Training for CA_3
Single window of past history : (100, 4)
(72, 20)
Epoch 1/100
50/50 [==============================] - 5s 101ms/step - loss: 0.7110 - val_loss: 0.6484
Epoch 2/100
50/50 [==============================] - 5s 94ms/step - loss: 0.6391 - val_loss: 0.6509
Epoch 3/100
50/50 [==============================] - 5s 95ms/step - loss: 0.6126 - val_loss: 0.6408
Epoch 4/100
50/50 [==============================] - 5s 97ms/step - loss: 0.6060 - val_loss: 0.6425
Epoch 5/100
50/50 [==============================] - 5s 95ms/step - loss: 0.5963 - val_loss: 0.6447
Epoch 6/100
50/50 [==============================] - 5s 95ms/step - loss: 0.5827 - val_loss: 0.6193
Epoch 7/100
50/50 [==============================] - 5s 94ms/step - loss: 0.5422 - val_loss: 0.5413
Epoch 8/100
50/50 [==============================] - 5s 94ms/step - loss: 0.4670 - val_loss: 0.3851
Epoch 9/100
50/50 [==============================] - 5s 97ms/step - loss: 0.4088 - val_loss: 0.3881
Epoch 10/100
50/50 [==============================] - 5s 98ms/step - loss: 0.3910 - val_loss: 0.3611
Epoch 11/100
50/50 [==============================] - 5s 95ms/step - loss: 0.3774 - val_loss: 0.3890
Epoch 12/100
50/50 [==============================] - 5s 96ms/step - loss: 0.3664 - val_loss: 0.3724
Epoch 13/100
50/50 [==============================] - 5s 96ms/step - loss: 0.3550 - val_loss: 0.3391
Epoch 14/100
50/50 [==============================] - 5s 96ms/step - loss: 0.3461 - val_loss: 0.3310
Epoch 15/100
50/50 [==============================] - 5s 97ms/step - loss: 0.3393 - val_loss: 0.3735
Epoch 16/100
50/50 [==============================] - 5s 97ms/step - loss: 0.3324 - val_loss: 0.3465
Epoch 17/100
50/50 [==============================] - 5s 96ms/step - loss: 0.3262 - val_loss: 0.3286
Epoch 18/100
50/50 [==============================] - 5s 95ms/step - loss: 0.3221 - val_loss: 0.3617
Epoch 19/100
50/50 [==============================] - 5s 96ms/step - loss: 0.3175 - val_loss: 0.4234
Epoch 20/100
50/50 [==============================] - 5s 97ms/step - loss: 0.3148 - val_loss: 0.3371
Epoch 21/100
50/50 [==============================] - 5s 98ms/step - loss: 0.3113 - val_loss: 0.3645

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Epoch 22/100
50/50 [==============================] - 5s 97ms/step - loss: 0.3112 - val_loss: 0.3723
Epoch 23/100
50/50 [==============================] - 5s 95ms/step - loss: 0.3162 - val_loss: 0.3498
Epoch 24/100
50/50 [==============================] - 5s 96ms/step - loss: 0.3019 - val_loss: 0.3415
Epoch 25/100
50/50 [==============================] - 5s 96ms/step - loss: 0.3009 - val_loss: 0.3548
Epoch 26/100
50/50 [==============================] - 5s 95ms/step - loss: 0.3004 - val_loss: 0.3576
Epoch 27/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2939 - val_loss: 0.3467
Epoch 28/100
50/50 [==============================] - 5s 95ms/step - loss: 0.2926 - val_loss: 0.3324
Epoch 29/100
50/50 [==============================] - 5s 94ms/step - loss: 0.2927 - val_loss: 0.3419
Epoch 30/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2869 - val_loss: 0.3794
Epoch 31/100
50/50 [==============================] - 5s 95ms/step - loss: 0.2846 - val_loss: 0.3541
Epoch 32/100
50/50 [==============================] - 5s 95ms/step - loss: 0.3053 - val_loss: 0.3510
Epoch 33/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2810 - val_loss: 0.3339
Epoch 34/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2795 - val_loss: 0.3433
Epoch 35/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2777 - val_loss: 0.3323
Epoch 36/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2827 - val_loss: 0.3307
Epoch 37/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2736 - val_loss: 0.3440
Epoch 38/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2748 - val_loss: 0.3164
Epoch 39/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2723 - val_loss: 0.3309
Epoch 40/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2751 - val_loss: 0.3279
Epoch 41/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2687 - val_loss: 0.3212
Epoch 42/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2673 - val_loss: 0.3594
Epoch 43/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2809 - val_loss: 0.3582
Epoch 44/100
```

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50/50 [==============================] - 5s 99ms/step - loss: 0.2668 - val_loss: 0.3561
Epoch 45/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2636 - val_loss: 0.3656
Epoch 46/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2650 - val_loss: 0.3690
Epoch 47/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2842 - val_loss: 0.4197
Epoch 48/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2725 - val_loss: 0.3611
Epoch 49/100
50/50 [==============================] - 5s 95ms/step - loss: 0.2607 - val_loss: 0.3440
Epoch 50/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2573 - val_loss: 0.3723
Epoch 51/100
50/50 [==============================] - 5s 94ms/step - loss: 0.2580 - val_loss: 0.3489
Epoch 52/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2570 - val_loss: 0.3677
Epoch 53/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2685 - val_loss: 0.3744
Epoch 54/100
50/50 [==============================] - 5s 95ms/step - loss: 0.2533 - val_loss: 0.3540
Epoch 55/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2536 - val_loss: 0.3554
Epoch 56/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2538 - val_loss: 0.3641
Epoch 57/100
50/50 [==============================] - 5s 95ms/step - loss: 0.2527 - val_loss: 0.3578
Epoch 58/100
50/50 [==============================] - 5s 95ms/step - loss: 0.4213 - val_loss: 0.4967
Epoch 59/100
50/50 [==============================] - 5s 94ms/step - loss: 0.3241 - val_loss: 0.3644
Epoch 60/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2705 - val_loss: 0.3940
Epoch 61/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2597 - val_loss: 0.3624
Epoch 62/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2549 - val_loss: 0.3751
Epoch 63/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2503 - val_loss: 0.3527
Epoch 64/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2491 - val_loss: 0.3505
Epoch 65/100
50/50 [==============================] - 5s 100ms/step - loss: 0.2470 - val_loss: 0.3513
Epoch 66/100
50/50 [==============================] - 5s 103ms/step - loss: 0.2455 - val_loss: 0.3645
```

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Epoch 67/100
50/50 [==============================] - 5s 104ms/step - loss: 0.2448 - val_loss: 0.3799
Epoch 68/100
50/50 [==============================] - 5s 103ms/step - loss: 0.2440 - val_loss: 0.3570
Epoch 69/100
50/50 [==============================] - 5s 102ms/step - loss: 0.2584 - val_loss: 0.3538
Epoch 70/100
50/50 [==============================] - 5s 101ms/step - loss: 0.2511 - val_loss: 0.3464
Epoch 71/100
50/50 [==============================] - 5s 107ms/step - loss: 0.2421 - val_loss: 0.3679
Epoch 72/100
50/50 [==============================] - 7s 137ms/step - loss: 0.2414 - val_loss: 0.3663
Epoch 73/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2403 - val_loss: 0.3673
Epoch 74/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2395 - val_loss: 0.3697
Epoch 75/100
50/50 [==============================] - 5s 100ms/step - loss: 0.2600 - val_loss: 0.3788
Epoch 76/100
50/50 [==============================] - 5s 101ms/step - loss: 0.2383 - val_loss: 0.3936
Epoch 77/100
50/50 [==============================] - 5s 103ms/step - loss: 0.2369 - val_loss: 0.3873
Epoch 78/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2373 - val_loss: 0.3863
Epoch 79/100
50/50 [==============================] - 5s 100ms/step - loss: 0.2360 - val_loss: 0.3856
Epoch 80/100
50/50 [==============================] - 5s 100ms/step - loss: 0.2743 - val_loss: 0.3921
Epoch 81/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2369 - val_loss: 0.3996
Epoch 82/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2349 - val_loss: 0.4231
Epoch 83/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2333 - val_loss: 0.4232
Epoch 84/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2329 - val_loss: 0.4125
Epoch 85/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2327 - val_loss: 0.4225
Epoch 86/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2319 - val_loss: 0.4097
Epoch 87/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2763 - val_loss: 0.4018
Epoch 88/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2356 - val_loss: 0.4284
Epoch 89/100
```

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50/50 [==============================] - 5s 99ms/step - loss: 0.2313 - val_loss: 0.4127
Epoch 90/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2298 - val_loss: 0.4238
Epoch 91/100
50/50 [==============================] - 5s 100ms/step - loss: 0.2295 - val_loss: 0.4415
Epoch 92/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2296 - val_loss: 0.4403
Epoch 93/100
50/50 [==============================] - 5s 100ms/step - loss: 0.2293 - val_loss: 0.4425
Epoch 94/100
50/50 [==============================] - 5s 100ms/step - loss: 0.2280 - val_loss: 0.4447
Epoch 95/100
50/50 [==============================] - 5s 100ms/step - loss: 0.2284 - val_loss: 0.4616
Epoch 96/100
50/50 [==============================] - 5s 100ms/step - loss: 0.2408 - val_loss: 0.4450
Epoch 97/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2281 - val_loss: 0.4497
Epoch 98/100
50/50 [==============================] - 5s 102ms/step - loss: 0.2261 - val_loss: 0.4604
Epoch 99/100
50/50 [==============================] - 5s 101ms/step - loss: 0.2256 - val_loss: 0.4602
Epoch 100/100
50/50 [==============================] - 5s 101ms/step - loss: 0.2249 - val_loss: 0.4693
```


Multi-Step Training and validation loss for CA_3

Multi_step LSTM for CA_3

Tail of Multi_step LSTM for CA_3
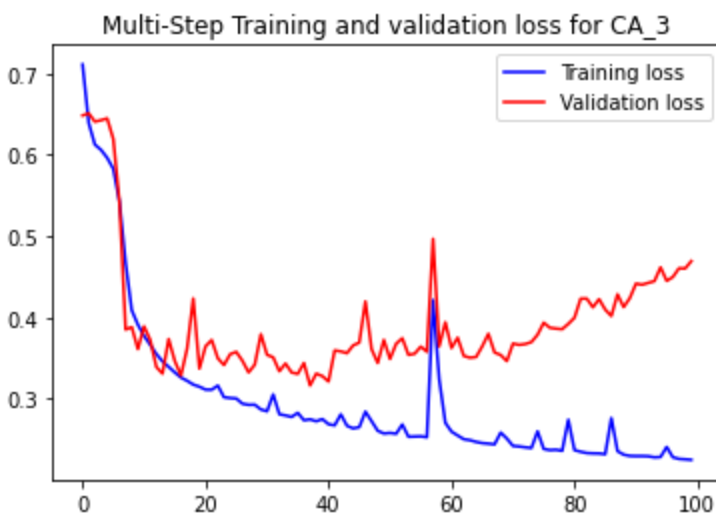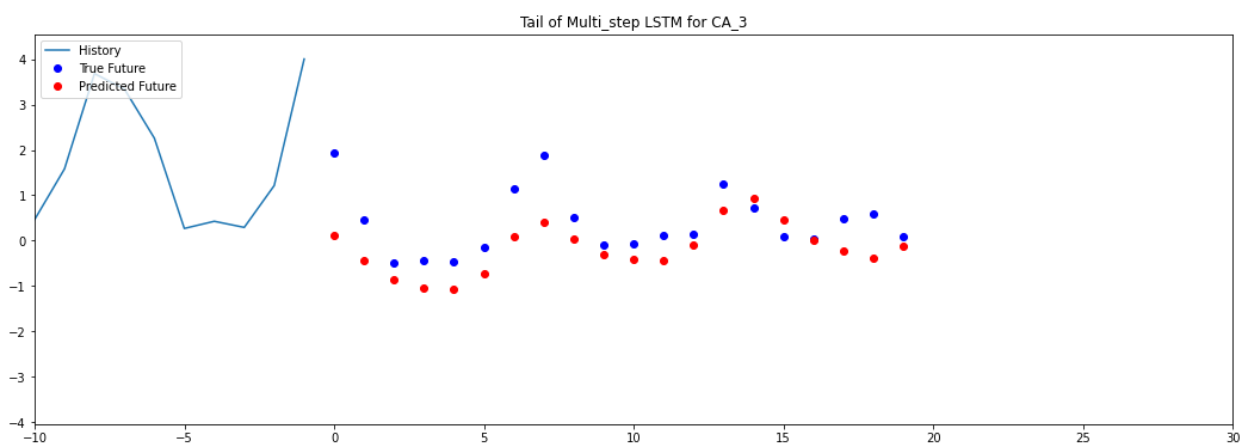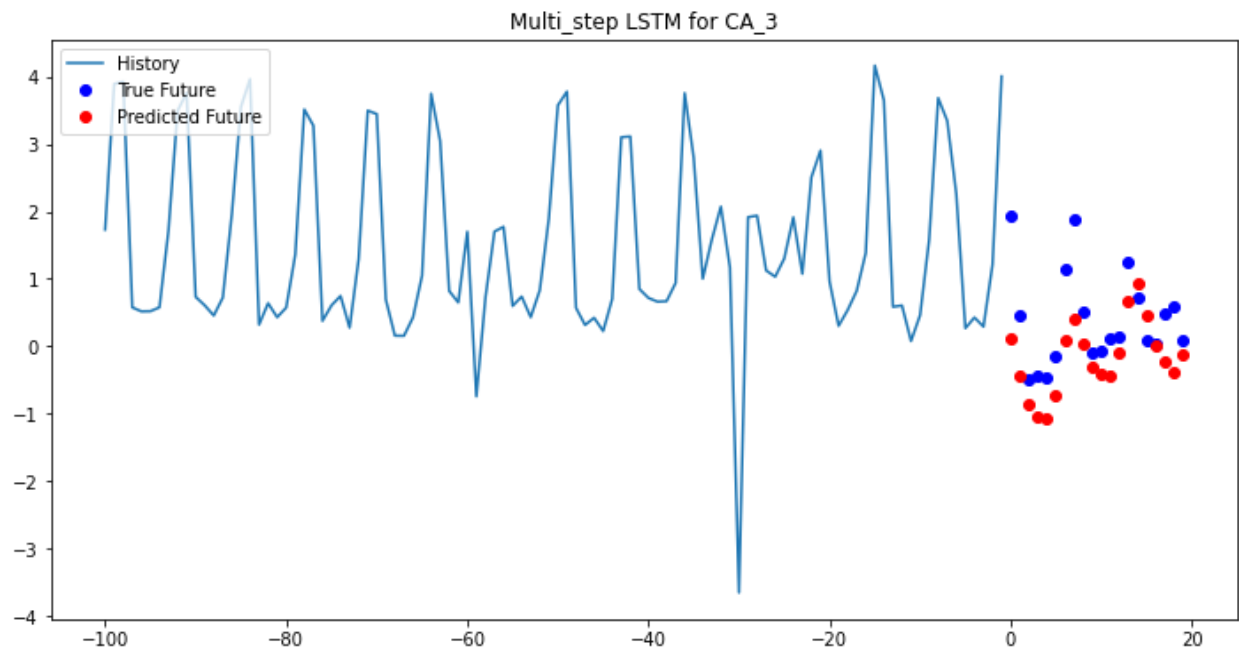
CA_3 - True Future: [8164. 6371. 5244. 5309. 5261. 5637. 7217. 8094. 6446. 5722. 5740. 5951.
 5986. 7347. 6696. 5930. 5882. 6421. 6547. 5928.]
CA_3 - Model Prediction: [5960.4717 5298.4976 4782.741 4547.894 4522.5073 4930.6606
5937.806
 6325.5513 5862.087 5459.8174 5315.875 5286.9253 5697.736 6635.5522
 6953.6177 6392.8486 5836.3735 5541.457 5364.158 5674.0093]
CA_3 - Model Percentage Error: [26.99079275 16.8341303   8.79593419 14.33614536 14.03711606
12.53041255
 17.72473116 21.84888474 9.05853376 4.58201009 7.38893728 11.15904398
  4.81563916 9.68351373 3.84733685 7.8052046   0.77569644 13.69791261
 18.06692832 4.28459384]%
CA_3 - Model Mean Percentage Error: 11.413174888099604%
===================================
===================================
Training for CA_4

