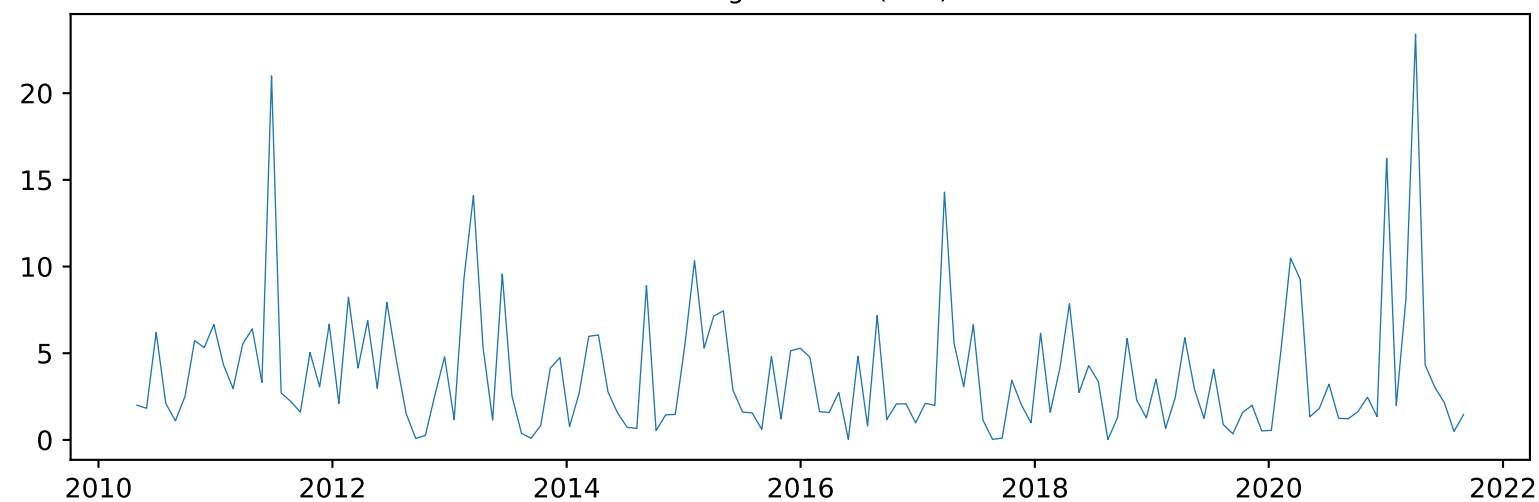
Quality Code: B, Number: 645, Percentage: 15.46%

Quality Code: C, Number: 92, Percentage: 2.21%

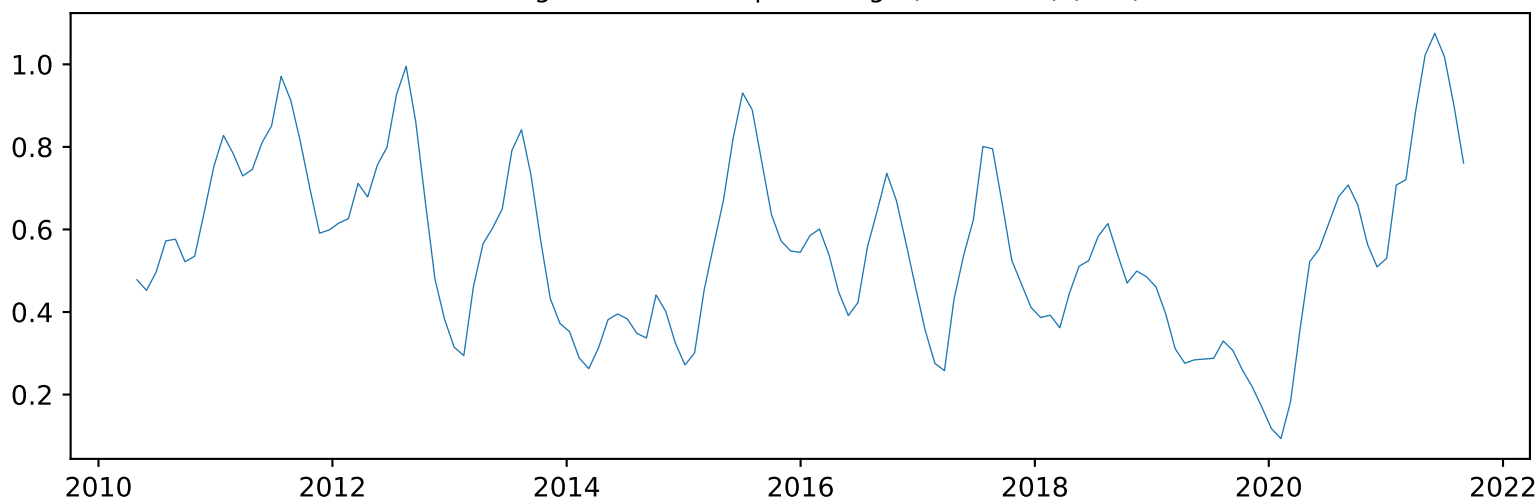
Average Standing Water Level (m)



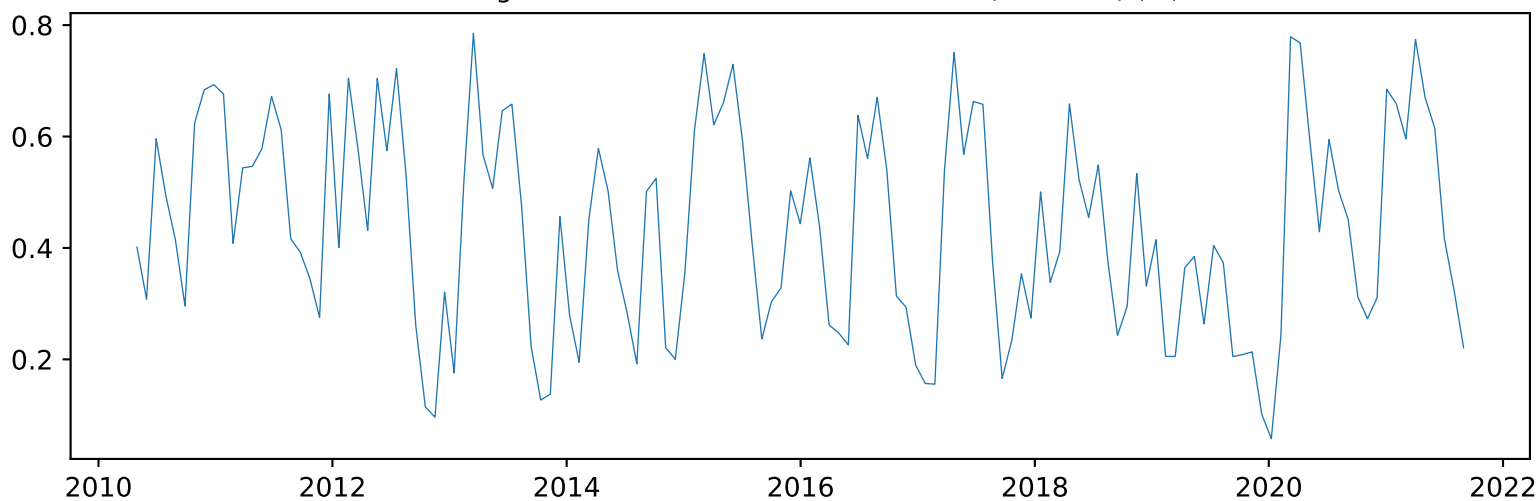
Average Rainfall (mm)



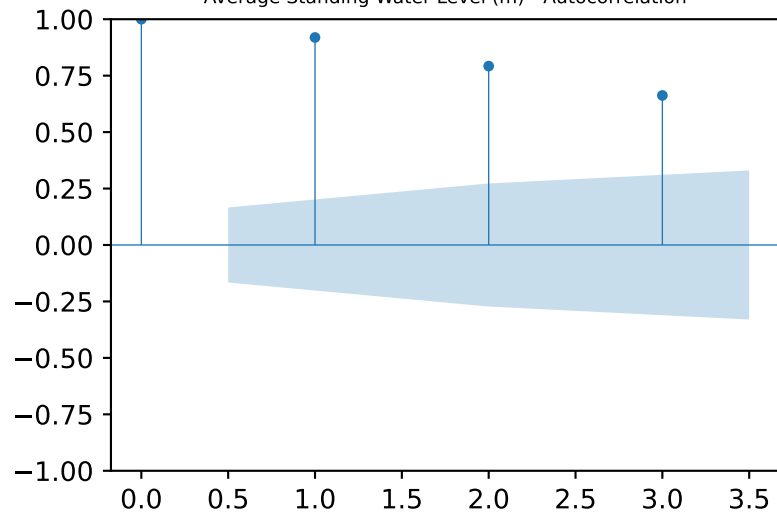
Average Absolute Deep Drainage (below 6m) (mm)



