

Starting main analysis script...

Parameters set:

Data file: data/slp.nc

Variable: msl

PCA Rank: 50

Method: DMD

Step 1: Loading and Preprocessing Data...

Loading data from data/slp.nc, variable msl...

Original data dimensions: Lon=161, Lat=101, Time=16071

Reshaped data dimensions (space x time): 16261 x 16071

Removing temporal mean...

Preprocessing complete.

Data loaded. Shape (space x time): 16261 x 16071

Step 2: Performing PCA/SVD...

Performing SVD...

SVD complete.

Truncating to rank 50...

PCA finished.

PCA complete. Using rank 50.

Variance captured by rank 50: 98.69%

Step 3: Plotting PCA Results...

Plotting PCA results...

PCA plotting finished.

Step 4: Performing Dynamic Analysis using DMD...

Running DMD...

Created snapshot matrices X1, X2 of size 50 x 16070.

Computing DMD operator via SVD projection...

Computed low-dimensional operator A_{tilde} (50 x 50).

Computing eigenvalues and eigenvectors...

Computing DMD modes...

Computed physical DMD modes (space x rank_dmd): 16261 x 50.

Calculating frequencies and growth rates...

DMD complete.

DMD analysis complete.

Step 5: Plotting Dynamic Analysis Results...

Plotting DMD results...

DMD plotting finished.

Step 6: Preparing Data for LSTM...

Data split: 12856 training samples, 3215 testing samples.

Normalizing data based on training set...

Creating input/output sequences...

Sequence creation complete.

Number of training sequences: 12846

Number of test sequences: 3205

LSTM data prepared. Sequence length: 10.

Number of features (PCA components): 50

Step 7: Defining LSTM Network Architecture...

LSTM layers defined: Input(50) -> LSTM(100) -> FC(50) -> Regression

Step 8: Specifying Training Options...

Converting YTrain for training...

Converted YTrain from cell array to numeric matrix (50 x 12846).

Step 9: Training LSTM Network...

LSTM training complete.

Step 10: Making Predictions on Test Set...

Predictions generated and denormalized.

Step 11: Evaluating and Visualizing Predictions...

Calculating RMSE...

Plotting prediction results for first few components...

Plotting complete.

Overall RMSE on test set: 0.0050

LSTM analysis finished.

>>