Single window of past history : (100, 4)
(72, 20)
Epoch 1/100
50/50 [==============================] - 5s 108ms/step - loss: 0.6232 - val_loss: 0.7191
Epoch 2/100
50/50 [==============================] - 5s 100ms/step - loss: 0.5174 - val_loss: 0.5953
Epoch 3/100
50/50 [==============================] - 5s 99ms/step - loss: 0.5115 - val_loss: 0.5836
Epoch 4/100
50/50 [==============================] - 5s 100ms/step - loss: 0.5103 - val_loss: 0.5792
Epoch 5/100
50/50 [==============================] - 5s 100ms/step - loss: 0.5068 - val_loss: 0.5773
Epoch 6/100
50/50 [==============================] - 5s 99ms/step - loss: 0.5041 - val_loss: 0.5690
Epoch 7/100
50/50 [==============================] - 5s 99ms/step - loss: 0.4989 - val_loss: 0.5567
Epoch 8/100
50/50 [==============================] - 5s 99ms/step - loss: 0.4866 - val_loss: 0.5180
Epoch 9/100
50/50 [==============================] - 5s 97ms/step - loss: 0.4473 - val_loss: 0.4539
Epoch 10/100
50/50 [==============================] - 5s 99ms/step - loss: 0.3889 - val_loss: 0.4055
Epoch 11/100
50/50 [==============================] - 5s 98ms/step - loss: 0.3669 - val_loss: 0.4067
Epoch 12/100
50/50 [==============================] - 5s 99ms/step - loss: 0.3584 - val_loss: 0.3832
Epoch 13/100
50/50 [==============================] - 5s 99ms/step - loss: 0.3521 - val_loss: 0.3955
Epoch 14/100
50/50 [==============================] - 5s 99ms/step - loss: 0.3498 - val_loss: 0.3750
Epoch 15/100
50/50 [==============================] - 5s 99ms/step - loss: 0.3451 - val_loss: 0.3898
Epoch 16/100
50/50 [==============================] - 5s 99ms/step - loss: 0.3421 - val_loss: 0.3841
Epoch 17/100
50/50 [==============================] - 5s 99ms/step - loss: 0.3407 - val_loss: 0.3848
Epoch 18/100
50/50 [==============================] - 5s 101ms/step - loss: 0.3397 - val_loss: 0.3781
Epoch 19/100
50/50 [==============================] - 5s 99ms/step - loss: 0.3352 - val_loss: 0.3851
Epoch 20/100
50/50 [==============================] - 5s 104ms/step - loss: 0.3333 - val_loss: 0.3837
Epoch 21/100
50/50 [==============================] - 5s 100ms/step - loss: 0.3295 - val_loss: 0.3956
Epoch 22/100

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50/50 [==============================] - 5s 104ms/step - loss: 0.3265 - val_loss: 0.3803
Epoch 23/100
50/50 [==============================] - 5s 102ms/step - loss: 0.3223 - val_loss: 0.3700
Epoch 24/100
50/50 [==============================] - 5s 99ms/step - loss: 0.3205 - val_loss: 0.3739
Epoch 25/100
50/50 [==============================] - 5s 99ms/step - loss: 0.3166 - val_loss: 0.3845
Epoch 26/100
50/50 [==============================] - 5s 99ms/step - loss: 0.3134 - val_loss: 0.3750
Epoch 27/100
50/50 [==============================] - 5s 98ms/step - loss: 0.3125 - val_loss: 0.3756
Epoch 28/100
50/50 [==============================] - 5s 100ms/step - loss: 0.3081 - val_loss: 0.3703
Epoch 29/100
50/50 [==============================] - 5s 100ms/step - loss: 0.3070 - val_loss: 0.3868
Epoch 30/100
50/50 [==============================] - 5s 100ms/step - loss: 0.3051 - val_loss: 0.3802
Epoch 31/100
50/50 [==============================] - 5s 98ms/step - loss: 0.3019 - val_loss: 0.4002
Epoch 32/100
50/50 [==============================] - 5s 99ms/step - loss: 0.3035 - val_loss: 0.3761
Epoch 33/100
50/50 [==============================] - 5s 97ms/step - loss: 0.3000 - val_loss: 0.3796
Epoch 34/100
50/50 [==============================] - 5s 100ms/step - loss: 0.2983 - val_loss: 0.3750
Epoch 35/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2983 - val_loss: 0.3743
Epoch 36/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2945 - val_loss: 0.3758
Epoch 37/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2950 - val_loss: 0.3749
Epoch 38/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2943 - val_loss: 0.3733
Epoch 39/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2932 - val_loss: 0.3717
Epoch 40/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2910 - val_loss: 0.3751
Epoch 41/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2909 - val_loss: 0.3760
Epoch 42/100
50/50 [==============================] - 5s 100ms/step - loss: 0.2896 - val_loss: 0.3819
Epoch 43/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2901 - val_loss: 0.3888
Epoch 44/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2895 - val_loss: 0.3785
```

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Epoch 45/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2868 - val_loss: 0.3832
Epoch 46/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2932 - val_loss: 0.3803
Epoch 47/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2865 - val_loss: 0.3891
Epoch 48/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2855 - val_loss: 0.3883
Epoch 49/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2875 - val_loss: 0.3839
Epoch 50/100
50/50 [==============================] - 5s 100ms/step - loss: 0.2845 - val_loss: 0.3887
Epoch 51/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2840 - val_loss: 0.3932
Epoch 52/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2836 - val_loss: 0.4054
Epoch 53/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2826 - val_loss: 0.3997
Epoch 54/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2834 - val_loss: 0.3897
Epoch 55/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2834 - val_loss: 0.3991
Epoch 56/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2821 - val_loss: 0.3944
Epoch 57/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2822 - val_loss: 0.4046
Epoch 58/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2800 - val_loss: 0.3951
Epoch 59/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2795 - val_loss: 0.4042
Epoch 60/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2840 - val_loss: 0.4247
Epoch 61/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2787 - val_loss: 0.4140
Epoch 62/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2793 - val_loss: 0.4004
Epoch 63/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2802 - val_loss: 0.4005
Epoch 64/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2767 - val_loss: 0.3990
Epoch 65/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2779 - val_loss: 0.3995
Epoch 66/100
50/50 [==============================] - 5s 102ms/step - loss: 0.2763 - val_loss: 0.3974
Epoch 67/100
```

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50/50 [==============================] - 5s 98ms/step - loss: 0.2775 - val_loss: 0.4042
Epoch 68/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2766 - val_loss: 0.4059
Epoch 69/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2739 - val_loss: 0.4032
Epoch 70/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2757 - val_loss: 0.4124
Epoch 71/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2743 - val_loss: 0.4072
Epoch 72/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2745 - val_loss: 0.4066
Epoch 73/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2747 - val_loss: 0.3984
Epoch 74/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2738 - val_loss: 0.4098
Epoch 75/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2734 - val_loss: 0.4118
Epoch 76/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2718 - val_loss: 0.4070
Epoch 77/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2730 - val_loss: 0.4091
Epoch 78/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2711 - val_loss: 0.4057
Epoch 79/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2709 - val_loss: 0.4151
Epoch 80/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2728 - val_loss: 0.4099
Epoch 81/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2698 - val_loss: 0.4144
Epoch 82/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2699 - val_loss: 0.4105
Epoch 83/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2699 - val_loss: 0.4074
Epoch 84/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2683 - val_loss: 0.4202
Epoch 85/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2700 - val_loss: 0.4193
Epoch 86/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2678 - val_loss: 0.4203
Epoch 87/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2676 - val_loss: 0.4172
Epoch 88/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2683 - val_loss: 0.4234
Epoch 89/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2674 - val_loss: 0.4143
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Epoch 90/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2670 - val_loss: 0.4314
Epoch 91/100
50/50 [==============================] - 6s 114ms/step - loss: 0.2659 - val_loss: 0.4173
Epoch 92/100
50/50 [==============================] - 6s 115ms/step - loss: 0.2652 - val_loss: 0.4147
Epoch 93/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2657 - val_loss: 0.4177
Epoch 94/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2667 - val_loss: 0.4168
Epoch 95/100
50/50 [==============================] - 5s 95ms/step - loss: 0.2645 - val_loss: 0.4134
Epoch 96/100
50/50 [==============================] - 5s 95ms/step - loss: 0.2638 - val_loss: 0.4114
Epoch 97/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2639 - val_loss: 0.4179
Epoch 98/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2646 - val_loss: 0.4259
Epoch 99/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2638 - val_loss: 0.4237
Epoch 100/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2637 - val_loss: 0.4104
```


Multi-Step Training and validation loss for CA_4

Multi_step LSTM for CA_4

Tail of Multi_step LSTM for CA_4
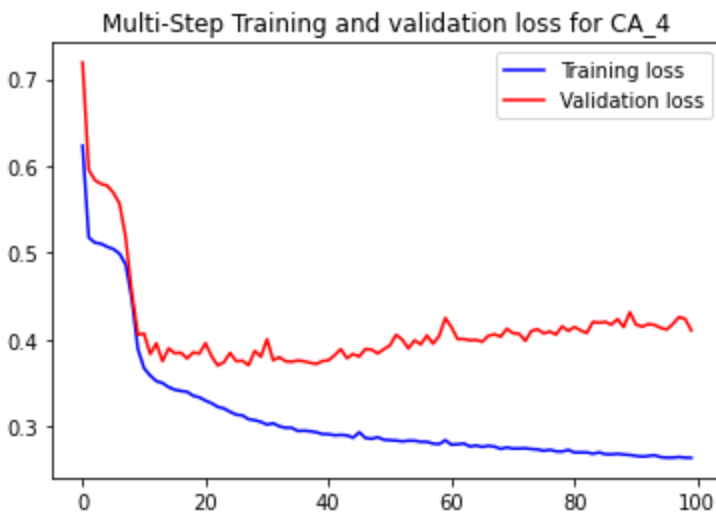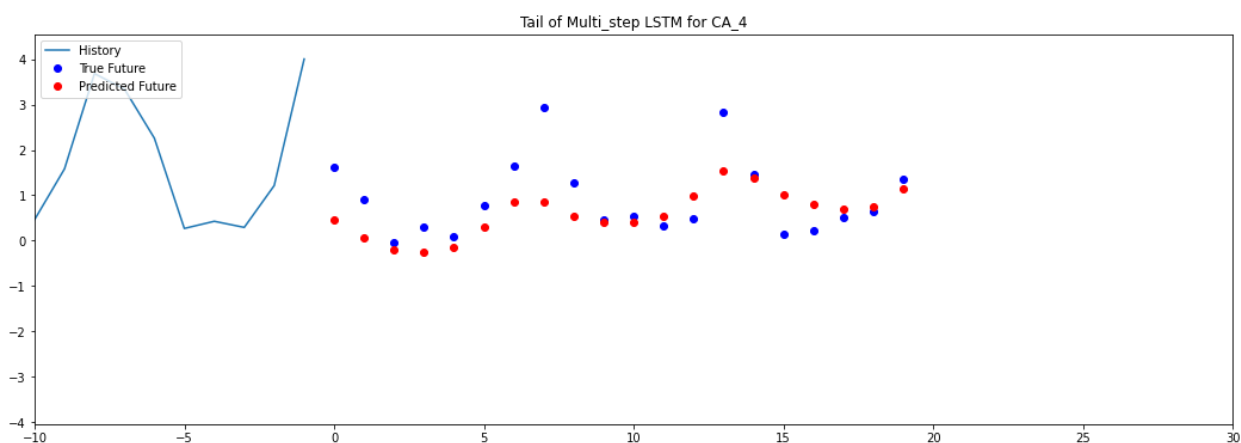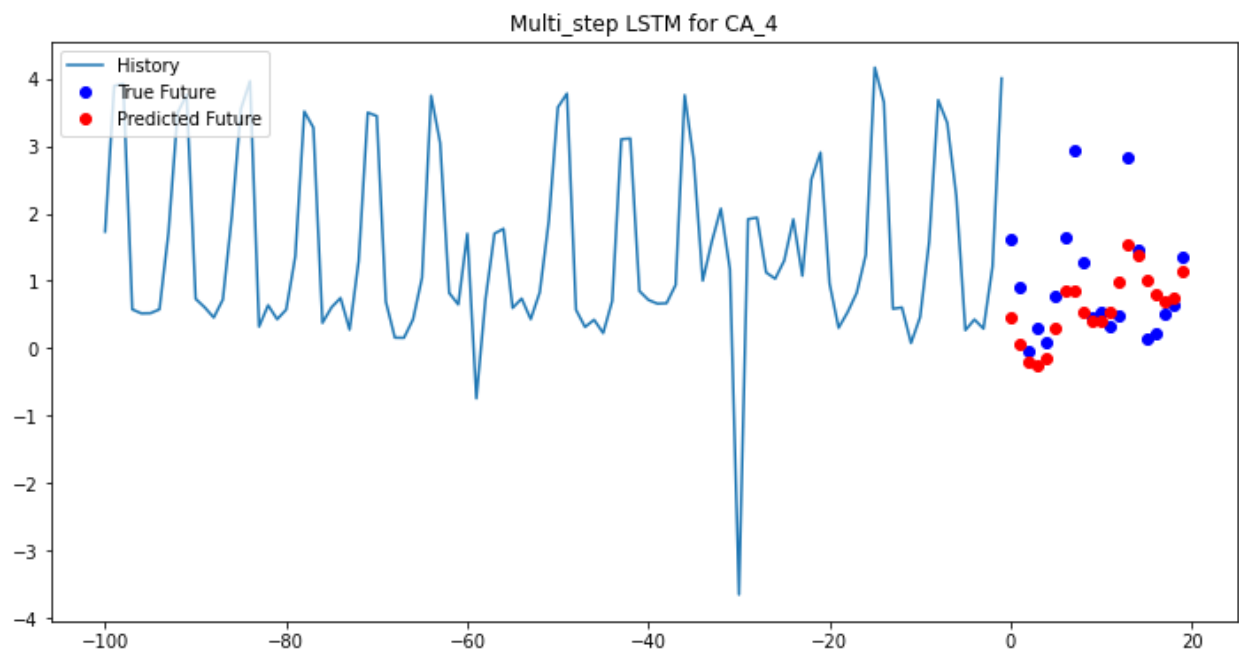
CA_4 - True Future: [2787. 2487. 2088. 2239. 2153. 2432. 2806. 3343. 2643. 2299. 2335. 2244.
 2316. 3301. 2727. 2166. 2207. 2323. 2383. 2677.]

CA_4 - Model Prediction: [2308.6685 2137.241 2021.5055 2006.7705 2045.3608 2237.4973
2471.361
 2470.3813 2340.8203 2281.591 2281.274 2332.3315 2528.5884 2760.537
 2692.1167 2534.5159 2448.707 2399.9   2422.8206 2589.0361]

CA_4 - Model Percentage Error: [17.16295454 14.06349148 3.18460282 10.37201841 4.99949652
7.99764332
 11.9258345 26.10286127 11.433208   0.75723948 2.30090254 3.93634327
  9.17911826 16.37270193 1.27918228 17.0136597 10.95183649 3.31037031
  1.6710263   3.28591211]%

CA_4 - Model Mean Percentage Error: 8.865020176062263%

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===================================
Training for CA_1