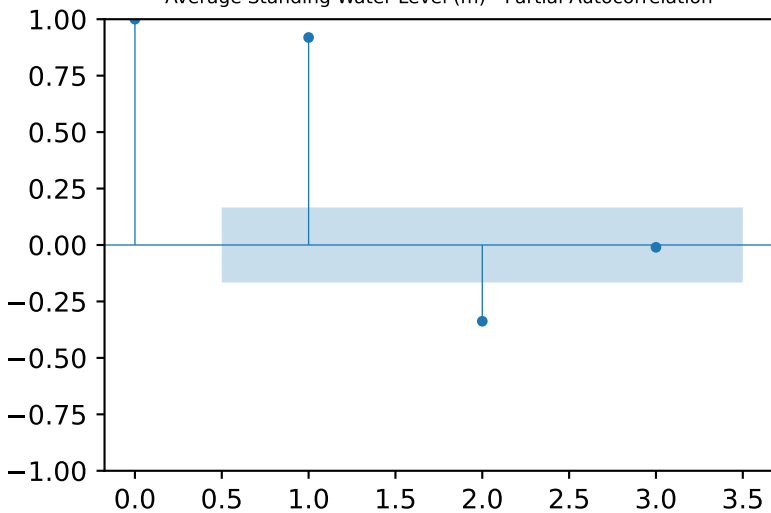
Average Absolute Root Zone Soil Moisture (0-100cm) (%)



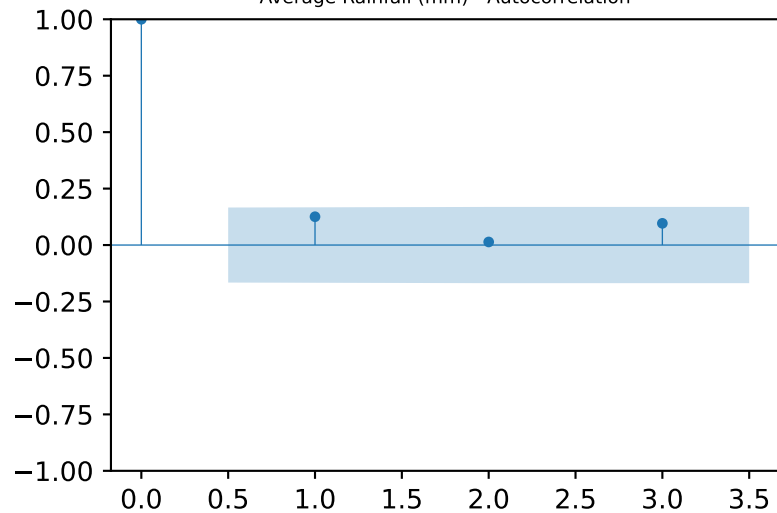
Average Standing Water Level (m) - Autocorrelation



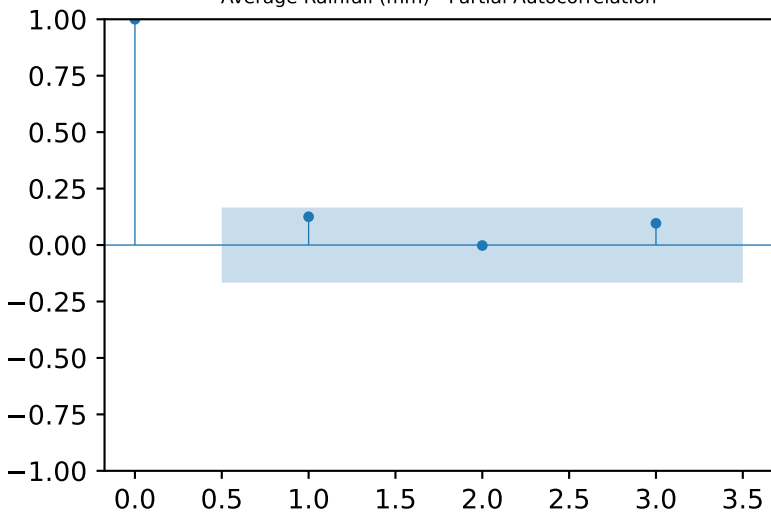
Average Standing Water Level (m) - Partial Autocorrelation



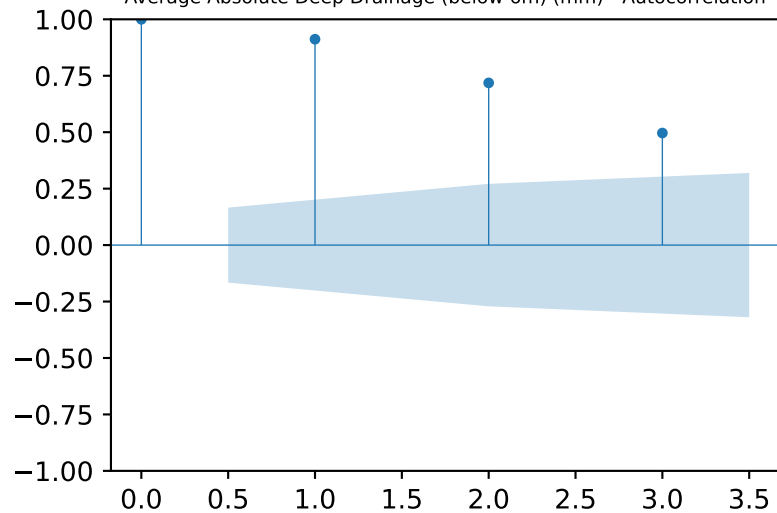
Average Rainfall (mm) - Autocorrelation



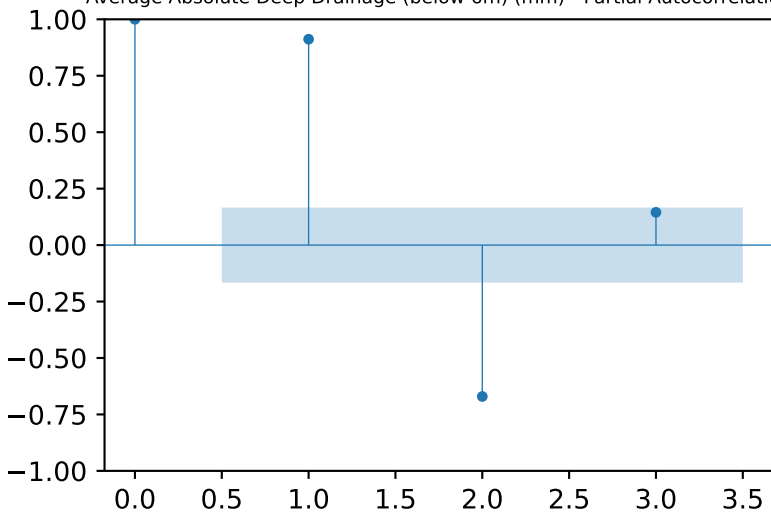
Average Rainfall (mm) - Partial Autocorrelation



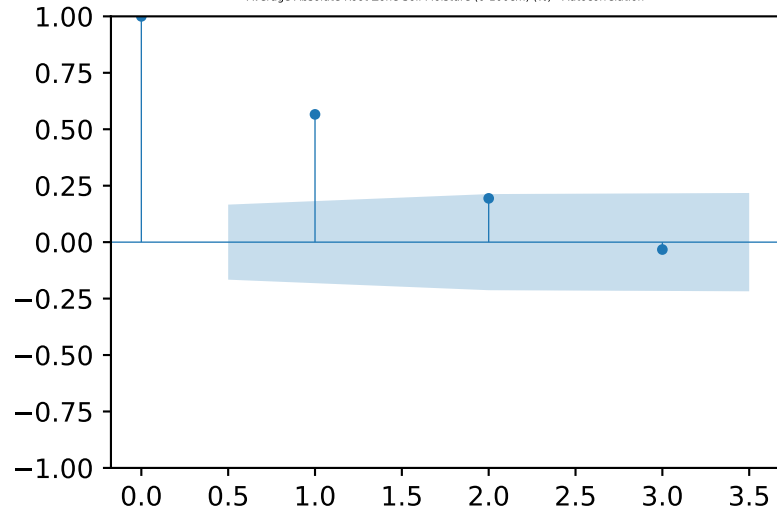
Average Absolute Deep Drainage (below 6m) (mm) - Autocorrelation



