```
Training for CA_4
Single window of past history : (100, 4)
(72, 20)
Epoch 1/100
50/50 [==============================] - 6s 114ms/step - loss: 0.7325 - val_loss: 1.0375
Epoch 2/100
50/50 [==============================] - 5s 104ms/step - loss: 0.6902 - val_loss: 0.9317
Epoch 3/100
50/50 [==============================] - 5s 106ms/step - loss: 0.6250 - val_loss: 0.7953
Epoch 4/100
50/50 [==============================] - 5s 108ms/step - loss: 0.5631 - val_loss: 0.6875
Epoch 5/100
50/50 [==============================] - 5s 110ms/step - loss: 0.5295 - val_loss: 0.6162
Epoch 6/100
50/50 [==============================] - 5s 105ms/step - loss: 0.5158 - val_loss: 0.5915
Epoch 7/100
50/50 [==============================] - 5s 104ms/step - loss: 0.5129 - val_loss: 0.5828
Epoch 8/100
50/50 [==============================] - 5s 104ms/step - loss: 0.5119 - val_loss: 0.5815
Epoch 9/100
50/50 [==============================] - 5s 106ms/step - loss: 0.5098 - val_loss: 0.5772
Epoch 10/100
50/50 [==============================] - 5s 110ms/step - loss: 0.5098 - val_loss: 0.5759
Epoch 11/100
50/50 [==============================] - 5s 109ms/step - loss: 0.5073 - val_loss: 0.5744
Epoch 12/100
50/50 [==============================] - 5s 106ms/step - loss: 0.5069 - val_loss: 0.5738
Epoch 13/100
50/50 [==============================] - 5s 104ms/step - loss: 0.5063 - val_loss: 0.5744
Epoch 14/100
50/50 [==============================] - 5s 107ms/step - loss: 0.5054 - val_loss: 0.5714
Epoch 15/100
50/50 [==============================] - 5s 105ms/step - loss: 0.5065 - val_loss: 0.5719
Epoch 16/100
50/50 [==============================] - 5s 107ms/step - loss: 0.5037 - val_loss: 0.5698
Epoch 17/100
50/50 [==============================] - 5s 109ms/step - loss: 0.5029 - val_loss: 0.5682
Epoch 18/100
50/50 [==============================] - 5s 107ms/step - loss: 0.5020 - val_loss: 0.5682
Epoch 19/100
50/50 [==============================] - 5s 102ms/step - loss: 0.5010 - val_loss: 0.5660
Epoch 20/100
50/50 [==============================] - 5s 105ms/step - loss: 0.5006 - val_loss: 0.5639
Epoch 21/100
50/50 [==============================] - 5s 106ms/step - loss: 0.4989 - val_loss: 0.5619
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Epoch 22/100
50/50 [==============================] - 5s 104ms/step - loss: 0.4971 - val_loss: 0.5601
Epoch 23/100
50/50 [==============================] - 6s 112ms/step - loss: 0.4964 - val_loss: 0.5572
Epoch 24/100
50/50 [==============================] - 6s 111ms/step - loss: 0.4935 - val_loss: 0.5558
Epoch 25/100
50/50 [==============================] - 5s 105ms/step - loss: 0.4922 - val_loss: 0.5529
Epoch 26/100
50/50 [==============================] - 5s 108ms/step - loss: 0.4912 - val_loss: 0.5477
Epoch 27/100
50/50 [==============================] - 5s 105ms/step - loss: 0.4864 - val_loss: 0.5418
Epoch 28/100
50/50 [==============================] - 5s 108ms/step - loss: 0.4830 - val_loss: 0.5340
Epoch 29/100
50/50 [==============================] - 5s 106ms/step - loss: 0.4764 - val_loss: 0.5240
Epoch 30/100
50/50 [==============================] - 5s 108ms/step - loss: 0.4707 - val_loss: 0.5068
Epoch 31/100
50/50 [==============================] - 5s 104ms/step - loss: 0.4591 - val_loss: 0.5942
Epoch 32/100
50/50 [==============================] - 5s 108ms/step - loss: 0.4486 - val_loss: 0.4714
Epoch 33/100
50/50 [==============================] - 5s 103ms/step - loss: 0.4285 - val_loss: 0.4461
Epoch 34/100
50/50 [==============================] - 5s 105ms/step - loss: 0.4115 - val_loss: 0.4365
Epoch 35/100
50/50 [==============================] - 5s 105ms/step - loss: 0.3938 - val_loss: 0.4102
Epoch 36/100
50/50 [==============================] - 5s 104ms/step - loss: 0.3818 - val_loss: 0.4048
Epoch 37/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3708 - val_loss: 0.4006
Epoch 38/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3654 - val_loss: 0.4103
Epoch 39/100
50/50 [==============================] - 5s 105ms/step - loss: 0.3621 - val_loss: 0.3855
Epoch 40/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3599 - val_loss: 0.3725
Epoch 41/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3572 - val_loss: 0.3759
Epoch 42/100
50/50 [==============================] - 5s 105ms/step - loss: 0.3569 - val_loss: 0.3753
Epoch 43/100
50/50 [==============================] - 5s 108ms/step - loss: 0.3542 - val_loss: 0.3807
Epoch 44/100
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50/50 [==============================] - 5s 104ms/step - loss: 0.3536 - val_loss: 0.3683
Epoch 45/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3508 - val_loss: 0.3669
Epoch 46/100
50/50 [==============================] - 5s 109ms/step - loss: 0.3508 - val_loss: 0.3773
Epoch 47/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3498 - val_loss: 0.3708
Epoch 48/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3489 - val_loss: 0.3683
Epoch 49/100
50/50 [==============================] - 6s 113ms/step - loss: 0.3482 - val_loss: 0.3632
Epoch 50/100
50/50 [==============================] - 5s 108ms/step - loss: 0.3480 - val_loss: 0.3596
Epoch 51/100
50/50 [==============================] - 5s 108ms/step - loss: 0.3454 - val_loss: 0.3676
Epoch 52/100
50/50 [==============================] - 5s 109ms/step - loss: 0.3456 - val_loss: 0.3743
Epoch 53/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3451 - val_loss: 0.3961
Epoch 54/100
50/50 [==============================] - 6s 116ms/step - loss: 0.3446 - val_loss: 0.3727
Epoch 55/100
50/50 [==============================] - 6s 112ms/step - loss: 0.3446 - val_loss: 0.4220
Epoch 56/100
50/50 [==============================] - 5s 108ms/step - loss: 0.3423 - val_loss: 0.3701
Epoch 57/100
50/50 [==============================] - 5s 105ms/step - loss: 0.3424 - val_loss: 0.3717
Epoch 58/100
50/50 [==============================] - 5s 105ms/step - loss: 0.3417 - val_loss: 0.3756
Epoch 59/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3415 - val_loss: 0.3733
Epoch 60/100
50/50 [==============================] - 6s 112ms/step - loss: 0.3411 - val_loss: 0.3961
Epoch 61/100
50/50 [==============================] - 6s 129ms/step - loss: 0.3415 - val_loss: 0.3705
Epoch 62/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3389 - val_loss: 0.3618
Epoch 63/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3384 - val_loss: 0.3706
Epoch 64/100
50/50 [==============================] - 5s 105ms/step - loss: 0.3398 - val_loss: 0.3819
Epoch 65/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3375 - val_loss: 0.3827
Epoch 66/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3378 - val_loss: 0.3776
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Epoch 67/100
50/50 [==============================] - 5s 105ms/step - loss: 0.3368 - val_loss: 0.3651
Epoch 68/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3372 - val_loss: 0.3662
Epoch 69/100
50/50 [==============================] - 5s 105ms/step - loss: 0.3364 - val_loss: 0.3881
Epoch 70/100
50/50 [==============================] - 5s 105ms/step - loss: 0.3348 - val_loss: 0.3876
Epoch 71/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3358 - val_loss: 0.3772
Epoch 72/100
50/50 [==============================] - 5s 105ms/step - loss: 0.3345 - val_loss: 0.3638
Epoch 73/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3339 - val_loss: 0.3811
Epoch 74/100
50/50 [==============================] - 5s 103ms/step - loss: 0.3332 - val_loss: 0.3789
Epoch 75/100
50/50 [==============================] - 5s 105ms/step - loss: 0.3335 - val_loss: 0.3636
Epoch 76/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3318 - val_loss: 0.3603
Epoch 77/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3311 - val_loss: 0.3705
Epoch 78/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3322 - val_loss: 0.3594
Epoch 79/100
50/50 [==============================] - 5s 108ms/step - loss: 0.3296 - val_loss: 0.3615
Epoch 80/100
50/50 [==============================] - 6s 113ms/step - loss: 0.3311 - val_loss: 0.3619
Epoch 81/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3298 - val_loss: 0.3577
Epoch 82/100
50/50 [==============================] - 5s 104ms/step - loss: 0.3292 - val_loss: 0.3628
Epoch 83/100
50/50 [==============================] - 5s 102ms/step - loss: 0.3280 - val_loss: 0.3658
Epoch 84/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3276 - val_loss: 0.3647
Epoch 85/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3262 - val_loss: 0.3560
Epoch 86/100
50/50 [==============================] - 5s 105ms/step - loss: 0.3255 - val_loss: 0.3807
Epoch 87/100
50/50 [==============================] - 8s 152ms/step - loss: 0.3265 - val_loss: 0.3695
Epoch 88/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3251 - val_loss: 0.3883
Epoch 89/100
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50/50 [==============================] - 6s 110ms/step - loss: 0.3245 - val_loss: 0.3652
Epoch 90/100
50/50 [==============================] - 5s 105ms/step - loss: 0.3228 - val_loss: 0.3711
Epoch 91/100
50/50 [==============================] - 5s 104ms/step - loss: 0.3223 - val_loss: 0.4058
Epoch 92/100
50/50 [==============================] - 5s 105ms/step - loss: 0.3211 - val_loss: 0.3735
Epoch 93/100
50/50 [==============================] - 5s 108ms/step - loss: 0.3211 - val_loss: 0.3679
Epoch 94/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3188 - val_loss: 0.3629
Epoch 95/100
50/50 [==============================] - 6s 110ms/step - loss: 0.3187 - val_loss: 0.3614
Epoch 96/100
50/50 [==============================] - 5s 104ms/step - loss: 0.3173 - val_loss: 0.3848
Epoch 97/100
50/50 [==============================] - 5s 105ms/step - loss: 0.3173 - val_loss: 0.3685
Epoch 98/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3164 - val_loss: 0.3546
Epoch 99/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3153 - val_loss: 0.3679
Epoch 100/100
50/50 [==============================] - 5s 102ms/step - loss: 0.3134 - val_loss: 0.4339

Multi-Step Training and validation loss for CA_4

Multi_step LSTM for CA_4

Tail of Multi_step LSTM for CA_4
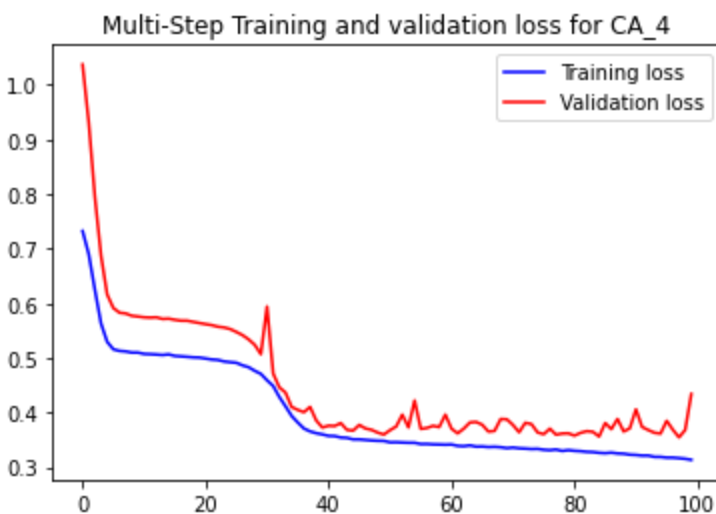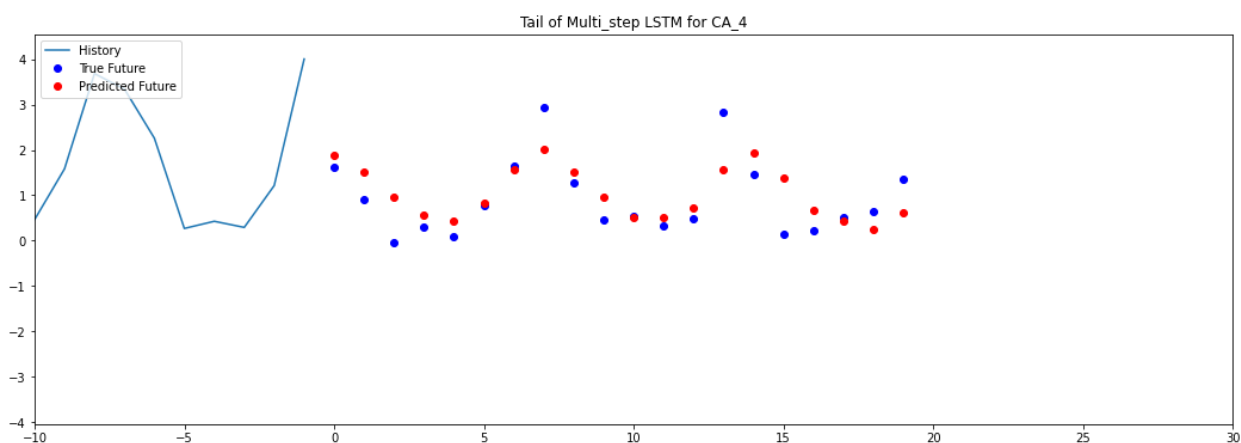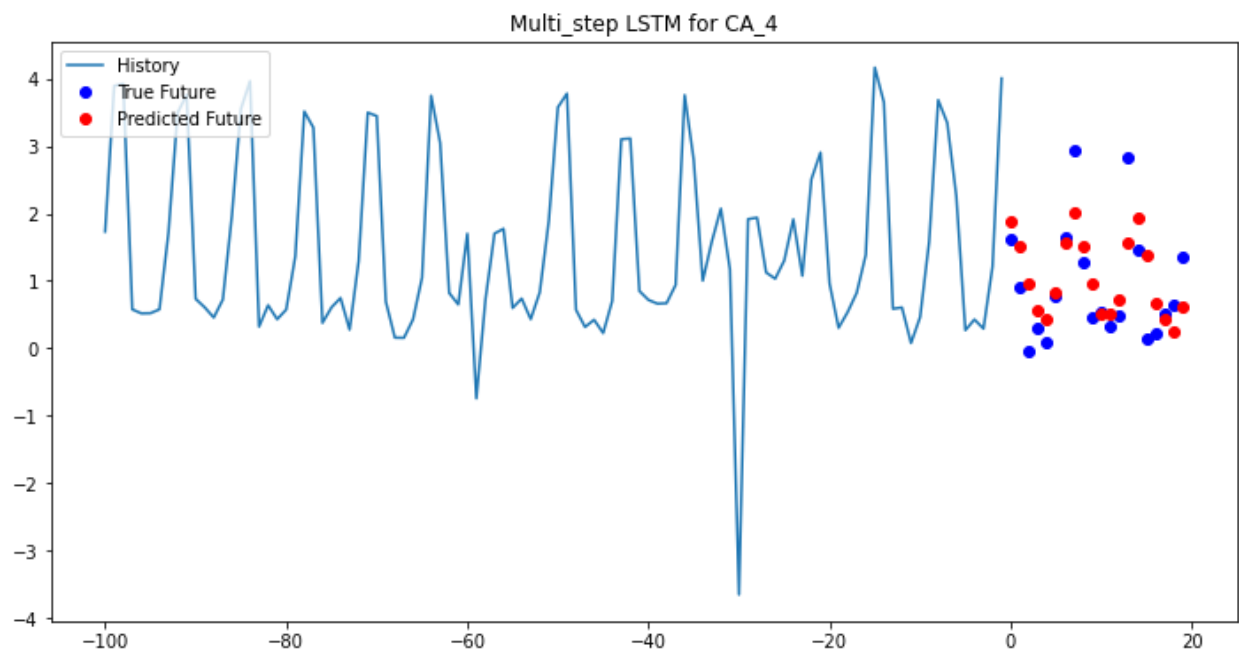
CA_4 - True Future: [2787. 2487. 2088. 2239. 2153. 2432. 2806. 3343. 2643. 2299. 2335. 2244.
 2316. 3301. 2727. 2166. 2207. 2323. 2383. 2677.]
CA_4 - Model Prediction: [2900.7405 2744.698 2514.2605 2345.253 2287.3257 2458.7478
2763.9983
 2956.8135 2745.5986 2516.6318 2326.118 2321.6877 2410.5984 2772.3267
 2918.416 2696.188 2394.1453 2293.4233 2213.4744 2365.0747]
CA_4 - Model Percentage Error: [4.08110795 10.36180129 20.41477481 4.74555291 6.23900063
1.09982742
 1.49685349 11.55209463 3.8819006   9.46636955 0.38038887 3.46202068
 4.0845591 16.01555104 7.01928917 24.47774646 8.47962228 1.27320965
 7.11395866 11.6520468]%
CA_4 - Model Mean Percentage Error: 7.864883798842882%
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Training for CA_2

Single window of past history : (100, 4)
(72, 20)
Epoch 1/100
50/50 [==============================] - 6s 119ms/step - loss: 0.7788 - val_loss: 1.8274
Epoch 2/100
50/50 [==============================] - 5s 106ms/step - loss: 0.7623 - val_loss: 1.8303
Epoch 3/100
50/50 [==============================] - 5s 104ms/step - loss: 0.7524 - val_loss: 1.8156
Epoch 4/100
50/50 [==============================] - 5s 108ms/step - loss: 0.7363 - val_loss: 1.7738
Epoch 5/100
50/50 [==============================] - 5s 103ms/step - loss: 0.7231 - val_loss: 1.6937
Epoch 6/100
50/50 [==============================] - 5s 104ms/step - loss: 0.7101 - val_loss: 1.5575
Epoch 7/100
50/50 [==============================] - 5s 107ms/step - loss: 0.6996 - val_loss: 1.4252
Epoch 8/100
50/50 [==============================] - 5s 105ms/step - loss: 0.6916 - val_loss: 1.3239
Epoch 9/100
50/50 [==============================] - 5s 106ms/step - loss: 0.6850 - val_loss: 1.2438
Epoch 10/100
50/50 [==============================] - 5s 108ms/step - loss: 0.6798 - val_loss: 1.1900
Epoch 11/100
50/50 [==============================] - 5s 104ms/step - loss: 0.6770 - val_loss: 1.1546
Epoch 12/100
50/50 [==============================] - 5s 109ms/step - loss: 0.6733 - val_loss: 1.1301
Epoch 13/100
50/50 [==============================] - 5s 106ms/step - loss: 0.6706 - val_loss: 1.1189
Epoch 14/100
50/50 [==============================] - 5s 105ms/step - loss: 0.6695 - val_loss: 1.1140
Epoch 15/100
50/50 [==============================] - 5s 105ms/step - loss: 0.6674 - val_loss: 1.1118
Epoch 16/100
50/50 [==============================] - 6s 111ms/step - loss: 0.6657 - val_loss: 1.1095
Epoch 17/100
50/50 [==============================] - 5s 106ms/step - loss: 0.6631 - val_loss: 1.1109
Epoch 18/100
50/50 [==============================] - 5s 107ms/step - loss: 0.6600 - val_loss: 1.1072
Epoch 19/100
50/50 [==============================] - 5s 106ms/step - loss: 0.6570 - val_loss: 1.1069
Epoch 20/100
50/50 [==============================] - 5s 103ms/step - loss: 0.6504 - val_loss: 1.1031
Epoch 21/100
50/50 [==============================] - 5s 103ms/step - loss: 0.6405 - val_loss: 1.0882
Epoch 22/100

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50/50 [==============================] - 5s 104ms/step - loss: 0.6198 - val_loss: 1.0843
Epoch 23/100
50/50 [==============================] - 5s 104ms/step - loss: 0.5486 - val_loss: 0.9422
Epoch 24/100
50/50 [==============================] - 5s 103ms/step - loss: 0.4631 - val_loss: 0.8359
Epoch 25/100
50/50 [==============================] - 5s 103ms/step - loss: 0.4103 - val_loss: 0.7673
Epoch 26/100
50/50 [==============================] - 5s 105ms/step - loss: 0.3866 - val_loss: 0.7968
Epoch 27/100
50/50 [==============================] - 5s 105ms/step - loss: 0.3737 - val_loss: 0.7425
Epoch 28/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3673 - val_loss: 0.7723
Epoch 29/100
50/50 [==============================] - 5s 104ms/step - loss: 0.3571 - val_loss: 0.6865
Epoch 30/100
50/50 [==============================] - 5s 105ms/step - loss: 0.3518 - val_loss: 0.6787
Epoch 31/100
50/50 [==============================] - 5s 108ms/step - loss: 0.3438 - val_loss: 0.6636
Epoch 32/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3364 - val_loss: 0.6590
Epoch 33/100
50/50 [==============================] - 5s 103ms/step - loss: 0.3289 - val_loss: 0.6609
Epoch 34/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3218 - val_loss: 0.6890
Epoch 35/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3104 - val_loss: 0.6371
Epoch 36/100
50/50 [==============================] - 6s 114ms/step - loss: 0.3046 - val_loss: 0.6160
Epoch 37/100
50/50 [==============================] - 6s 118ms/step - loss: 0.2944 - val_loss: 0.6069
Epoch 38/100
50/50 [==============================] - 5s 107ms/step - loss: 0.2926 - val_loss: 0.5770
Epoch 39/100
50/50 [==============================] - 5s 108ms/step - loss: 0.2924 - val_loss: 0.5911
Epoch 40/100
50/50 [==============================] - 5s 102ms/step - loss: 0.2803 - val_loss: 0.5665
Epoch 41/100
50/50 [==============================] - 5s 105ms/step - loss: 0.2828 - val_loss: 0.5433
Epoch 42/100
50/50 [==============================] - 5s 103ms/step - loss: 0.2740 - val_loss: 0.5552
Epoch 43/100
50/50 [==============================] - 5s 104ms/step - loss: 0.2920 - val_loss: 0.5646
Epoch 44/100
50/50 [==============================] - 5s 103ms/step - loss: 0.2694 - val_loss: 0.7339
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Epoch 45/100
50/50 [==============================] - 5s 104ms/step - loss: 0.2803 - val_loss: 0.5827
Epoch 46/100
50/50 [==============================] - 5s 103ms/step - loss: 0.2667 - val_loss: 0.7387
Epoch 47/100
50/50 [==============================] - 5s 105ms/step - loss: 0.2660 - val_loss: 0.6505
Epoch 48/100
50/50 [==============================] - 5s 105ms/step - loss: 0.2635 - val_loss: 0.7018
Epoch 49/100
50/50 [==============================] - 5s 106ms/step - loss: 0.2616 - val_loss: 0.5658
Epoch 50/100
50/50 [==============================] - 5s 103ms/step - loss: 0.2598 - val_loss: 0.6606
Epoch 51/100
50/50 [==============================] - 5s 104ms/step - loss: 0.2607 - val_loss: 0.6938
Epoch 52/100
50/50 [==============================] - 5s 103ms/step - loss: 0.2593 - val_loss: 0.8462
Epoch 53/100
50/50 [==============================] - 5s 105ms/step - loss: 0.2580 - val_loss: 0.6936
Epoch 54/100
50/50 [==============================] - 5s 102ms/step - loss: 0.3237 - val_loss: 1.1183
Epoch 55/100
50/50 [==============================] - 5s 102ms/step - loss: 0.6694 - val_loss: 1.0901
Epoch 56/100
50/50 [==============================] - 5s 103ms/step - loss: 0.6456 - val_loss: 1.0733
Epoch 57/100
50/50 [==============================] - 5s 102ms/step - loss: 0.6280 - val_loss: 1.0548
Epoch 58/100
50/50 [==============================] - 5s 105ms/step - loss: 0.5911 - val_loss: 1.0013
Epoch 59/100
50/50 [==============================] - 5s 107ms/step - loss: 0.5012 - val_loss: 0.8752
Epoch 60/100
50/50 [==============================] - 5s 107ms/step - loss: 0.4036 - val_loss: 0.7644
Epoch 61/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3530 - val_loss: 0.7209
Epoch 62/100
50/50 [==============================] - 5s 105ms/step - loss: 0.3345 - val_loss: 0.6515
Epoch 63/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3201 - val_loss: 0.6218
Epoch 64/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3110 - val_loss: 0.6068
Epoch 65/100
50/50 [==============================] - 5s 105ms/step - loss: 0.3004 - val_loss: 0.6001
Epoch 66/100
50/50 [==============================] - 5s 104ms/step - loss: 0.2918 - val_loss: 0.5987
Epoch 67/100
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50/50 [==============================] - 5s 102ms/step - loss: 0.2863 - val_loss: 0.5810
Epoch 68/100
50/50 [==============================] - 5s 103ms/step - loss: 0.2803 - val_loss: 0.5790
Epoch 69/100
50/50 [==============================] - 5s 103ms/step - loss: 0.2762 - val_loss: 0.5540
Epoch 70/100
50/50 [==============================] - 5s 104ms/step - loss: 0.2725 - val_loss: 0.5621
Epoch 71/100
50/50 [==============================] - 5s 104ms/step - loss: 0.2693 - val_loss: 0.5754
Epoch 72/100
50/50 [==============================] - 5s 105ms/step - loss: 0.2714 - val_loss: 0.5321
Epoch 73/100
50/50 [==============================] - 5s 109ms/step - loss: 0.2671 - val_loss: 0.5306
Epoch 74/100
50/50 [==============================] - 5s 106ms/step - loss: 0.2629 - val_loss: 0.5289
Epoch 75/100
50/50 [==============================] - 5s 106ms/step - loss: 0.2829 - val_loss: 0.5272
Epoch 76/100
50/50 [==============================] - 5s 106ms/step - loss: 0.2611 - val_loss: 0.5244
Epoch 77/100
50/50 [==============================] - 5s 105ms/step - loss: 0.2601 - val_loss: 0.5181
Epoch 78/100
50/50 [==============================] - 5s 105ms/step - loss: 0.2597 - val_loss: 0.5286
Epoch 79/100
50/50 [==============================] - 5s 104ms/step - loss: 0.2570 - val_loss: 0.5039
Epoch 80/100
50/50 [==============================] - 5s 106ms/step - loss: 0.2556 - val_loss: 0.5318
Epoch 81/100
50/50 [==============================] - 5s 105ms/step - loss: 0.2584 - val_loss: 0.8690
Epoch 82/100
50/50 [==============================] - 5s 105ms/step - loss: 0.2665 - val_loss: 0.5156
Epoch 83/100
50/50 [==============================] - 5s 101ms/step - loss: 0.2557 - val_loss: 0.5084
Epoch 84/100
50/50 [==============================] - 5s 102ms/step - loss: 0.2528 - val_loss: 0.5159
Epoch 85/100
50/50 [==============================] - 5s 103ms/step - loss: 0.2538 - val_loss: 0.5078
Epoch 86/100
50/50 [==============================] - 5s 103ms/step - loss: 0.2530 - val_loss: 0.5289
Epoch 87/100
50/50 [==============================] - 5s 106ms/step - loss: 0.2551 - val_loss: 1.4701
Epoch 88/100
50/50 [==============================] - 5s 104ms/step - loss: 0.4862 - val_loss: 0.6284
Epoch 89/100
50/50 [==============================] - 5s 107ms/step - loss: 0.2704 - val_loss: 0.5160
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Epoch 90/100
50/50 [==============================] - 5s 104ms/step - loss: 0.2571 - val_loss: 0.5115
Epoch 91/100
50/50 [==============================] - 5s 105ms/step - loss: 0.2551 - val_loss: 0.5182
Epoch 92/100
50/50 [==============================] - 5s 106ms/step - loss: 0.2516 - val_loss: 0.5144
Epoch 93/100
50/50 [==============================] - 5s 109ms/step - loss: 0.2516 - val_loss: 0.5233
Epoch 94/100
50/50 [==============================] - 6s 112ms/step - loss: 0.2813 - val_loss: 0.7215
Epoch 95/100
50/50 [==============================] - 6s 112ms/step - loss: 0.2782 - val_loss: 0.5148
Epoch 96/100
50/50 [==============================] - 5s 107ms/step - loss: 0.2515 - val_loss: 0.5048
Epoch 97/100
50/50 [==============================] - 5s 104ms/step - loss: 0.2486 - val_loss: 0.5109
Epoch 98/100
50/50 [==============================] - 5s 109ms/step - loss: 0.2481 - val_loss: 0.5249
Epoch 99/100
50/50 [==============================] - 8s 151ms/step - loss: 0.2477 - val_loss: 0.5296
Epoch 100/100
50/50 [==============================] - 5s 107ms/step - loss: 0.2483 - val_loss: 0.5118

Multi-Step Training and validation loss for CA_2

Multi_step LSTM for CA_2

Tail of Multi_step LSTM for CA_2
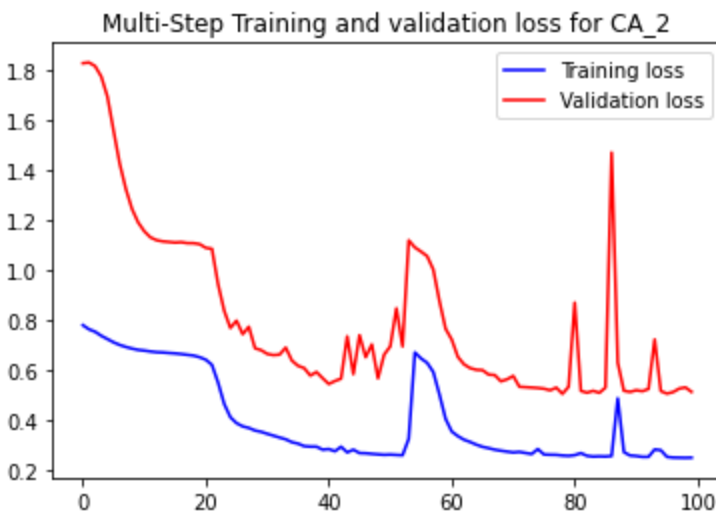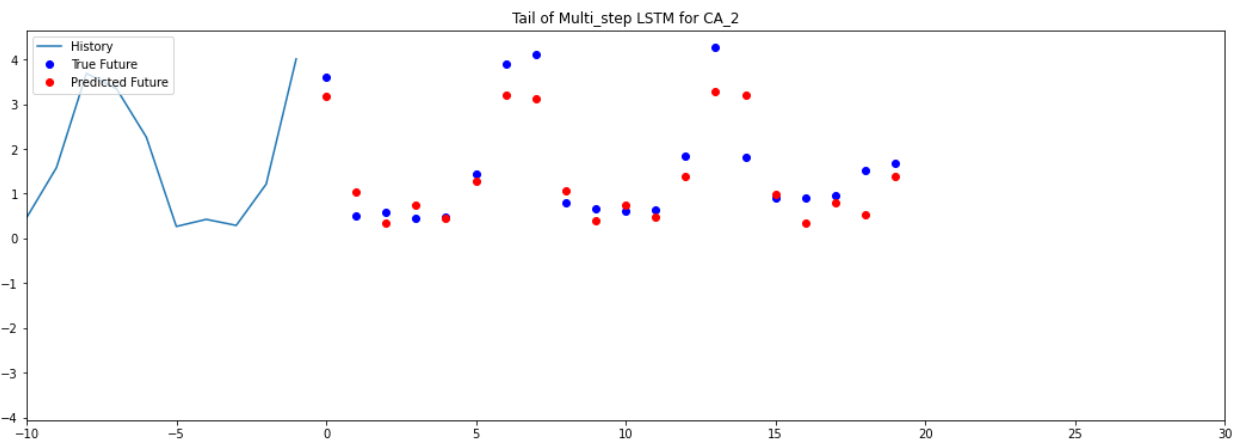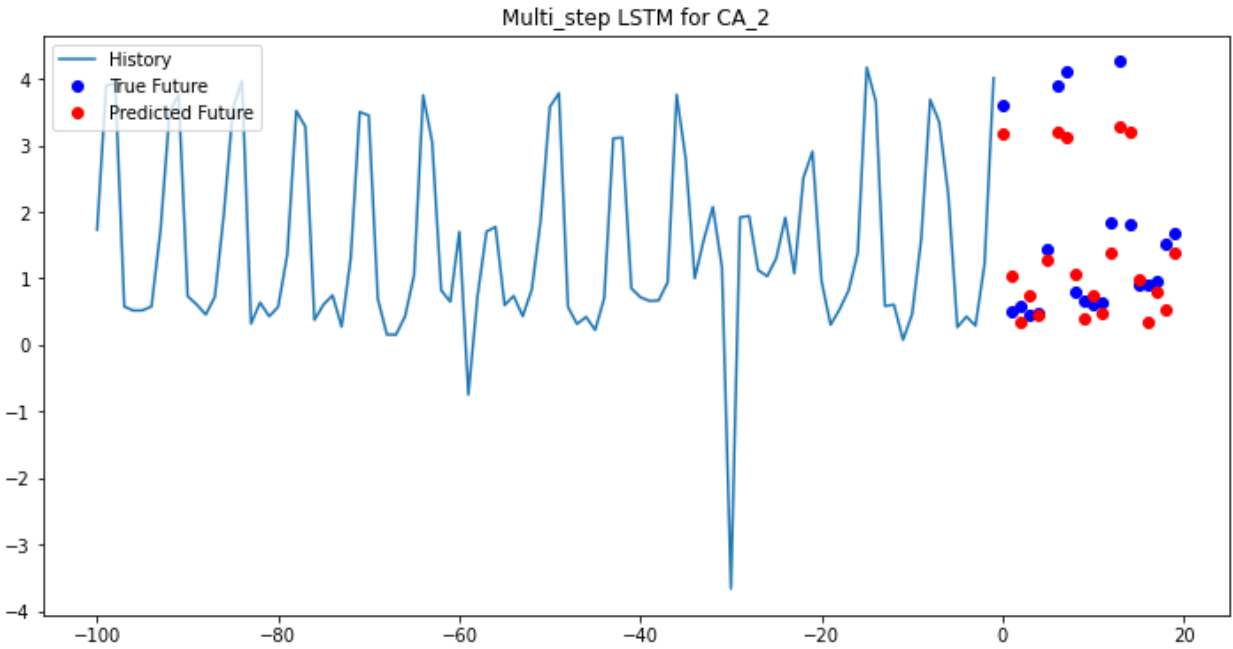
CA_2 - True Future: [5647. 3240. 3294. 3189. 3211. 3964. 5873. 6037. 3454. 3360. 3314. 3333. 4276. 6150. 4251. 3537. 3549. 3586. 4026. 4140.]

CA_2 - Model Prediction: [5313.541 3657.4272 3105.958 3427.9849 3199.7607 3841.1846 5324.6553
 5274.9062 3673.7576 3147.4614 3416.6025 3209.662 3916.0405 5387.5664
 5335.423 3610.4077 3111.4417 3469.7678 3252.45   3927.5713]

CA_2 - Model Percentage Error: [5.90506436 12.88355698 5.7086215   7.49403773 0.3500236 3.09827017
  9.33670571 12.62371625 6.36240789 6.3255528   3.09603316 3.70050677
  8.41813547 12.39729421 25.50982949 2.07542309 12.32906029 3.24127657
 19.21386112 5.13112828]%

CA_2 - Model Mean Percentage Error: 8.26002527259951%

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Training for CA_3