```
Single window of past history : (100, 4)
(72, 20)
Epoch 1/100
50/50 [==============================] - 5s 105ms/step - loss: 0.7670 - val_loss: 0.7239
Epoch 2/100
50/50 [==============================] - 5s 96ms/step - loss: 0.7252 - val_loss: 0.7186
Epoch 3/100
50/50 [==============================] - 5s 98ms/step - loss: 0.7026 - val_loss: 0.7179
Epoch 4/100
50/50 [==============================] - 5s 97ms/step - loss: 0.6949 - val_loss: 0.7189
Epoch 5/100
50/50 [==============================] - 5s 96ms/step - loss: 0.6920 - val_loss: 0.7226
Epoch 6/100
50/50 [==============================] - 5s 96ms/step - loss: 0.6868 - val_loss: 0.7203
Epoch 7/100
50/50 [==============================] - 5s 96ms/step - loss: 0.6776 - val_loss: 0.7175
Epoch 8/100
50/50 [==============================] - 5s 96ms/step - loss: 0.6476 - val_loss: 0.6763
Epoch 9/100
50/50 [==============================] - 5s 98ms/step - loss: 0.5717 - val_loss: 0.5141
Epoch 10/100
50/50 [==============================] - 5s 99ms/step - loss: 0.4295 - val_loss: 0.4350
Epoch 11/100
50/50 [==============================] - 5s 98ms/step - loss: 0.3969 - val_loss: 0.4326
Epoch 12/100
50/50 [==============================] - 5s 97ms/step - loss: 0.3843 - val_loss: 0.4138
Epoch 13/100
50/50 [==============================] - 5s 97ms/step - loss: 0.3804 - val_loss: 0.4084
Epoch 14/100
50/50 [==============================] - 5s 95ms/step - loss: 0.3725 - val_loss: 0.4040
Epoch 15/100
50/50 [==============================] - 5s 96ms/step - loss: 0.3640 - val_loss: 0.3882
Epoch 16/100
50/50 [==============================] - 5s 95ms/step - loss: 0.3516 - val_loss: 0.3665
Epoch 17/100
50/50 [==============================] - 5s 97ms/step - loss: 0.3494 - val_loss: 0.3672
Epoch 18/100
50/50 [==============================] - 5s 98ms/step - loss: 0.3301 - val_loss: 0.3386
Epoch 19/100
50/50 [==============================] - 5s 96ms/step - loss: 0.3160 - val_loss: 0.3572
Epoch 20/100
50/50 [==============================] - 5s 96ms/step - loss: 0.3108 - val_loss: 0.4597
Epoch 21/100
50/50 [==============================] - 5s 97ms/step - loss: 0.3113 - val_loss: 0.4071
Epoch 22/100
```

```
50/50 [==============================] - 5s 97ms/step - loss: 0.3006 - val_loss: 0.3258
Epoch 23/100
50/50 [==============================] - 5s 99ms/step - loss: 0.3017 - val_loss: 0.3257
Epoch 24/100
50/50 [==============================] - 5s 101ms/step - loss: 0.3056 - val_loss: 0.3425
Epoch 25/100
50/50 [==============================] - 5s 100ms/step - loss: 0.2886 - val_loss: 0.3315
Epoch 26/100
50/50 [==============================] - 5s 100ms/step - loss: 0.3015 - val_loss: 0.3364
Epoch 27/100
50/50 [==============================] - 5s 103ms/step - loss: 0.2834 - val_loss: 0.3270
Epoch 28/100
50/50 [==============================] - 5s 102ms/step - loss: 0.2826 - val_loss: 0.4046
Epoch 29/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2843 - val_loss: 0.3278
Epoch 30/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2760 - val_loss: 0.3317
Epoch 31/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2741 - val_loss: 0.3474
Epoch 32/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2833 - val_loss: 0.6126
Epoch 33/100
50/50 [==============================] - 5s 99ms/step - loss: 0.3371 - val_loss: 0.3416
Epoch 34/100
50/50 [==============================] - 5s 100ms/step - loss: 0.2707 - val_loss: 0.3232
Epoch 35/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2671 - val_loss: 0.3311
Epoch 36/100
50/50 [==============================] - 5s 100ms/step - loss: 0.2648 - val_loss: 0.3325
Epoch 37/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2638 - val_loss: 0.3517
Epoch 38/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2627 - val_loss: 0.3850
Epoch 39/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2605 - val_loss: 0.5309
Epoch 40/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2597 - val_loss: 0.3277
Epoch 41/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2583 - val_loss: 0.4071
Epoch 42/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2577 - val_loss: 0.4099
Epoch 43/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2569 - val_loss: 0.6538
Epoch 44/100
50/50 [==============================] - 5s 99ms/step - loss: 0.4222 - val_loss: 0.3514
```

```
Epoch 45/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2639 - val_loss: 0.3244
Epoch 46/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2564 - val_loss: 0.3461
Epoch 47/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2538 - val_loss: 0.3259
Epoch 48/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2537 - val_loss: 0.3802
Epoch 49/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2523 - val_loss: 0.3081
Epoch 50/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2508 - val_loss: 0.5216
Epoch 51/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2501 - val_loss: 0.5258
Epoch 52/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2499 - val_loss: 0.6359
Epoch 53/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2491 - val_loss: 0.5604
Epoch 54/100
50/50 [==============================] - 5s 100ms/step - loss: 0.2477 - val_loss: 0.5450
Epoch 55/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2476 - val_loss: 0.5708
Epoch 56/100
50/50 [==============================] - 5s 100ms/step - loss: 0.2464 - val_loss: 0.5157
Epoch 57/100
50/50 [==============================] - 5s 100ms/step - loss: 0.2465 - val_loss: 0.2858
Epoch 58/100
50/50 [==============================] - 5s 99ms/step - loss: 0.3831 - val_loss: 0.3327
Epoch 59/100
50/50 [==============================] - 5s 101ms/step - loss: 0.2505 - val_loss: 0.3301
Epoch 60/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2443 - val_loss: 0.3622
Epoch 61/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2420 - val_loss: 0.4828
Epoch 62/100
50/50 [==============================] - 5s 100ms/step - loss: 0.2439 - val_loss: 0.4521
Epoch 63/100
50/50 [==============================] - 5s 100ms/step - loss: 0.2413 - val_loss: 0.3998
Epoch 64/100
50/50 [==============================] - 5s 100ms/step - loss: 0.3971 - val_loss: 0.3529
Epoch 65/100
50/50 [==============================] - 5s 101ms/step - loss: 0.2636 - val_loss: 0.3323
Epoch 66/100
50/50 [==============================] - 5s 101ms/step - loss: 0.2472 - val_loss: 0.3444
Epoch 67/100
```

```
50/50 [==============================] - 5s 102ms/step - loss: 0.2428 - val_loss: 0.3364
Epoch 68/100
50/50 [==============================] - 5s 101ms/step - loss: 0.2405 - val_loss: 0.3495
Epoch 69/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2400 - val_loss: 0.3845
Epoch 70/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2388 - val_loss: 0.3376
Epoch 71/100
50/50 [==============================] - 5s 101ms/step - loss: 0.2397 - val_loss: 0.4779
Epoch 72/100
50/50 [==============================] - 5s 100ms/step - loss: 0.2374 - val_loss: 0.3751
Epoch 73/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2382 - val_loss: 0.4336
Epoch 74/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2358 - val_loss: 0.5221
Epoch 75/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2364 - val_loss: 0.5196
Epoch 76/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2344 - val_loss: 0.4672
Epoch 77/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2551 - val_loss: 0.4682
Epoch 78/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2352 - val_loss: 0.5568
Epoch 79/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2338 - val_loss: 0.5549
Epoch 80/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2324 - val_loss: 0.5332
Epoch 81/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2342 - val_loss: 0.5152
Epoch 82/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2332 - val_loss: 0.5629
Epoch 83/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2315 - val_loss: 0.7000
Epoch 84/100
50/50 [==============================] - 5s 98ms/step - loss: 0.5013 - val_loss: 0.5966
Epoch 85/100
50/50 [==============================] - 5s 96ms/step - loss: 0.3867 - val_loss: 0.3731
Epoch 86/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2887 - val_loss: 0.3950
Epoch 87/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2637 - val_loss: 0.3699
Epoch 88/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2509 - val_loss: 0.3684
Epoch 89/100
50/50 [==============================] - 5s 102ms/step - loss: 0.2443 - val_loss: 0.3476
```

Epoch 90/100
50/50 [==============================] - 5s 101ms/step - loss: 0.2390 - val_loss: 0.3535
Epoch 91/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2372 - val_loss: 0.4210
Epoch 92/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2362 - val_loss: 0.3766
Epoch 93/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2346 - val_loss: 0.3637
Epoch 94/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2323 - val_loss: 0.4013
Epoch 95/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2330 - val_loss: 0.4953
Epoch 96/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2306 - val_loss: 0.4103
Epoch 97/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2319 - val_loss: 0.4520
Epoch 98/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2296 - val_loss: 0.4360
Epoch 99/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2302 - val_loss: 0.4411
Epoch 100/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2293 - val_loss: 0.5150

Multi-Step Training and validation loss for CA_1

Multi_step LSTM for CA_1

Tail of Multi_step LSTM for CA_1
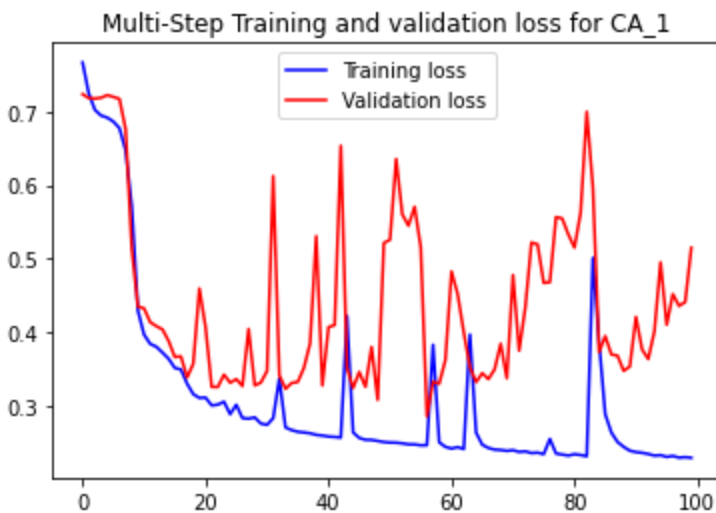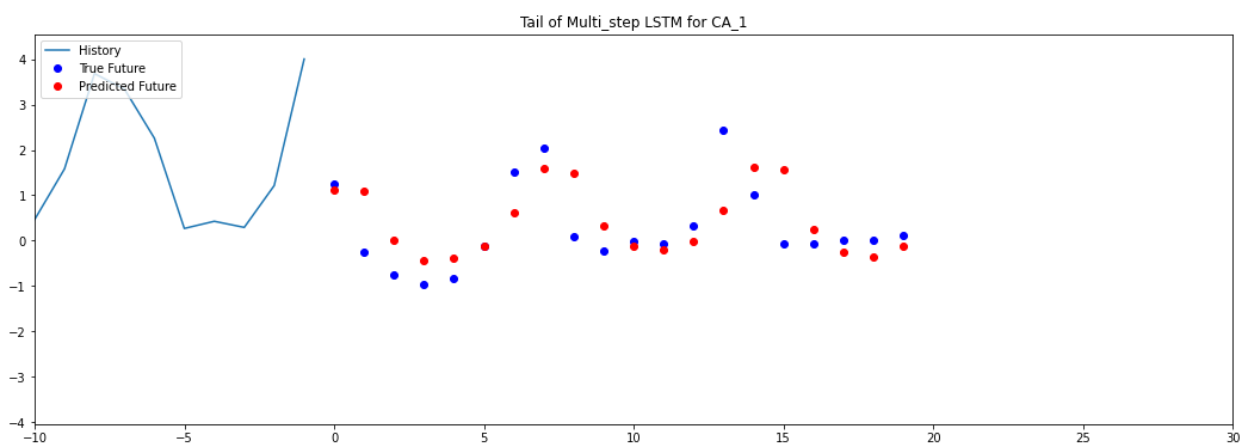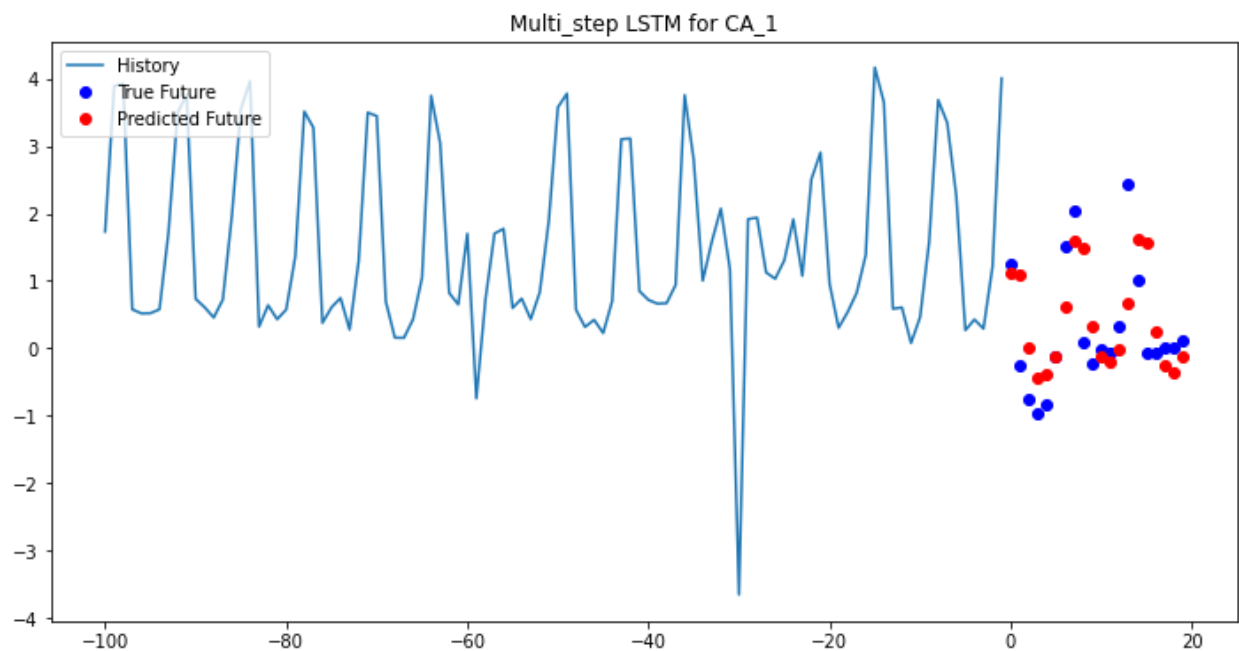
CA_1 - True Future: [5247. 3741. 3246. 3031. 3173. 3871. 5498. 6032. 4075. 3765. 3983. 3928.
 4327. 6412. 4986. 3933. 3936. 3995. 4007. 4111.]
CA_1 - Model Prediction: [5099.0293 5086.763 3996.879 3561.0283 3612.3975 3869.7031
4613.4185
 5570.285 5475.156 4308.219 3872.8125 3795.4792 3982.6614 4662.9517
 5602.177 5548.283 4229.9307 3742.9722 3649.32   3882.2495]
CA_1 - Model Percentage Error: [2.82010107e+00 3.59733543e+01 2.31324370e+01
1.74869126e+01
 1.38480133e+01 3.35023250e-02 1.60891514e+01 7.65442380e+00
 3.43596506e+01 1.44281338e+01 2.76644489e+00 3.37374623e+00
 7.95790670e+00 2.72777346e+01 1.23581379e+01 4.10700026e+01
 7.46775061e+00 6.30858153e+00 8.92637713e+00 5.56435145e+00]%
CA_1 - Model Mean Percentage Error: 14.444835691365629%
===================================
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Training for CA_2
Single window of past history : (100, 4)
(72, 20)
Epoch 1/100
50/50 [==============================] - 5s 108ms/step - loss: 0.7768 - val_loss: 1.8941
Epoch 2/100
50/50 [==============================] - 5s 100ms/step - loss: 0.7292 - val_loss: 1.5279
Epoch 3/100
50/50 [==============================] - 5s 97ms/step - loss: 0.6849 - val_loss: 1.1502
Epoch 4/100
50/50 [==============================] - 5s 97ms/step - loss: 0.6659 - val_loss: 1.1062
Epoch 5/100
50/50 [==============================] - 5s 100ms/step - loss: 0.6293 - val_loss: 1.0183
Epoch 6/100
50/50 [==============================] - 5s 97ms/step - loss: 0.6907 - val_loss: 1.4223
Epoch 7/100
50/50 [==============================] - 5s 100ms/step - loss: 0.6463 - val_loss: 1.2137
Epoch 8/100
50/50 [==============================] - 5s 100ms/step - loss: 0.5877 - val_loss: 1.0960
Epoch 9/100
50/50 [==============================] - 5s 97ms/step - loss: 0.4973 - val_loss: 1.0321
Epoch 10/100
50/50 [==============================] - 5s 96ms/step - loss: 0.4227 - val_loss: 0.8215
Epoch 11/100
50/50 [==============================] - 6s 117ms/step - loss: 0.3897 - val_loss: 0.7602
Epoch 12/100
50/50 [==============================] - 6s 112ms/step - loss: 0.3759 - val_loss: 0.7298
Epoch 13/100
50/50 [==============================] - 5s 95ms/step - loss: 0.3445 - val_loss: 0.6873
Epoch 14/100
50/50 [==============================] - 5s 100ms/step - loss: 0.3001 - val_loss: 0.6023
Epoch 15/100
50/50 [==============================] - 5s 98ms/step - loss: 0.3100 - val_loss: 0.5990
Epoch 16/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2822 - val_loss: 0.5811
Epoch 17/100
50/50 [==============================] - 5s 101ms/step - loss: 0.2774 - val_loss: 0.5770
Epoch 18/100
50/50 [==============================] - 5s 103ms/step - loss: 0.2895 - val_loss: 0.5983
Epoch 19/100
50/50 [==============================] - 5s 101ms/step - loss: 0.2754 - val_loss: 0.5464
Epoch 20/100
50/50 [==============================] - 5s 104ms/step - loss: 0.2881 - val_loss: 0.5928
Epoch 21/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2720 - val_loss: 0.5506