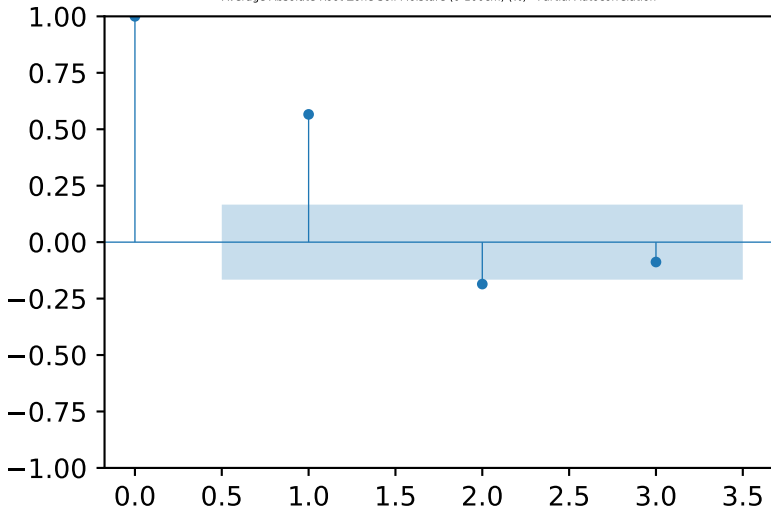
Average Absolute Deep Drainage (below 6m) (mm) - Partial Autocorrelation



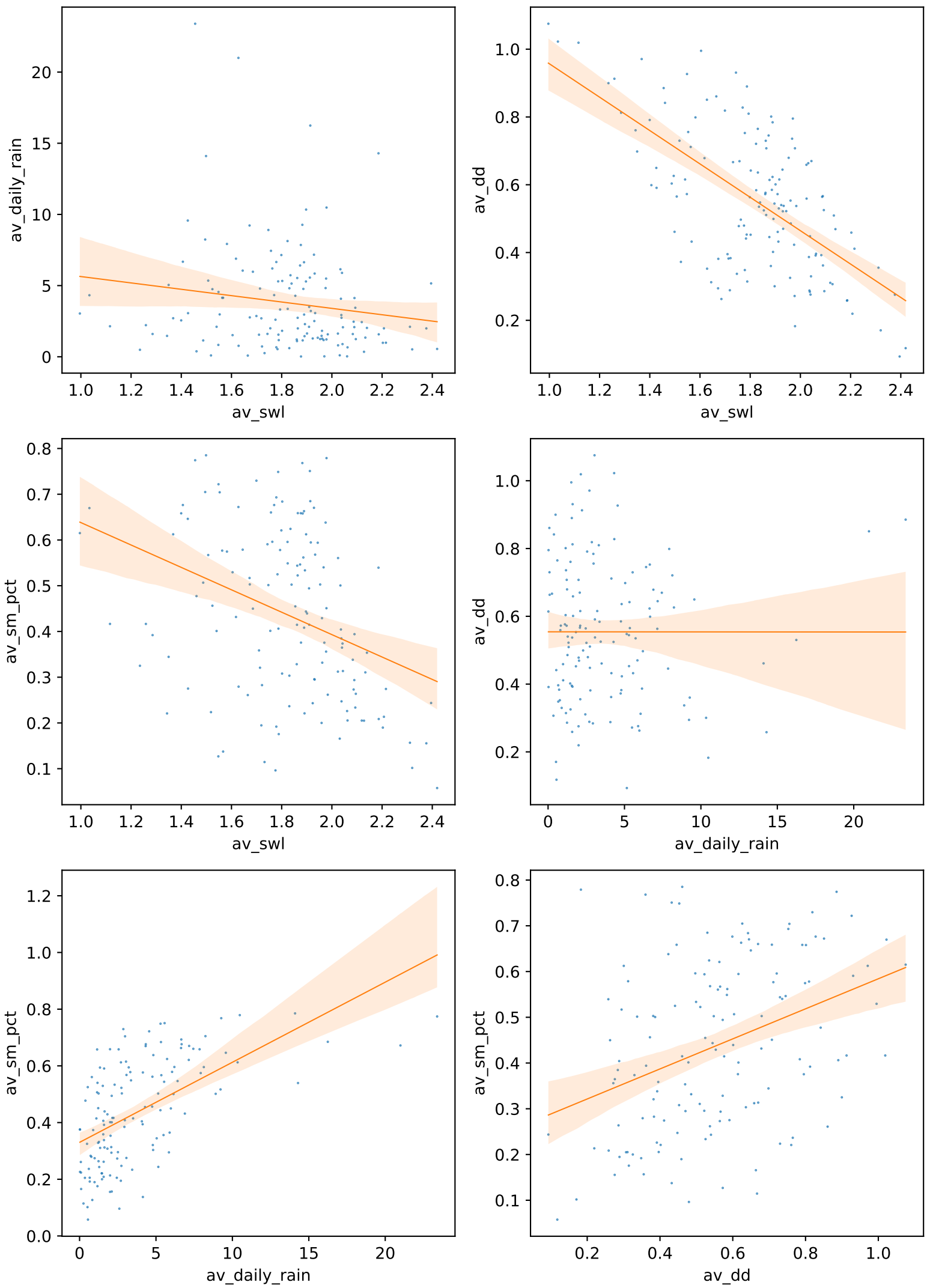
Average Absolute Root Zone Soil Moisture (0-100cm) (%) - Autocorrelation



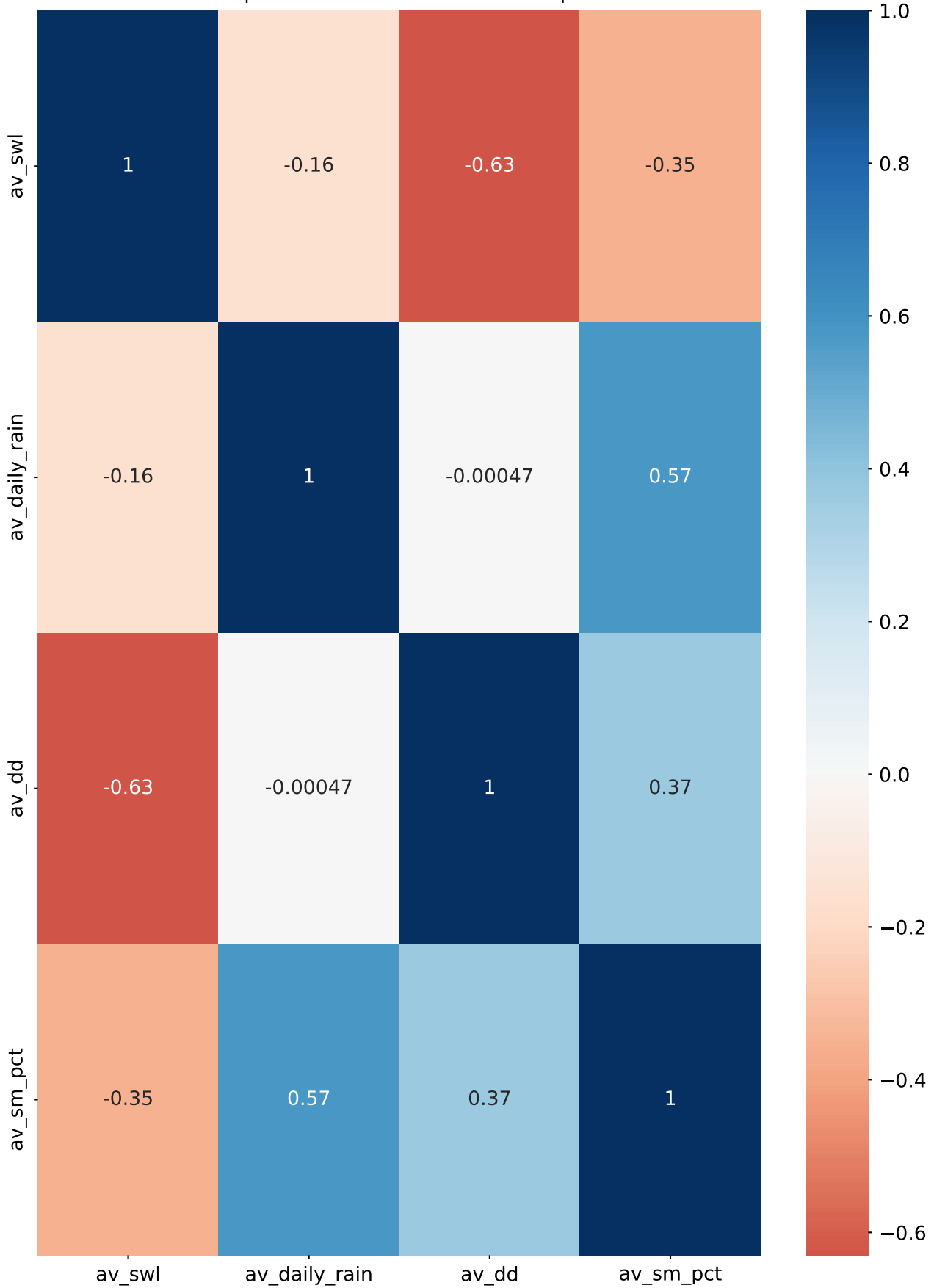
Average Absolute Root Zone Soil Moisture (0-100cm) (%) - Partial Autocorrelation