```
Single window of past history : (100, 4)
(72, 20)
Epoch 1/100
50/50 [==============================] - 6s 112ms/step - loss: 0.7336 - val_loss: 0.6600
Epoch 2/100
50/50 [==============================] - 5s 104ms/step - loss: 0.7259 - val_loss: 0.6558
Epoch 3/100
50/50 [==============================] - 5s 104ms/step - loss: 0.7130 - val_loss: 0.6531
Epoch 4/100
50/50 [==============================] - 6s 113ms/step - loss: 0.6923 - val_loss: 0.6494
Epoch 5/100
50/50 [==============================] - 5s 108ms/step - loss: 0.6705 - val_loss: 0.6449
Epoch 6/100
50/50 [==============================] - 6s 110ms/step - loss: 0.6499 - val_loss: 0.6415
Epoch 7/100
50/50 [==============================] - 6s 114ms/step - loss: 0.6362 - val_loss: 0.6395
Epoch 8/100
50/50 [==============================] - 6s 115ms/step - loss: 0.6276 - val_loss: 0.6392
Epoch 9/100
50/50 [==============================] - 6s 110ms/step - loss: 0.6236 - val_loss: 0.6398
Epoch 10/100
50/50 [==============================] - 5s 108ms/step - loss: 0.6210 - val_loss: 0.6409
Epoch 11/100
50/50 [==============================] - 5s 107ms/step - loss: 0.6193 - val_loss: 0.6416
Epoch 12/100
50/50 [==============================] - 5s 102ms/step - loss: 0.6184 - val_loss: 0.6419
Epoch 13/100
50/50 [==============================] - 5s 106ms/step - loss: 0.6172 - val_loss: 0.6420
Epoch 14/100
50/50 [==============================] - 5s 104ms/step - loss: 0.6168 - val_loss: 0.6413
Epoch 15/100
50/50 [==============================] - 5s 106ms/step - loss: 0.6169 - val_loss: 0.6415
Epoch 16/100
50/50 [==============================] - 5s 104ms/step - loss: 0.6151 - val_loss: 0.6408
Epoch 17/100
50/50 [==============================] - 5s 105ms/step - loss: 0.6153 - val_loss: 0.6413
Epoch 18/100
50/50 [==============================] - 5s 103ms/step - loss: 0.6156 - val_loss: 0.6406
Epoch 19/100
50/50 [==============================] - 5s 105ms/step - loss: 0.6133 - val_loss: 0.6398
Epoch 20/100
50/50 [==============================] - 5s 102ms/step - loss: 0.6140 - val_loss: 0.6396
Epoch 21/100
50/50 [==============================] - 5s 104ms/step - loss: 0.6130 - val_loss: 0.6392
Epoch 22/100
```

```
50/50 [==============================] - 5s 107ms/step - loss: 0.6125 - val_loss: 0.6393
Epoch 23/100
50/50 [==============================] - 5s 105ms/step - loss: 0.6120 - val_loss: 0.6387
Epoch 24/100
50/50 [==============================] - 5s 104ms/step - loss: 0.6124 - val_loss: 0.6383
Epoch 25/100
50/50 [==============================] - 5s 107ms/step - loss: 0.6105 - val_loss: 0.6375
Epoch 26/100
50/50 [==============================] - 5s 106ms/step - loss: 0.6100 - val_loss: 0.6374
Epoch 27/100
50/50 [==============================] - 5s 105ms/step - loss: 0.6097 - val_loss: 0.6360
Epoch 28/100
50/50 [==============================] - 8s 151ms/step - loss: 0.6087 - val_loss: 0.6369
Epoch 29/100
50/50 [==============================] - 6s 116ms/step - loss: 0.6073 - val_loss: 0.6361
Epoch 30/100
50/50 [==============================] - 5s 108ms/step - loss: 0.6063 - val_loss: 0.6353
Epoch 31/100
50/50 [==============================] - 5s 108ms/step - loss: 0.6049 - val_loss: 0.6355
Epoch 32/100
50/50 [==============================] - 5s 105ms/step - loss: 0.6031 - val_loss: 0.6350
Epoch 33/100
50/50 [==============================] - 5s 106ms/step - loss: 0.6018 - val_loss: 0.6351
Epoch 34/100
50/50 [==============================] - 5s 107ms/step - loss: 0.5999 - val_loss: 0.6340
Epoch 35/100
50/50 [==============================] - 6s 110ms/step - loss: 0.5976 - val_loss: 0.6346
Epoch 36/100
50/50 [==============================] - 5s 109ms/step - loss: 0.5963 - val_loss: 0.6326
Epoch 37/100
50/50 [==============================] - 5s 109ms/step - loss: 0.5938 - val_loss: 0.6315
Epoch 38/100
50/50 [==============================] - 5s 110ms/step - loss: 0.5911 - val_loss: 0.6350
Epoch 39/100
50/50 [==============================] - 5s 105ms/step - loss: 0.5889 - val_loss: 0.6339
Epoch 40/100
50/50 [==============================] - 5s 104ms/step - loss: 0.5851 - val_loss: 0.6276
Epoch 41/100
50/50 [==============================] - 5s 107ms/step - loss: 0.5823 - val_loss: 0.6256
Epoch 42/100
50/50 [==============================] - 5s 106ms/step - loss: 0.5772 - val_loss: 0.6200
Epoch 43/100
50/50 [==============================] - 5s 104ms/step - loss: 0.5730 - val_loss: 0.6171
Epoch 44/100
50/50 [==============================] - 5s 103ms/step - loss: 0.5631 - val_loss: 0.6114
```

```
Epoch 45/100
50/50 [==============================] - 5s 102ms/step - loss: 0.5540 - val_loss: 0.6031
Epoch 46/100
50/50 [==============================] - 5s 103ms/step - loss: 0.5371 - val_loss: 0.5813
Epoch 47/100
50/50 [==============================] - 5s 103ms/step - loss: 0.5145 - val_loss: 0.5522
Epoch 48/100
50/50 [==============================] - 5s 104ms/step - loss: 0.4892 - val_loss: 0.5131
Epoch 49/100
50/50 [==============================] - 5s 106ms/step - loss: 0.4589 - val_loss: 0.4893
Epoch 50/100
50/50 [==============================] - 6s 111ms/step - loss: 0.4313 - val_loss: 0.4360
Epoch 51/100
50/50 [==============================] - 5s 108ms/step - loss: 0.4120 - val_loss: 0.3990
Epoch 52/100
50/50 [==============================] - 5s 102ms/step - loss: 0.4009 - val_loss: 0.3905
Epoch 53/100
50/50 [==============================] - 5s 104ms/step - loss: 0.3926 - val_loss: 0.3948
Epoch 54/100
50/50 [==============================] - 5s 104ms/step - loss: 0.3891 - val_loss: 0.4029
Epoch 55/100
50/50 [==============================] - 5s 101ms/step - loss: 0.3849 - val_loss: 0.3870
Epoch 56/100
50/50 [==============================] - 5s 104ms/step - loss: 0.3835 - val_loss: 0.3973
Epoch 57/100
50/50 [==============================] - 5s 105ms/step - loss: 0.3799 - val_loss: 0.3723
Epoch 58/100
50/50 [==============================] - 5s 104ms/step - loss: 0.3785 - val_loss: 0.3815
Epoch 59/100
50/50 [==============================] - 5s 102ms/step - loss: 0.3788 - val_loss: 0.3972
Epoch 60/100
50/50 [==============================] - 5s 103ms/step - loss: 0.3706 - val_loss: 0.3829
Epoch 61/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3692 - val_loss: 0.3859
Epoch 62/100
50/50 [==============================] - 5s 104ms/step - loss: 0.3739 - val_loss: 0.3848
Epoch 63/100
50/50 [==============================] - 5s 103ms/step - loss: 0.3628 - val_loss: 0.3945
Epoch 64/100
50/50 [==============================] - 5s 102ms/step - loss: 0.3636 - val_loss: 0.3847
Epoch 65/100
50/50 [==============================] - 5s 103ms/step - loss: 0.3609 - val_loss: 0.3854
Epoch 66/100
50/50 [==============================] - 5s 102ms/step - loss: 0.3587 - val_loss: 0.4071
Epoch 67/100
```