```
Epoch 22/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2695 - val_loss: 0.6001
Epoch 23/100
50/50 [==============================] - 5s 100ms/step - loss: 0.2663 - val_loss: 1.3953
Epoch 24/100
50/50 [==============================] - 5s 104ms/step - loss: 0.2918 - val_loss: 0.5299
Epoch 25/100
50/50 [==============================] - 5s 108ms/step - loss: 0.2629 - val_loss: 0.5221
Epoch 26/100
50/50 [==============================] - 5s 107ms/step - loss: 0.2610 - val_loss: 0.5126
Epoch 27/100
50/50 [==============================] - 5s 103ms/step - loss: 0.2591 - val_loss: 0.5142
Epoch 28/100
50/50 [==============================] - 5s 100ms/step - loss: 0.2571 - val_loss: 0.5108
Epoch 29/100
50/50 [==============================] - 5s 102ms/step - loss: 0.5138 - val_loss: 1.0143
Epoch 30/100
50/50 [==============================] - 5s 103ms/step - loss: 0.3742 - val_loss: 0.6441
Epoch 31/100
50/50 [==============================] - 5s 102ms/step - loss: 0.2723 - val_loss: 0.5736
Epoch 32/100
50/50 [==============================] - 5s 101ms/step - loss: 0.2596 - val_loss: 0.5191
Epoch 33/100
50/50 [==============================] - 5s 100ms/step - loss: 0.2553 - val_loss: 0.5192
Epoch 34/100
50/50 [==============================] - 5s 101ms/step - loss: 0.2512 - val_loss: 0.4869
Epoch 35/100
50/50 [==============================] - 5s 105ms/step - loss: 0.2481 - val_loss: 0.5063
Epoch 36/100
50/50 [==============================] - 5s 108ms/step - loss: 0.2492 - val_loss: 0.5392
Epoch 37/100
50/50 [==============================] - 5s 108ms/step - loss: 0.3998 - val_loss: 0.9531
Epoch 38/100
50/50 [==============================] - 5s 104ms/step - loss: 0.3639 - val_loss: 0.6275
Epoch 39/100
50/50 [==============================] - 5s 106ms/step - loss: 0.2578 - val_loss: 0.5202
Epoch 40/100
50/50 [==============================] - 5s 102ms/step - loss: 0.2475 - val_loss: 0.5216
Epoch 41/100
50/50 [==============================] - 5s 101ms/step - loss: 0.2434 - val_loss: 0.5526
Epoch 42/100
50/50 [==============================] - 5s 103ms/step - loss: 0.2413 - val_loss: 0.5324
Epoch 43/100
50/50 [==============================] - 5s 102ms/step - loss: 0.2411 - val_loss: 0.5552
Epoch 44/100
```

```
50/50 [==============================] - 5s 102ms/step - loss: 0.2378 - val_loss: 0.5718
Epoch 45/100
50/50 [==============================] - 5s 102ms/step - loss: 0.2378 - val_loss: 0.6326
Epoch 46/100
50/50 [==============================] - 5s 101ms/step - loss: 0.2357 - val_loss: 0.5770
Epoch 47/100
50/50 [==============================] - 5s 100ms/step - loss: 0.2369 - val_loss: 0.5471
Epoch 48/100
50/50 [==============================] - 5s 103ms/step - loss: 0.2350 - val_loss: 1.0615
Epoch 49/100
50/50 [==============================] - 5s 103ms/step - loss: 0.2336 - val_loss: 0.5720
Epoch 50/100
50/50 [==============================] - 5s 101ms/step - loss: 0.2328 - val_loss: 0.5694
Epoch 51/100
50/50 [==============================] - 5s 101ms/step - loss: 0.2327 - val_loss: 0.6345
Epoch 52/100
50/50 [==============================] - 5s 101ms/step - loss: 0.2468 - val_loss: 0.5630
Epoch 53/100
50/50 [==============================] - 5s 100ms/step - loss: 0.2333 - val_loss: 0.5605
Epoch 54/100
50/50 [==============================] - 5s 104ms/step - loss: 0.2308 - val_loss: 0.5819
Epoch 55/100
50/50 [==============================] - 5s 103ms/step - loss: 0.2638 - val_loss: 0.5488
Epoch 56/100
50/50 [==============================] - 5s 102ms/step - loss: 0.2326 - val_loss: 0.5599
Epoch 57/100
50/50 [==============================] - 5s 104ms/step - loss: 0.2302 - val_loss: 0.5733
Epoch 58/100
50/50 [==============================] - 5s 104ms/step - loss: 0.2300 - val_loss: 0.5408
Epoch 59/100
50/50 [==============================] - 5s 103ms/step - loss: 0.2296 - val_loss: 0.5353
Epoch 60/100
50/50 [==============================] - 5s 103ms/step - loss: 0.2293 - val_loss: 0.5597
Epoch 61/100
50/50 [==============================] - 5s 102ms/step - loss: 0.2270 - val_loss: 0.6002
Epoch 62/100
50/50 [==============================] - 5s 103ms/step - loss: 0.2353 - val_loss: 0.6749
Epoch 63/100
50/50 [==============================] - 5s 102ms/step - loss: 0.2271 - val_loss: 0.6948
Epoch 64/100
50/50 [==============================] - 5s 102ms/step - loss: 0.2264 - val_loss: 0.6146
Epoch 65/100
50/50 [==============================] - 5s 102ms/step - loss: 0.2264 - val_loss: 0.6023
Epoch 66/100
50/50 [==============================] - 5s 101ms/step - loss: 0.2246 - val_loss: 0.6726
```

```
Epoch 67/100
50/50 [==============================] - 5s 104ms/step - loss: 0.2241 - val_loss: 0.6185
Epoch 68/100
50/50 [==============================] - 5s 105ms/step - loss: 0.2257 - val_loss: 0.6406
Epoch 69/100
50/50 [==============================] - 5s 106ms/step - loss: 0.2231 - val_loss: 0.6457
Epoch 70/100
50/50 [==============================] - 5s 104ms/step - loss: 0.2220 - val_loss: 0.6300
Epoch 71/100
50/50 [==============================] - 5s 104ms/step - loss: 0.2225 - val_loss: 0.6684
Epoch 72/100
50/50 [==============================] - 5s 102ms/step - loss: 0.3421 - val_loss: 1.0219
Epoch 73/100
50/50 [==============================] - 5s 104ms/step - loss: 0.3784 - val_loss: 0.7027
Epoch 74/100
50/50 [==============================] - 5s 102ms/step - loss: 0.2535 - val_loss: 0.7435
Epoch 75/100
50/50 [==============================] - 5s 102ms/step - loss: 0.2340 - val_loss: 0.8030
Epoch 76/100
50/50 [==============================] - 5s 101ms/step - loss: 0.2288 - val_loss: 0.8308
Epoch 77/100
50/50 [==============================] - 5s 103ms/step - loss: 0.2266 - val_loss: 0.8867
Epoch 78/100
50/50 [==============================] - 5s 101ms/step - loss: 0.2255 - val_loss: 0.8435
Epoch 79/100
50/50 [==============================] - 5s 101ms/step - loss: 0.2241 - val_loss: 0.9420
Epoch 80/100
50/50 [==============================] - 5s 102ms/step - loss: 0.2232 - val_loss: 0.9206
Epoch 81/100
50/50 [==============================] - 5s 101ms/step - loss: 0.3089 - val_loss: 0.9066
Epoch 82/100
50/50 [==============================] - 5s 101ms/step - loss: 0.2657 - val_loss: 0.7068
Epoch 83/100
50/50 [==============================] - 5s 102ms/step - loss: 0.2272 - val_loss: 0.7724
Epoch 84/100
50/50 [==============================] - 5s 102ms/step - loss: 0.2236 - val_loss: 0.8629
Epoch 85/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2221 - val_loss: 0.9643
Epoch 86/100
50/50 [==============================] - 5s 100ms/step - loss: 0.2213 - val_loss: 0.9206
Epoch 87/100
50/50 [==============================] - 5s 101ms/step - loss: 0.2204 - val_loss: 0.8903
Epoch 88/100
50/50 [==============================] - 5s 100ms/step - loss: 0.2200 - val_loss: 0.8402
Epoch 89/100
```