Input Variable Correlation



Input Variable Correlation Heatmap



<><> TensorFlow Keras LSTM Model <><>

Optimiser: adam  
Loss: mse  
Number of Epochs: 100  
Percentage of Training Data for Validation: 20.0%  
Time Series Order: Chronological  
Verbose: Off

<><> Model Architecture <><>

Input Shape (Samples, Timesteps, Features): (108, 3, 4)  
LSTM Layers: 1  
LSTM Cells per Layer: 64  
Fully Connected Hidden Layers: 2  
Fully Connected Hidden Neurons per Layer: 32  
Fully Connected Output Neurons: 1  
LSTM Dropout Rate: 20.0%  
LSTM Recurrent Dropout Rate: 20.0%

Model: "sequential\_41"

Layer (type)	Output Shape	Param #
=====		
lstm_41 (LSTM)	(None, 64)	17664
dense_123 (Dense)	(None, 32)	2080
dense_124 (Dense)	(None, 32)	1056
dense_125 (Dense)	(None, 1)	33
=====		
Total params: 20,833		
Trainable params: 20,833		
Non-trainable params: 0		

<><> Training Loss <><>

Epoch: 10,    Loss: 0.041445955634117126  
Epoch: 20,    Loss: 0.02049490250647068  
Epoch: 30,    Loss: 0.017580140382051468  
Epoch: 40,    Loss: 0.017410919070243835  
Epoch: 50,    Loss: 0.011530487798154354  
Epoch: 60,    Loss: 0.010788568295538425  
Epoch: 70,    Loss: 0.01471047941595316  
Epoch: 80,    Loss: 0.013187914155423641  
Epoch: 90,    Loss: 0.009620350785553455  
Epoch: 100,   Loss: 0.010743100196123123

<><> Validation Loss <><>

Epoch: 10, Loss: 0.007542377803474665  
Epoch: 20, Loss: 0.010953768156468868  
Epoch: 30, Loss: 0.011052243411540985  
Epoch: 40, Loss: 0.007491824217140675  
Epoch: 50, Loss: 0.007637816946953535  
Epoch: 60, Loss: 0.007148528005927801  
Epoch: 70, Loss: 0.00927836261689663  
Epoch: 80, Loss: 0.004195725079625845  
Epoch: 90, Loss: 0.006567772012203932  
Epoch: 100, Loss: 0.006666709203273058

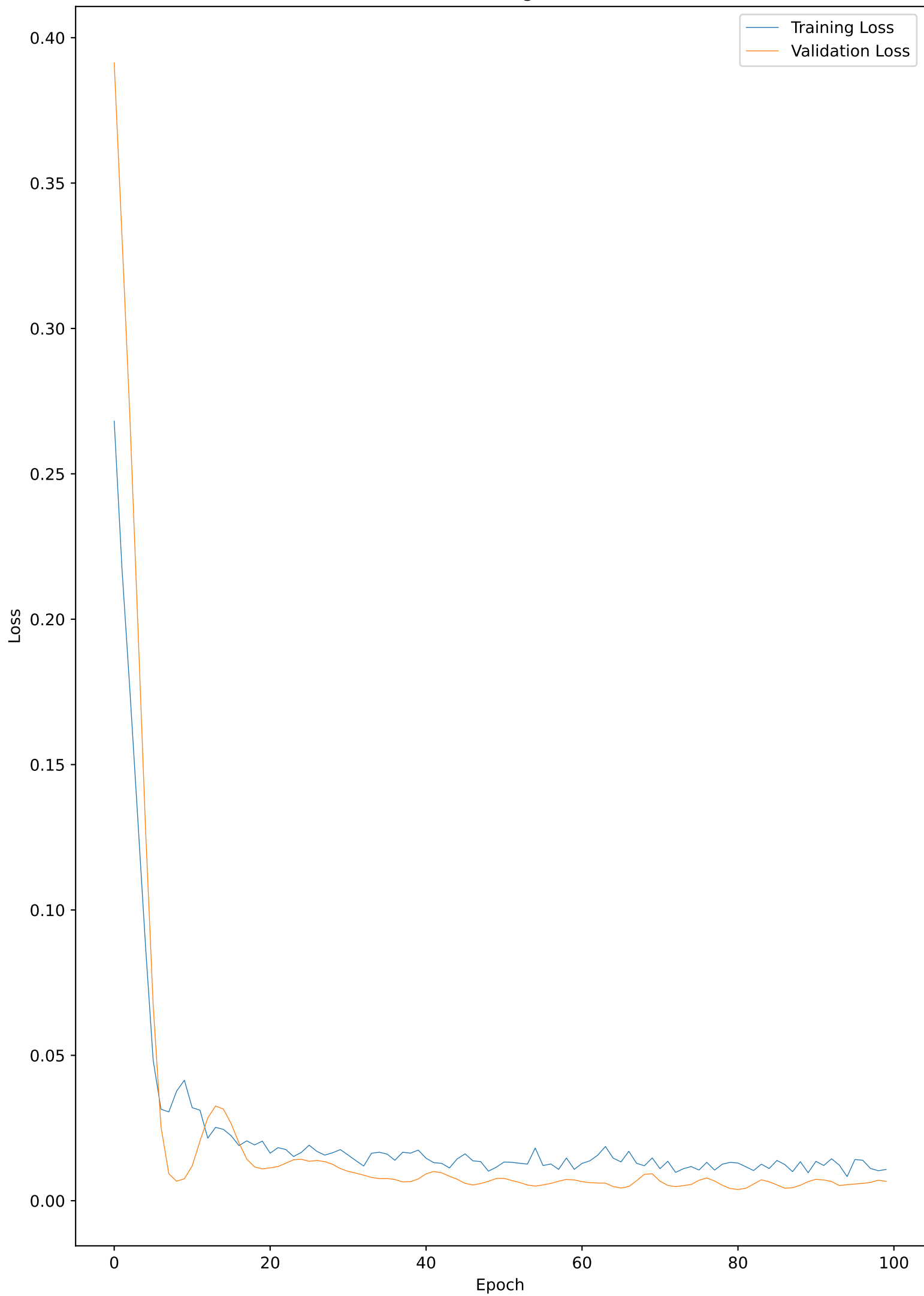
<><> Training Set Scores <><>

Train Root Mean Squared Error: 0.08216  
Train Mean Squared Error: 0.00675  
Train Normalised Root Mean Squared Error: 0.10466  
Train Coefficient of Determination: 0.72943  
Train Normalised Nash Sutcliffe Efficiency: 0.78705  
Train Mean Absolute Error: 0.06484  
Train Pearson's Correlation Coefficient: 0.92804  
Train Index of Agreement: 0.88741  
Train Kling-Gupta Efficiency: 0.56423  
Train Mean Bias Error: -0.01006  
Train Mean Absolute Percentage Error: 0.05219