```
50/50 [==============================] - 5s 103ms/step - loss: 0.3570 - val_loss: 0.3988
Epoch 68/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3560 - val_loss: 0.3981
Epoch 69/100
50/50 [==============================] - 5s 103ms/step - loss: 0.3505 - val_loss: 0.3936
Epoch 70/100
50/50 [==============================] - 5s 105ms/step - loss: 0.3550 - val_loss: 0.3922
Epoch 71/100
50/50 [==============================] - 5s 101ms/step - loss: 0.3453 - val_loss: 0.4057
Epoch 72/100
50/50 [==============================] - 5s 109ms/step - loss: 0.3466 - val_loss: 0.4090
Epoch 73/100
50/50 [==============================] - 5s 110ms/step - loss: 0.3441 - val_loss: 0.4089
Epoch 74/100
50/50 [==============================] - 5s 108ms/step - loss: 0.3443 - val_loss: 0.4384
Epoch 75/100
50/50 [==============================] - 5s 108ms/step - loss: 0.3387 - val_loss: 0.4393
Epoch 76/100
50/50 [==============================] - 5s 109ms/step - loss: 0.3366 - val_loss: 0.3966
Epoch 77/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3338 - val_loss: 0.4172
Epoch 78/100
50/50 [==============================] - 5s 105ms/step - loss: 0.3322 - val_loss: 0.3816
Epoch 79/100
50/50 [==============================] - 5s 103ms/step - loss: 0.3328 - val_loss: 0.4142
Epoch 80/100
50/50 [==============================] - 5s 104ms/step - loss: 0.3266 - val_loss: 0.4541
Epoch 81/100
50/50 [==============================] - 5s 103ms/step - loss: 0.3259 - val_loss: 0.4163
Epoch 82/100
50/50 [==============================] - 5s 103ms/step - loss: 0.3219 - val_loss: 0.3899
Epoch 83/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3244 - val_loss: 0.3899
Epoch 84/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3200 - val_loss: 0.4164
Epoch 85/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3199 - val_loss: 0.3874
Epoch 86/100
50/50 [==============================] - 5s 102ms/step - loss: 0.3170 - val_loss: 0.3959
Epoch 87/100
50/50 [==============================] - 5s 103ms/step - loss: 0.3144 - val_loss: 0.3789
Epoch 88/100
50/50 [==============================] - 5s 104ms/step - loss: 0.3126 - val_loss: 0.3707
Epoch 89/100
50/50 [==============================] - 5s 108ms/step - loss: 0.3104 - val_loss: 0.3896
```

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Epoch 90/100
50/50 [==============================] - 5s 102ms/step - loss: 0.3097 - val_loss: 0.4104
Epoch 91/100
50/50 [==============================] - 5s 104ms/step - loss: 0.3073 - val_loss: 0.3868
Epoch 92/100
50/50 [==============================] - 5s 105ms/step - loss: 0.3054 - val_loss: 0.3783
Epoch 93/100
50/50 [==============================] - 5s 103ms/step - loss: 0.3013 - val_loss: 0.3574
Epoch 94/100
50/50 [==============================] - 5s 103ms/step - loss: 0.3034 - val_loss: 0.3678
Epoch 95/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3023 - val_loss: 0.3923
Epoch 96/100
50/50 [==============================] - 5s 107ms/step - loss: 0.2977 - val_loss: 0.3587
Epoch 97/100
50/50 [==============================] - 5s 104ms/step - loss: 0.2994 - val_loss: 0.3899
Epoch 98/100
50/50 [==============================] - 5s 103ms/step - loss: 0.2980 - val_loss: 0.3897
Epoch 99/100
50/50 [==============================] - 5s 104ms/step - loss: 0.2988 - val_loss: 0.3835
Epoch 100/100
50/50 [==============================] - 5s 101ms/step - loss: 0.2944 - val_loss: 0.3926
```


Multi-Step Training and validation loss for CA_3

Multi_step LSTM for CA_3

Tail of Multi_step LSTM for CA_3
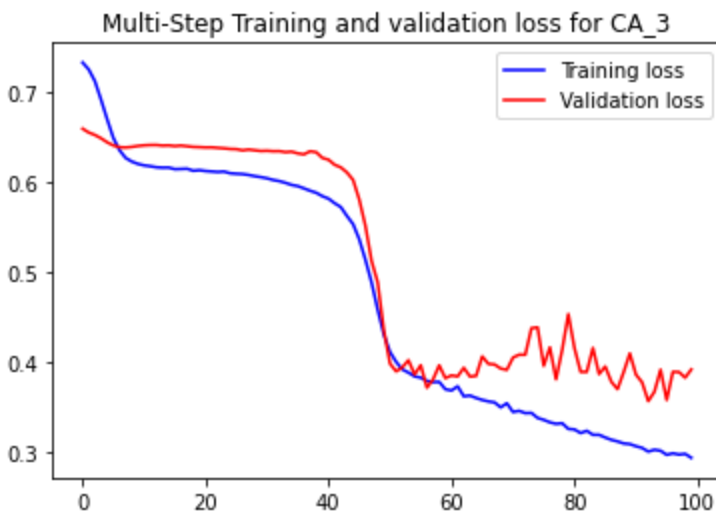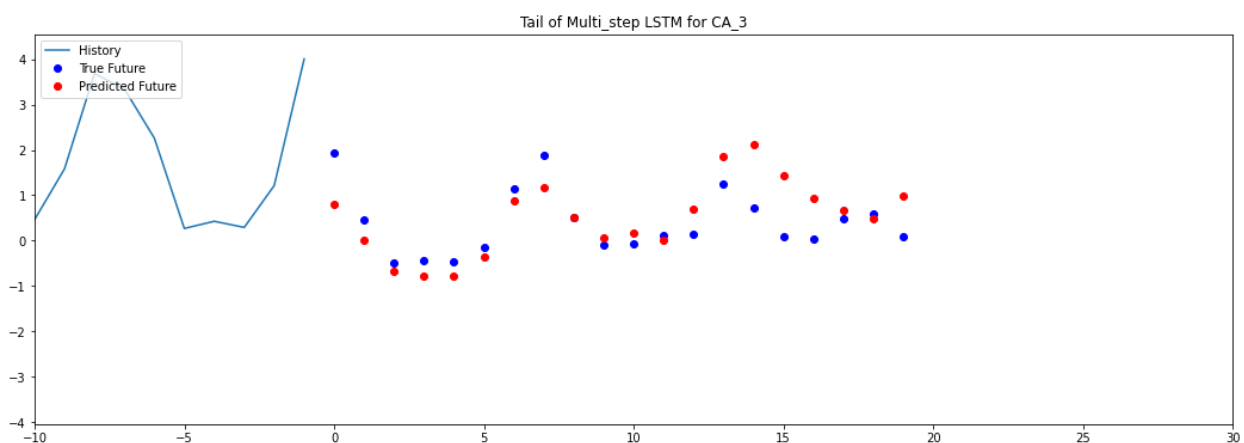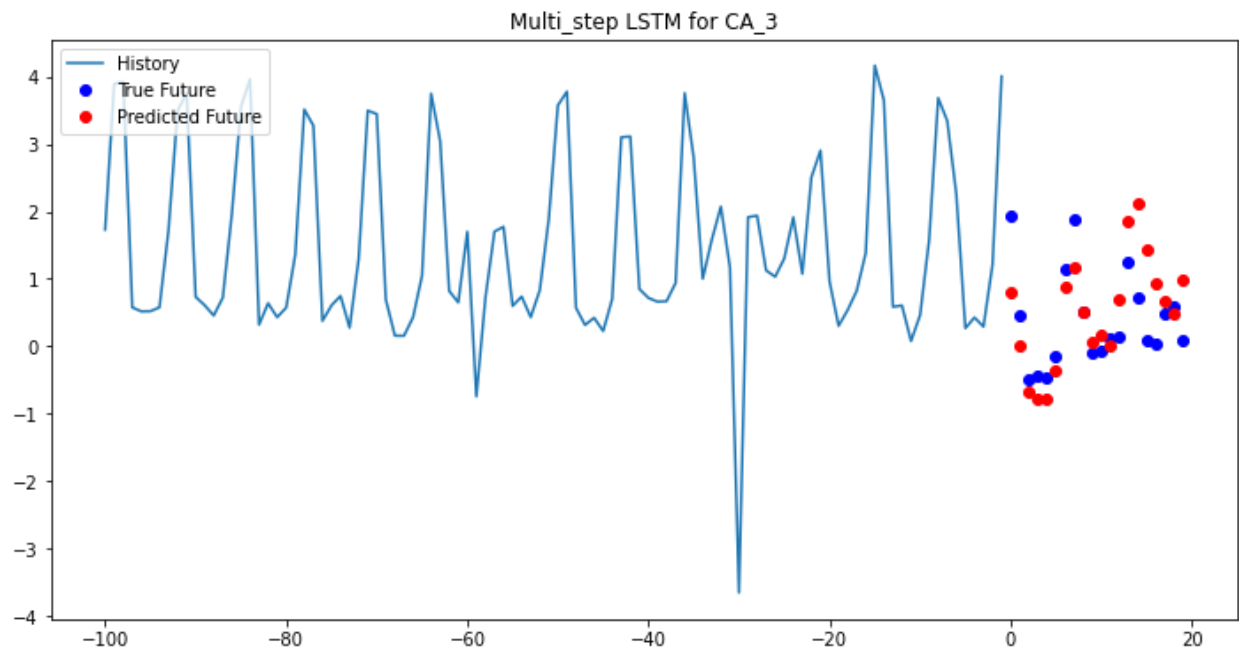
CA_3 - True Future: [8164. 6371. 5244. 5309. 5261. 5637. 7217. 8094. 6446. 5722. 5740. 5951.
 5986. 7347. 6696. 5930. 5882. 6421. 6547. 5928.]
CA_3 - Model Prediction: [6786.9824 5852.697 4994.8926 4869.213 4895.104 5379.8374
6883.545
 7231.3184 6458.1665 5891.617 6036.7383 5847.1206 6676.6167 8083.95
 8405.758 7558.4175 6948.761 6630.8765 6409.153 7013.9053]
CA_3 - Model Percentage Error: [16.86694731 8.13535116 4.75033222 8.28380315 6.95487542
4.56204715
 4.62041123 10.65828565 0.18874502 2.96429898 5.16965647 1.7455788
 11.53719845 10.0306274 25.53401751 27.46066578 18.13602908 3.26859469
 2.10550127 18.31824011]%
CA_3 - Model Mean Percentage Error: 9.564560342039146%
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===================================
Training for CA_1

Single window of past history : (100, 4)
(72, 20)
Epoch 1/100
50/50 [==============================] - 6s 113ms/step - loss: 0.7784 - val_loss: 0.7276
Epoch 2/100
50/50 [==============================] - 5s 106ms/step - loss: 0.7688 - val_loss: 0.7252
Epoch 3/100
50/50 [==============================] - 5s 106ms/step - loss: 0.7513 - val_loss: 0.7235
Epoch 4/100
50/50 [==============================] - 5s 105ms/step - loss: 0.7267 - val_loss: 0.7208
Epoch 5/100
50/50 [==============================] - 5s 106ms/step - loss: 0.7130 - val_loss: 0.7180
Epoch 6/100
50/50 [==============================] - 6s 111ms/step - loss: 0.7072 - val_loss: 0.7163
Epoch 7/100
50/50 [==============================] - 6s 115ms/step - loss: 0.7034 - val_loss: 0.7154
Epoch 8/100
50/50 [==============================] - 6s 120ms/step - loss: 0.7015 - val_loss: 0.7150
Epoch 9/100
50/50 [==============================] - 6s 129ms/step - loss: 0.7000 - val_loss: 0.7148
Epoch 10/100
50/50 [==============================] - 6s 126ms/step - loss: 0.6990 - val_loss: 0.7147
Epoch 11/100
50/50 [==============================] - 5s 110ms/step - loss: 0.6971 - val_loss: 0.7147
Epoch 12/100
50/50 [==============================] - 5s 107ms/step - loss: 0.6967 - val_loss: 0.7148
Epoch 13/100
50/50 [==============================] - 5s 107ms/step - loss: 0.6951 - val_loss: 0.7150
Epoch 14/100
50/50 [==============================] - 5s 106ms/step - loss: 0.6938 - val_loss: 0.7149
Epoch 15/100
50/50 [==============================] - 5s 105ms/step - loss: 0.6939 - val_loss: 0.7151
Epoch 16/100
50/50 [==============================] - 5s 102ms/step - loss: 0.6918 - val_loss: 0.7151
Epoch 17/100
50/50 [==============================] - 5s 103ms/step - loss: 0.6920 - val_loss: 0.7150
Epoch 18/100
50/50 [==============================] - 5s 106ms/step - loss: 0.6899 - val_loss: 0.7149
Epoch 19/100
50/50 [==============================] - 5s 106ms/step - loss: 0.6889 - val_loss: 0.7149
Epoch 20/100
50/50 [==============================] - 5s 104ms/step - loss: 0.6872 - val_loss: 0.7147
Epoch 21/100
50/50 [==============================] - 5s 107ms/step - loss: 0.6857 - val_loss: 0.7145
Epoch 22/100

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50/50 [==============================] - 5s 109ms/step - loss: 0.6828 - val_loss: 0.7141
Epoch 23/100
50/50 [==============================] - 5s 108ms/step - loss: 0.6800 - val_loss: 0.7133
Epoch 24/100
50/50 [==============================] - 5s 108ms/step - loss: 0.6756 - val_loss: 0.7121
Epoch 25/100
50/50 [==============================] - 5s 106ms/step - loss: 0.6678 - val_loss: 0.7090
Epoch 26/100
50/50 [==============================] - 5s 105ms/step - loss: 0.6567 - val_loss: 0.7029
Epoch 27/100
50/50 [==============================] - 5s 105ms/step - loss: 0.6351 - val_loss: 0.6898
Epoch 28/100
50/50 [==============================] - 5s 109ms/step - loss: 0.5890 - val_loss: 0.6284
Epoch 29/100
50/50 [==============================] - 6s 110ms/step - loss: 0.5007 - val_loss: 0.4994
Epoch 30/100
50/50 [==============================] - 5s 104ms/step - loss: 0.4360 - val_loss: 0.4359
Epoch 31/100
50/50 [==============================] - 5s 105ms/step - loss: 0.4149 - val_loss: 0.4164
Epoch 32/100
50/50 [==============================] - 5s 105ms/step - loss: 0.4075 - val_loss: 0.4353
Epoch 33/100
50/50 [==============================] - 5s 106ms/step - loss: 0.4009 - val_loss: 0.4070
Epoch 34/100
50/50 [==============================] - 5s 104ms/step - loss: 0.3982 - val_loss: 0.3998
Epoch 35/100
50/50 [==============================] - 5s 104ms/step - loss: 0.3944 - val_loss: 0.3977
Epoch 36/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3913 - val_loss: 0.4032
Epoch 37/100
50/50 [==============================] - 5s 108ms/step - loss: 0.3885 - val_loss: 0.4311
Epoch 38/100
50/50 [==============================] - 5s 105ms/step - loss: 0.3865 - val_loss: 0.3969
Epoch 39/100
50/50 [==============================] - 5s 109ms/step - loss: 0.3840 - val_loss: 0.3914
Epoch 40/100
50/50 [==============================] - 5s 109ms/step - loss: 0.3827 - val_loss: 0.3998
Epoch 41/100
50/50 [==============================] - 5s 108ms/step - loss: 0.3795 - val_loss: 0.3834
Epoch 42/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3770 - val_loss: 0.3914
Epoch 43/100
50/50 [==============================] - 5s 105ms/step - loss: 0.3760 - val_loss: 0.3846
Epoch 44/100
50/50 [==============================] - 5s 105ms/step - loss: 0.3718 - val_loss: 0.3779
```

```
Epoch 45/100
50/50 [==============================] - 5s 108ms/step - loss: 0.3715 - val_loss: 0.3835
Epoch 46/100
50/50 [==============================] - 5s 103ms/step - loss: 0.3676 - val_loss: 0.3752
Epoch 47/100
50/50 [==============================] - 5s 102ms/step - loss: 0.3651 - val_loss: 0.4155
Epoch 48/100
50/50 [==============================] - 5s 105ms/step - loss: 0.3622 - val_loss: 0.3688
Epoch 49/100
50/50 [==============================] - 5s 103ms/step - loss: 0.3584 - val_loss: 0.3753
Epoch 50/100
50/50 [==============================] - 5s 105ms/step - loss: 0.3547 - val_loss: 0.3690
Epoch 51/100
50/50 [==============================] - 5s 103ms/step - loss: 0.3529 - val_loss: 0.3687
Epoch 52/100
50/50 [==============================] - 5s 104ms/step - loss: 0.3475 - val_loss: 0.3842
Epoch 53/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3443 - val_loss: 0.4373
Epoch 54/100
50/50 [==============================] - 5s 104ms/step - loss: 0.3414 - val_loss: 0.3590
Epoch 55/100
50/50 [==============================] - 5s 104ms/step - loss: 0.3375 - val_loss: 0.3487
Epoch 56/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3337 - val_loss: 0.3503
Epoch 57/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3300 - val_loss: 0.3414
Epoch 58/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3251 - val_loss: 0.3607
Epoch 59/100
50/50 [==============================] - 5s 109ms/step - loss: 0.3243 - val_loss: 0.3441
Epoch 60/100
50/50 [==============================] - 5s 105ms/step - loss: 0.3216 - val_loss: 0.3503
Epoch 61/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3214 - val_loss: 0.3805
Epoch 62/100
50/50 [==============================] - 5s 102ms/step - loss: 0.3134 - val_loss: 0.3819
Epoch 63/100
50/50 [==============================] - 5s 103ms/step - loss: 0.3132 - val_loss: 0.3433
Epoch 64/100
50/50 [==============================] - 5s 109ms/step - loss: 0.3077 - val_loss: 0.4042
Epoch 65/100
50/50 [==============================] - 5s 109ms/step - loss: 0.3086 - val_loss: 0.3434
Epoch 66/100
50/50 [==============================] - 5s 104ms/step - loss: 0.3032 - val_loss: 0.3478
Epoch 67/100
```

```
50/50 [==============================] - 5s 107ms/step - loss: 0.3099 - val_loss: 0.3664
Epoch 68/100
50/50 [==============================] - 5s 105ms/step - loss: 0.2968 - val_loss: 0.3796
Epoch 69/100
50/50 [==============================] - 5s 106ms/step - loss: 0.2964 - val_loss: 0.3617
Epoch 70/100
50/50 [==============================] - 6s 112ms/step - loss: 0.2961 - val_loss: 0.3907
Epoch 71/100
50/50 [==============================] - 6s 110ms/step - loss: 0.2924 - val_loss: 0.3973
Epoch 72/100
50/50 [==============================] - 6s 112ms/step - loss: 0.2924 - val_loss: 0.4731
Epoch 73/100
50/50 [==============================] - 5s 109ms/step - loss: 0.2915 - val_loss: 0.4217
Epoch 74/100
50/50 [==============================] - 6s 111ms/step - loss: 0.2882 - val_loss: 0.4682
Epoch 75/100
50/50 [==============================] - 5s 106ms/step - loss: 0.2881 - val_loss: 0.4598
Epoch 76/100
50/50 [==============================] - 5s 104ms/step - loss: 0.2872 - val_loss: 0.4686
Epoch 77/100
50/50 [==============================] - 5s 106ms/step - loss: 0.4049 - val_loss: 0.4366
Epoch 78/100
50/50 [==============================] - 5s 108ms/step - loss: 0.3046 - val_loss: 0.4891
Epoch 79/100
50/50 [==============================] - 5s 106ms/step - loss: 0.2869 - val_loss: 0.4975
Epoch 80/100
50/50 [==============================] - 5s 102ms/step - loss: 0.2846 - val_loss: 0.4813
Epoch 81/100
50/50 [==============================] - 5s 104ms/step - loss: 0.2831 - val_loss: 0.4549
Epoch 82/100
50/50 [==============================] - 5s 103ms/step - loss: 0.2824 - val_loss: 0.4647
Epoch 83/100
50/50 [==============================] - 5s 104ms/step - loss: 0.2801 - val_loss: 0.4831
Epoch 84/100
50/50 [==============================] - 5s 108ms/step - loss: 0.2789 - val_loss: 0.4451
Epoch 85/100
50/50 [==============================] - 5s 105ms/step - loss: 0.2781 - val_loss: 0.4183
Epoch 86/100
50/50 [==============================] - 5s 107ms/step - loss: 0.2777 - val_loss: 0.4370
Epoch 87/100
50/50 [==============================] - 5s 106ms/step - loss: 0.2760 - val_loss: 0.4507
Epoch 88/100
50/50 [==============================] - 5s 107ms/step - loss: 0.2765 - val_loss: 0.4042
Epoch 89/100
50/50 [==============================] - 5s 105ms/step - loss: 0.2757 - val_loss: 0.4463
```