```
50/50 [==============================] - 5s 105ms/step - loss: 0.2193 - val_loss: 0.8330
Epoch 90/100
50/50 [==============================] - 5s 102ms/step - loss: 0.2191 - val_loss: 0.7882
Epoch 91/100
50/50 [==============================] - 5s 102ms/step - loss: 0.2179 - val_loss: 0.7208
Epoch 92/100
50/50 [==============================] - 5s 102ms/step - loss: 0.2181 - val_loss: 0.6777
Epoch 93/100
50/50 [==============================] - 5s 102ms/step - loss: 0.2173 - val_loss: 0.7288
Epoch 94/100
50/50 [==============================] - 5s 102ms/step - loss: 0.2175 - val_loss: 0.7276
Epoch 95/100
50/50 [==============================] - 5s 101ms/step - loss: 0.2168 - val_loss: 0.6694
Epoch 96/100
50/50 [==============================] - 5s 102ms/step - loss: 0.2173 - val_loss: 0.6793
Epoch 97/100
50/50 [==============================] - 5s 101ms/step - loss: 0.2163 - val_loss: 0.6552
Epoch 98/100
50/50 [==============================] - 5s 101ms/step - loss: 0.2166 - val_loss: 0.7050
Epoch 99/100
50/50 [==============================] - 5s 102ms/step - loss: 0.2159 - val_loss: 0.6846
Epoch 100/100
50/50 [==============================] - 5s 104ms/step - loss: 0.2165 - val_loss: 0.7576
```


Multi-Step Training and validation loss for CA_2

Multi_step LSTM for CA_2

Tail of Multi_step LSTM for CA_2
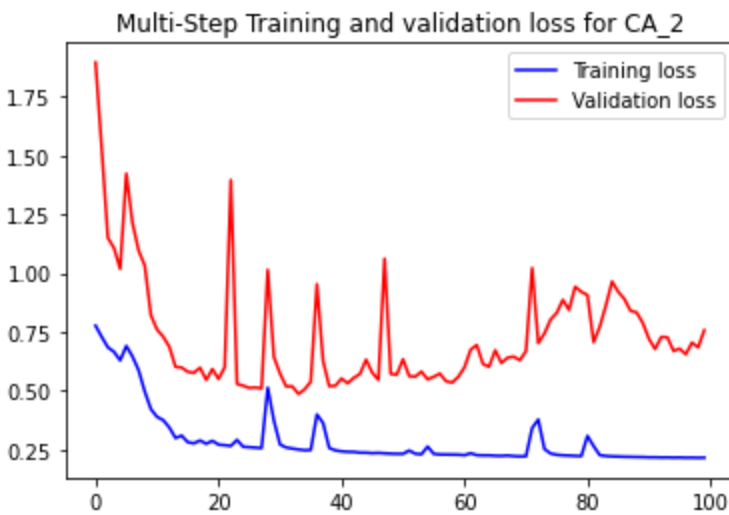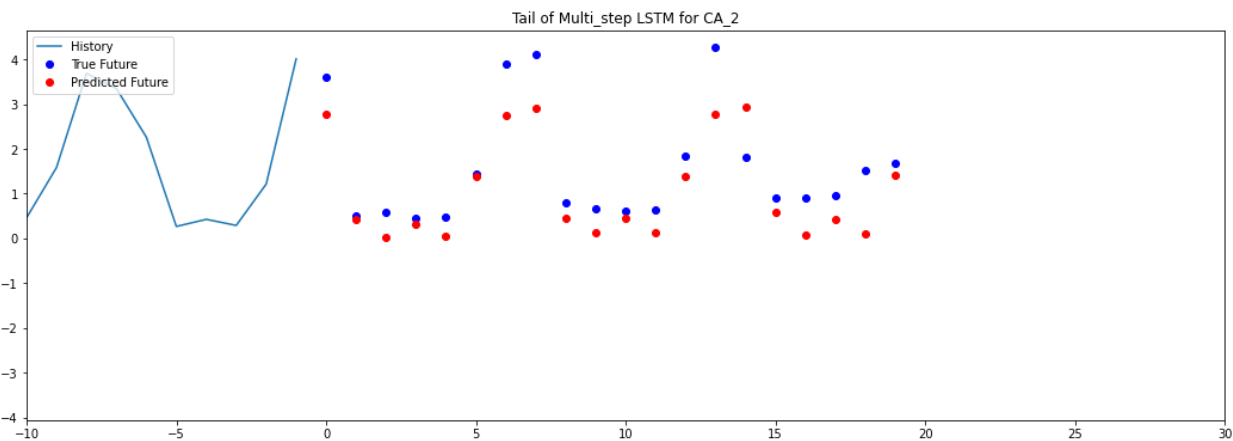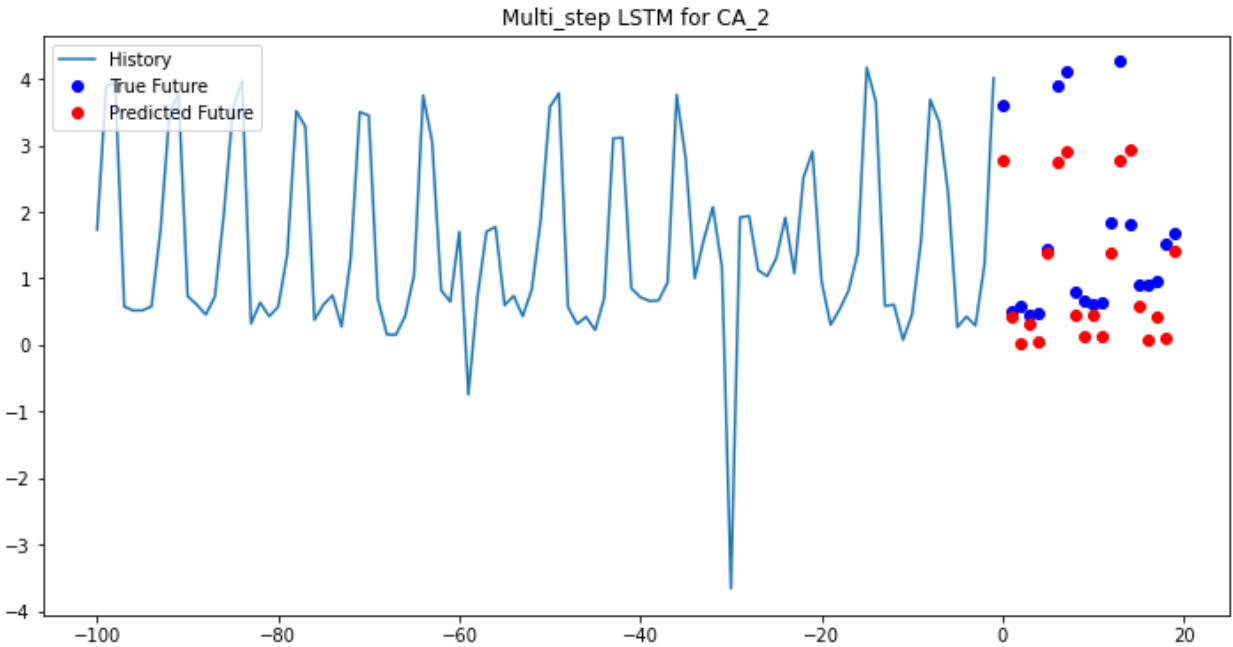
CA_2 - True Future: [5647. 3240. 3294. 3189. 3211. 3964. 5873. 6037. 3454. 3360. 3314. 3333.
 4276. 6150. 4251. 3537. 3549. 3586. 4026. 4140.]
CA_2 - Model Prediction: [5000.3486 3168.0662 2864.1099 3095.2942 2881.734 3923.0776
4981.55
 5104.752 3185.2693 2943.5508 3195.9175 2945.8325 3911.083 5003.562
 5122.8213 3291.8323 2904.436 3165.098 2928.6858 3930.8726]
CA_2 - Model Percentage Error: [11.45123724 2.22018018 13.05070239 2.93840735 10.25431683
1.03235023
 15.17878759 15.4422403   7.78027542 12.39432199 3.56314181 11.61618603
  8.53407372 18.6412681   20.50861654 6.9315161 18.16184742 11.73737032
 27.25569322 5.05138747]%
CA_2 - Model Mean Percentage Error: 11.187196012918125%
====================================
====================================
Training for TX_1

Single window of past history : (100, 3)
(72, 20)
Epoch 1/100
50/50 [==============================] - 5s 108ms/step - loss: 0.7550 - val_loss: 0.7805
Epoch 2/100
50/50 [==============================] - 5s 99ms/step - loss: 0.7456 - val_loss: 0.7711
Epoch 3/100
50/50 [==============================] - 5s 101ms/step - loss: 0.7276 - val_loss: 0.7398
Epoch 4/100
50/50 [==============================] - 5s 101ms/step - loss: 0.7067 - val_loss: 0.7053
Epoch 5/100
50/50 [==============================] - 5s 101ms/step - loss: 0.6982 - val_loss: 0.7083
Epoch 6/100
50/50 [==============================] - 5s 102ms/step - loss: 0.6932 - val_loss: 0.7193
Epoch 7/100
50/50 [==============================] - 5s 106ms/step - loss: 0.6825 - val_loss: 0.7458
Epoch 8/100
50/50 [==============================] - 6s 111ms/step - loss: 0.6597 - val_loss: 0.6741
Epoch 9/100
50/50 [==============================] - 5s 107ms/step - loss: 0.5672 - val_loss: 0.5098
Epoch 10/100
50/50 [==============================] - 5s 105ms/step - loss: 0.5073 - val_loss: 0.5041
Epoch 11/100
50/50 [==============================] - 5s 104ms/step - loss: 0.4854 - val_loss: 0.5102
Epoch 12/100
50/50 [==============================] - 5s 108ms/step - loss: 0.4706 - val_loss: 0.4478
Epoch 13/100
50/50 [==============================] - 5s 107ms/step - loss: 0.4506 - val_loss: 0.4378
Epoch 14/100
50/50 [==============================] - 5s 108ms/step - loss: 0.4938 - val_loss: 0.4391
Epoch 15/100
50/50 [==============================] - 5s 107ms/step - loss: 0.5303 - val_loss: 0.6859
Epoch 16/100
50/50 [==============================] - 5s 108ms/step - loss: 0.6338 - val_loss: 0.6221
Epoch 17/100
50/50 [==============================] - 5s 104ms/step - loss: 0.5123 - val_loss: 0.4389
Epoch 18/100
50/50 [==============================] - 5s 106ms/step - loss: 0.4485 - val_loss: 0.4066
Epoch 19/100
50/50 [==============================] - 5s 104ms/step - loss: 0.4022 - val_loss: 0.4016
Epoch 20/100
50/50 [==============================] - 5s 105ms/step - loss: 0.4005 - val_loss: 0.3950
Epoch 21/100
50/50 [==============================] - 5s 105ms/step - loss: 0.3787 - val_loss: 0.3940
Epoch 22/100

```
50/50 [==============================] - 5s 105ms/step - loss: 0.6252 - val_loss: 0.6125
Epoch 23/100
50/50 [==============================] - 5s 107ms/step - loss: 0.5085 - val_loss: 0.4723
Epoch 24/100
50/50 [==============================] - 5s 108ms/step - loss: 0.3983 - val_loss: 0.4057
Epoch 25/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3732 - val_loss: 0.3933
Epoch 26/100
50/50 [==============================] - 6s 117ms/step - loss: 0.3648 - val_loss: 0.3989
Epoch 27/100
50/50 [==============================] - 7s 132ms/step - loss: 0.3597 - val_loss: 0.3640
Epoch 28/100
50/50 [==============================] - 5s 104ms/step - loss: 0.3560 - val_loss: 0.3759
Epoch 29/100
50/50 [==============================] - 5s 104ms/step - loss: 0.3504 - val_loss: 0.3624
Epoch 30/100
50/50 [==============================] - 5s 103ms/step - loss: 0.3463 - val_loss: 0.3816
Epoch 31/100
50/50 [==============================] - 5s 105ms/step - loss: 0.3448 - val_loss: 0.3598
Epoch 32/100
50/50 [==============================] - 5s 104ms/step - loss: 0.3421 - val_loss: 0.3970
Epoch 33/100
50/50 [==============================] - 5s 104ms/step - loss: 0.3398 - val_loss: 0.3542
Epoch 34/100
50/50 [==============================] - 5s 104ms/step - loss: 0.4284 - val_loss: 0.7382
Epoch 35/100
50/50 [==============================] - 5s 104ms/step - loss: 0.6402 - val_loss: 0.6620
Epoch 36/100
50/50 [==============================] - 5s 104ms/step - loss: 0.5672 - val_loss: 0.5847
Epoch 37/100
50/50 [==============================] - 5s 104ms/step - loss: 0.4471 - val_loss: 0.4917
Epoch 38/100
50/50 [==============================] - 5s 104ms/step - loss: 0.3837 - val_loss: 0.4480
Epoch 39/100
50/50 [==============================] - 5s 104ms/step - loss: 0.3555 - val_loss: 0.4343
Epoch 40/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3434 - val_loss: 0.3949
Epoch 41/100
50/50 [==============================] - 5s 102ms/step - loss: 0.3389 - val_loss: 0.3897
Epoch 42/100
50/50 [==============================] - 5s 105ms/step - loss: 0.3318 - val_loss: 0.3738
Epoch 43/100
50/50 [==============================] - 5s 103ms/step - loss: 0.4760 - val_loss: 0.4182
Epoch 44/100
50/50 [==============================] - 5s 105ms/step - loss: 0.3584 - val_loss: 0.3814
```

```
Epoch 45/100
50/50 [==============================] - 5s 108ms/step - loss: 0.3359 - val_loss: 0.3817
Epoch 46/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3276 - val_loss: 0.3679
Epoch 47/100
50/50 [==============================] - 5s 102ms/step - loss: 0.3243 - val_loss: 0.3676
Epoch 48/100
50/50 [==============================] - 5s 104ms/step - loss: 0.3222 - val_loss: 0.3652
Epoch 49/100
50/50 [==============================] - 5s 103ms/step - loss: 0.3194 - val_loss: 0.3700
Epoch 50/100
50/50 [==============================] - 5s 107ms/step - loss: 0.3187 - val_loss: 0.3763
Epoch 51/100
50/50 [==============================] - 5s 103ms/step - loss: 0.3168 - val_loss: 0.3777
Epoch 52/100
50/50 [==============================] - 5s 104ms/step - loss: 0.5956 - val_loss: 0.6304
Epoch 53/100
50/50 [==============================] - 5s 103ms/step - loss: 0.5273 - val_loss: 0.4924
Epoch 54/100
50/50 [==============================] - 5s 104ms/step - loss: 0.4221 - val_loss: 0.4654
Epoch 55/100
50/50 [==============================] - 5s 103ms/step - loss: 0.3821 - val_loss: 0.4397
Epoch 56/100
50/50 [==============================] - 5s 102ms/step - loss: 0.3569 - val_loss: 0.4188
Epoch 57/100
50/50 [==============================] - 5s 103ms/step - loss: 0.3367 - val_loss: 0.4045
Epoch 58/100
50/50 [==============================] - 5s 104ms/step - loss: 0.3265 - val_loss: 0.3904
Epoch 59/100
50/50 [==============================] - 5s 101ms/step - loss: 0.3213 - val_loss: 0.3882
Epoch 60/100
50/50 [==============================] - 5s 103ms/step - loss: 0.3179 - val_loss: 0.4023
Epoch 61/100
50/50 [==============================] - 5s 103ms/step - loss: 0.3151 - val_loss: 0.3921
Epoch 62/100
50/50 [==============================] - 5s 103ms/step - loss: 0.3388 - val_loss: 0.3830
Epoch 63/100
50/50 [==============================] - 5s 103ms/step - loss: 0.3171 - val_loss: 0.3789
Epoch 64/100
50/50 [==============================] - 5s 102ms/step - loss: 0.3111 - val_loss: 0.3697
Epoch 65/100
50/50 [==============================] - 5s 104ms/step - loss: 0.3117 - val_loss: 0.3641
Epoch 66/100
50/50 [==============================] - 5s 106ms/step - loss: 0.3092 - val_loss: 0.3773
Epoch 67/100
```

```
50/50 [==============================] - 5s 104ms/step - loss: 0.3075 - val_loss: 0.3833
Epoch 68/100
50/50 [==============================] - 5s 100ms/step - loss: 0.3065 - val_loss: 0.3833
Epoch 69/100
50/50 [==============================] - 5s 103ms/step - loss: 0.3058 - val_loss: 0.3725
Epoch 70/100
50/50 [==============================] - 5s 102ms/step - loss: 0.3050 - val_loss: 0.3642
Epoch 71/100
50/50 [==============================] - 5s 99ms/step - loss: 0.3038 - val_loss: 0.3765
Epoch 72/100
50/50 [==============================] - 5s 101ms/step - loss: 0.3040 - val_loss: 0.3639
Epoch 73/100
50/50 [==============================] - 5s 100ms/step - loss: 0.3017 - val_loss: 0.3757
Epoch 74/100
50/50 [==============================] - 5s 101ms/step - loss: 0.3013 - val_loss: 0.3698
Epoch 75/100
50/50 [==============================] - 5s 101ms/step - loss: 0.3022 - val_loss: 0.3775
Epoch 76/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2999 - val_loss: 0.3640
Epoch 77/100
50/50 [==============================] - 5s 98ms/step - loss: 0.3002 - val_loss: 0.3590
Epoch 78/100
50/50 [==============================] - 5s 100ms/step - loss: 0.3218 - val_loss: 0.3698
Epoch 79/100
50/50 [==============================] - 5s 101ms/step - loss: 0.3023 - val_loss: 0.3519
Epoch 80/100
50/50 [==============================] - 5s 100ms/step - loss: 0.2980 - val_loss: 0.3629
Epoch 81/100
50/50 [==============================] - 5s 101ms/step - loss: 0.2967 - val_loss: 0.3662
Epoch 82/100
50/50 [==============================] - 5s 103ms/step - loss: 0.2969 - val_loss: 0.3549
Epoch 83/100
50/50 [==============================] - 5s 100ms/step - loss: 0.2958 - val_loss: 0.3510
Epoch 84/100
50/50 [==============================] - 5s 102ms/step - loss: 0.2955 - val_loss: 0.3620
Epoch 85/100
50/50 [==============================] - 5s 100ms/step - loss: 0.2951 - val_loss: 0.3660
Epoch 86/100
50/50 [==============================] - 5s 100ms/step - loss: 0.3216 - val_loss: 0.3627
Epoch 87/100
50/50 [==============================] - 5s 100ms/step - loss: 0.2993 - val_loss: 0.3495
Epoch 88/100
50/50 [==============================] - 5s 100ms/step - loss: 0.2932 - val_loss: 0.3564
Epoch 89/100
50/50 [==============================] - 5s 100ms/step - loss: 0.2928 - val_loss: 0.3560
```