<><> Test Set Scores <><>

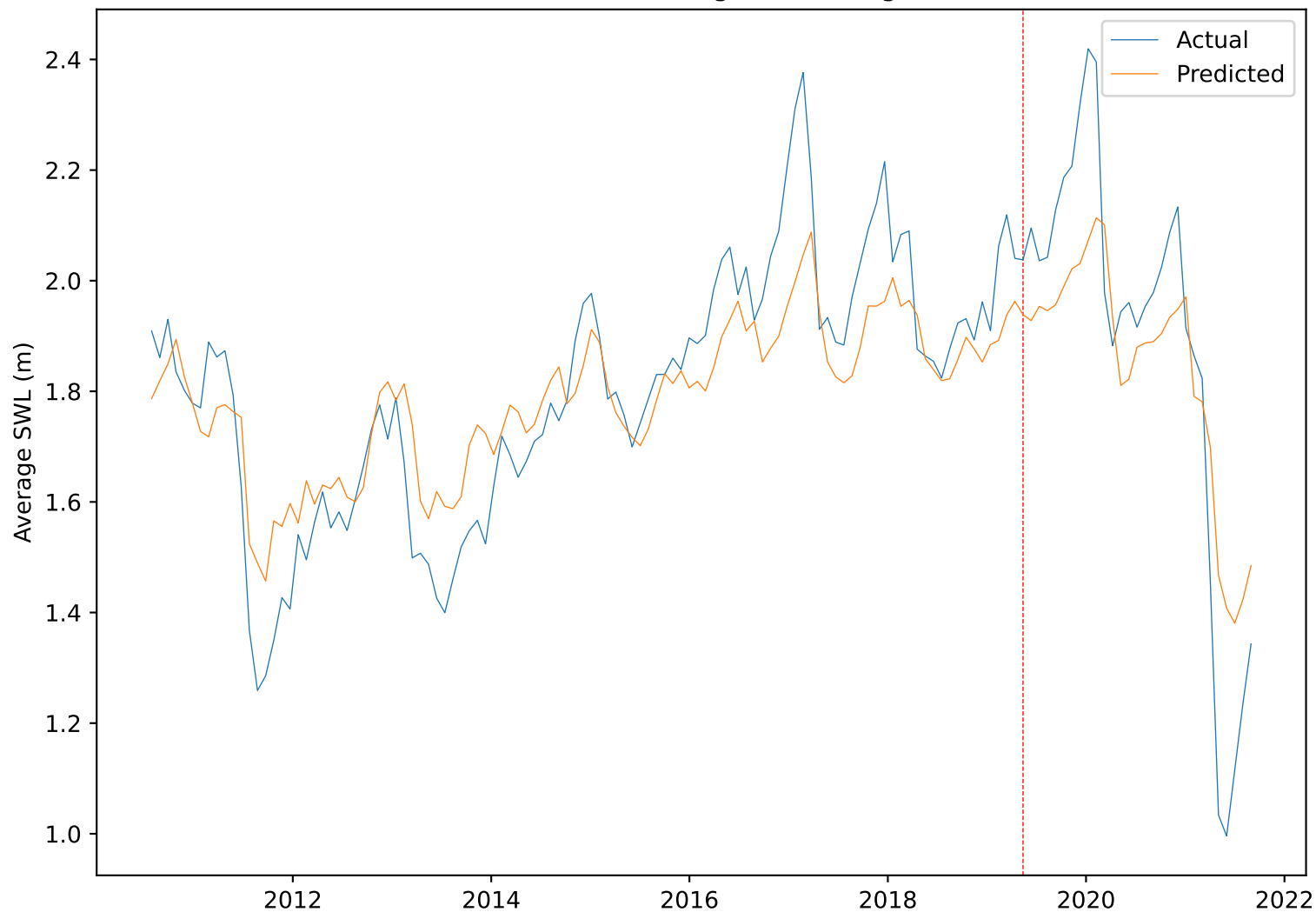
Test Root Mean Squared Error: 0.14069  
Test Mean Squared Error: 0.01979  
Test Normalised Root Mean Squared Error: 0.14069  
Test Coefficient of Determination: 0.73534  
Test Normalised Nash Sutcliffe Efficiency: 0.79072  
Test Mean Absolute Error: 0.11962  
Test Pearson's Correlation Coefficient: 0.95498  
Test Index of Agreement: 0.88737  
Test Kling-Gupta Efficiency: 0.53985  
Test Mean Bias Error: -0.02365  
Test Mean Absolute Percentage Error: 0.10499