```
Epoch 90/100
50/50 [==============================] - 5s 102ms/step - loss: 0.2753 - val_loss: 0.4399
Epoch 91/100
50/50 [==============================] - 5s 102ms/step - loss: 0.2736 - val_loss: 0.4429
Epoch 92/100
50/50 [==============================] - 5s 103ms/step - loss: 0.2727 - val_loss: 0.4240
Epoch 93/100
50/50 [==============================] - 5s 104ms/step - loss: 0.2723 - val_loss: 0.3750
Epoch 94/100
50/50 [==============================] - 5s 103ms/step - loss: 0.2717 - val_loss: 0.4406
Epoch 95/100
50/50 [==============================] - 5s 103ms/step - loss: 0.2713 - val_loss: 0.4139
Epoch 96/100
50/50 [==============================] - 5s 109ms/step - loss: 0.2704 - val_loss: 0.4165
Epoch 97/100
50/50 [==============================] - 5s 105ms/step - loss: 0.2679 - val_loss: 0.4497
Epoch 98/100
50/50 [==============================] - 5s 103ms/step - loss: 0.2683 - val_loss: 0.4368
Epoch 99/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3706 - val_loss: 0.6707
Epoch 100/100
50/50 [==============================] - 5s 105ms/step - loss: 0.5213 - val_loss: 0.3992
```


Multi-Step Training and validation loss for CA_1

Multi_step LSTM for CA_1

Tail of Multi_step LSTM for CA_1
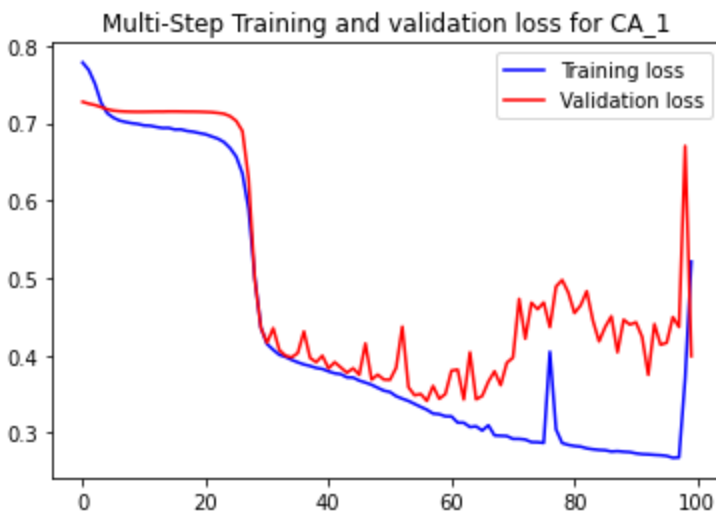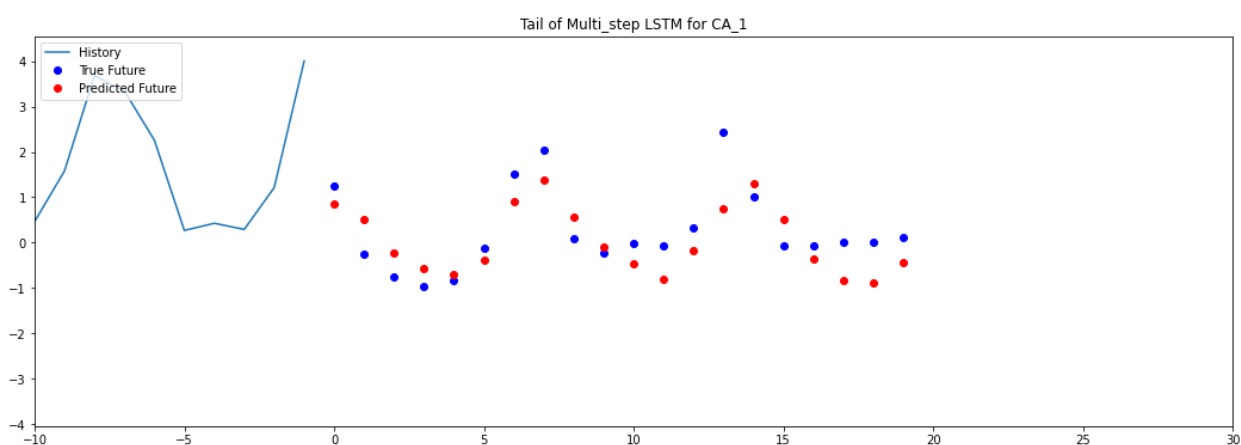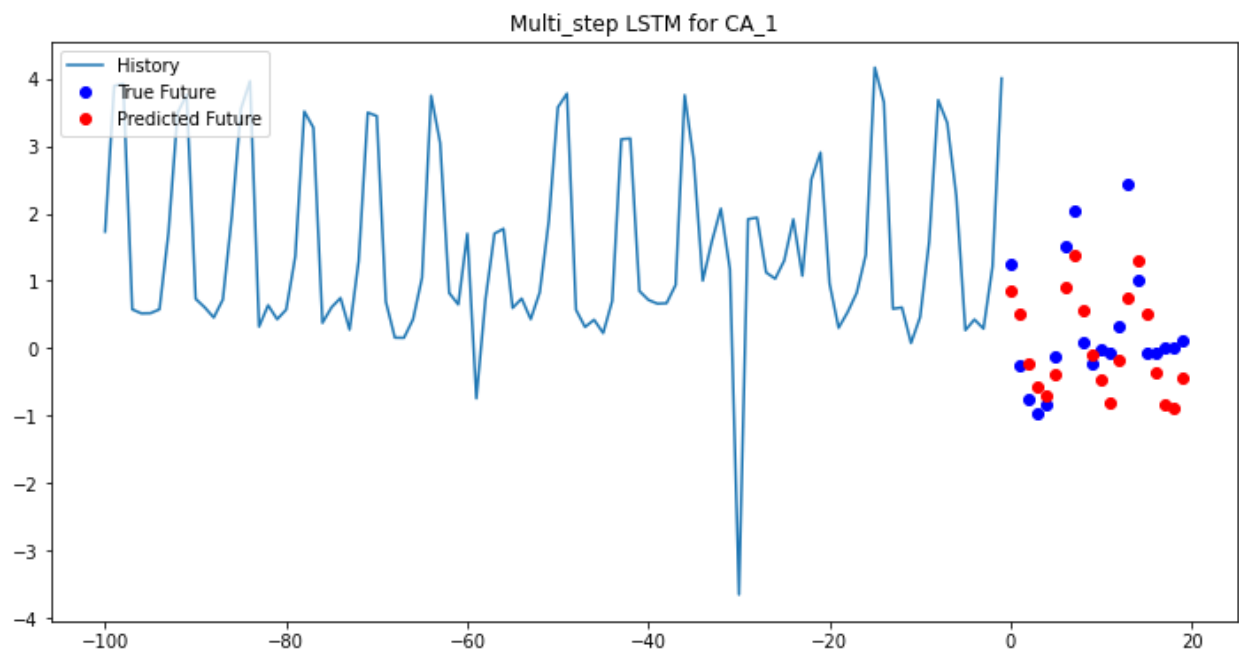
CA_1 - True Future: [5247. 3741. 3246. 3031. 3173. 3871. 5498. 6032. 4075. 3765. 3983. 3928.
 4327. 6412. 4986. 3933. 3936. 3995. 4007. 4111.]
CA_1 - Model Prediction: [4850.4917 4502.566 3779.5574 3418.2158 3289.2786 3599.0151
4887.7485
 5368.0386 4544.1133 3903.1284 3521.444 3197.5903 3825.9077 4748.0747
 5285.914 4510.405 3644.138 3156.1553 3111.242 3560.4814]
CA_1 - Model Percentage Error: [7.55685727 20.35728196 16.43738056 12.77518378 3.66462542
7.02621708
 11.09951737 11.00731807 11.51198236 3.66874948 11.58814733 18.59495081
 11.5805936 25.95017612 6.0151236 14.68102683 7.41519463 20.99736487
 22.35483046 13.3913538]%
CA_1 - Model Mean Percentage Error: 12.883693769618693%
===================================
===================================
Training for TX_1

Single window of past history : (100, 3)
(72, 20)
Epoch 1/100
50/50 [==============================] - 6s 111ms/step - loss: 0.7584 - val_loss: 0.7664
Epoch 2/100
50/50 [==============================] - 5s 103ms/step - loss: 0.7547 - val_loss: 0.7720
Epoch 3/100
50/50 [==============================] - 5s 108ms/step - loss: 0.7534 - val_loss: 0.7757
Epoch 4/100
50/50 [==============================] - 5s 105ms/step - loss: 0.7519 - val_loss: 0.7773
Epoch 5/100
50/50 [==============================] - 5s 106ms/step - loss: 0.7503 - val_loss: 0.7782
Epoch 6/100
50/50 [==============================] - 5s 107ms/step - loss: 0.7490 - val_loss: 0.7777
Epoch 7/100
50/50 [==============================] - 5s 109ms/step - loss: 0.7461 - val_loss: 0.7759
Epoch 8/100
50/50 [==============================] - 5s 108ms/step - loss: 0.7433 - val_loss: 0.7726
Epoch 9/100
50/50 [==============================] - 5s 108ms/step - loss: 0.7393 - val_loss: 0.7672
Epoch 10/100
50/50 [==============================] - 6s 111ms/step - loss: 0.7326 - val_loss: 0.7596
Epoch 11/100
50/50 [==============================] - 5s 109ms/step - loss: 0.7286 - val_loss: 0.7533
Epoch 12/100
50/50 [==============================] - 5s 108ms/step - loss: 0.7222 - val_loss: 0.7448
Epoch 13/100
50/50 [==============================] - 5s 104ms/step - loss: 0.7167 - val_loss: 0.7361
Epoch 14/100
50/50 [==============================] - 5s 106ms/step - loss: 0.7119 - val_loss: 0.7284
Epoch 15/100
50/50 [==============================] - 5s 104ms/step - loss: 0.7288 - val_loss: 0.7244
Epoch 16/100
50/50 [==============================] - 5s 105ms/step - loss: 0.7431 - val_loss: 0.7195
Epoch 17/100
50/50 [==============================] - 5s 108ms/step - loss: 0.7362 - val_loss: 0.7155
Epoch 18/100
50/50 [==============================] - 5s 107ms/step - loss: 0.7328 - val_loss: 0.7116
Epoch 19/100
50/50 [==============================] - 5s 104ms/step - loss: 0.7293 - val_loss: 0.7095
Epoch 20/100
50/50 [==============================] - 5s 108ms/step - loss: 0.7261 - val_loss: 0.7053
Epoch 21/100
50/50 [==============================] - 8s 156ms/step - loss: 0.7233 - val_loss: 0.7022
Epoch 22/100

```
50/50 [==============================] - 5s 105ms/step - loss: 0.7198 - val_loss: 0.6995
Epoch 23/100
50/50 [==============================] - 5s 106ms/step - loss: 0.7165 - val_loss: 0.6989
Epoch 24/100
50/50 [==============================] - 5s 107ms/step - loss: 0.7134 - val_loss: 0.6921
Epoch 25/100
50/50 [==============================] - 5s 109ms/step - loss: 0.7093 - val_loss: 0.6928
Epoch 26/100
50/50 [==============================] - 5s 107ms/step - loss: 0.7066 - val_loss: 0.6910
Epoch 27/100
50/50 [==============================] - 5s 106ms/step - loss: 0.7023 - val_loss: 0.6868
Epoch 28/100
50/50 [==============================] - 5s 103ms/step - loss: 0.6968 - val_loss: 0.6854
Epoch 29/100
50/50 [==============================] - 5s 105ms/step - loss: 0.6922 - val_loss: 0.6858
Epoch 30/100
50/50 [==============================] - 5s 105ms/step - loss: 0.6825 - val_loss: 0.6779
Epoch 31/100
50/50 [==============================] - 5s 105ms/step - loss: 0.6669 - val_loss: 0.6384
Epoch 32/100
50/50 [==============================] - 5s 108ms/step - loss: 0.6311 - val_loss: 0.6152
Epoch 33/100
50/50 [==============================] - 6s 110ms/step - loss: 0.5842 - val_loss: 0.5757
Epoch 34/100
50/50 [==============================] - 5s 109ms/step - loss: 0.5476 - val_loss: 0.5352
Epoch 35/100
50/50 [==============================] - 5s 106ms/step - loss: 0.5300 - val_loss: 0.5118
Epoch 36/100
50/50 [==============================] - 5s 103ms/step - loss: 0.5196 - val_loss: 0.5115
Epoch 37/100
50/50 [==============================] - 5s 104ms/step - loss: 0.5162 - val_loss: 0.5005
Epoch 38/100
50/50 [==============================] - 6s 110ms/step - loss: 0.5093 - val_loss: 0.4789
Epoch 39/100
50/50 [==============================] - 5s 106ms/step - loss: 0.5058 - val_loss: 0.4885
Epoch 40/100
50/50 [==============================] - 5s 107ms/step - loss: 0.5031 - val_loss: 0.4622
Epoch 41/100
50/50 [==============================] - 5s 106ms/step - loss: 0.4989 - val_loss: 0.4573
Epoch 42/100
50/50 [==============================] - 5s 104ms/step - loss: 0.4944 - val_loss: 0.4352
Epoch 43/100
50/50 [==============================] - 5s 107ms/step - loss: 0.4881 - val_loss: 0.5460
Epoch 44/100
50/50 [==============================] - 5s 108ms/step - loss: 0.4868 - val_loss: 0.4297
```

```
Epoch 45/100
50/50 [==============================] - 5s 106ms/step - loss: 0.4775 - val_loss: 0.4397
Epoch 46/100
50/50 [==============================] - 5s 105ms/step - loss: 0.4747 - val_loss: 0.4386
Epoch 47/100
50/50 [==============================] - 5s 104ms/step - loss: 0.4607 - val_loss: 0.4177
Epoch 48/100
50/50 [==============================] - 5s 105ms/step - loss: 0.4568 - val_loss: 0.4248
Epoch 49/100
50/50 [==============================] - 5s 107ms/step - loss: 0.4654 - val_loss: 0.6850
Epoch 50/100
50/50 [==============================] - 5s 108ms/step - loss: 0.4693 - val_loss: 0.4052
Epoch 51/100
50/50 [==============================] - 5s 108ms/step - loss: 0.4409 - val_loss: 0.3924
Epoch 52/100
50/50 [==============================] - 5s 103ms/step - loss: 0.4588 - val_loss: 0.3850
Epoch 53/100
50/50 [==============================] - 5s 108ms/step - loss: 0.4282 - val_loss: 0.3955
Epoch 54/100
50/50 [==============================] - 5s 109ms/step - loss: 0.4478 - val_loss: 0.4327
Epoch 55/100
50/50 [==============================] - 5s 106ms/step - loss: 0.4427 - val_loss: 0.4015
Epoch 56/100
50/50 [==============================] - 5s 108ms/step - loss: 0.4590 - val_loss: 0.4380
Epoch 57/100
50/50 [==============================] - 5s 106ms/step - loss: 0.4256 - val_loss: 0.3964
Epoch 58/100
50/50 [==============================] - 5s 103ms/step - loss: 0.4203 - val_loss: 0.3668
Epoch 59/100
50/50 [==============================] - 5s 104ms/step - loss: 0.4328 - val_loss: 0.3895
Epoch 60/100
50/50 [==============================] - 5s 105ms/step - loss: 0.4142 - val_loss: 0.4153
Epoch 61/100
50/50 [==============================] - 5s 106ms/step - loss: 0.4098 - val_loss: 0.3917
Epoch 62/100
50/50 [==============================] - 5s 105ms/step - loss: 0.4071 - val_loss: 0.3908
Epoch 63/100
50/50 [==============================] - 5s 106ms/step - loss: 0.6282 - val_loss: 0.5098
Epoch 64/100
50/50 [==============================] - 5s 105ms/step - loss: 0.4275 - val_loss: 0.4057
Epoch 65/100
50/50 [==============================] - 5s 108ms/step - loss: 0.4060 - val_loss: 0.4061
Epoch 66/100
50/50 [==============================] - 5s 109ms/step - loss: 0.4005 - val_loss: 0.3965
Epoch 67/100
```

```
50/50 [==============================] - 6s 113ms/step - loss: 0.3962 - val_loss: 0.3946
Epoch 68/100
50/50 [==============================] - 5s 106ms/step - loss: 0.4379 - val_loss: 0.3848
Epoch 69/100
50/50 [==============================] - 5s 108ms/step - loss: 0.3898 - val_loss: 0.4027
Epoch 70/100
50/50 [==============================] - 5s 108ms/step - loss: 0.3859 - val_loss: 0.4009
Epoch 71/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3821 - val_loss: 0.3948
Epoch 72/100
50/50 [==============================] - 5s 108ms/step - loss: 0.5779 - val_loss: 0.6724
Epoch 73/100
50/50 [==============================] - 5s 106ms/step - loss: 0.6086 - val_loss: 0.5368
Epoch 74/100
50/50 [==============================] - 5s 106ms/step - loss: 0.4371 - val_loss: 0.4163
Epoch 75/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3840 - val_loss: 0.4008
Epoch 76/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3741 - val_loss: 0.4524
Epoch 77/100
50/50 [==============================] - 5s 109ms/step - loss: 0.3705 - val_loss: 0.4184
Epoch 78/100
50/50 [==============================] - 6s 119ms/step - loss: 0.3681 - val_loss: 0.4328
Epoch 79/100
50/50 [==============================] - 5s 108ms/step - loss: 0.3669 - val_loss: 0.4462
Epoch 80/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3625 - val_loss: 0.4202
Epoch 81/100
50/50 [==============================] - 5s 109ms/step - loss: 0.3603 - val_loss: 0.4305
Epoch 82/100
50/50 [==============================] - 5s 107ms/step - loss: 0.4362 - val_loss: 0.7193
Epoch 83/100
50/50 [==============================] - 5s 107ms/step - loss: 0.6109 - val_loss: 0.6277
Epoch 84/100
50/50 [==============================] - 5s 106ms/step - loss: 0.4128 - val_loss: 0.4473
Epoch 85/100
50/50 [==============================] - 5s 108ms/step - loss: 0.3660 - val_loss: 0.4577
Epoch 86/100
50/50 [==============================] - 5s 105ms/step - loss: 0.3608 - val_loss: 0.4762
Epoch 87/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3577 - val_loss: 0.4345
Epoch 88/100
50/50 [==============================] - 5s 109ms/step - loss: 0.3555 - val_loss: 0.4484
Epoch 89/100
50/50 [==============================] - 6s 110ms/step - loss: 0.3550 - val_loss: 0.4720
```

```
Epoch 90/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3524 - val_loss: 0.3989
Epoch 91/100
50/50 [==============================] - 6s 111ms/step - loss: 0.3519 - val_loss: 0.4292
Epoch 92/100
50/50 [==============================] - 6s 113ms/step - loss: 0.3502 - val_loss: 0.3940
Epoch 93/100
50/50 [==============================] - 6s 110ms/step - loss: 0.3503 - val_loss: 0.3872
Epoch 94/100
50/50 [==============================] - 6s 111ms/step - loss: 0.3487 - val_loss: 0.3991
Epoch 95/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3486 - val_loss: 0.4137
Epoch 96/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3456 - val_loss: 0.3737
Epoch 97/100
50/50 [==============================] - 6s 110ms/step - loss: 0.3454 - val_loss: 0.4252
Epoch 98/100
50/50 [==============================] - 6s 110ms/step - loss: 0.3443 - val_loss: 0.4091
Epoch 99/100
50/50 [==============================] - 6s 111ms/step - loss: 0.3449 - val_loss: 0.3913
Epoch 100/100
50/50 [==============================] - 6s 111ms/step - loss: 0.3409 - val_loss: 0.4053
```


Multi-Step Training and validation loss for TX_1

Multi_step LSTM for TX_1

Tail of Multi_step LSTM for TX_1
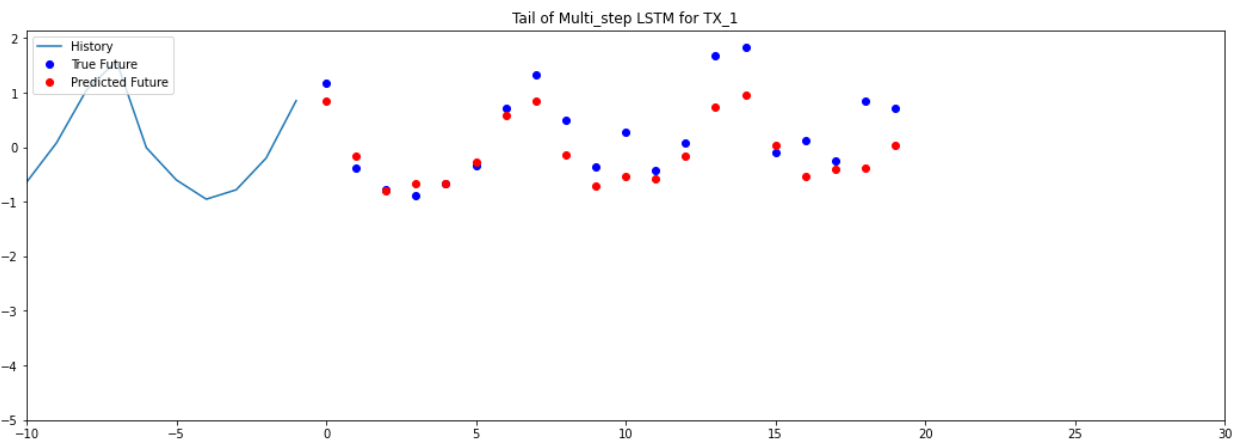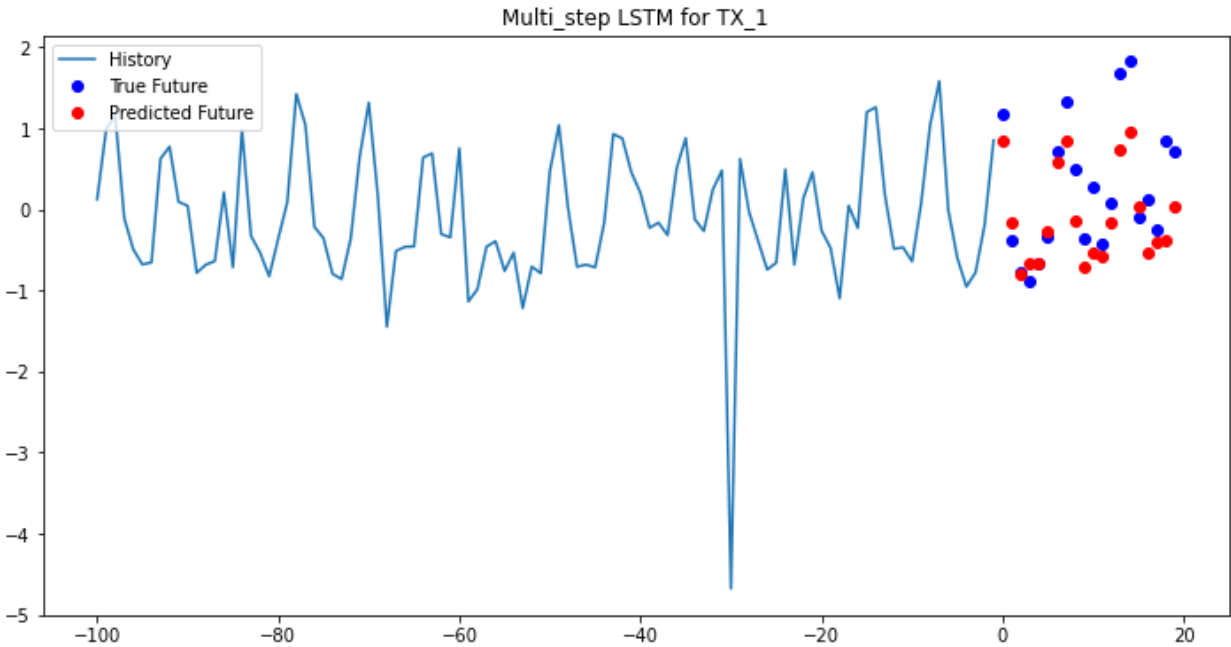
TX_1 - True Future: [3639. 2666. 2426. 2357. 2497. 2693. 3347. 3727. 3213. 2681. 3081. 2645.
 2949. 3939. 4034. 2845. 2978. 2745. 3431. 3343.]
TX_1 - Model Prediction: [3428.125 2808.8132 2417.0354 2496.0894 2492.1738 2741.574
3272.8843
 3434.0867 2813.5798 2473.269 2579.8665 2551.386 2811.7666 3364.8926
 3491.5493 2934.3496 2572.12   2655.8157 2674.4666 2921.7957]
TX_1 - Model Percentage Error: [5.79486123 5.35683542 0.36952183 5.90111818 0.19327881
1.80371239
  2.21439267 7.85922538 12.43137772 7.74826397 16.2652887   3.53928218
  4.65355709 14.57495359 13.44696786 3.14058381 13.62927746 3.24897363
 22.04994017 12.59959156]%
TX_1 - Model Mean Percentage Error: 7.841050182285872%
====================================
====================================
Training for TX_3