```
Epoch 90/100
50/50 [==============================] - 5s 102ms/step - loss: 0.2924 - val_loss: 0.3571
Epoch 91/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2920 - val_loss: 0.3516
Epoch 92/100
50/50 [==============================] - 5s 101ms/step - loss: 0.2915 - val_loss: 0.3561
Epoch 93/100
50/50 [==============================] - 5s 101ms/step - loss: 0.2908 - val_loss: 0.3697
Epoch 94/100
50/50 [==============================] - 5s 101ms/step - loss: 0.2906 - val_loss: 0.3674
Epoch 95/100
50/50 [==============================] - 5s 101ms/step - loss: 0.2907 - val_loss: 0.3780
Epoch 96/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2895 - val_loss: 0.3655
Epoch 97/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2897 - val_loss: 0.3786
Epoch 98/100
50/50 [==============================] - 5s 101ms/step - loss: 0.2882 - val_loss: 0.3739
Epoch 99/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2888 - val_loss: 0.3715
Epoch 100/100
50/50 [==============================] - 5s 99ms/step - loss: 0.3030 - val_loss: 0.5679
```


Multi-Step Training and validation loss for TX_1

Multi_step LSTM for TX_1

Tail of Multi_step LSTM for TX_1
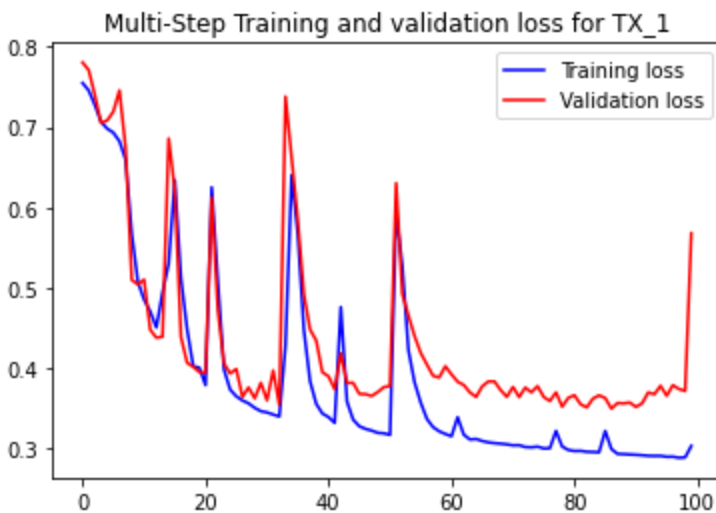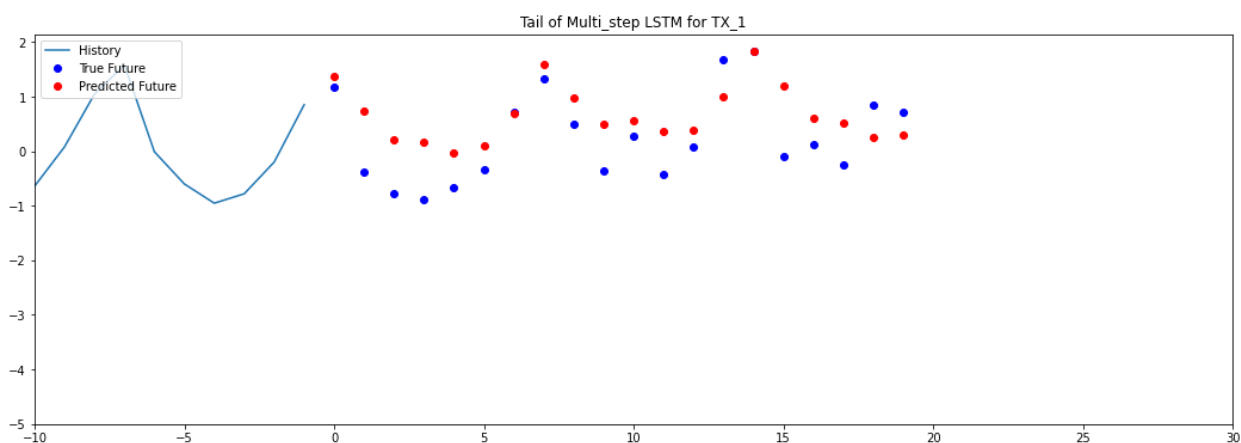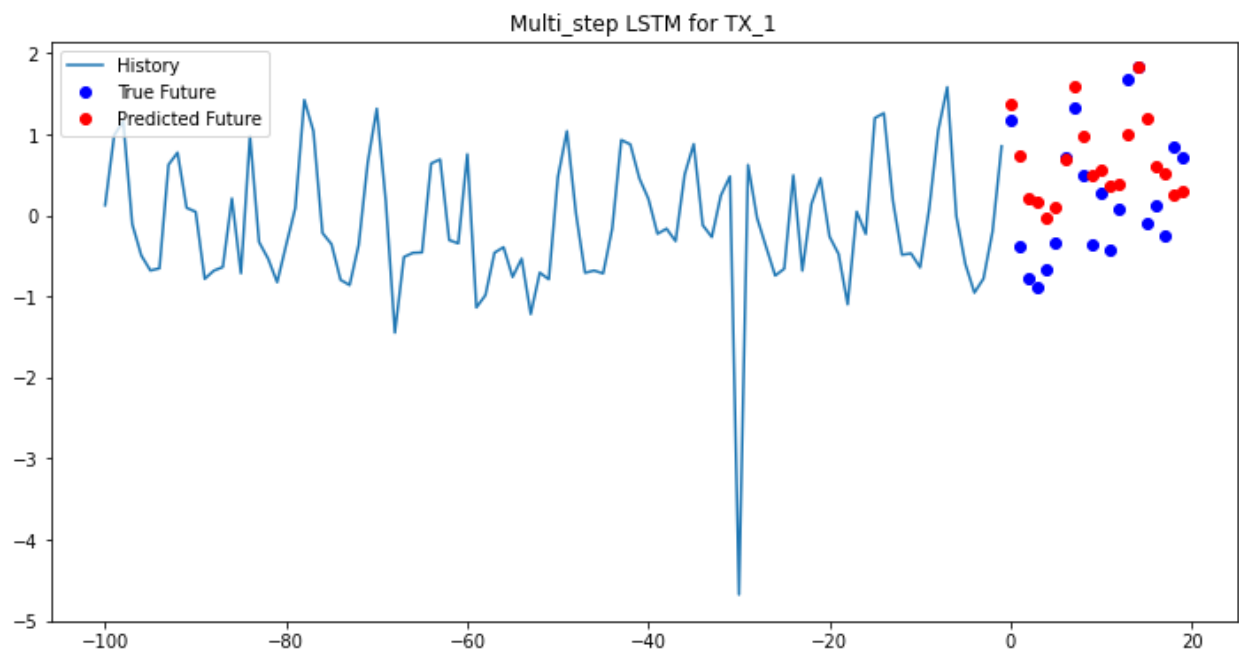
TX_1 - True Future: [3639. 2666. 2426. 2357. 2497. 2693. 3347. 3727. 3213. 2681. 3081. 2645. 2949. 3939. 4034. 2845. 2978. 2745. 3431. 3343.]

TX_1 - Model Prediction: [3757.236 3360.4895 3039.2988 3013.6252 2892.1477 2964.3691 3339.52
 3890.2588 3504.9692 3211.4404 3248.7463 3135.283 3148.3423 3529.2502
 4033.7056 3641.5034 3286.6584 3230.7756 3057.3271 3084.9163]

TX_1 - Model Percentage Error: [3.24913669e+00 2.60498688e+01 2.52802485e+01 2.78585169e+01
 1.58248981e+01 1.00768340e+01 2.23483133e-01 4.38043437e+00
 9.08712226e+00 1.97851708e+01 5.44454196e+00 1.85362177e+01
 6.75965701e+00 1.04023802e+01 7.29880004e-03 2.79966052e+01
 1.03646221e+01 1.76967444e+01 1.08910770e+01 7.72012385e+00]%

TX_1 - Model Mean Percentage Error: 12.881749095321492%

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Training for TX_3

Single window of past history : (100, 3)

(72, 20)

Epoch 1/100

50/50 [==============================] - 5s 105ms/step - loss: 0.7438 - val_loss: 1.0323

Epoch 2/100

50/50 [==============================] - 5s 94ms/step - loss: 0.6760 - val_loss: 0.7788

Epoch 3/100

50/50 [==============================] - 5s 95ms/step - loss: 0.6365 - val_loss: 0.6795

Epoch 4/100

50/50 [==============================] - 5s 97ms/step - loss: 0.6266 - val_loss: 0.7023

Epoch 5/100

50/50 [==============================] - 5s 93ms/step - loss: 0.6201 - val_loss: 0.6999

Epoch 6/100

50/50 [==============================] - 5s 95ms/step - loss: 0.6101 - val_loss: 0.7017

Epoch 7/100

50/50 [==============================] - 5s 95ms/step - loss: 0.5901 - val_loss: 0.7303

Epoch 8/100

50/50 [==============================] - 5s 94ms/step - loss: 0.5337 - val_loss: 0.6073

Epoch 9/100

50/50 [==============================] - 5s 95ms/step - loss: 0.4654 - val_loss: 0.5909

Epoch 10/100

50/50 [==============================] - 5s 96ms/step - loss: 0.4429 - val_loss: 0.5417

Epoch 11/100

50/50 [==============================] - 5s 93ms/step - loss: 0.4337 - val_loss: 0.5899

Epoch 12/100

50/50 [==============================] - 5s 96ms/step - loss: 0.4294 - val_loss: 0.4944

Epoch 13/100

50/50 [==============================] - 5s 95ms/step - loss: 0.4234 - val_loss: 0.5690

Epoch 14/100

50/50 [==============================] - 5s 95ms/step - loss: 0.4127 - val_loss: 0.5307

Epoch 15/100

50/50 [==============================] - 5s 95ms/step - loss: 0.4048 - val_loss: 0.4335

Epoch 16/100

50/50 [==============================] - 5s 95ms/step - loss: 0.3965 - val_loss: 0.4350

Epoch 17/100

50/50 [==============================] - 5s 94ms/step - loss: 0.3854 - val_loss: 0.4589

Epoch 18/100

50/50 [==============================] - 5s 95ms/step - loss: 0.3757 - val_loss: 0.4399

Epoch 19/100

50/50 [==============================] - 5s 98ms/step - loss: 0.3671 - val_loss: 0.4832

Epoch 20/100

50/50 [==============================] - 5s 98ms/step - loss: 0.3639 - val_loss: 0.4705

Epoch 21/100

50/50 [==============================] - 5s 97ms/step - loss: 0.3600 - val_loss: 0.5091

```
Epoch 22/100
50/50 [==============================] - 5s 98ms/step - loss: 0.3513 - val_loss: 0.4713
Epoch 23/100
50/50 [==============================] - 5s 101ms/step - loss: 0.3495 - val_loss: 0.5088
Epoch 24/100
50/50 [==============================] - 5s 99ms/step - loss: 0.3436 - val_loss: 0.4992
Epoch 25/100
50/50 [==============================] - 5s 98ms/step - loss: 0.3434 - val_loss: 0.4888
Epoch 26/100
50/50 [==============================] - 5s 100ms/step - loss: 0.3387 - val_loss: 0.5475
Epoch 27/100
50/50 [==============================] - 5s 102ms/step - loss: 0.3335 - val_loss: 0.5177
Epoch 28/100
50/50 [==============================] - 5s 99ms/step - loss: 0.3336 - val_loss: 0.5768
Epoch 29/100
50/50 [==============================] - 5s 98ms/step - loss: 0.3311 - val_loss: 0.5492
Epoch 30/100
50/50 [==============================] - 5s 98ms/step - loss: 0.3255 - val_loss: 0.5722
Epoch 31/100
50/50 [==============================] - 5s 99ms/step - loss: 0.3233 - val_loss: 0.7196
Epoch 32/100
50/50 [==============================] - 5s 97ms/step - loss: 0.3342 - val_loss: 0.5838
Epoch 33/100
50/50 [==============================] - 5s 99ms/step - loss: 0.3206 - val_loss: 0.6037
Epoch 34/100
50/50 [==============================] - 5s 98ms/step - loss: 0.3229 - val_loss: 0.5765
Epoch 35/100
50/50 [==============================] - 5s 99ms/step - loss: 0.3139 - val_loss: 0.5969
Epoch 36/100
50/50 [==============================] - 5s 99ms/step - loss: 0.3463 - val_loss: 0.5850
Epoch 37/100
50/50 [==============================] - 5s 97ms/step - loss: 0.3153 - val_loss: 0.6210
Epoch 38/100
50/50 [==============================] - 5s 98ms/step - loss: 0.3089 - val_loss: 0.5847
Epoch 39/100
50/50 [==============================] - 5s 97ms/step - loss: 0.3164 - val_loss: 0.5999
Epoch 40/100
50/50 [==============================] - 5s 99ms/step - loss: 0.3076 - val_loss: 0.6027
Epoch 41/100
50/50 [==============================] - 5s 98ms/step - loss: 0.3224 - val_loss: 0.5638
Epoch 42/100
50/50 [==============================] - 5s 98ms/step - loss: 0.3055 - val_loss: 0.5981
Epoch 43/100
50/50 [==============================] - 5s 97ms/step - loss: 0.3179 - val_loss: 0.5602
Epoch 44/100
```

```
50/50 [==============================] - 6s 114ms/step - loss: 0.3035 - val_loss: 0.5686
Epoch 45/100
50/50 [==============================] - 6s 119ms/step - loss: 0.3173 - val_loss: 0.5671
Epoch 46/100
50/50 [==============================] - 5s 99ms/step - loss: 0.3020 - val_loss: 0.5579
Epoch 47/100
50/50 [==============================] - 5s 98ms/step - loss: 0.3097 - val_loss: 0.5674
Epoch 48/100
50/50 [==============================] - 5s 99ms/step - loss: 0.3007 - val_loss: 0.5604
Epoch 49/100
50/50 [==============================] - 5s 99ms/step - loss: 0.3058 - val_loss: 0.5688
Epoch 50/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2992 - val_loss: 0.5341
Epoch 51/100
50/50 [==============================] - 5s 98ms/step - loss: 0.3066 - val_loss: 0.5502
Epoch 52/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2984 - val_loss: 0.5321
Epoch 53/100
50/50 [==============================] - 5s 99ms/step - loss: 0.3058 - val_loss: 0.5309
Epoch 54/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2966 - val_loss: 0.5223
Epoch 55/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2998 - val_loss: 0.5171
Epoch 56/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2962 - val_loss: 0.5238
Epoch 57/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2942 - val_loss: 0.5279
Epoch 58/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2974 - val_loss: 0.5538
Epoch 59/100
50/50 [==============================] - 5s 100ms/step - loss: 0.3151 - val_loss: 0.5348
Epoch 60/100
50/50 [==============================] - 5s 101ms/step - loss: 0.2931 - val_loss: 0.5196
Epoch 61/100
50/50 [==============================] - 5s 100ms/step - loss: 0.2914 - val_loss: 0.5446
Epoch 62/100
50/50 [==============================] - 5s 98ms/step - loss: 0.3001 - val_loss: 0.5336
Epoch 63/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2920 - val_loss: 0.5325
Epoch 64/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2892 - val_loss: 0.5362
Epoch 65/100
50/50 [==============================] - 5s 100ms/step - loss: 0.3009 - val_loss: 0.5313
Epoch 66/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2893 - val_loss: 0.5211
```

```
Epoch 67/100
50/50 [==============================] - 5s 100ms/step - loss: 0.2897 - val_loss: 0.5177
Epoch 68/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2889 - val_loss: 0.5387
Epoch 69/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2988 - val_loss: 0.5296
Epoch 70/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2877 - val_loss: 0.5577
Epoch 71/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2879 - val_loss: 0.5560
Epoch 72/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2996 - val_loss: 0.5444
Epoch 73/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2861 - val_loss: 0.5371
Epoch 74/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2883 - val_loss: 0.5325
Epoch 75/100
50/50 [==============================] - 5s 98ms/step - loss: 0.3001 - val_loss: 0.5497
Epoch 76/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2856 - val_loss: 0.5510
Epoch 77/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2854 - val_loss: 0.5550
Epoch 78/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2958 - val_loss: 0.5500
Epoch 79/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2843 - val_loss: 0.5728
Epoch 80/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2844 - val_loss: 0.5924
Epoch 81/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2983 - val_loss: 0.5611
Epoch 82/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2834 - val_loss: 0.5918
Epoch 83/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2883 - val_loss: 0.5535
Epoch 84/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2823 - val_loss: 0.5926
Epoch 85/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2830 - val_loss: 0.6056
Epoch 86/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2901 - val_loss: 0.6094
Epoch 87/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2826 - val_loss: 0.5544
Epoch 88/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2822 - val_loss: 0.6167
Epoch 89/100
```