LSTM Learning Curves

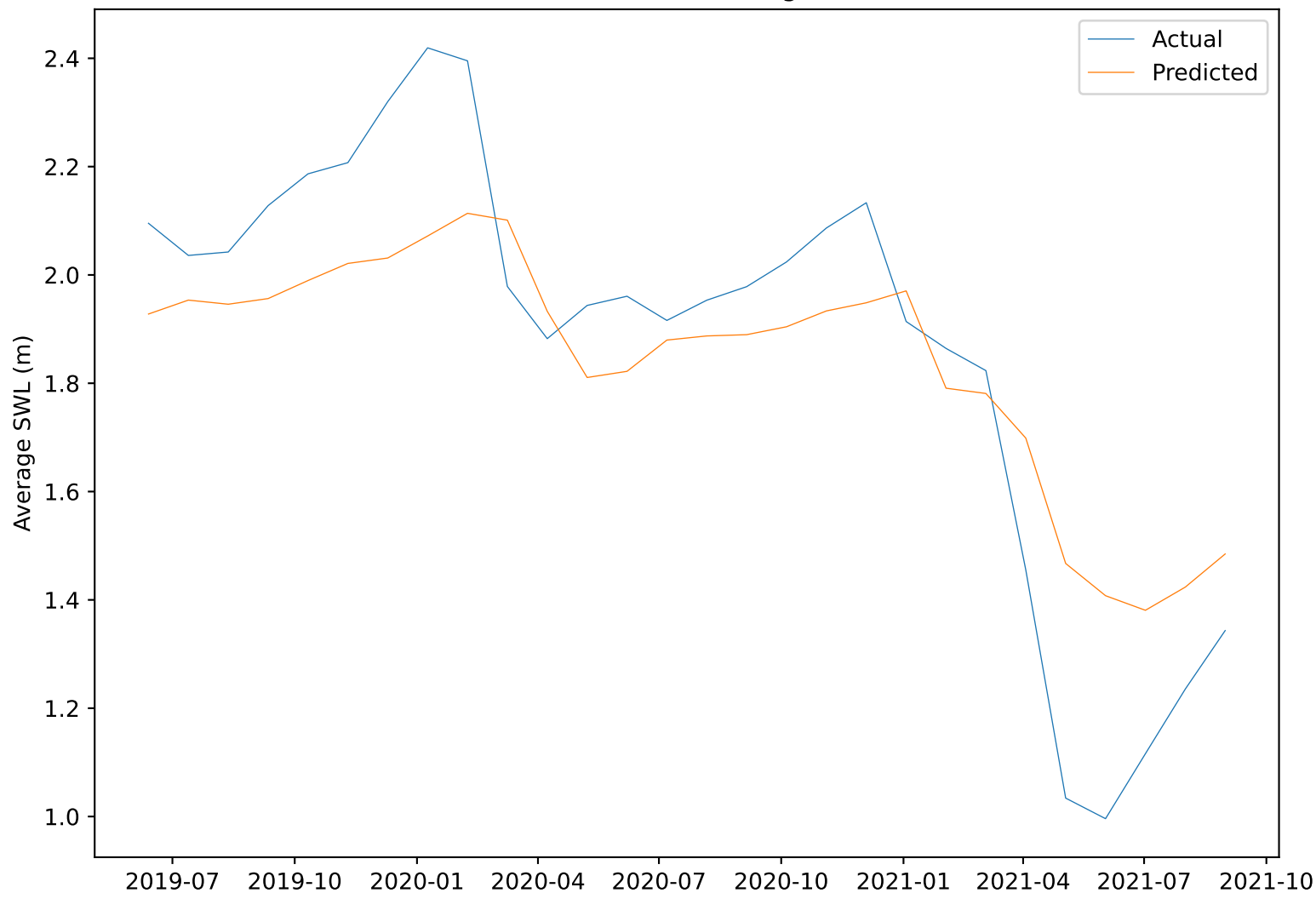




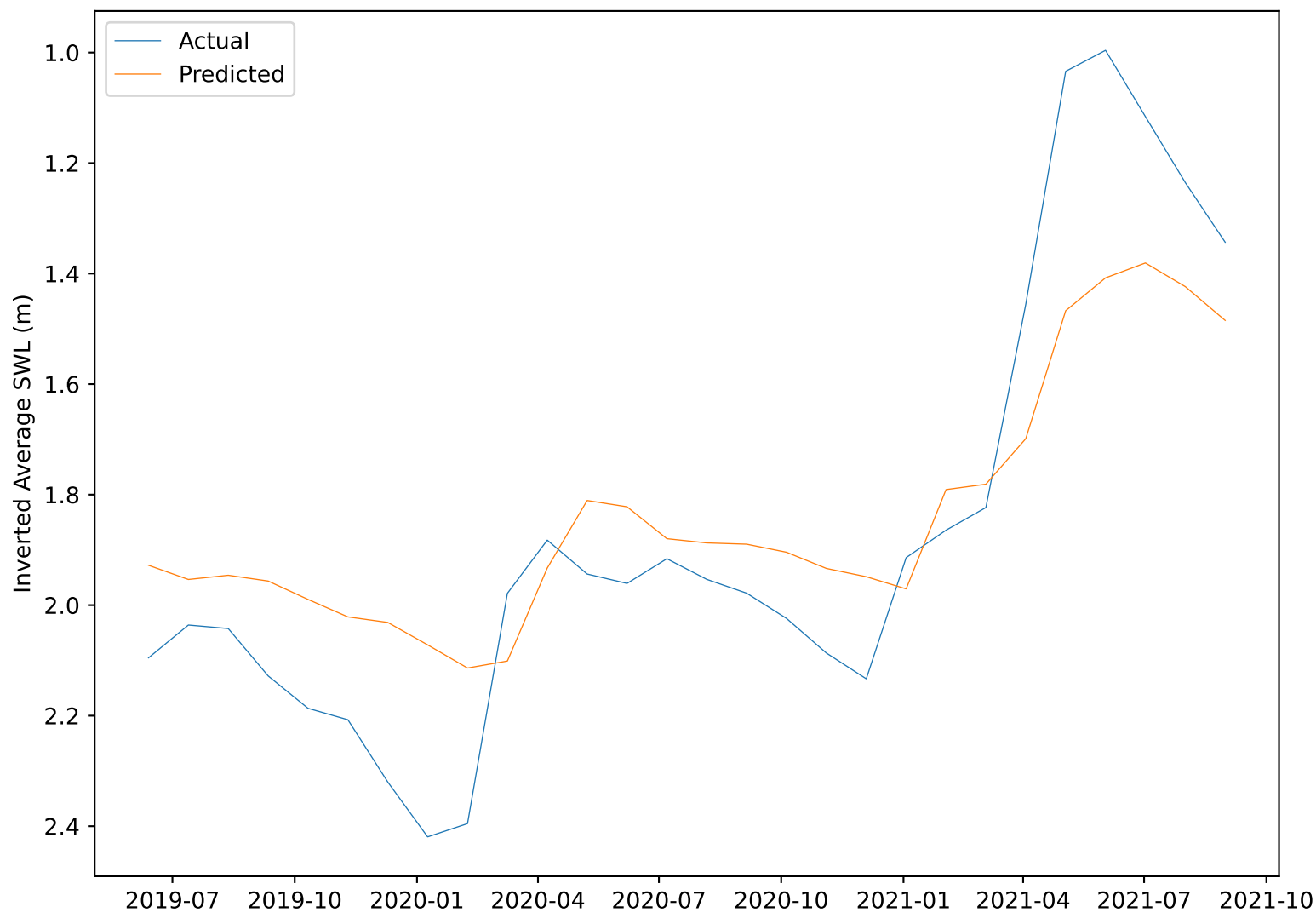
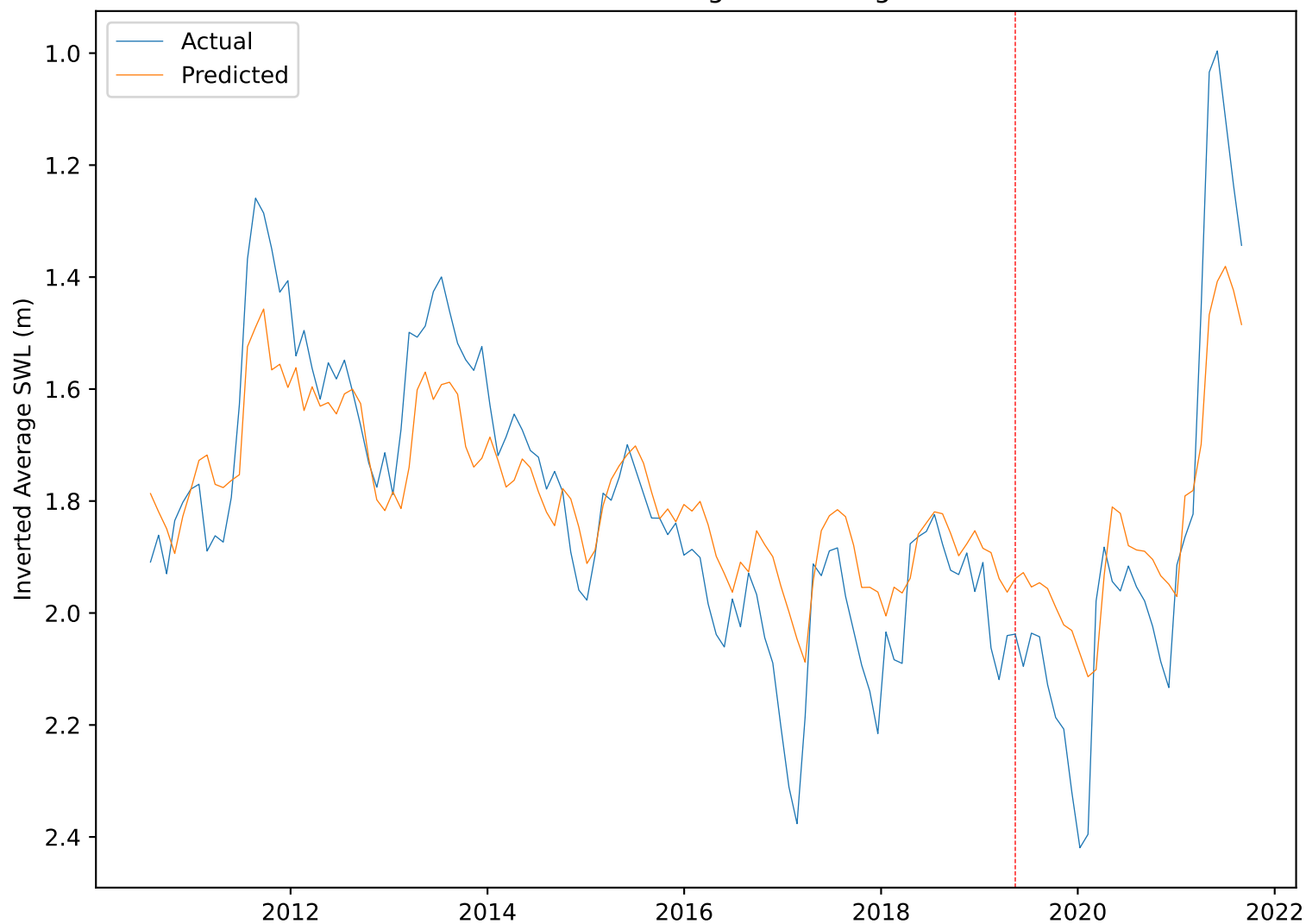
# LSTM Model: Training and Testing Sets



## LSTM Model: Testing Set



# LSTM Model: Training and Testing Sets



<><> Scikit Learn SVR Model <><>

Kernel Function: rbf  
Kernel Coefficient: scale  
Epsilon: 0.1  
Stopping Criterion Tolerance: 1e-05  
Regularisation Parameter: 1.0  
Shrinking: True  
Time Series Order: Chronological  
Verbose: Off

<><> Model Architecture <><>

Number of Support Vectors: 20  
Input/Support Vector Size: 12

<><> 5-Fold Cross Validation Mean Training Loss <><>

Epoch: 8, Loss: 0.0019374427545810011  
Epoch: 16, Loss: 0.00658206100054521  
Epoch: 24, Loss: 0.005878276236353975  
Epoch: 32, Loss: 0.0053705562940711115  
Epoch: 40, Loss: 0.005025177619068231  
Epoch: 48, Loss: 0.004763305960099366  
Epoch: 56, Loss: 0.004267592007814004  
Epoch: 64, Loss: 0.004320165174492026  
Epoch: 72, Loss: 0.0043240064164985995  
Epoch: 80, Loss: 0.004055122782769806

<><> 5-Fold Cross Validation Mean Validation Loss <><>

Epoch: 8, Loss: 0.02183136536234781  
Epoch: 16, Loss: 0.03278169737716904  
Epoch: 24, Loss: 0.03314699926910146  
Epoch: 32, Loss: 0.028628936585510485  
Epoch: 40, Loss: 0.02644091323330467  
Epoch: 48, Loss: 0.02561856809187283  
Epoch: 56, Loss: 0.017910745025780616  
Epoch: 64, Loss: 0.018026115889585415  
Epoch: 72, Loss: 0.01151435651717271  
Epoch: 80, Loss: 0.008860935177434285