```
Single window of past history : (100, 3)
(72, 20)
Epoch 1/100
50/50 [==============================] - 6s 119ms/step - loss: 0.7576 - val_loss: 1.0973
Epoch 2/100
50/50 [==============================] - 6s 113ms/step - loss: 0.7485 - val_loss: 1.0808
Epoch 3/100
50/50 [==============================] - 5s 107ms/step - loss: 0.7360 - val_loss: 1.0597
Epoch 4/100
50/50 [==============================] - 6s 115ms/step - loss: 0.7172 - val_loss: 1.0272
Epoch 5/100
50/50 [==============================] - 6s 117ms/step - loss: 0.6986 - val_loss: 0.9814
Epoch 6/100
50/50 [==============================] - 6s 110ms/step - loss: 0.6788 - val_loss: 0.9208
Epoch 7/100
50/50 [==============================] - 5s 107ms/step - loss: 0.6655 - val_loss: 0.8596
Epoch 8/100
50/50 [==============================] - 5s 107ms/step - loss: 0.6541 - val_loss: 0.8061
Epoch 9/100
50/50 [==============================] - 5s 106ms/step - loss: 0.6473 - val_loss: 0.7594
Epoch 10/100
50/50 [==============================] - 6s 115ms/step - loss: 0.6408 - val_loss: 0.7253
Epoch 11/100
50/50 [==============================] - 6s 114ms/step - loss: 0.6366 - val_loss: 0.7036
Epoch 12/100
50/50 [==============================] - 5s 110ms/step - loss: 0.6326 - val_loss: 0.6892
Epoch 13/100
50/50 [==============================] - 5s 108ms/step - loss: 0.6302 - val_loss: 0.6817
Epoch 14/100
50/50 [==============================] - 6s 110ms/step - loss: 0.6282 - val_loss: 0.6903
Epoch 15/100
50/50 [==============================] - 6s 114ms/step - loss: 0.6273 - val_loss: 0.6865
Epoch 16/100
50/50 [==============================] - 6s 112ms/step - loss: 0.6250 - val_loss: 0.6906
Epoch 17/100
50/50 [==============================] - 6s 111ms/step - loss: 0.6227 - val_loss: 0.7044
Epoch 18/100
50/50 [==============================] - 5s 109ms/step - loss: 0.6221 - val_loss: 0.7013
Epoch 19/100
50/50 [==============================] - 6s 111ms/step - loss: 0.6200 - val_loss: 0.7280
Epoch 20/100
50/50 [==============================] - 6s 110ms/step - loss: 0.6180 - val_loss: 0.7213
Epoch 21/100
50/50 [==============================] - 6s 113ms/step - loss: 0.6163 - val_loss: 0.7320
Epoch 22/100
```

```
50/50 [==============================] - 5s 106ms/step - loss: 0.6128 - val_loss: 0.7462
Epoch 23/100
50/50 [==============================] - 5s 106ms/step - loss: 0.6101 - val_loss: 0.7538
Epoch 24/100
50/50 [==============================] - 5s 107ms/step - loss: 0.6038 - val_loss: 0.7432
Epoch 25/100
50/50 [==============================] - 5s 107ms/step - loss: 0.5963 - val_loss: 0.7035
Epoch 26/100
50/50 [==============================] - 5s 108ms/step - loss: 0.5860 - val_loss: 0.7137
Epoch 27/100
50/50 [==============================] - 5s 107ms/step - loss: 0.5943 - val_loss: 0.6329
Epoch 28/100
50/50 [==============================] - 5s 103ms/step - loss: 0.5397 - val_loss: 0.6621
Epoch 29/100
50/50 [==============================] - 5s 106ms/step - loss: 0.4903 - val_loss: 0.5362
Epoch 30/100
50/50 [==============================] - 7s 140ms/step - loss: 0.4595 - val_loss: 0.5416
Epoch 31/100
50/50 [==============================] - 7s 136ms/step - loss: 0.4475 - val_loss: 0.5235
Epoch 32/100
50/50 [==============================] - 6s 114ms/step - loss: 0.4395 - val_loss: 0.5743
Epoch 33/100
50/50 [==============================] - 6s 114ms/step - loss: 0.4396 - val_loss: 0.6116
Epoch 34/100
50/50 [==============================] - 6s 113ms/step - loss: 0.4351 - val_loss: 0.5164
Epoch 35/100
50/50 [==============================] - 5s 107ms/step - loss: 0.4330 - val_loss: 0.5706
Epoch 36/100
50/50 [==============================] - 5s 105ms/step - loss: 0.4297 - val_loss: 0.5342
Epoch 37/100
50/50 [==============================] - 5s 105ms/step - loss: 0.4306 - val_loss: 0.4954
Epoch 38/100
50/50 [==============================] - 5s 104ms/step - loss: 0.4274 - val_loss: 0.5512
Epoch 39/100
50/50 [==============================] - 5s 105ms/step - loss: 0.4244 - val_loss: 0.5170
Epoch 40/100
50/50 [==============================] - 5s 106ms/step - loss: 0.4226 - val_loss: 0.5200
Epoch 41/100
50/50 [==============================] - 5s 105ms/step - loss: 0.4229 - val_loss: 0.5132
Epoch 42/100
50/50 [==============================] - 5s 104ms/step - loss: 0.4198 - val_loss: 0.5295
Epoch 43/100
50/50 [==============================] - 5s 105ms/step - loss: 0.4188 - val_loss: 0.5387
Epoch 44/100
50/50 [==============================] - 5s 105ms/step - loss: 0.4149 - val_loss: 0.4929
```

```
Epoch 45/100
50/50 [==============================] - 5s 106ms/step - loss: 0.4131 - val_loss: 0.5147
Epoch 46/100
50/50 [==============================] - 6s 110ms/step - loss: 0.4107 - val_loss: 0.5158
Epoch 47/100
50/50 [==============================] - 5s 106ms/step - loss: 0.4064 - val_loss: 0.4990
Epoch 48/100
50/50 [==============================] - 5s 107ms/step - loss: 0.4053 - val_loss: 0.5071
Epoch 49/100
50/50 [==============================] - 5s 108ms/step - loss: 0.4002 - val_loss: 0.4818
Epoch 50/100
50/50 [==============================] - 5s 108ms/step - loss: 0.3996 - val_loss: 0.4746
Epoch 51/100
50/50 [==============================] - 5s 108ms/step - loss: 0.3943 - val_loss: 0.4943
Epoch 52/100
50/50 [==============================] - 5s 109ms/step - loss: 0.3907 - val_loss: 0.4485
Epoch 53/100
50/50 [==============================] - 5s 105ms/step - loss: 0.3880 - val_loss: 0.4438
Epoch 54/100
50/50 [==============================] - 5s 104ms/step - loss: 0.3836 - val_loss: 0.4788
Epoch 55/100
50/50 [==============================] - 5s 109ms/step - loss: 0.3803 - val_loss: 0.4654
Epoch 56/100
50/50 [==============================] - 5s 109ms/step - loss: 0.3785 - val_loss: 0.4586
Epoch 57/100
50/50 [==============================] - 5s 109ms/step - loss: 0.3765 - val_loss: 0.4720
Epoch 58/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3716 - val_loss: 0.4532
Epoch 59/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3699 - val_loss: 0.5414
Epoch 60/100
50/50 [==============================] - 6s 119ms/step - loss: 0.3691 - val_loss: 0.4986
Epoch 61/100
50/50 [==============================] - 6s 113ms/step - loss: 0.3639 - val_loss: 0.5552
Epoch 62/100
50/50 [==============================] - 5s 108ms/step - loss: 0.3678 - val_loss: 0.6000
Epoch 63/100
50/50 [==============================] - 5s 108ms/step - loss: 0.3627 - val_loss: 0.5234
Epoch 64/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3609 - val_loss: 0.6108
Epoch 65/100
50/50 [==============================] - 5s 104ms/step - loss: 0.3593 - val_loss: 0.5758
Epoch 66/100
50/50 [==============================] - 5s 105ms/step - loss: 0.3567 - val_loss: 0.4816
Epoch 67/100
```

```
50/50 [==============================] - 5s 106ms/step - loss: 0.3532 - val_loss: 0.5450
Epoch 68/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3551 - val_loss: 0.5288
Epoch 69/100
50/50 [==============================] - 5s 104ms/step - loss: 0.3503 - val_loss: 0.5756
Epoch 70/100
50/50 [==============================] - 5s 105ms/step - loss: 0.3506 - val_loss: 0.5252
Epoch 71/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3500 - val_loss: 0.5276
Epoch 72/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3485 - val_loss: 0.5651
Epoch 73/100
50/50 [==============================] - 5s 109ms/step - loss: 0.3466 - val_loss: 0.5300
Epoch 74/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3434 - val_loss: 0.5378
Epoch 75/100
50/50 [==============================] - 5s 103ms/step - loss: 0.3443 - val_loss: 0.5631
Epoch 76/100
50/50 [==============================] - 5s 105ms/step - loss: 0.3410 - val_loss: 0.6085
Epoch 77/100
50/50 [==============================] - 5s 102ms/step - loss: 0.3434 - val_loss: 0.5604
Epoch 78/100
50/50 [==============================] - 5s 103ms/step - loss: 0.3387 - val_loss: 0.5704
Epoch 79/100
50/50 [==============================] - 5s 109ms/step - loss: 0.3387 - val_loss: 0.5603
Epoch 80/100
50/50 [==============================] - 5s 109ms/step - loss: 0.3391 - val_loss: 0.5622
Epoch 81/100
50/50 [==============================] - 5s 109ms/step - loss: 0.3375 - val_loss: 0.5659
Epoch 82/100
50/50 [==============================] - 6s 114ms/step - loss: 0.3361 - val_loss: 0.6001
Epoch 83/100
50/50 [==============================] - 6s 112ms/step - loss: 0.3354 - val_loss: 0.5782
Epoch 84/100
50/50 [==============================] - 5s 105ms/step - loss: 0.3344 - val_loss: 0.5849
Epoch 85/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3324 - val_loss: 0.5488
Epoch 86/100
50/50 [==============================] - 5s 104ms/step - loss: 0.3308 - val_loss: 0.5798
Epoch 87/100
50/50 [==============================] - 5s 103ms/step - loss: 0.3307 - val_loss: 0.5264
Epoch 88/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3291 - val_loss: 0.5624
Epoch 89/100
50/50 [==============================] - 6s 112ms/step - loss: 0.3268 - val_loss: 0.5519
```

```
Epoch 90/100
50/50 [==============================] - 5s 108ms/step - loss: 0.3293 - val_loss: 0.5508
Epoch 91/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3282 - val_loss: 0.5461
Epoch 92/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3261 - val_loss: 0.5525
Epoch 93/100
50/50 [==============================] - 5s 103ms/step - loss: 0.3249 - val_loss: 0.5677
Epoch 94/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3232 - val_loss: 0.5017
Epoch 95/100
50/50 [==============================] - 5s 105ms/step - loss: 0.3245 - val_loss: 0.4856
Epoch 96/100
50/50 [==============================] - 5s 105ms/step - loss: 0.3205 - val_loss: 0.5298
Epoch 97/100
50/50 [==============================] - 5s 104ms/step - loss: 0.3208 - val_loss: 0.5408
Epoch 98/100
50/50 [==============================] - 5s 108ms/step - loss: 0.3209 - val_loss: 0.5631
Epoch 99/100
50/50 [==============================] - 5s 103ms/step - loss: 0.3229 - val_loss: 0.5722
Epoch 100/100
50/50 [==============================] - 5s 108ms/step - loss: 0.3167 - val_loss: 0.5616
```


Multi-Step Training and validation loss for TX_3

Multi_step LSTM for TX_3

Tail of Multi_step LSTM for TX_3
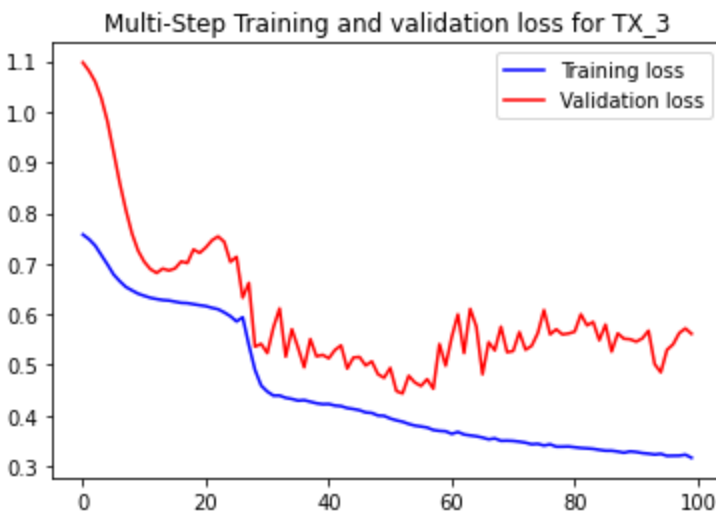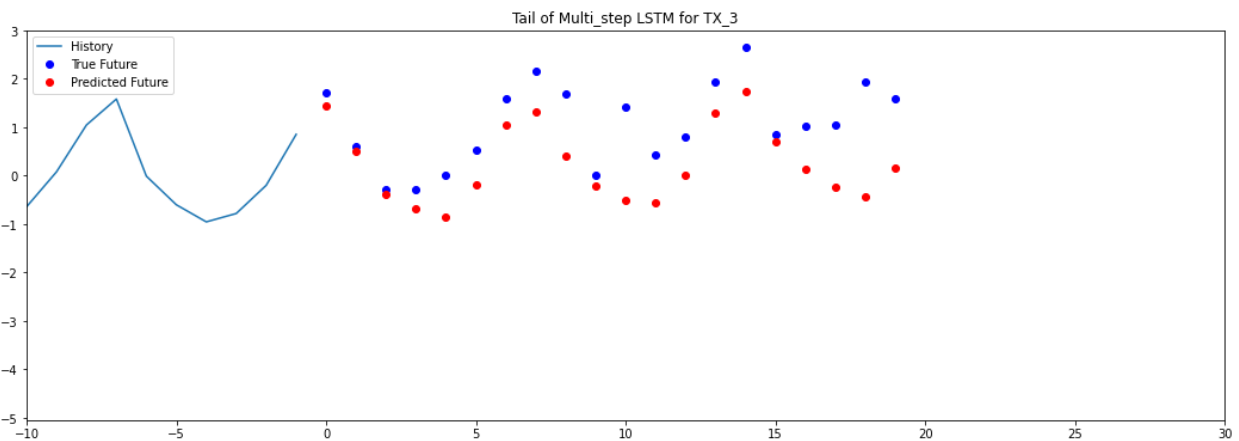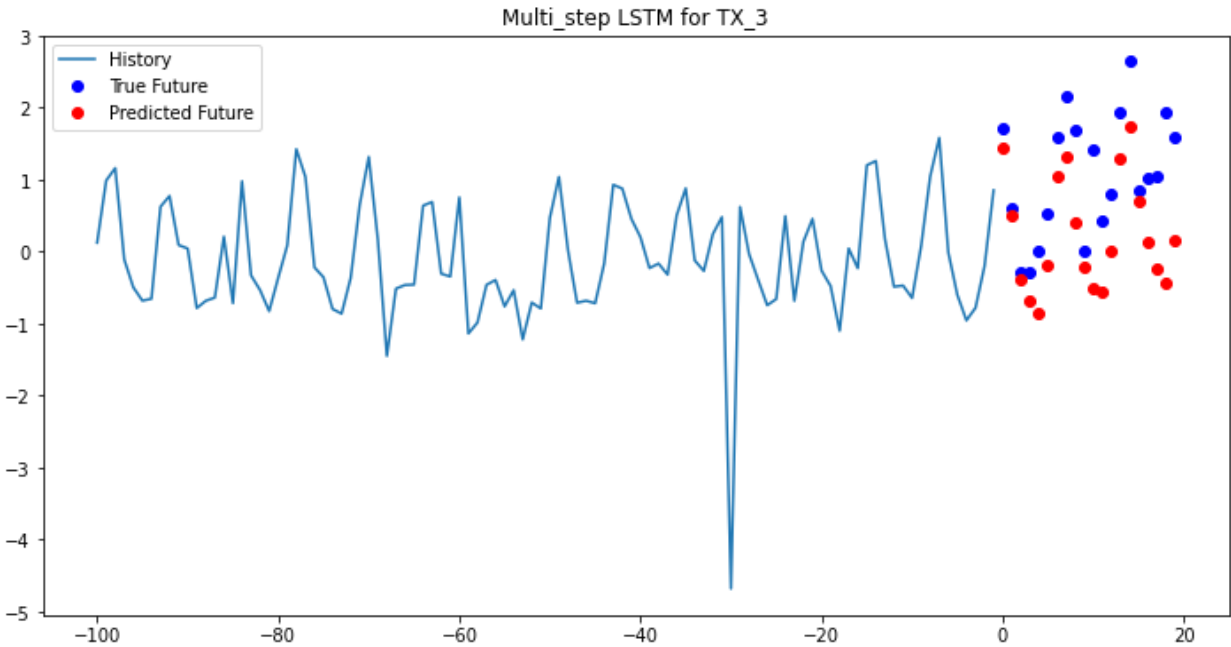
TX_3 - True Future: [4286. 3538. 2934. 2939. 3135. 3486. 4202. 4575. 4262. 3141. 4091. 3421. 3664. 4432. 4905. 3707. 3825. 3831. 4438. 4198.]

TX_3 - Model Prediction: [4092.1934 3470.323 2867.0083 2669.0627 2558.0522 2995.9424 3836.0554
 4009.5896 3394.2903 2992.3108 2787.5833 2763.1992 3134.11   3992.9517
 4291.006 3598.9226 3217.198 2965.615 2840.8413 3243.1506]

TX_3 - Model Percentage Error: [4.52185349 1.91286043 2.283289   9.18466335 18.40343713 14.05787772
  8.70881914 12.35869728 20.35921438 4.73381754 31.86059027 19.22831866
 14.46206039 9.90632536 12.51771948 2.91549481 15.89024842 22.58901096
 35.98825352 22.74533981]%

TX_3 - Model Mean Percentage Error: 14.231394555823119%

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Training for TX_2

```
Single window of past history : (100, 3)
(72, 20)
Epoch 1/100
50/50 [==============================] - 6s 116ms/step - loss: 0.7676 - val_loss: 0.6858
Epoch 2/100
50/50 [==============================] - 5s 104ms/step - loss: 0.7624 - val_loss: 0.6906
Epoch 3/100
50/50 [==============================] - 5s 104ms/step - loss: 0.7576 - val_loss: 0.6939
Epoch 4/100
50/50 [==============================] - 5s 108ms/step - loss: 0.7506 - val_loss: 0.6957
Epoch 5/100
50/50 [==============================] - 5s 109ms/step - loss: 0.7405 - val_loss: 0.6984
Epoch 6/100
50/50 [==============================] - 5s 106ms/step - loss: 0.7307 - val_loss: 0.7124
Epoch 7/100
50/50 [==============================] - 5s 109ms/step - loss: 0.7193 - val_loss: 0.7324
Epoch 8/100
50/50 [==============================] - 5s 106ms/step - loss: 0.7099 - val_loss: 0.7435
Epoch 9/100
50/50 [==============================] - 5s 106ms/step - loss: 0.7023 - val_loss: 0.7498
Epoch 10/100
50/50 [==============================] - 5s 106ms/step - loss: 0.6992 - val_loss: 0.7516
Epoch 11/100
50/50 [==============================] - 5s 107ms/step - loss: 0.6939 - val_loss: 0.7535
Epoch 12/100
50/50 [==============================] - 5s 108ms/step - loss: 0.6936 - val_loss: 0.7527
Epoch 13/100
50/50 [==============================] - 5s 107ms/step - loss: 0.6931 - val_loss: 0.7565
Epoch 14/100
50/50 [==============================] - 5s 107ms/step - loss: 0.6916 - val_loss: 0.7517
Epoch 15/100
50/50 [==============================] - 5s 109ms/step - loss: 0.6914 - val_loss: 0.7527
Epoch 16/100
50/50 [==============================] - 5s 110ms/step - loss: 0.6913 - val_loss: 0.7509
Epoch 17/100
50/50 [==============================] - 5s 109ms/step - loss: 0.6891 - val_loss: 0.7526
Epoch 18/100
50/50 [==============================] - 5s 107ms/step - loss: 0.6892 - val_loss: 0.7522
Epoch 19/100
50/50 [==============================] - 6s 112ms/step - loss: 0.6893 - val_loss: 0.7512
Epoch 20/100
50/50 [==============================] - 5s 109ms/step - loss: 0.6888 - val_loss: 0.7498
Epoch 21/100
50/50 [==============================] - 6s 111ms/step - loss: 0.6880 - val_loss: 0.7524
Epoch 22/100
```

```
50/50 [==============================] - 5s 106ms/step - loss: 0.6886 - val_loss: 0.7490
Epoch 23/100
50/50 [==============================] - 5s 107ms/step - loss: 0.6864 - val_loss: 0.7495
Epoch 24/100
50/50 [==============================] - 5s 106ms/step - loss: 0.6871 - val_loss: 0.7509
Epoch 25/100
50/50 [==============================] - 5s 105ms/step - loss: 0.6858 - val_loss: 0.7511
Epoch 26/100
50/50 [==============================] - 5s 106ms/step - loss: 0.6853 - val_loss: 0.7536
Epoch 27/100
50/50 [==============================] - 5s 105ms/step - loss: 0.6854 - val_loss: 0.7508
Epoch 28/100
50/50 [==============================] - 5s 106ms/step - loss: 0.6847 - val_loss: 0.7506
Epoch 29/100
50/50 [==============================] - 5s 106ms/step - loss: 0.6848 - val_loss: 0.7535
Epoch 30/100
50/50 [==============================] - 5s 107ms/step - loss: 0.6832 - val_loss: 0.7563
Epoch 31/100
50/50 [==============================] - 5s 107ms/step - loss: 0.6825 - val_loss: 0.7556
Epoch 32/100
50/50 [==============================] - 5s 110ms/step - loss: 0.6834 - val_loss: 0.7571
Epoch 33/100
50/50 [==============================] - 5s 108ms/step - loss: 0.6824 - val_loss: 0.7557
Epoch 34/100
50/50 [==============================] - 5s 108ms/step - loss: 0.6811 - val_loss: 0.7580
Epoch 35/100
50/50 [==============================] - 5s 108ms/step - loss: 0.6814 - val_loss: 0.7650
Epoch 36/100
50/50 [==============================] - 5s 106ms/step - loss: 0.6802 - val_loss: 0.7647
Epoch 37/100
50/50 [==============================] - 5s 108ms/step - loss: 0.6794 - val_loss: 0.7709
Epoch 38/100
50/50 [==============================] - 6s 110ms/step - loss: 0.6799 - val_loss: 0.7682
Epoch 39/100
50/50 [==============================] - 5s 107ms/step - loss: 0.6791 - val_loss: 0.7689
Epoch 40/100
50/50 [==============================] - 6s 120ms/step - loss: 0.6775 - val_loss: 0.7782
Epoch 41/100
50/50 [==============================] - 7s 140ms/step - loss: 0.6772 - val_loss: 0.7847
Epoch 42/100
50/50 [==============================] - 5s 108ms/step - loss: 0.6757 - val_loss: 0.7767
Epoch 43/100
50/50 [==============================] - 5s 108ms/step - loss: 0.6747 - val_loss: 0.7784
Epoch 44/100
50/50 [==============================] - 6s 116ms/step - loss: 0.6732 - val_loss: 0.7700
```