```
50/50 [==============================] - 5s 101ms/step - loss: 0.2813 - val_loss: 0.5527
Epoch 90/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2906 - val_loss: 0.5489
Epoch 91/100
50/50 [==============================] - 5s 100ms/step - loss: 0.2833 - val_loss: 0.6051
Epoch 92/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2809 - val_loss: 0.6117
Epoch 93/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2941 - val_loss: 0.5832
Epoch 94/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2801 - val_loss: 0.6273
Epoch 95/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2800 - val_loss: 0.5683
Epoch 96/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2884 - val_loss: 0.6010
Epoch 97/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2795 - val_loss: 0.6227
Epoch 98/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2784 - val_loss: 0.6255
Epoch 99/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2786 - val_loss: 0.6260
Epoch 100/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2852 - val_loss: 0.6032
```


Multi-Step Training and validation loss for TX_3

Multi_step LSTM for TX_3

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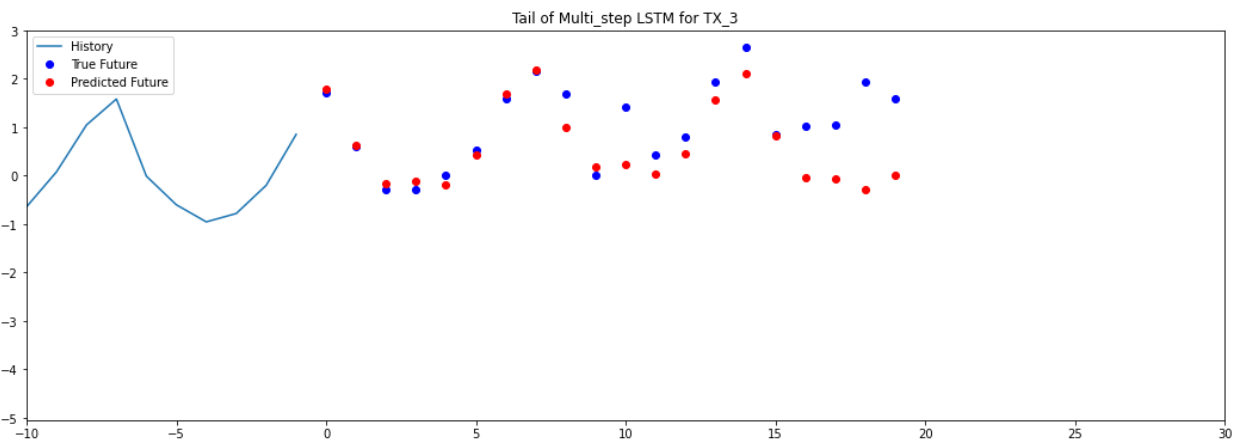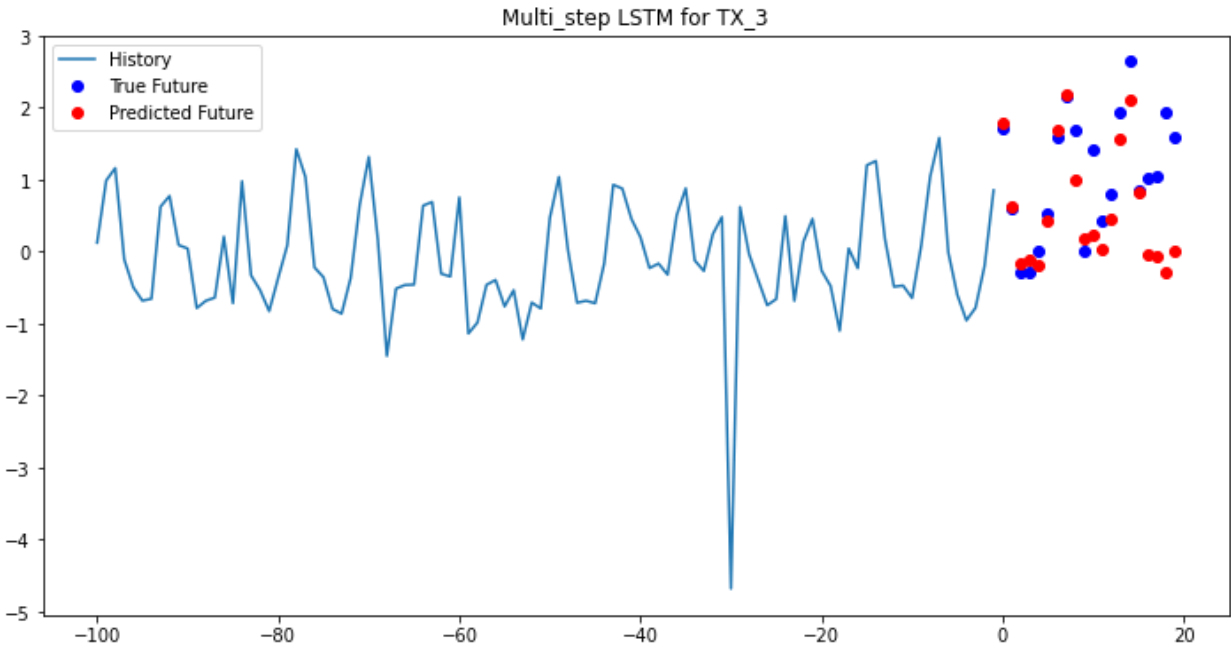
TX_3 - True Future: [4286. 3538. 2934. 2939. 3135. 3486. 4202. 4575. 4262. 3141. 4091. 3421.
 3664. 4432. 4905. 3707. 3825. 3831. 4438. 4198.]

TX_3 - Model Prediction: [4325.066 3545.5908 3025.4373 3049.2617 3002.185 3416.2903
4257.922
 4603.6416 3795.9438 3260.277 3279.9326 3145.4136 3429.896 4179.026
 4541.078 3677.714 3106.267 3091.4646 2942.5508 3128.8665]

TX_3 - Model Percentage Error: [0.91147732 0.21455117 3.11647089 3.75167468 4.23652126
1.99970501
 1.33083948 0.62604594 10.93515139 3.79742437 19.82565101 8.05572715
 6.38930142 5.70789984 7.41940622 0.79001588 18.79040288 19.30397808
 33.6964673 25.46768806]%

TX_3 - Model Mean Percentage Error: 8.818319967700248%

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Training for TX_2

```
Single window of past history : (100, 3)
(72, 20)
Epoch 1/100
50/50 [==============================] - 5s 102ms/step - loss: 0.7602 - val_loss: 0.6986
Epoch 2/100
50/50 [==============================] - 5s 94ms/step - loss: 0.7316 - val_loss: 0.7585
Epoch 3/100
50/50 [==============================] - 5s 94ms/step - loss: 0.7005 - val_loss: 0.7531
Epoch 4/100
50/50 [==============================] - 5s 94ms/step - loss: 0.6921 - val_loss: 0.7529
Epoch 5/100
50/50 [==============================] - 5s 94ms/step - loss: 0.6907 - val_loss: 0.7563
Epoch 6/100
50/50 [==============================] - 5s 95ms/step - loss: 0.6888 - val_loss: 0.7549
Epoch 7/100
50/50 [==============================] - 5s 95ms/step - loss: 0.6861 - val_loss: 0.7544
Epoch 8/100
50/50 [==============================] - 5s 95ms/step - loss: 0.6901 - val_loss: 0.7497
Epoch 9/100
50/50 [==============================] - 5s 95ms/step - loss: 0.6916 - val_loss: 0.7517
Epoch 10/100
50/50 [==============================] - 5s 95ms/step - loss: 0.6827 - val_loss: 0.7564
Epoch 11/100
50/50 [==============================] - 5s 95ms/step - loss: 0.6707 - val_loss: 0.7707
Epoch 12/100
50/50 [==============================] - 5s 94ms/step - loss: 0.6235 - val_loss: 0.6714
Epoch 13/100
50/50 [==============================] - 5s 94ms/step - loss: 0.5150 - val_loss: 0.4970
Epoch 14/100
50/50 [==============================] - 5s 93ms/step - loss: 0.4672 - val_loss: 0.5285
Epoch 15/100
50/50 [==============================] - 5s 94ms/step - loss: 0.4578 - val_loss: 0.4315
Epoch 16/100
50/50 [==============================] - 5s 94ms/step - loss: 0.4432 - val_loss: 0.4784
Epoch 17/100
50/50 [==============================] - 5s 92ms/step - loss: 0.4310 - val_loss: 0.5030
Epoch 18/100
50/50 [==============================] - 5s 94ms/step - loss: 0.4190 - val_loss: 0.4930
Epoch 19/100
50/50 [==============================] - 5s 95ms/step - loss: 0.4091 - val_loss: 0.4593
Epoch 20/100
50/50 [==============================] - 5s 92ms/step - loss: 0.3971 - val_loss: 0.4749
Epoch 21/100
50/50 [==============================] - 5s 94ms/step - loss: 0.3880 - val_loss: 0.4601
Epoch 22/100
```

```
50/50 [==============================] - 5s 93ms/step - loss: 0.3863 - val_loss: 0.4744
Epoch 23/100
50/50 [==============================] - 5s 94ms/step - loss: 0.3697 - val_loss: 0.4799
Epoch 24/100
50/50 [==============================] - 5s 94ms/step - loss: 0.3924 - val_loss: 0.4694
Epoch 25/100
50/50 [==============================] - 5s 94ms/step - loss: 0.3560 - val_loss: 0.4690
Epoch 26/100
50/50 [==============================] - 5s 95ms/step - loss: 0.5694 - val_loss: 0.6194
Epoch 27/100
50/50 [==============================] - 5s 95ms/step - loss: 0.4195 - val_loss: 0.4769
Epoch 28/100
50/50 [==============================] - 5s 94ms/step - loss: 0.3568 - val_loss: 0.4695
Epoch 29/100
50/50 [==============================] - 5s 94ms/step - loss: 0.3472 - val_loss: 0.4591
Epoch 30/100
50/50 [==============================] - 5s 94ms/step - loss: 0.3858 - val_loss: 0.4106
Epoch 31/100
50/50 [==============================] - 5s 93ms/step - loss: 0.3564 - val_loss: 0.3995
Epoch 32/100
50/50 [==============================] - 5s 94ms/step - loss: 0.3604 - val_loss: 0.4181
Epoch 33/100
50/50 [==============================] - 5s 95ms/step - loss: 0.3444 - val_loss: 0.4018
Epoch 34/100
50/50 [==============================] - 5s 96ms/step - loss: 0.3519 - val_loss: 0.4073
Epoch 35/100
50/50 [==============================] - 5s 95ms/step - loss: 0.4399 - val_loss: 0.6732
Epoch 36/100
50/50 [==============================] - 5s 94ms/step - loss: 0.4668 - val_loss: 0.4569
Epoch 37/100
50/50 [==============================] - 5s 94ms/step - loss: 0.3495 - val_loss: 0.4565
Epoch 38/100
50/50 [==============================] - 5s 95ms/step - loss: 0.3380 - val_loss: 0.4202
Epoch 39/100
50/50 [==============================] - 5s 95ms/step - loss: 0.3342 - val_loss: 0.4339
Epoch 40/100
50/50 [==============================] - 5s 94ms/step - loss: 0.3302 - val_loss: 0.4554
Epoch 41/100
50/50 [==============================] - 5s 94ms/step - loss: 0.3276 - val_loss: 0.4541
Epoch 42/100
50/50 [==============================] - 5s 94ms/step - loss: 0.3559 - val_loss: 0.4744
Epoch 43/100
50/50 [==============================] - 5s 94ms/step - loss: 0.3269 - val_loss: 0.4718
Epoch 44/100
50/50 [==============================] - 5s 95ms/step - loss: 0.3214 - val_loss: 0.4711
```

```
Epoch 45/100
50/50 [==============================] - 5s 93ms/step - loss: 0.3201 - val_loss: 0.4847
Epoch 46/100
50/50 [==============================] - 5s 92ms/step - loss: 0.3413 - val_loss: 0.4796
Epoch 47/100
50/50 [==============================] - 5s 94ms/step - loss: 0.3181 - val_loss: 0.4670
Epoch 48/100
50/50 [==============================] - 5s 95ms/step - loss: 0.3152 - val_loss: 0.4735
Epoch 49/100
50/50 [==============================] - 5s 94ms/step - loss: 0.3877 - val_loss: 0.5301
Epoch 50/100
50/50 [==============================] - 5s 95ms/step - loss: 0.3330 - val_loss: 0.5051
Epoch 51/100
50/50 [==============================] - 5s 95ms/step - loss: 0.3139 - val_loss: 0.4842
Epoch 52/100
50/50 [==============================] - 5s 96ms/step - loss: 0.3115 - val_loss: 0.4614
Epoch 53/100
50/50 [==============================] - 5s 94ms/step - loss: 0.3082 - val_loss: 0.4584
Epoch 54/100
50/50 [==============================] - 5s 94ms/step - loss: 0.3059 - val_loss: 0.4696
Epoch 55/100
50/50 [==============================] - 5s 93ms/step - loss: 0.3054 - val_loss: 0.4695
Epoch 56/100
50/50 [==============================] - 5s 94ms/step - loss: 0.3059 - val_loss: 0.4560
Epoch 57/100
50/50 [==============================] - 5s 95ms/step - loss: 0.4046 - val_loss: 0.4631
Epoch 58/100
50/50 [==============================] - 5s 93ms/step - loss: 0.3181 - val_loss: 0.4568
Epoch 59/100
50/50 [==============================] - 5s 95ms/step - loss: 0.3041 - val_loss: 0.4878
Epoch 60/100
50/50 [==============================] - 5s 94ms/step - loss: 0.3063 - val_loss: 0.4599
Epoch 61/100
50/50 [==============================] - 5s 94ms/step - loss: 0.3062 - val_loss: 0.4694
Epoch 62/100
50/50 [==============================] - 5s 93ms/step - loss: 0.2998 - val_loss: 0.4727
Epoch 63/100
50/50 [==============================] - 5s 95ms/step - loss: 0.3297 - val_loss: 0.4601
Epoch 64/100
50/50 [==============================] - 5s 94ms/step - loss: 0.3010 - val_loss: 0.4813
Epoch 65/100
50/50 [==============================] - 5s 93ms/step - loss: 0.2991 - val_loss: 0.4515
Epoch 66/100
50/50 [==============================] - 5s 91ms/step - loss: 0.4082 - val_loss: 0.4073
Epoch 67/100
```