<><> Training Set Scores <><>

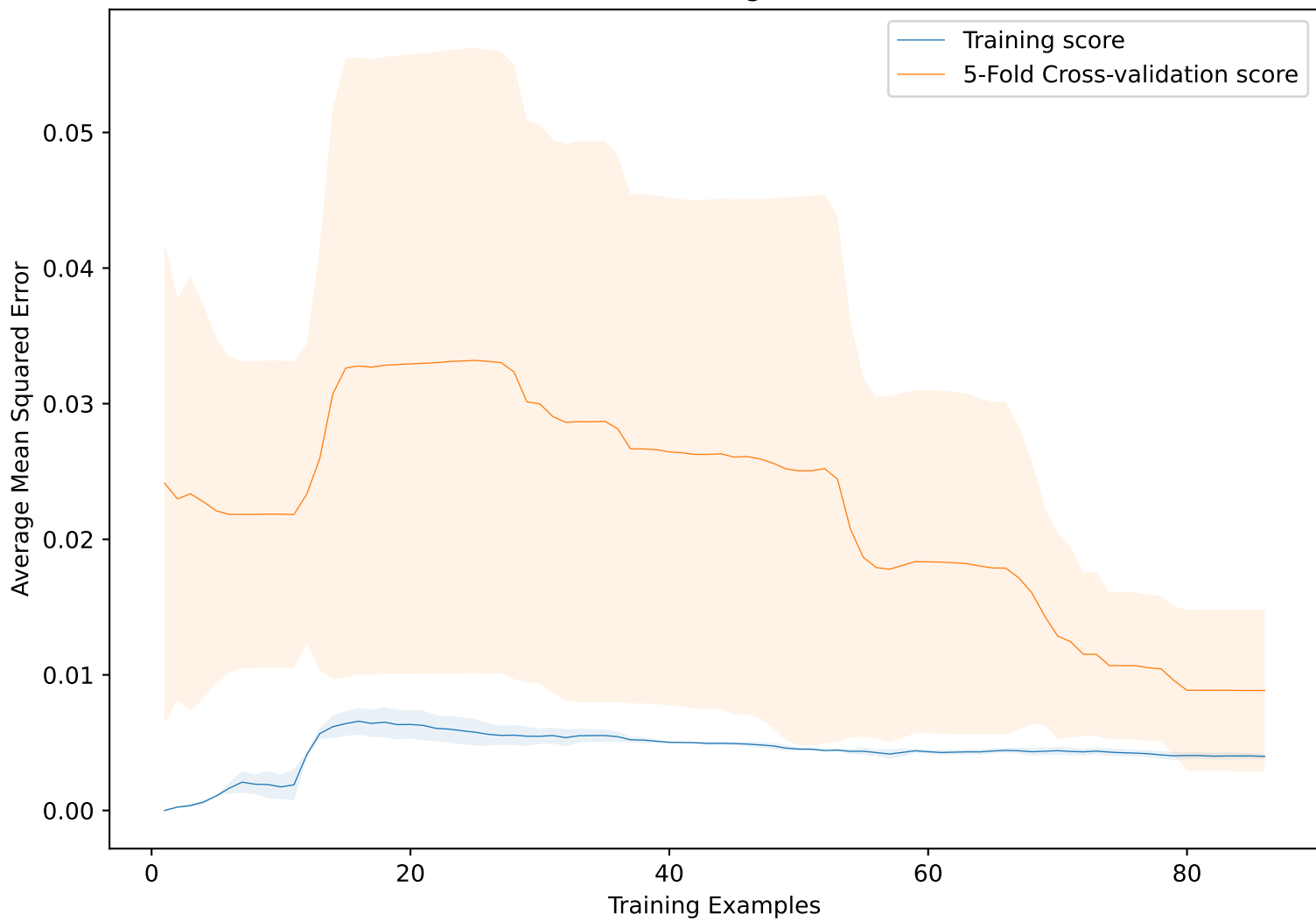
Train Root Mean Squared Error: 0.06136  
Train Mean Squared Error: 0.00377  
Train Normalised Root Mean Squared Error: 0.07817  
Train Coefficient of Determination: 0.84906  
Train Normalised Nash Sutcliffe Efficiency: 0.86886

Train Mean Absolute Error: 0.05042  
Train Pearson's Correlation Coefficient: 0.93395  
Train Index of Agreement: 0.95126  
Train Kling-Gupta Efficiency: 0.774  
Train Mean Bias Error: -0.0042  
Train Mean Absolute Percentage Error: 0.04072

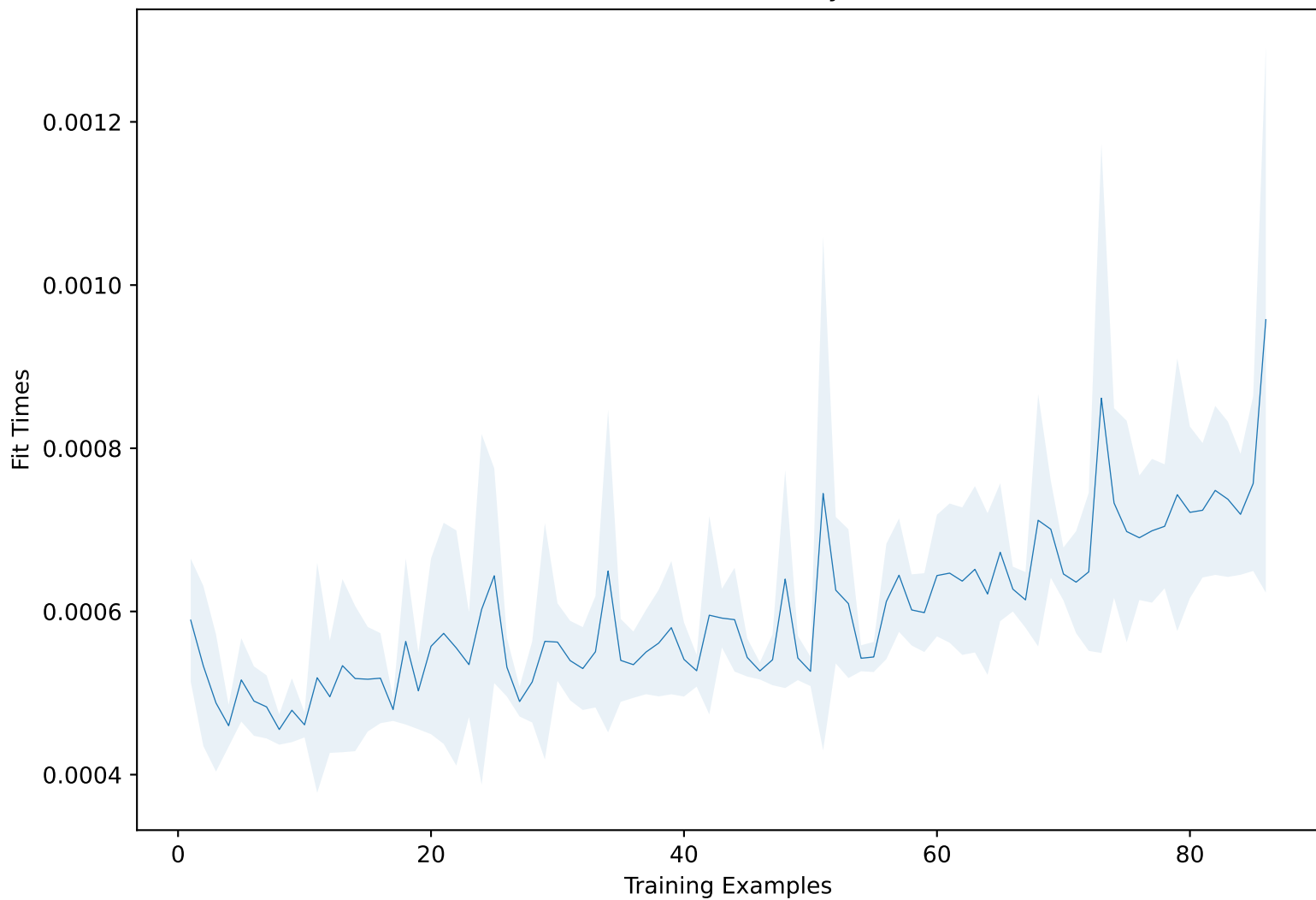
<><> Test Set Scores <><>

Test Root Mean Squared Error: 0.15213  
Test Mean Squared Error: 0.02314  
Test Normalised Root Mean Squared Error: 0.15213  
Test Coefficient of Determination: 0.69054  
Test Normalised Nash Sutcliffe Efficiency: 0.76368  
Test Mean Absolute Error: 0.12396  
Test Pearson's Correlation Coefficient: 0.91134  
Test Index of Agreement: 0.86559  
Test Kling-Gupta Efficiency: 0.53208  
Test Mean Bias Error: -0.01495  
Test Mean Absolute Percentage Error: 0.11234