```
Epoch 45/100
50/50 [==============================] - 7s 139ms/step - loss: 0.6719 - val_loss: 0.7991
Epoch 46/100
50/50 [==============================] - 6s 112ms/step - loss: 0.6690 - val_loss: 0.8022
Epoch 47/100
50/50 [==============================] - 5s 109ms/step - loss: 0.6675 - val_loss: 0.8039
Epoch 48/100
50/50 [==============================] - 5s 109ms/step - loss: 0.6634 - val_loss: 0.7911
Epoch 49/100
50/50 [==============================] - 5s 109ms/step - loss: 0.6588 - val_loss: 0.7800
Epoch 50/100
50/50 [==============================] - 5s 107ms/step - loss: 0.6523 - val_loss: 0.8913
Epoch 51/100
50/50 [==============================] - 5s 107ms/step - loss: 0.6432 - val_loss: 0.7967
Epoch 52/100
50/50 [==============================] - 5s 106ms/step - loss: 0.6171 - val_loss: 0.7784
Epoch 53/100
50/50 [==============================] - 5s 109ms/step - loss: 0.5887 - val_loss: 0.7215
Epoch 54/100
50/50 [==============================] - 5s 107ms/step - loss: 0.5536 - val_loss: 0.6681
Epoch 55/100
50/50 [==============================] - 5s 107ms/step - loss: 0.5159 - val_loss: 0.6323
Epoch 56/100
50/50 [==============================] - 5s 103ms/step - loss: 0.4875 - val_loss: 0.5738
Epoch 57/100
50/50 [==============================] - 5s 103ms/step - loss: 0.4673 - val_loss: 0.5577
Epoch 58/100
50/50 [==============================] - 5s 106ms/step - loss: 0.4618 - val_loss: 0.5051
Epoch 59/100
50/50 [==============================] - 5s 107ms/step - loss: 0.4549 - val_loss: 0.5625
Epoch 60/100
50/50 [==============================] - 5s 108ms/step - loss: 0.4479 - val_loss: 0.5414
Epoch 61/100
50/50 [==============================] - 5s 105ms/step - loss: 0.4461 - val_loss: 0.5053
Epoch 62/100
50/50 [==============================] - 5s 107ms/step - loss: 0.4421 - val_loss: 0.4964
Epoch 63/100
50/50 [==============================] - 6s 111ms/step - loss: 0.4374 - val_loss: 0.5058
Epoch 64/100
50/50 [==============================] - 5s 109ms/step - loss: 0.4335 - val_loss: 0.4989
Epoch 65/100
50/50 [==============================] - 5s 107ms/step - loss: 0.4315 - val_loss: 0.6079
Epoch 66/100
50/50 [==============================] - 5s 103ms/step - loss: 0.4282 - val_loss: 0.5668
Epoch 67/100
```

```
50/50 [==============================] - 5s 107ms/step - loss: 0.4288 - val_loss: 0.5210
Epoch 68/100
50/50 [==============================] - 5s 106ms/step - loss: 0.4218 - val_loss: 0.5485
Epoch 69/100
50/50 [==============================] - 5s 104ms/step - loss: 0.4214 - val_loss: 0.4915
Epoch 70/100
50/50 [==============================] - 5s 106ms/step - loss: 0.4162 - val_loss: 0.5888
Epoch 71/100
50/50 [==============================] - 5s 109ms/step - loss: 0.4153 - val_loss: 0.4978
Epoch 72/100
50/50 [==============================] - 5s 104ms/step - loss: 0.4115 - val_loss: 0.5065
Epoch 73/100
50/50 [==============================] - 5s 103ms/step - loss: 0.4106 - val_loss: 0.5005
Epoch 74/100
50/50 [==============================] - 5s 106ms/step - loss: 0.4085 - val_loss: 0.5033
Epoch 75/100
50/50 [==============================] - 5s 107ms/step - loss: 0.4029 - val_loss: 0.5039
Epoch 76/100
50/50 [==============================] - 5s 101ms/step - loss: 0.4028 - val_loss: 0.4861
Epoch 77/100
50/50 [==============================] - 5s 105ms/step - loss: 0.4024 - val_loss: 0.5181
Epoch 78/100
50/50 [==============================] - 5s 103ms/step - loss: 0.3968 - val_loss: 0.4737
Epoch 79/100
50/50 [==============================] - 5s 105ms/step - loss: 0.3982 - val_loss: 0.4799
Epoch 80/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3899 - val_loss: 0.4814
Epoch 81/100
50/50 [==============================] - 5s 109ms/step - loss: 0.3925 - val_loss: 0.4502
Epoch 82/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3877 - val_loss: 0.4576
Epoch 83/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3859 - val_loss: 0.4801
Epoch 84/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3972 - val_loss: 0.4410
Epoch 85/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3783 - val_loss: 0.4692
Epoch 86/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3973 - val_loss: 0.5819
Epoch 87/100
50/50 [==============================] - 6s 111ms/step - loss: 0.3824 - val_loss: 0.4465
Epoch 88/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3733 - val_loss: 0.4471
Epoch 89/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3679 - val_loss: 0.4543
```

```
Epoch 90/100
50/50 [==============================] - 5s 108ms/step - loss: 0.3947 - val_loss: 0.4340
Epoch 91/100
50/50 [==============================] - 5s 108ms/step - loss: 0.3667 - val_loss: 0.4453
Epoch 92/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3643 - val_loss: 0.4605
Epoch 93/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3617 - val_loss: 0.4775
Epoch 94/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3854 - val_loss: 0.4405
Epoch 95/100
50/50 [==============================] - 6s 111ms/step - loss: 0.3582 - val_loss: 0.4435
Epoch 96/100
50/50 [==============================] - 5s 105ms/step - loss: 0.3577 - val_loss: 0.4185
Epoch 97/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3579 - val_loss: 0.4465
Epoch 98/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3716 - val_loss: 0.6616
Epoch 99/100
50/50 [==============================] - 5s 110ms/step - loss: 0.5239 - val_loss: 0.4199
Epoch 100/100
50/50 [==============================] - 5s 108ms/step - loss: 0.3630 - val_loss: 0.4407
```


Multi-Step Training and validation loss for TX_2

Multi_step LSTM for TX_2

Tail of Multi_step LSTM for TX_2
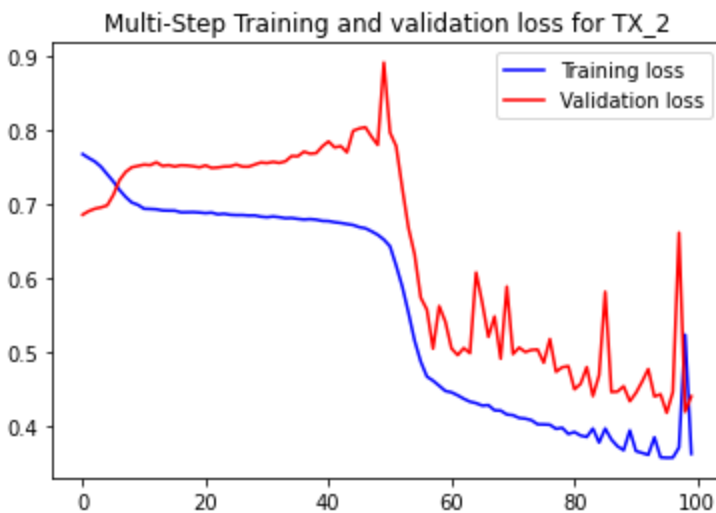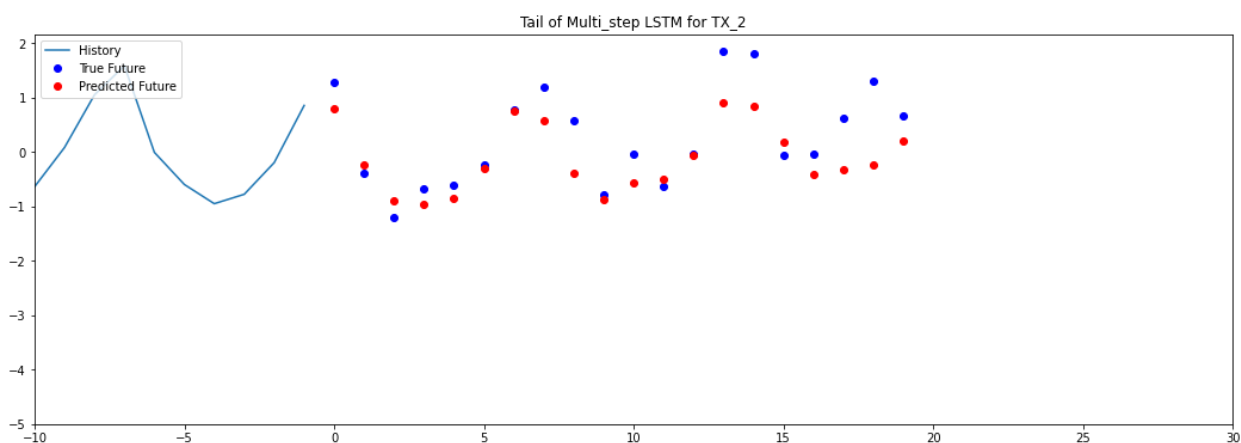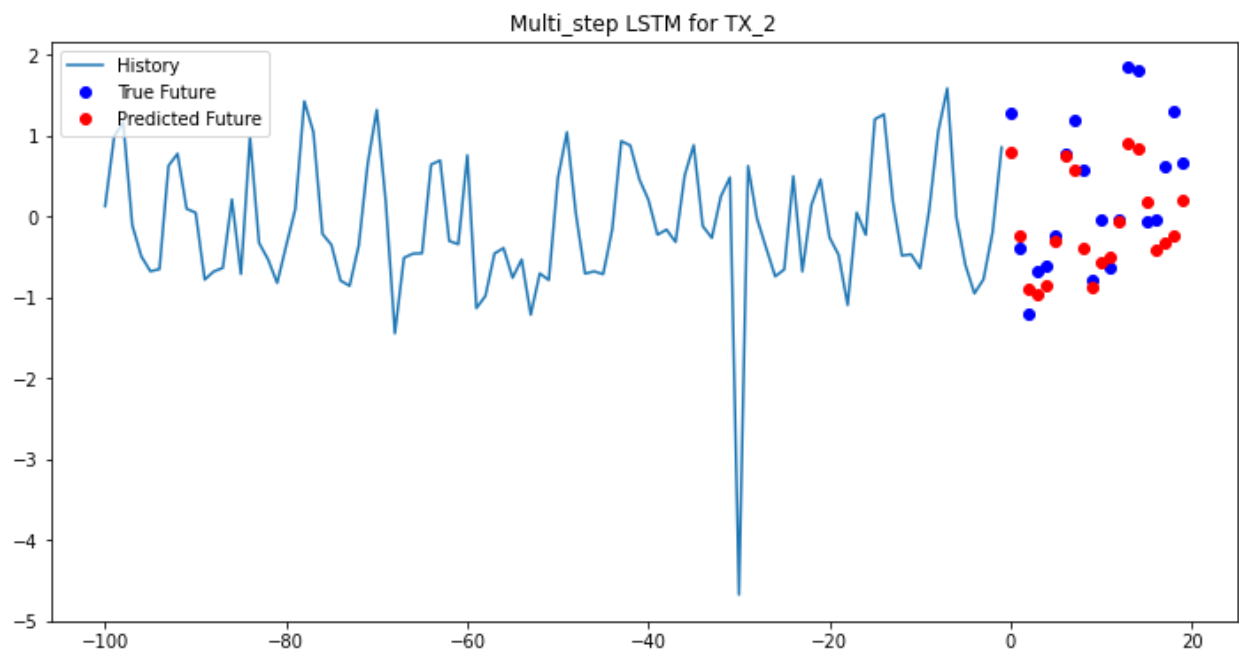
TX_2 - True Future: [4794. 3441. 2798. 3216. 3264. 3562. 4384. 4712. 4225. 3121. 3722. 3245.
 3737. 5240. 5210. 3714. 3737. 4259. 4799. 4295.]
TX_2 - Model Prediction: [4394.18   3570.4329 3041.7876 2994.8347 3081.601 3516.4492
4369.4775
 4230.718 3439.4304 3061.5737 3306.628 3352.8555 3718.9878 4487.8154
 4426.559 3899.7556 3432.8523 3493.9766 3574.6548 3917.5972]
TX_2 - Model Percentage Error: [8.34000468 3.76148972 8.71292343 6.87702995 5.58820238
1.2787979
  0.33126051 10.21396915 18.59336284 1.90407784 11.15991591 3.32374326
  0.48199644 14.35466737 15.0372537   5.00149745 8.13882004 17.96251321
 25.51250708 8.78702752]%
TX_2 - Model Mean Percentage Error: 8.768053020805878%
===================================
===================================
Training for WI_1

```
Single window of past history : (100, 3)
(72, 20)
Epoch 1/100
50/50 [==============================] - 6s 128ms/step - loss: 0.7840 - val_loss: 1.2909
Epoch 2/100
50/50 [==============================] - 5s 109ms/step - loss: 0.7040 - val_loss: 1.2158
Epoch 3/100
50/50 [==============================] - 5s 106ms/step - loss: 0.5869 - val_loss: 1.0956
Epoch 4/100
50/50 [==============================] - 5s 108ms/step - loss: 0.5293 - val_loss: 0.9627
Epoch 5/100
50/50 [==============================] - 5s 109ms/step - loss: 0.5091 - val_loss: 0.8944
Epoch 6/100
50/50 [==============================] - 5s 107ms/step - loss: 0.5035 - val_loss: 0.8575
Epoch 7/100
50/50 [==============================] - 6s 111ms/step - loss: 0.4995 - val_loss: 0.8562
Epoch 8/100
50/50 [==============================] - 6s 112ms/step - loss: 0.4980 - val_loss: 0.8573
Epoch 9/100
50/50 [==============================] - 5s 106ms/step - loss: 0.4957 - val_loss: 0.8450
Epoch 10/100
50/50 [==============================] - 5s 106ms/step - loss: 0.4968 - val_loss: 0.8473
Epoch 11/100
50/50 [==============================] - 5s 107ms/step - loss: 0.4931 - val_loss: 0.8447
Epoch 12/100
50/50 [==============================] - 5s 104ms/step - loss: 0.4945 - val_loss: 0.8397
Epoch 13/100
50/50 [==============================] - 5s 106ms/step - loss: 0.4939 - val_loss: 0.8495
Epoch 14/100
50/50 [==============================] - 5s 106ms/step - loss: 0.4931 - val_loss: 0.8376
Epoch 15/100
50/50 [==============================] - 5s 107ms/step - loss: 0.4923 - val_loss: 0.8468
Epoch 16/100
50/50 [==============================] - 5s 107ms/step - loss: 0.4925 - val_loss: 0.8397
Epoch 17/100
50/50 [==============================] - 5s 105ms/step - loss: 0.4909 - val_loss: 0.8427
Epoch 18/100
50/50 [==============================] - 5s 107ms/step - loss: 0.4915 - val_loss: 0.8428
Epoch 19/100
50/50 [==============================] - 5s 108ms/step - loss: 0.4902 - val_loss: 0.8406
Epoch 20/100
50/50 [==============================] - 5s 107ms/step - loss: 0.4912 - val_loss: 0.8296
Epoch 21/100
50/50 [==============================] - 5s 106ms/step - loss: 0.4895 - val_loss: 0.8294
Epoch 22/100
```

```
50/50 [==============================] - 5s 105ms/step - loss: 0.4883 - val_loss: 0.8265
Epoch 23/100
50/50 [==============================] - 5s 104ms/step - loss: 0.4887 - val_loss: 0.8203
Epoch 24/100
50/50 [==============================] - 5s 105ms/step - loss: 0.4862 - val_loss: 0.8181
Epoch 25/100
50/50 [==============================] - 5s 109ms/step - loss: 0.4864 - val_loss: 0.8190
Epoch 26/100
50/50 [==============================] - 6s 119ms/step - loss: 0.4860 - val_loss: 0.8154
Epoch 27/100
50/50 [==============================] - 5s 104ms/step - loss: 0.4842 - val_loss: 0.8123
Epoch 28/100
50/50 [==============================] - 5s 104ms/step - loss: 0.4831 - val_loss: 0.8099
Epoch 29/100
50/50 [==============================] - 5s 105ms/step - loss: 0.4807 - val_loss: 0.8077
Epoch 30/100
50/50 [==============================] - 5s 105ms/step - loss: 0.4789 - val_loss: 0.8178
Epoch 31/100
50/50 [==============================] - 5s 108ms/step - loss: 0.4768 - val_loss: 0.9628
Epoch 32/100
50/50 [==============================] - 5s 108ms/step - loss: 0.4736 - val_loss: 0.7803
Epoch 33/100
50/50 [==============================] - 6s 110ms/step - loss: 0.4695 - val_loss: 0.8192
Epoch 34/100
50/50 [==============================] - 6s 112ms/step - loss: 0.4555 - val_loss: 0.7255
Epoch 35/100
50/50 [==============================] - 6s 115ms/step - loss: 0.4221 - val_loss: 0.6786
Epoch 36/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3963 - val_loss: 0.7631
Epoch 37/100
50/50 [==============================] - 5s 104ms/step - loss: 0.3710 - val_loss: 0.5632
Epoch 38/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3510 - val_loss: 0.5801
Epoch 39/100
50/50 [==============================] - 5s 109ms/step - loss: 0.3395 - val_loss: 0.5179
Epoch 40/100
50/50 [==============================] - 5s 108ms/step - loss: 0.3342 - val_loss: 0.5350
Epoch 41/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3279 - val_loss: 0.5367
Epoch 42/100
50/50 [==============================] - 5s 108ms/step - loss: 0.3254 - val_loss: 0.5186
Epoch 43/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3217 - val_loss: 0.5095
Epoch 44/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3176 - val_loss: 0.4911
```

```
Epoch 45/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3143 - val_loss: 0.4951
Epoch 46/100
50/50 [==============================] - 6s 112ms/step - loss: 0.3119 - val_loss: 0.5114
Epoch 47/100
50/50 [==============================] - 6s 111ms/step - loss: 0.3087 - val_loss: 0.4696
Epoch 48/100
50/50 [==============================] - 5s 109ms/step - loss: 0.3041 - val_loss: 0.4786
Epoch 49/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3041 - val_loss: 0.4674
Epoch 50/100
50/50 [==============================] - 7s 141ms/step - loss: 0.2979 - val_loss: 0.4934
Epoch 51/100
50/50 [==============================] - 6s 116ms/step - loss: 0.2945 - val_loss: 0.5358
Epoch 52/100
50/50 [==============================] - 5s 106ms/step - loss: 0.2949 - val_loss: 0.4701
Epoch 53/100
50/50 [==============================] - 5s 109ms/step - loss: 0.2889 - val_loss: 0.4483
Epoch 54/100
50/50 [==============================] - 6s 111ms/step - loss: 0.2811 - val_loss: 0.4317
Epoch 55/100
50/50 [==============================] - 5s 107ms/step - loss: 0.2804 - val_loss: 0.4713
Epoch 56/100
50/50 [==============================] - 6s 110ms/step - loss: 0.2772 - val_loss: 0.4647
Epoch 57/100
50/50 [==============================] - 6s 122ms/step - loss: 0.2750 - val_loss: 0.4631
Epoch 58/100
50/50 [==============================] - 6s 114ms/step - loss: 0.2693 - val_loss: 0.4734
Epoch 59/100
50/50 [==============================] - 6s 114ms/step - loss: 0.2673 - val_loss: 0.4605
Epoch 60/100
50/50 [==============================] - 5s 110ms/step - loss: 0.2642 - val_loss: 0.4673
Epoch 61/100
50/50 [==============================] - 5s 110ms/step - loss: 0.2627 - val_loss: 0.4779
Epoch 62/100
50/50 [==============================] - 5s 109ms/step - loss: 0.2599 - val_loss: 0.4780
Epoch 63/100
50/50 [==============================] - 5s 109ms/step - loss: 0.2568 - val_loss: 0.5076
Epoch 64/100
50/50 [==============================] - 5s 107ms/step - loss: 0.2563 - val_loss: 0.4846
Epoch 65/100
50/50 [==============================] - 5s 104ms/step - loss: 0.2532 - val_loss: 0.4648
Epoch 66/100
50/50 [==============================] - 5s 107ms/step - loss: 0.2571 - val_loss: 0.5002
Epoch 67/100
```

```
50/50 [==============================] - 5s 107ms/step - loss: 0.2522 - val_loss: 0.4965
Epoch 68/100
50/50 [==============================] - 6s 112ms/step - loss: 0.2504 - val_loss: 0.5024
Epoch 69/100
50/50 [==============================] - 5s 109ms/step - loss: 0.2498 - val_loss: 0.5063
Epoch 70/100
50/50 [==============================] - 5s 107ms/step - loss: 0.2762 - val_loss: 0.6628
Epoch 71/100
50/50 [==============================] - 5s 107ms/step - loss: 0.2602 - val_loss: 0.5071
Epoch 72/100
50/50 [==============================] - 5s 107ms/step - loss: 0.2472 - val_loss: 0.5046
Epoch 73/100
50/50 [==============================] - 5s 108ms/step - loss: 0.2456 - val_loss: 0.5146
Epoch 74/100
50/50 [==============================] - 5s 108ms/step - loss: 0.2457 - val_loss: 0.5074
Epoch 75/100
50/50 [==============================] - 5s 105ms/step - loss: 0.2546 - val_loss: 0.5153
Epoch 76/100
50/50 [==============================] - 5s 106ms/step - loss: 0.2432 - val_loss: 0.4865
Epoch 77/100
50/50 [==============================] - 5s 108ms/step - loss: 0.2432 - val_loss: 0.5152
Epoch 78/100
50/50 [==============================] - 6s 112ms/step - loss: 0.2834 - val_loss: 0.5081
Epoch 79/100
50/50 [==============================] - 6s 111ms/step - loss: 0.2426 - val_loss: 0.5078
Epoch 80/100
50/50 [==============================] - 5s 107ms/step - loss: 0.2415 - val_loss: 0.5137
Epoch 81/100
50/50 [==============================] - 5s 107ms/step - loss: 0.2415 - val_loss: 0.5229
Epoch 82/100
50/50 [==============================] - 5s 107ms/step - loss: 0.2396 - val_loss: 0.5309
Epoch 83/100
50/50 [==============================] - 5s 106ms/step - loss: 0.2429 - val_loss: 0.5070
Epoch 84/100
50/50 [==============================] - 5s 105ms/step - loss: 0.2387 - val_loss: 0.5197
Epoch 85/100
50/50 [==============================] - 5s 108ms/step - loss: 0.2393 - val_loss: 0.5166
Epoch 86/100
50/50 [==============================] - 5s 103ms/step - loss: 0.2402 - val_loss: 0.5184
Epoch 87/100
50/50 [==============================] - 5s 103ms/step - loss: 0.2751 - val_loss: 0.7486
Epoch 88/100
50/50 [==============================] - 5s 102ms/step - loss: 0.3642 - val_loss: 0.4917
Epoch 89/100
50/50 [==============================] - 5s 104ms/step - loss: 0.2420 - val_loss: 0.5243
```

```
Epoch 90/100
50/50 [==============================] - 5s 106ms/step - loss: 0.2381 - val_loss: 0.5356
Epoch 91/100
50/50 [==============================] - 5s 106ms/step - loss: 0.2364 - val_loss: 0.5173
Epoch 92/100
50/50 [==============================] - 5s 103ms/step - loss: 0.2360 - val_loss: 0.5168
Epoch 93/100
50/50 [==============================] - 5s 105ms/step - loss: 0.2354 - val_loss: 0.5147
Epoch 94/100
50/50 [==============================] - 5s 105ms/step - loss: 0.2348 - val_loss: 0.5163
Epoch 95/100
50/50 [==============================] - 5s 105ms/step - loss: 0.2406 - val_loss: 0.5458
Epoch 96/100
50/50 [==============================] - 5s 105ms/step - loss: 0.2345 - val_loss: 0.5221
Epoch 97/100
50/50 [==============================] - 5s 105ms/step - loss: 0.2350 - val_loss: 0.5114
Epoch 98/100
50/50 [==============================] - 5s 107ms/step - loss: 0.2329 - val_loss: 0.5236
Epoch 99/100
50/50 [==============================] - 5s 105ms/step - loss: 0.2335 - val_loss: 0.5186
Epoch 100/100
50/50 [==============================] - 5s 108ms/step - loss: 0.2322 - val_loss: 0.5110
```


Multi-Step Training and validation loss for WI_1

Multi_step LSTM for WI_1

Tail of Multi_step LSTM for WI_1
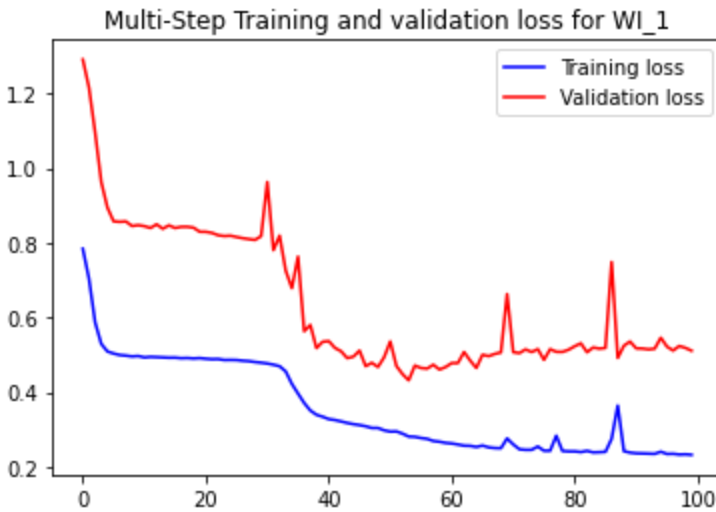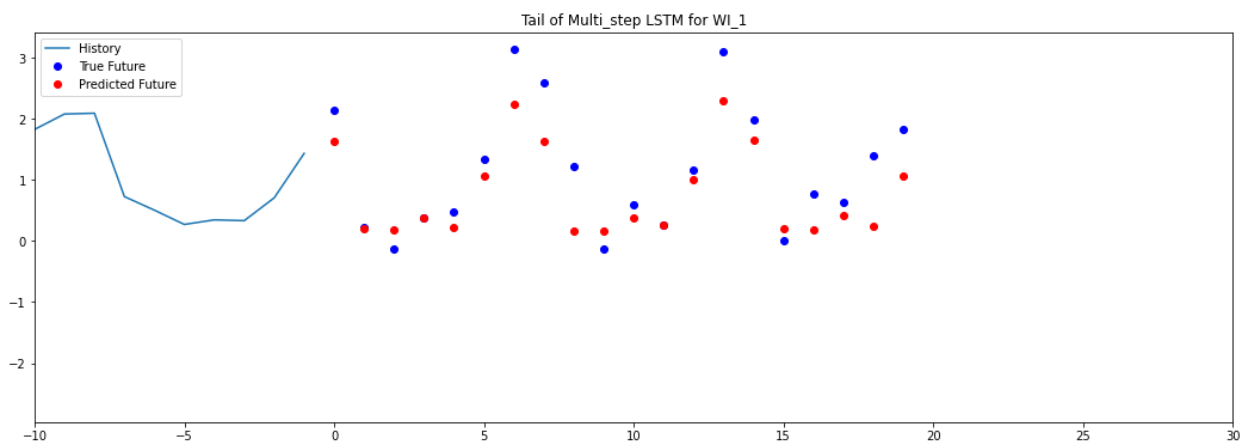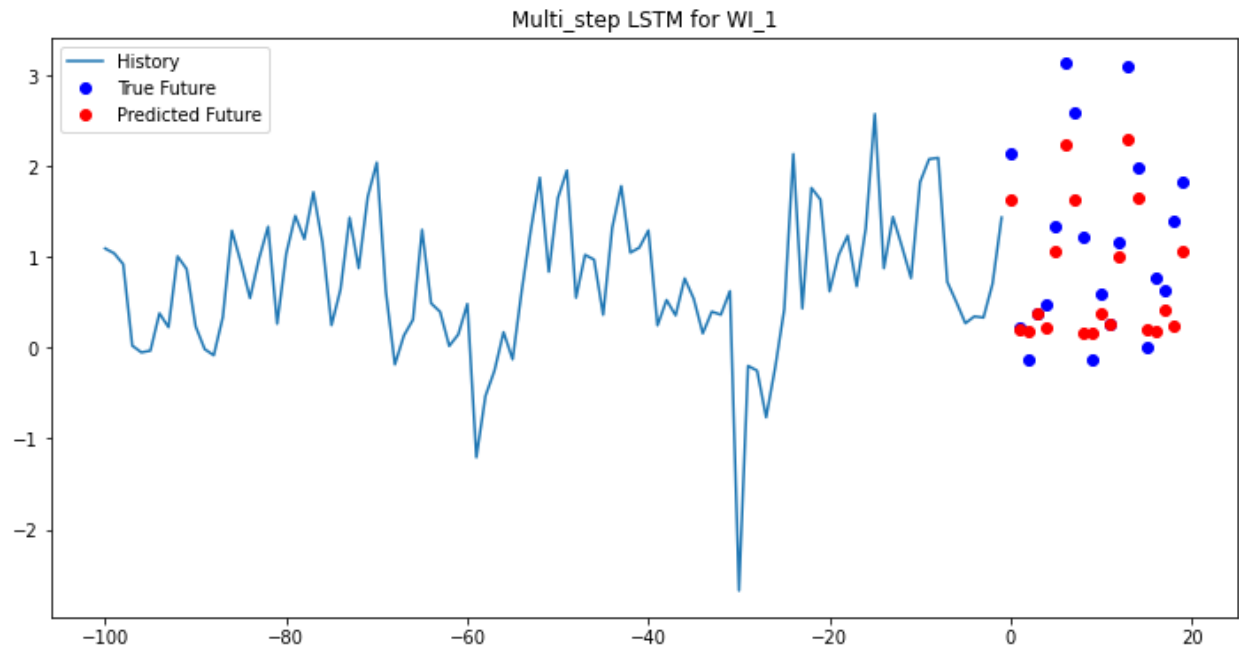
WI_1 - True Future: [4600. 2798. 2466. 2937. 3036. 3845. 5538. 5034. 3740. 2460. 3135. 2831.
 3676. 5516. 4461. 2597. 3313. 3180. 3899. 4308.]
WI_1 - Model Prediction: [4114.694 2776.4592 2747.0076 2943.0215 2784.691 3583.4358
 4697.6406
 4118.996 2731.3645 2744.4236 2949.0378 2830.9272 3534.8977 4760.2295
 4139.5234 2770.8792 2761.2266 2974.8152 2814.8943 3582.5476]
WI_1 - Model Percentage Error: [1.05501337e+01 7.69863170e-01 1.13952785e+01 2.05021599e-01
 8.27763775e+00 6.80271025e+00 1.51744199e+01 1.81764781e+01
 2.69688636e+01 1.15619343e+01 5.93180728e+00 2.56990132e-03
 3.83847375e+00 1.37014233e+01 7.20637889e+00 6.69538507e+00
 1.66547974e+01 6.45235266e+00 2.78047118e+01 1.68396563e+01]%
WI_1 - Model Mean Percentage Error: 10.75049486039006%
===================================
===================================
Training for WI_2

Single window of past history : (100, 3)
(72, 20)
Epoch 1/100
50/50 [==============================] - 6s 117ms/step - loss: 0.7766 - val_loss: 1.4268
Epoch 2/100
50/50 [==============================] - 6s 111ms/step - loss: 0.6505 - val_loss: 1.2196
Epoch 3/100
50/50 [==============================] - 5s 106ms/step - loss: 0.5217 - val_loss: 1.1672
Epoch 4/100
50/50 [==============================] - 5s 110ms/step - loss: 0.4818 - val_loss: 1.1481
Epoch 5/100
50/50 [==============================] - 5s 109ms/step - loss: 0.4746 - val_loss: 1.1497
Epoch 6/100
50/50 [==============================] - 6s 110ms/step - loss: 0.4688 - val_loss: 1.1275
Epoch 7/100
50/50 [==============================] - 6s 111ms/step - loss: 0.4562 - val_loss: 1.0761
Epoch 8/100
50/50 [==============================] - 5s 106ms/step - loss: 0.4434 - val_loss: 1.0482
Epoch 9/100
50/50 [==============================] - 5s 109ms/step - loss: 0.4294 - val_loss: 0.9955
Epoch 10/100
50/50 [==============================] - 6s 123ms/step - loss: 0.4162 - val_loss: 1.0197
Epoch 11/100
50/50 [==============================] - 6s 113ms/step - loss: 0.4099 - val_loss: 0.9881
Epoch 12/100
50/50 [==============================] - 7s 131ms/step - loss: 0.4019 - val_loss: 0.9754
Epoch 13/100
50/50 [==============================] - 6s 117ms/step - loss: 0.3954 - val_loss: 0.9700
Epoch 14/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3914 - val_loss: 0.9027
Epoch 15/100
50/50 [==============================] - 5s 104ms/step - loss: 0.3883 - val_loss: 0.8608
Epoch 16/100
50/50 [==============================] - 5s 104ms/step - loss: 0.3838 - val_loss: 0.8329
Epoch 17/100
50/50 [==============================] - 5s 101ms/step - loss: 0.3824 - val_loss: 0.8078
Epoch 18/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3794 - val_loss: 0.7896
Epoch 19/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3780 - val_loss: 0.8046
Epoch 20/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3763 - val_loss: 0.7061
Epoch 21/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3737 - val_loss: 0.7857
Epoch 22/100

```
50/50 [==============================] - 5s 106ms/step - loss: 0.3723 - val_loss: 0.8609
Epoch 23/100
50/50 [==============================] - 5s 109ms/step - loss: 0.3709 - val_loss: 1.0007
Epoch 24/100
50/50 [==============================] - 5s 110ms/step - loss: 0.3699 - val_loss: 0.7765
Epoch 25/100
50/50 [==============================] - 6s 111ms/step - loss: 0.3676 - val_loss: 0.7837
Epoch 26/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3664 - val_loss: 0.9058
Epoch 27/100
50/50 [==============================] - 5s 104ms/step - loss: 0.3641 - val_loss: 0.7979
Epoch 28/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3630 - val_loss: 0.8928
Epoch 29/100
50/50 [==============================] - 5s 110ms/step - loss: 0.3607 - val_loss: 0.8425
Epoch 30/100
50/50 [==============================] - 5s 110ms/step - loss: 0.3601 - val_loss: 0.8928
Epoch 31/100
50/50 [==============================] - 6s 115ms/step - loss: 0.3601 - val_loss: 0.8879
Epoch 32/100
50/50 [==============================] - 6s 114ms/step - loss: 0.3561 - val_loss: 0.7665
Epoch 33/100
50/50 [==============================] - 6s 110ms/step - loss: 0.3549 - val_loss: 0.8081
Epoch 34/100
50/50 [==============================] - 5s 109ms/step - loss: 0.3544 - val_loss: 0.7800
Epoch 35/100
50/50 [==============================] - 6s 111ms/step - loss: 0.3528 - val_loss: 0.7680
Epoch 36/100
50/50 [==============================] - 5s 110ms/step - loss: 0.3500 - val_loss: 0.9673
Epoch 37/100
50/50 [==============================] - 5s 109ms/step - loss: 0.3516 - val_loss: 0.7213
Epoch 38/100
50/50 [==============================] - 6s 110ms/step - loss: 0.3488 - val_loss: 0.7284
Epoch 39/100
50/50 [==============================] - 6s 111ms/step - loss: 0.3474 - val_loss: 0.9351
Epoch 40/100
50/50 [==============================] - 5s 105ms/step - loss: 0.3457 - val_loss: 0.8249
Epoch 41/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3459 - val_loss: 0.9328
Epoch 42/100
50/50 [==============================] - 5s 110ms/step - loss: 0.3434 - val_loss: 0.7981
Epoch 43/100
50/50 [==============================] - 6s 110ms/step - loss: 0.3433 - val_loss: 1.0125
Epoch 44/100
50/50 [==============================] - 5s 104ms/step - loss: 0.3419 - val_loss: 0.8511
```

```
Epoch 45/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3419 - val_loss: 0.8192
Epoch 46/100
50/50 [==============================] - 6s 111ms/step - loss: 0.3405 - val_loss: 0.8696
Epoch 47/100
50/50 [==============================] - 5s 110ms/step - loss: 0.3380 - val_loss: 0.7867
Epoch 48/100
50/50 [==============================] - 5s 109ms/step - loss: 0.3391 - val_loss: 0.9105
Epoch 49/100
50/50 [==============================] - 6s 110ms/step - loss: 0.3381 - val_loss: 0.7978
Epoch 50/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3370 - val_loss: 0.8364
Epoch 51/100
50/50 [==============================] - 6s 110ms/step - loss: 0.3358 - val_loss: 0.8484
Epoch 52/100
50/50 [==============================] - 5s 104ms/step - loss: 0.3348 - val_loss: 0.7654
Epoch 53/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3333 - val_loss: 0.7251
Epoch 54/100
50/50 [==============================] - 6s 111ms/step - loss: 0.3335 - val_loss: 0.8561
Epoch 55/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3331 - val_loss: 0.8205
Epoch 56/100
50/50 [==============================] - 5s 109ms/step - loss: 0.3317 - val_loss: 0.8663
Epoch 57/100
50/50 [==============================] - 5s 110ms/step - loss: 0.3306 - val_loss: 0.8073
Epoch 58/100
50/50 [==============================] - 5s 109ms/step - loss: 0.3297 - val_loss: 0.7318
Epoch 59/100
50/50 [==============================] - 7s 140ms/step - loss: 0.3279 - val_loss: 0.7919
Epoch 60/100
50/50 [==============================] - 6s 114ms/step - loss: 0.3283 - val_loss: 0.8481
Epoch 61/100
50/50 [==============================] - 5s 103ms/step - loss: 0.3268 - val_loss: 0.7592
Epoch 62/100
50/50 [==============================] - 5s 109ms/step - loss: 0.3255 - val_loss: 0.7916
Epoch 63/100
50/50 [==============================] - 5s 109ms/step - loss: 0.3241 - val_loss: 0.7769
Epoch 64/100
50/50 [==============================] - 6s 110ms/step - loss: 0.3222 - val_loss: 0.8423
Epoch 65/100
50/50 [==============================] - 5s 109ms/step - loss: 0.3221 - val_loss: 0.8240
Epoch 66/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3201 - val_loss: 0.7893
Epoch 67/100
```

```
50/50 [==============================] - 5s 104ms/step - loss: 0.3208 - val_loss: 0.7317
Epoch 68/100
50/50 [==============================] - 6s 117ms/step - loss: 0.3168 - val_loss: 0.8601
Epoch 69/100
50/50 [==============================] - 6s 113ms/step - loss: 0.3171 - val_loss: 0.7733
Epoch 70/100
50/50 [==============================] - 5s 103ms/step - loss: 0.3147 - val_loss: 0.7660
Epoch 71/100
50/50 [==============================] - 5s 105ms/step - loss: 0.3143 - val_loss: 0.7828
Epoch 72/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3118 - val_loss: 0.7463
Epoch 73/100
50/50 [==============================] - 5s 104ms/step - loss: 0.3114 - val_loss: 0.8107
Epoch 74/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3101 - val_loss: 0.7727
Epoch 75/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3075 - val_loss: 0.7438
Epoch 76/100
50/50 [==============================] - 5s 104ms/step - loss: 0.3069 - val_loss: 0.7272
Epoch 77/100
50/50 [==============================] - 5s 104ms/step - loss: 0.3045 - val_loss: 0.8419
Epoch 78/100
50/50 [==============================] - 5s 103ms/step - loss: 0.3040 - val_loss: 0.7493
Epoch 79/100
50/50 [==============================] - 5s 104ms/step - loss: 0.3042 - val_loss: 0.7698
Epoch 80/100
50/50 [==============================] - 5s 108ms/step - loss: 0.3015 - val_loss: 0.8406
Epoch 81/100
50/50 [==============================] - 6s 110ms/step - loss: 0.2987 - val_loss: 0.7340
Epoch 82/100
50/50 [==============================] - 5s 108ms/step - loss: 0.2991 - val_loss: 0.6923
Epoch 83/100
50/50 [==============================] - 5s 105ms/step - loss: 0.2969 - val_loss: 0.6907
Epoch 84/100
50/50 [==============================] - 5s 106ms/step - loss: 0.2955 - val_loss: 0.7705
Epoch 85/100
50/50 [==============================] - 5s 110ms/step - loss: 0.2957 - val_loss: 0.6720
Epoch 86/100
50/50 [==============================] - 5s 109ms/step - loss: 0.2930 - val_loss: 0.7015
Epoch 87/100
50/50 [==============================] - 6s 110ms/step - loss: 0.2909 - val_loss: 0.7121
Epoch 88/100
50/50 [==============================] - 6s 110ms/step - loss: 0.2919 - val_loss: 0.6783
Epoch 89/100
50/50 [==============================] - 5s 109ms/step - loss: 0.2901 - val_loss: 0.6723
```