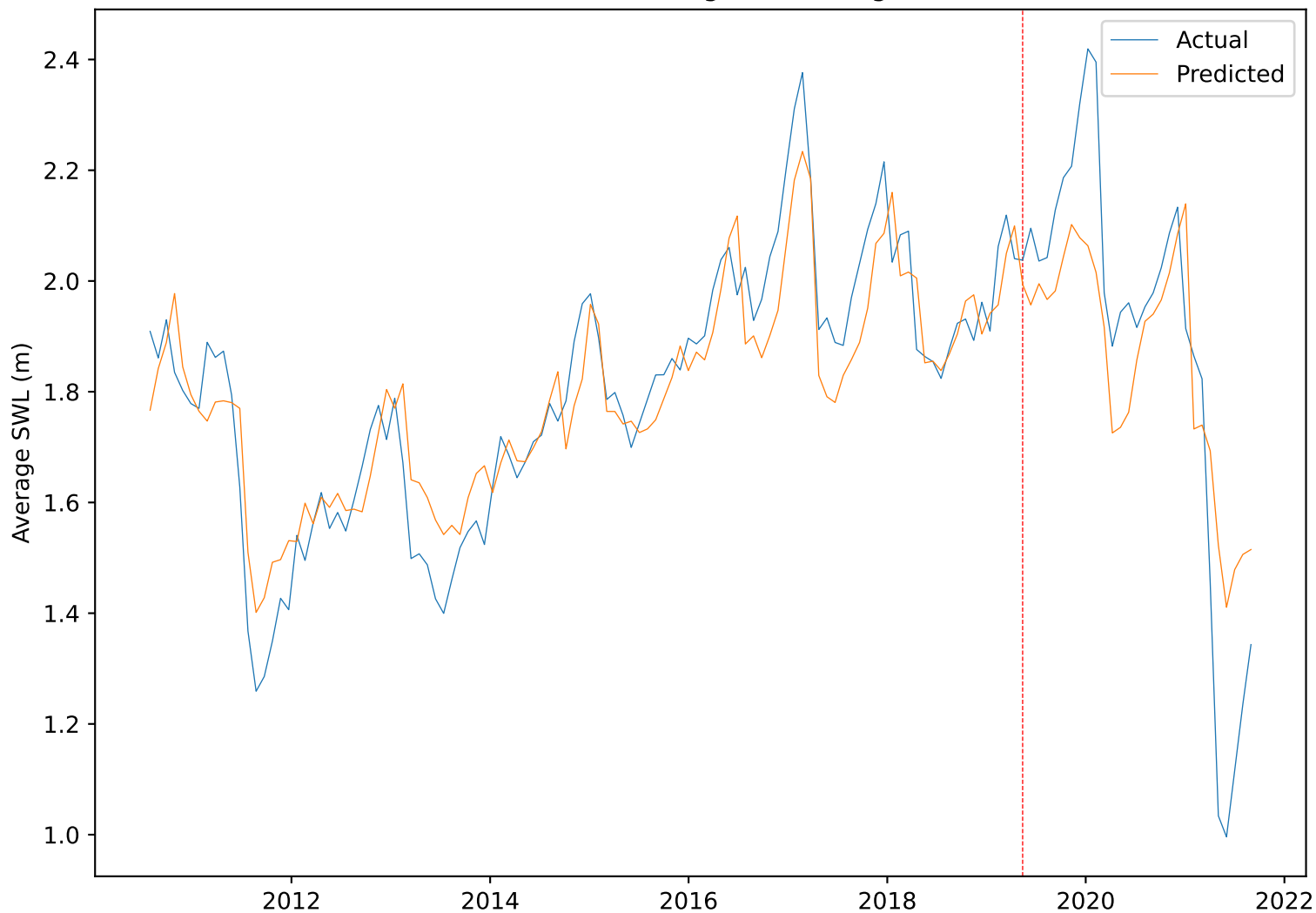
SVR Learning Curve



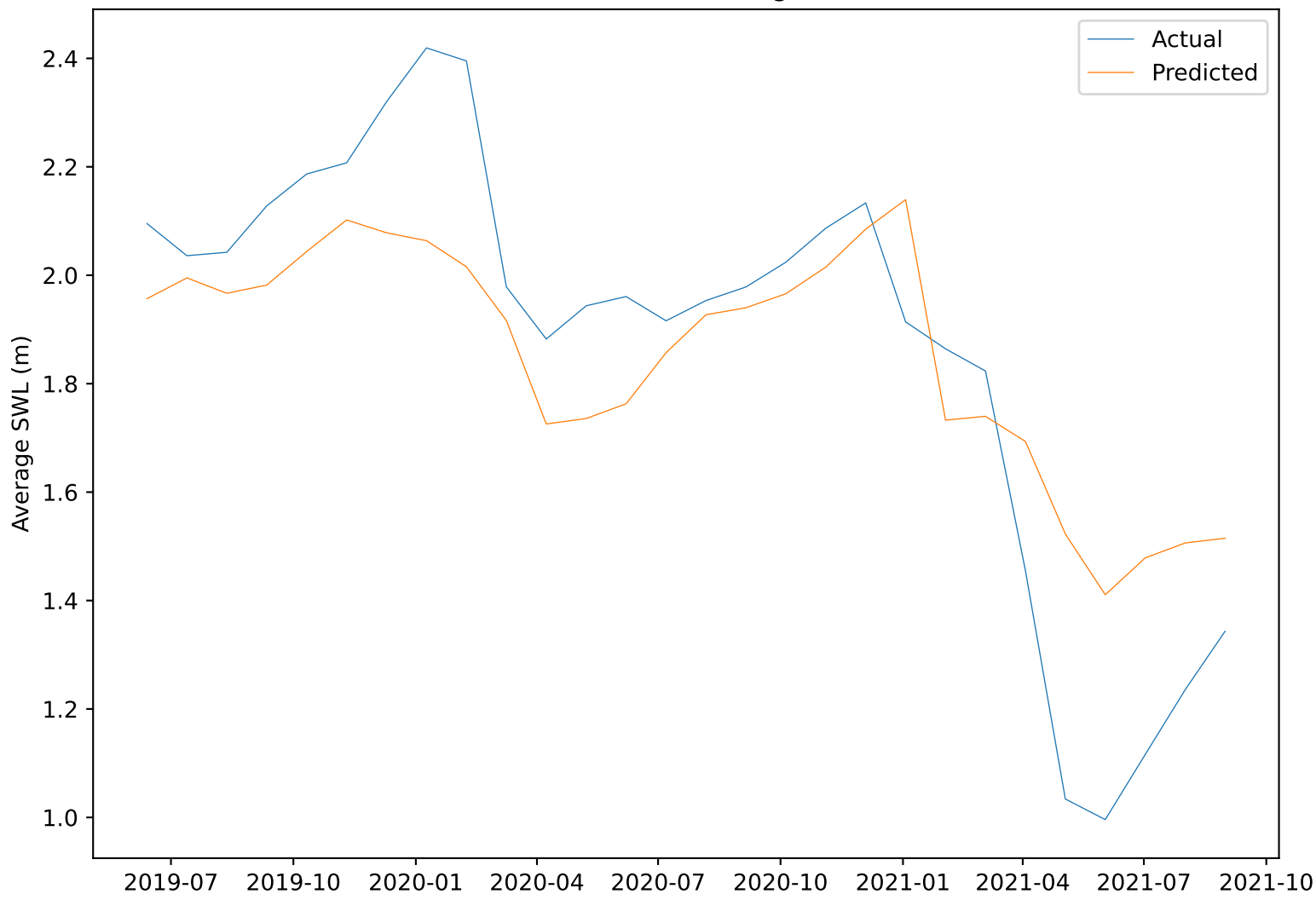
Model Scalability



SVR Model: Training and Testing Sets



SVR Model: Testing Set



SVR Model: Training and Testing Sets