```
Epoch 90/100
50/50 [==============================] - 6s 119ms/step - loss: 0.2907 - val_loss: 0.6595
Epoch 91/100
50/50 [==============================] - 6s 115ms/step - loss: 0.2889 - val_loss: 0.6605
Epoch 92/100
50/50 [==============================] - 6s 112ms/step - loss: 0.2882 - val_loss: 0.6758
Epoch 93/100
50/50 [==============================] - 5s 107ms/step - loss: 0.2879 - val_loss: 0.6544
Epoch 94/100
50/50 [==============================] - 5s 108ms/step - loss: 0.2866 - val_loss: 0.6468
Epoch 95/100
50/50 [==============================] - 6s 112ms/step - loss: 0.2863 - val_loss: 0.5903
Epoch 96/100
50/50 [==============================] - 6s 110ms/step - loss: 0.2850 - val_loss: 0.6508
Epoch 97/100
50/50 [==============================] - 5s 108ms/step - loss: 0.2850 - val_loss: 0.6567
Epoch 98/100
50/50 [==============================] - 6s 114ms/step - loss: 0.2846 - val_loss: 0.5950
Epoch 99/100
50/50 [==============================] - 6s 112ms/step - loss: 0.2837 - val_loss: 0.6286
Epoch 100/100
50/50 [==============================] - 6s 113ms/step - loss: 0.2827 - val_loss: 0.6476
```


Multi-Step Training and validation loss for WI_2

Multi_step LSTM for WI_2

Tail of Multi_step LSTM for WI_2
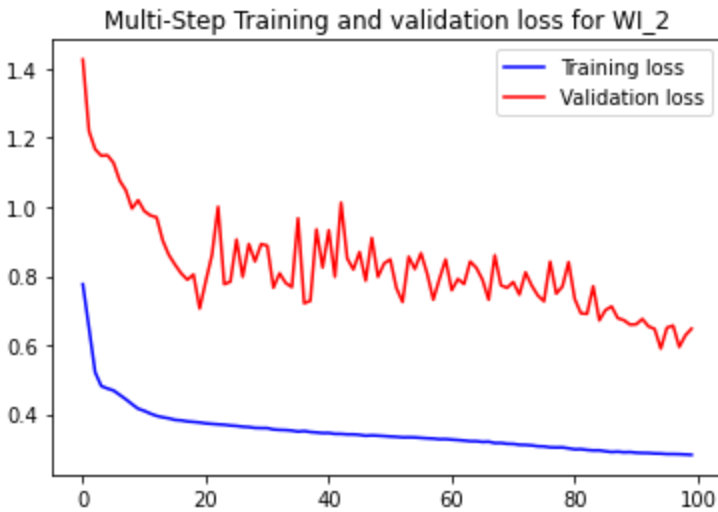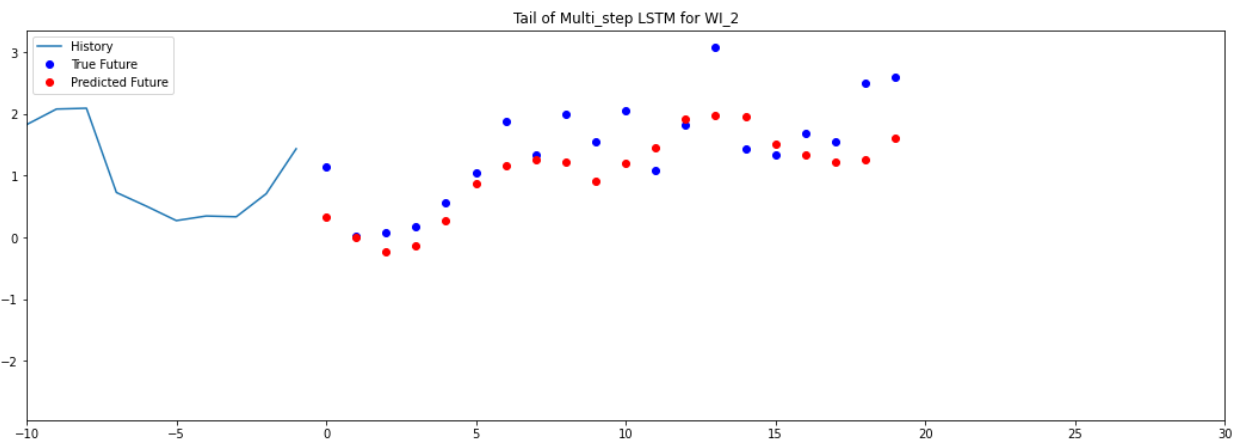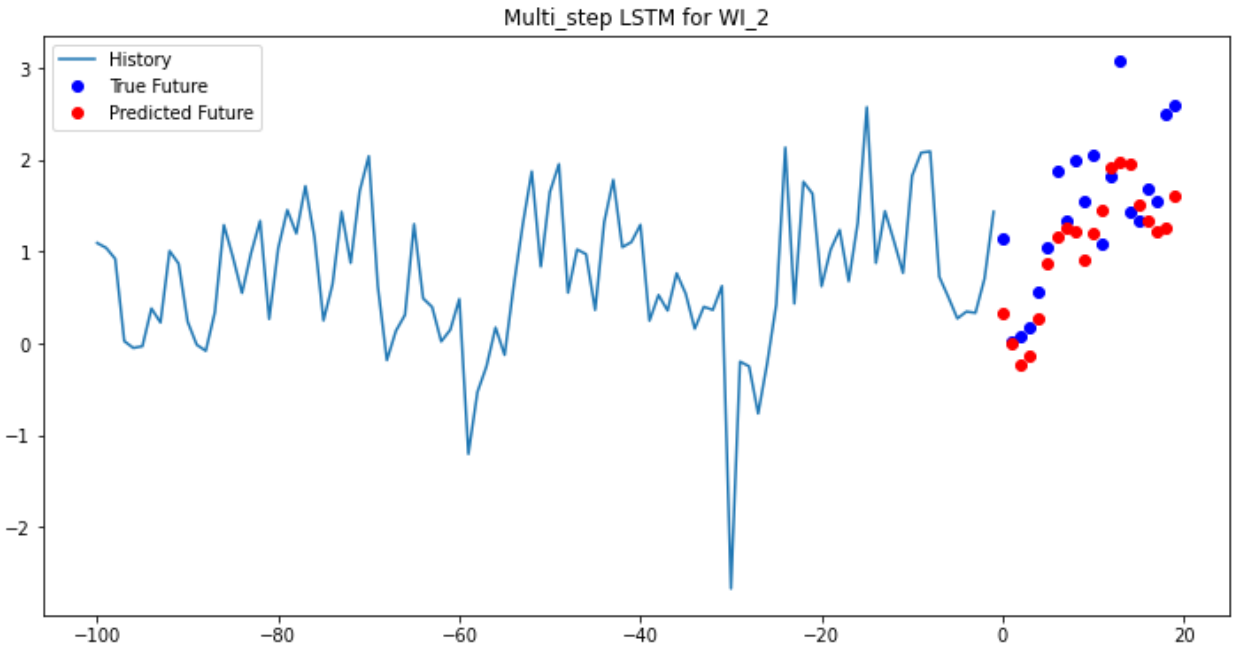
WI_2 - True Future: [4670. 3301. 3386. 3500. 3961. 4569. 5586. 4915. 5718. 5169. 5786. 4607.
5506. 7046. 5046. 4907. 5358. 5180. 6333. 6463.]

WI_2 - Model Prediction: [3673.137 3275.2886 2992.178 3102.206 3613.0015 4345.6343 4702.423
4820.1704 4773.7812 4404.26   4745.605 5066.975 5622.246 5694.3047
5667.5103 5140.2896 4924.558 4780.9062 4828.148 5255.032]

WI_2 - Model Percentage Error: [21.34610358 0.77889808 11.63089254 11.36554129 8.78562321
4.88872232
 15.81770763 1.92939145 16.51309461 14.79474239 17.98124818 9.9842652
  2.11126215 19.18386762 12.31688969 4.7542195   8.08962103 7.70451255
 23.76207249 18.69051174]%

WI_2 - Model Mean Percentage Error: 11.621459362305234%

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===================================
Training for WI_3
Single window of past history : (100, 3)

```
(72, 20)
Epoch 1/100
50/50 [==============================] - 6s 122ms/step - loss: 0.7916 - val_loss: 1.0472
Epoch 2/100
50/50 [==============================] - 5s 105ms/step - loss: 0.7807 - val_loss: 1.0953
Epoch 3/100
50/50 [==============================] - 5s 103ms/step - loss: 0.7702 - val_loss: 1.1390
Epoch 4/100
50/50 [==============================] - 5s 103ms/step - loss: 0.7617 - val_loss: 1.1380
Epoch 5/100
50/50 [==============================] - 5s 106ms/step - loss: 0.7553 - val_loss: 1.0964
Epoch 6/100
50/50 [==============================] - 5s 108ms/step - loss: 0.7433 - val_loss: 1.0510
Epoch 7/100
50/50 [==============================] - 5s 104ms/step - loss: 0.7369 - val_loss: 1.0371
Epoch 8/100
50/50 [==============================] - 5s 104ms/step - loss: 0.7277 - val_loss: 1.0205
Epoch 9/100
50/50 [==============================] - 5s 102ms/step - loss: 0.7231 - val_loss: 1.0128
Epoch 10/100
50/50 [==============================] - 5s 104ms/step - loss: 0.7154 - val_loss: 1.0098
Epoch 11/100
50/50 [==============================] - 5s 105ms/step - loss: 0.7104 - val_loss: 1.0123
Epoch 12/100
50/50 [==============================] - 5s 104ms/step - loss: 0.7051 - val_loss: 1.0074
Epoch 13/100
50/50 [==============================] - 5s 108ms/step - loss: 0.6997 - val_loss: 1.0025
Epoch 14/100
50/50 [==============================] - 5s 105ms/step - loss: 0.6936 - val_loss: 0.9968
Epoch 15/100
50/50 [==============================] - 5s 104ms/step - loss: 0.6861 - val_loss: 0.9944
Epoch 16/100
50/50 [==============================] - 5s 106ms/step - loss: 0.6775 - val_loss: 0.9864
Epoch 17/100
50/50 [==============================] - 5s 107ms/step - loss: 0.6650 - val_loss: 0.9786
Epoch 18/100
50/50 [==============================] - 5s 108ms/step - loss: 0.6564 - val_loss: 0.9644
Epoch 19/100
50/50 [==============================] - 5s 107ms/step - loss: 0.6476 - val_loss: 0.9417
Epoch 20/100
50/50 [==============================] - 5s 109ms/step - loss: 0.6380 - val_loss: 0.9204
Epoch 21/100
50/50 [==============================] - 5s 110ms/step - loss: 0.6377 - val_loss: 0.9556
Epoch 22/100
50/50 [==============================] - 6s 114ms/step - loss: 0.6481 - val_loss: 0.9129
```

```
Epoch 23/100
50/50 [==============================] - 6s 128ms/step - loss: 0.6290 - val_loss: 0.8906
Epoch 24/100
50/50 [==============================] - 6s 129ms/step - loss: 0.6209 - val_loss: 0.8862
Epoch 25/100
50/50 [==============================] - 6s 118ms/step - loss: 0.6144 - val_loss: 0.8603
Epoch 26/100
50/50 [==============================] - 5s 108ms/step - loss: 0.6113 - val_loss: 0.8569
Epoch 27/100
50/50 [==============================] - 5s 108ms/step - loss: 0.6072 - val_loss: 0.8477
Epoch 28/100
50/50 [==============================] - 6s 113ms/step - loss: 0.6049 - val_loss: 0.8301
Epoch 29/100
50/50 [==============================] - 6s 111ms/step - loss: 0.6028 - val_loss: 0.8171
Epoch 30/100
50/50 [==============================] - 6s 111ms/step - loss: 0.5999 - val_loss: 0.8262
Epoch 31/100
50/50 [==============================] - 5s 109ms/step - loss: 0.5971 - val_loss: 0.7907
Epoch 32/100
50/50 [==============================] - 6s 111ms/step - loss: 0.5935 - val_loss: 0.8250
Epoch 33/100
50/50 [==============================] - 5s 110ms/step - loss: 0.5930 - val_loss: 0.8077
Epoch 34/100
50/50 [==============================] - 5s 108ms/step - loss: 0.5850 - val_loss: 0.7945
Epoch 35/100
50/50 [==============================] - 5s 110ms/step - loss: 0.5778 - val_loss: 0.8062
Epoch 36/100
50/50 [==============================] - 5s 106ms/step - loss: 0.5684 - val_loss: 0.7799
Epoch 37/100
50/50 [==============================] - 5s 105ms/step - loss: 0.5512 - val_loss: 0.7260
Epoch 38/100
50/50 [==============================] - 5s 106ms/step - loss: 0.5264 - val_loss: 0.7542
Epoch 39/100
50/50 [==============================] - 6s 110ms/step - loss: 0.5015 - val_loss: 0.6932
Epoch 40/100
50/50 [==============================] - 6s 111ms/step - loss: 0.4809 - val_loss: 0.6345
Epoch 41/100
50/50 [==============================] - 5s 109ms/step - loss: 0.4587 - val_loss: 0.7287
Epoch 42/100
50/50 [==============================] - 5s 106ms/step - loss: 0.4457 - val_loss: 0.6691
Epoch 43/100
50/50 [==============================] - 5s 109ms/step - loss: 0.4332 - val_loss: 0.6207
Epoch 44/100
50/50 [==============================] - 6s 117ms/step - loss: 0.4250 - val_loss: 0.5914
Epoch 45/100
```

```
50/50 [==============================] - 5s 107ms/step - loss: 0.4237 - val_loss: 0.5862
Epoch 46/100
50/50 [==============================] - 5s 104ms/step - loss: 0.4191 - val_loss: 0.6612
Epoch 47/100
50/50 [==============================] - 5s 105ms/step - loss: 0.4174 - val_loss: 0.6029
Epoch 48/100
50/50 [==============================] - 5s 107ms/step - loss: 0.4158 - val_loss: 0.6098
Epoch 49/100
50/50 [==============================] - 5s 103ms/step - loss: 0.4141 - val_loss: 0.5699
Epoch 50/100
50/50 [==============================] - 5s 108ms/step - loss: 0.4103 - val_loss: 0.6024
Epoch 51/100
50/50 [==============================] - 6s 110ms/step - loss: 0.4113 - val_loss: 0.6008
Epoch 52/100
50/50 [==============================] - 6s 110ms/step - loss: 0.4090 - val_loss: 0.5856
Epoch 53/100
50/50 [==============================] - 6s 110ms/step - loss: 0.4079 - val_loss: 0.5898
Epoch 54/100
50/50 [==============================] - 6s 110ms/step - loss: 0.4063 - val_loss: 0.5888
Epoch 55/100
50/50 [==============================] - 5s 109ms/step - loss: 0.4051 - val_loss: 0.5878
Epoch 56/100
50/50 [==============================] - 5s 108ms/step - loss: 0.4021 - val_loss: 0.6140
Epoch 57/100
50/50 [==============================] - 5s 108ms/step - loss: 0.4028 - val_loss: 0.5516
Epoch 58/100
50/50 [==============================] - 5s 110ms/step - loss: 0.3988 - val_loss: 0.5767
Epoch 59/100
50/50 [==============================] - 6s 111ms/step - loss: 0.4016 - val_loss: 0.6006
Epoch 60/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3955 - val_loss: 0.5582
Epoch 61/100
50/50 [==============================] - 5s 109ms/step - loss: 0.3967 - val_loss: 0.5963
Epoch 62/100
50/50 [==============================] - 6s 111ms/step - loss: 0.3948 - val_loss: 0.5332
Epoch 63/100
50/50 [==============================] - 5s 105ms/step - loss: 0.3954 - val_loss: 0.5801
Epoch 64/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3921 - val_loss: 0.5505
Epoch 65/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3916 - val_loss: 0.5609
Epoch 66/100
50/50 [==============================] - 5s 108ms/step - loss: 0.3893 - val_loss: 0.5705
Epoch 67/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3878 - val_loss: 0.5713
```

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Epoch 68/100
50/50 [==============================] - 7s 149ms/step - loss: 0.3881 - val_loss: 0.5686
Epoch 69/100
50/50 [==============================] - 5s 103ms/step - loss: 0.3880 - val_loss: 0.6327
Epoch 70/100
50/50 [==============================] - 5s 101ms/step - loss: 0.3864 - val_loss: 0.5877
Epoch 71/100
50/50 [==============================] - 5s 103ms/step - loss: 0.3826 - val_loss: 0.5889
Epoch 72/100
50/50 [==============================] - 5s 104ms/step - loss: 0.3828 - val_loss: 0.5331
Epoch 73/100
50/50 [==============================] - 5s 100ms/step - loss: 0.3820 - val_loss: 0.5704
Epoch 74/100
50/50 [==============================] - 5s 101ms/step - loss: 0.3809 - val_loss: 0.5120
Epoch 75/100
50/50 [==============================] - 5s 101ms/step - loss: 0.3801 - val_loss: 0.5458
Epoch 76/100
50/50 [==============================] - 5s 104ms/step - loss: 0.3793 - val_loss: 0.5004
Epoch 77/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3795 - val_loss: 0.5206
Epoch 78/100
50/50 [==============================] - 5s 104ms/step - loss: 0.3773 - val_loss: 0.5492
Epoch 79/100
50/50 [==============================] - 6s 115ms/step - loss: 0.3773 - val_loss: 0.5312
Epoch 80/100
50/50 [==============================] - 6s 114ms/step - loss: 0.3770 - val_loss: 0.5653
Epoch 81/100
50/50 [==============================] - 5s 109ms/step - loss: 0.3755 - val_loss: 0.5711
Epoch 82/100
50/50 [==============================] - 5s 108ms/step - loss: 0.3729 - val_loss: 0.5436
Epoch 83/100
50/50 [==============================] - 5s 108ms/step - loss: 0.3758 - val_loss: 0.5609
Epoch 84/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3735 - val_loss: 0.5579
Epoch 85/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3718 - val_loss: 0.5805
Epoch 86/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3722 - val_loss: 0.5504
Epoch 87/100
50/50 [==============================] - 5s 105ms/step - loss: 0.3714 - val_loss: 0.5470
Epoch 88/100
50/50 [==============================] - 5s 102ms/step - loss: 0.3701 - val_loss: 0.5384
Epoch 89/100
50/50 [==============================] - 5s 108ms/step - loss: 0.3685 - val_loss: 0.5305
Epoch 90/100
```

50/50 [==============================] - 5s 103ms/step - loss: 0.3692 - val_loss: 0.5525
Epoch 91/100
50/50 [==============================] - 5s 104ms/step - loss: 0.3698 - val_loss: 0.5812
Epoch 92/100
50/50 [==============================] - 5s 103ms/step - loss: 0.3669 - val_loss: 0.5467
Epoch 93/100
50/50 [==============================] - 5s 101ms/step - loss: 0.3667 - val_loss: 0.5325
Epoch 94/100
50/50 [==============================] - 5s 99ms/step - loss: 0.3652 - val_loss: 0.5502
Epoch 95/100
50/50 [==============================] - 5s 102ms/step - loss: 0.3654 - val_loss: 0.5464
Epoch 96/100
50/50 [==============================] - 5s 102ms/step - loss: 0.3658 - val_loss: 0.5397
Epoch 97/100
50/50 [==============================] - 5s 104ms/step - loss: 0.3646 - val_loss: 0.5265
Epoch 98/100
50/50 [==============================] - 5s 108ms/step - loss: 0.3625 - val_loss: 0.5341
Epoch 99/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3624 - val_loss: 0.5250
Epoch 100/100
50/50 [==============================] - 6s 114ms/step - loss: 0.3616 - val_loss: 0.5592

Multi-Step Training and validation loss for WI_3

Multi_step LSTM for WI_3

Tail of Multi_step LSTM for WI_3
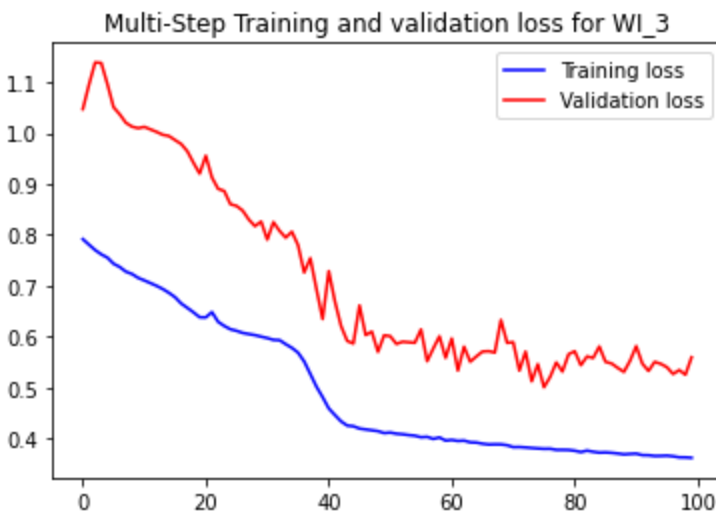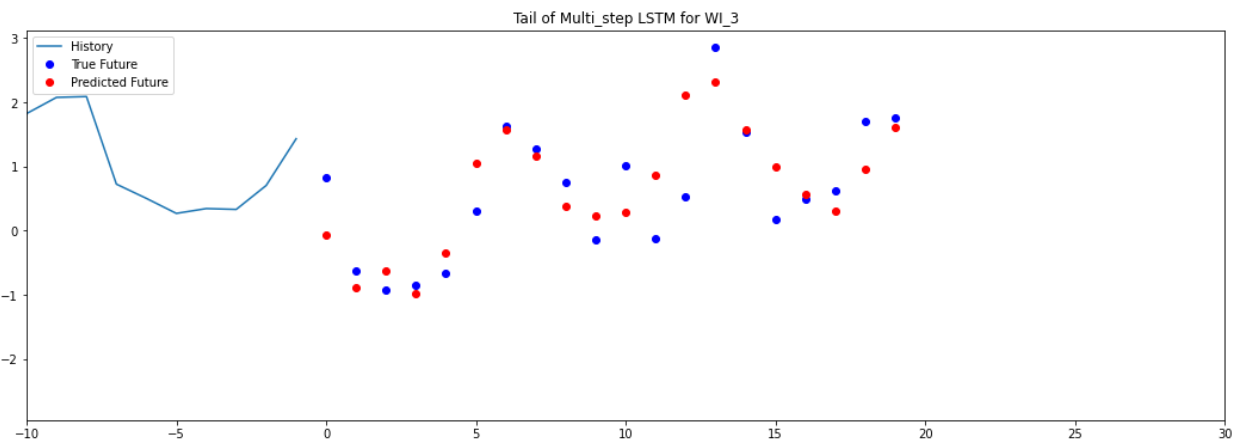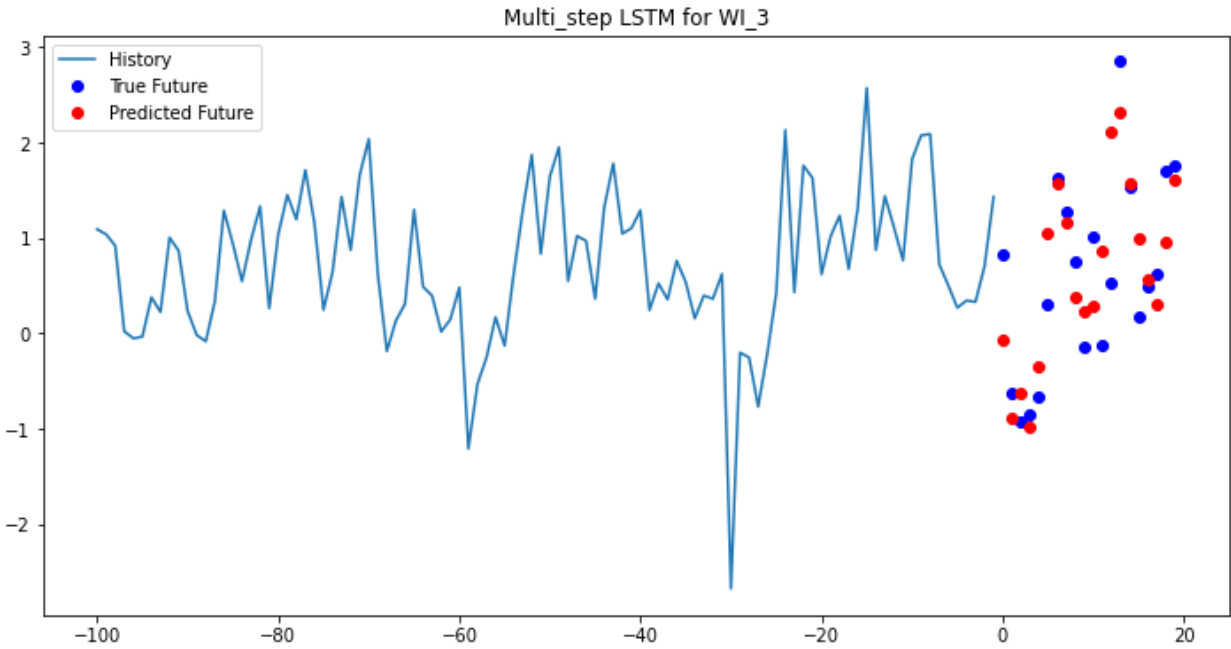
WI_3 - True Future: [3998. 2806. 2564. 2632. 2775. 3580. 4653. 4362. 3938. 3210. 4153. 3219. 3756. 5657. 4577. 3468. 3728. 3833. 4721. 4759.]

WI_3 - Model Prediction: [3264.2744 2594.6196 2812.2795 2527.121 3037.7957 4188.173 4617.6084
 4274.6904 3628.5042 3510.0496 3558.4988 4033.309 5050.083 5220.0195
 4616.5312 4145.6826 3781.1113 3575.0974 4103.6797 4637.3076]

WI_3 - Model Percentage Error: [18.35231581 7.53315649 9.68328943 3.98476088 9.47011367 16.98806848
  0.76061899 2.00159492 7.85921406 9.34733833 14.31498244 25.29695812
 34.4537542   7.72459729 0.86369347 19.54102126 1.42466009 6.72847868
 13.07604983 2.55709987]%

WI_3 - Model Mean Percentage Error: 10.598088315143986%

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