```
50/50 [==============================] - 5s 100ms/step - loss: 0.3246 - val_loss: 0.4188
Epoch 68/100
50/50 [==============================] - 7s 143ms/step - loss: 0.3087 - val_loss: 0.4456
Epoch 69/100
50/50 [==============================] - 5s 93ms/step - loss: 0.3080 - val_loss: 0.4352
Epoch 70/100
50/50 [==============================] - 5s 94ms/step - loss: 0.3035 - val_loss: 0.4268
Epoch 71/100
50/50 [==============================] - 5s 95ms/step - loss: 0.3015 - val_loss: 0.4148
Epoch 72/100
50/50 [==============================] - 5s 94ms/step - loss: 0.2992 - val_loss: 0.4185
Epoch 73/100
50/50 [==============================] - 5s 95ms/step - loss: 0.3291 - val_loss: 0.3958
Epoch 74/100
50/50 [==============================] - 5s 92ms/step - loss: 0.3033 - val_loss: 0.4147
Epoch 75/100
50/50 [==============================] - 5s 94ms/step - loss: 0.2972 - val_loss: 0.3986
Epoch 76/100
50/50 [==============================] - 5s 95ms/step - loss: 0.2968 - val_loss: 0.4042
Epoch 77/100
50/50 [==============================] - 5s 94ms/step - loss: 0.2957 - val_loss: 0.4097
Epoch 78/100
50/50 [==============================] - 5s 94ms/step - loss: 0.2940 - val_loss: 0.4296
Epoch 79/100
50/50 [==============================] - 5s 94ms/step - loss: 0.3319 - val_loss: 0.3894
Epoch 80/100
50/50 [==============================] - 5s 94ms/step - loss: 0.2966 - val_loss: 0.3966
Epoch 81/100
50/50 [==============================] - 5s 95ms/step - loss: 0.2934 - val_loss: 0.3938
Epoch 82/100
50/50 [==============================] - 5s 95ms/step - loss: 0.2903 - val_loss: 0.3913
Epoch 83/100
50/50 [==============================] - 6s 116ms/step - loss: 0.2925 - val_loss: 0.3773
Epoch 84/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2903 - val_loss: 0.3864
Epoch 85/100
50/50 [==============================] - 5s 93ms/step - loss: 0.2950 - val_loss: 0.3974
Epoch 86/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2895 - val_loss: 0.4078
Epoch 87/100
50/50 [==============================] - 5s 94ms/step - loss: 0.2886 - val_loss: 0.3988
Epoch 88/100
50/50 [==============================] - 5s 94ms/step - loss: 0.3434 - val_loss: 0.4478
Epoch 89/100
50/50 [==============================] - 5s 95ms/step - loss: 0.3131 - val_loss: 0.3788
```

```
Epoch 90/100
50/50 [==============================] - 5s 94ms/step - loss: 0.2918 - val_loss: 0.3870
Epoch 91/100
50/50 [==============================] - 5s 93ms/step - loss: 0.2883 - val_loss: 0.3807
Epoch 92/100
50/50 [==============================] - 5s 94ms/step - loss: 0.2872 - val_loss: 0.3768
Epoch 93/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2864 - val_loss: 0.3974
Epoch 94/100
50/50 [==============================] - 5s 94ms/step - loss: 0.2881 - val_loss: 0.3896
Epoch 95/100
50/50 [==============================] - 5s 92ms/step - loss: 0.2845 - val_loss: 0.3897
Epoch 96/100
50/50 [==============================] - 5s 94ms/step - loss: 0.2851 - val_loss: 0.3870
Epoch 97/100
50/50 [==============================] - 5s 94ms/step - loss: 0.2844 - val_loss: 0.3873
Epoch 98/100
50/50 [==============================] - 5s 93ms/step - loss: 0.2839 - val_loss: 0.3761
Epoch 99/100
50/50 [==============================] - 5s 94ms/step - loss: 0.3141 - val_loss: 0.3829
Epoch 100/100
50/50 [==============================] - 5s 94ms/step - loss: 0.2863 - val_loss: 0.3857
```


Multi-Step Training and validation loss for TX_2

Multi_step LSTM for TX_2

Tail of Multi_step LSTM for TX_2
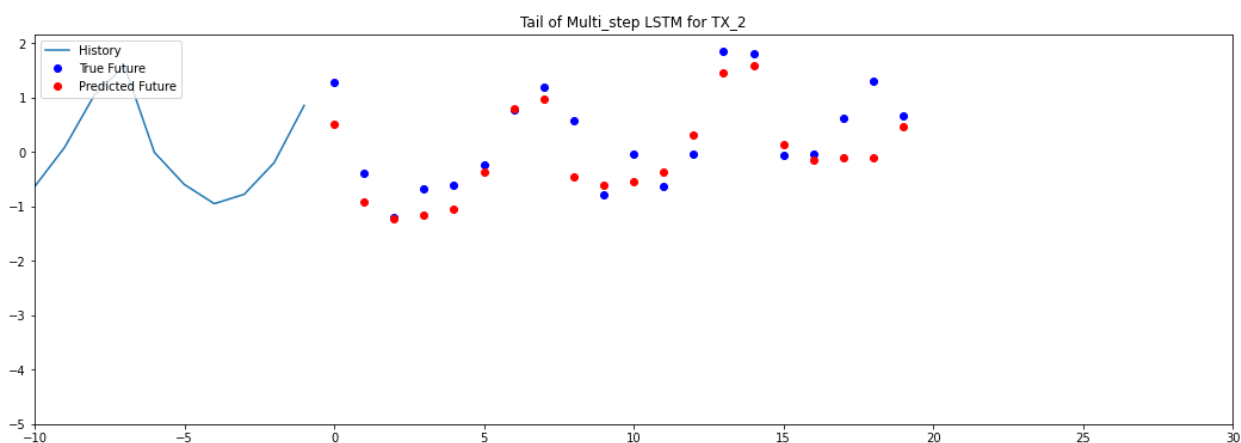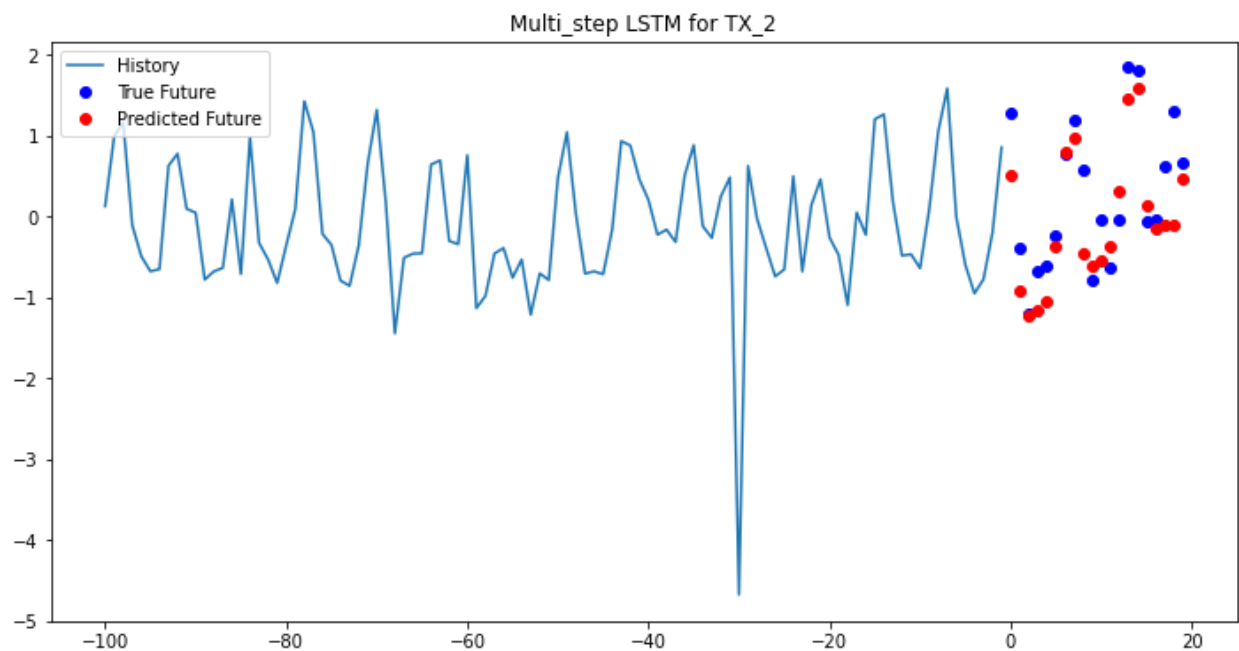
TX_2 - True Future: [4794. 3441. 2798. 3216. 3264. 3562. 4384. 4712. 4225. 3121. 3722. 3245. 3737. 5240. 5210. 3714. 3737. 4259. 4799. 4295.]

TX_2 - Model Prediction: [4172.0874 3023.0645 2770.3892 2818.5708 2907.9065 3468.1729 4398.5537
 4536.515 3401.191 3277.0688 3326.7861 3456.2495 4009.3975 4929.5728
 5028.2017 3870.8623 3635.9155 3675.11   3680.5107 4137.0547]

TX_2 - Model Percentage Error: [12.97272836 12.14575841 0.98680628 12.35787311 10.90972751 2.63411422
  0.33197333 3.72421187 19.49843981 5.0006039 10.61831991 6.51000036
  7.28920152 5.92418409 3.48941151 4.22354078 2.70496314 13.70955371
 23.3067151   3.67742288]%

TX_2 - Model Mean Percentage Error: 8.100777490898293%

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Training for WI_1

Single window of past history : (100, 3)
(72, 20)
Epoch 1/100
50/50 [==============================] - 5s 103ms/step - loss: 0.6780 - val_loss: 0.9828
Epoch 2/100
50/50 [==============================] - 5s 93ms/step - loss: 0.5044 - val_loss: 0.8559
Epoch 3/100
50/50 [==============================] - 5s 93ms/step - loss: 0.4958 - val_loss: 0.8507
Epoch 4/100
50/50 [==============================] - 5s 93ms/step - loss: 0.4930 - val_loss: 0.8394
Epoch 5/100
50/50 [==============================] - 5s 95ms/step - loss: 0.4903 - val_loss: 0.8394
Epoch 6/100
50/50 [==============================] - 5s 95ms/step - loss: 0.4893 - val_loss: 0.8185
Epoch 7/100
50/50 [==============================] - 5s 95ms/step - loss: 0.4830 - val_loss: 0.7962
Epoch 8/100
50/50 [==============================] - 5s 95ms/step - loss: 0.4754 - val_loss: 0.7926
Epoch 9/100
50/50 [==============================] - 5s 95ms/step - loss: 0.4355 - val_loss: 0.6212
Epoch 10/100
50/50 [==============================] - 5s 95ms/step - loss: 0.3884 - val_loss: 0.5657
Epoch 11/100
50/50 [==============================] - 5s 96ms/step - loss: 0.3359 - val_loss: 0.5277
Epoch 12/100
50/50 [==============================] - 5s 95ms/step - loss: 0.3244 - val_loss: 0.5168
Epoch 13/100
50/50 [==============================] - 5s 96ms/step - loss: 0.3150 - val_loss: 0.4865
Epoch 14/100
50/50 [==============================] - 5s 96ms/step - loss: 0.3053 - val_loss: 0.5034
Epoch 15/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2945 - val_loss: 0.5133
Epoch 16/100
50/50 [==============================] - 5s 95ms/step - loss: 0.2847 - val_loss: 0.5213
Epoch 17/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2731 - val_loss: 0.4997
Epoch 18/100
50/50 [==============================] - 5s 95ms/step - loss: 0.2646 - val_loss: 0.5554
Epoch 19/100
50/50 [==============================] - 5s 95ms/step - loss: 0.3303 - val_loss: 0.5048
Epoch 20/100
50/50 [==============================] - 5s 95ms/step - loss: 0.2603 - val_loss: 0.5043
Epoch 21/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2523 - val_loss: 0.4832
Epoch 22/100

```
50/50 [==============================] - 5s 96ms/step - loss: 0.2763 - val_loss: 0.5069
Epoch 23/100
50/50 [==============================] - 5s 95ms/step - loss: 0.2487 - val_loss: 0.4950
Epoch 24/100
50/50 [==============================] - 5s 95ms/step - loss: 0.2435 - val_loss: 0.4905
Epoch 25/100
50/50 [==============================] - 5s 94ms/step - loss: 0.3039 - val_loss: 0.5028
Epoch 26/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2464 - val_loss: 0.4651
Epoch 27/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2413 - val_loss: 0.5098
Epoch 28/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2479 - val_loss: 0.4896
Epoch 29/100
50/50 [==============================] - 5s 95ms/step - loss: 0.2398 - val_loss: 0.4541
Epoch 30/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2368 - val_loss: 0.4931
Epoch 31/100
50/50 [==============================] - 5s 95ms/step - loss: 0.2516 - val_loss: 0.4473
Epoch 32/100
50/50 [==============================] - 5s 94ms/step - loss: 0.2366 - val_loss: 0.4787
Epoch 33/100
50/50 [==============================] - 5s 94ms/step - loss: 0.2798 - val_loss: 0.6835
Epoch 34/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2663 - val_loss: 0.4856
Epoch 35/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2340 - val_loss: 0.4522
Epoch 36/100
50/50 [==============================] - 5s 95ms/step - loss: 0.2309 - val_loss: 0.4428
Epoch 37/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2304 - val_loss: 0.4207
Epoch 38/100
50/50 [==============================] - 5s 94ms/step - loss: 0.2519 - val_loss: 0.4171
Epoch 39/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2288 - val_loss: 0.4061
Epoch 40/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2265 - val_loss: 0.4083
Epoch 41/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2249 - val_loss: 0.4051
Epoch 42/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2367 - val_loss: 0.5685
Epoch 43/100
50/50 [==============================] - 5s 95ms/step - loss: 0.2853 - val_loss: 0.4103
Epoch 44/100
50/50 [==============================] - 5s 95ms/step - loss: 0.2352 - val_loss: 0.3853
```

```
Epoch 45/100
50/50 [==============================] - 5s 95ms/step - loss: 0.2244 - val_loss: 0.3899
Epoch 46/100
50/50 [==============================] - 5s 95ms/step - loss: 0.2223 - val_loss: 0.3812
Epoch 47/100
50/50 [==============================] - 5s 94ms/step - loss: 0.2212 - val_loss: 0.3733
Epoch 48/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2203 - val_loss: 0.4079
Epoch 49/100
50/50 [==============================] - 5s 95ms/step - loss: 0.2199 - val_loss: 0.3689
Epoch 50/100
50/50 [==============================] - 5s 96ms/step - loss: 0.3262 - val_loss: 0.6154
Epoch 51/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2491 - val_loss: 0.4722
Epoch 52/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2229 - val_loss: 0.4244
Epoch 53/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2194 - val_loss: 0.4936
Epoch 54/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2177 - val_loss: 0.5439
Epoch 55/100
50/50 [==============================] - 5s 95ms/step - loss: 0.2169 - val_loss: 0.5585
Epoch 56/100
50/50 [==============================] - 5s 95ms/step - loss: 0.2165 - val_loss: 0.4518
Epoch 57/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2251 - val_loss: 0.4802
Epoch 58/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2150 - val_loss: 0.4112
Epoch 59/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2142 - val_loss: 0.4189
Epoch 60/100
50/50 [==============================] - 5s 95ms/step - loss: 0.2138 - val_loss: 0.4189
Epoch 61/100
50/50 [==============================] - 5s 95ms/step - loss: 0.2126 - val_loss: 0.4351
Epoch 62/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2131 - val_loss: 0.4370
Epoch 63/100
50/50 [==============================] - 5s 95ms/step - loss: 0.2110 - val_loss: 0.3998
Epoch 64/100
50/50 [==============================] - 5s 95ms/step - loss: 0.2562 - val_loss: 0.5502
Epoch 65/100
50/50 [==============================] - 5s 95ms/step - loss: 0.2143 - val_loss: 0.4707
Epoch 66/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2106 - val_loss: 0.3940
Epoch 67/100
```

```
50/50 [==============================] - 5s 95ms/step - loss: 0.2109 - val_loss: 0.4291
Epoch 68/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2082 - val_loss: 0.4208
Epoch 69/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2094 - val_loss: 0.4401
Epoch 70/100
50/50 [==============================] - 5s 95ms/step - loss: 0.2132 - val_loss: 0.4280
Epoch 71/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2072 - val_loss: 0.4542
Epoch 72/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2074 - val_loss: 0.4673
Epoch 73/100
50/50 [==============================] - 5s 95ms/step - loss: 0.2060 - val_loss: 0.4472
Epoch 74/100
50/50 [==============================] - 5s 95ms/step - loss: 0.2056 - val_loss: 0.4753
Epoch 75/100
50/50 [==============================] - 5s 95ms/step - loss: 0.2056 - val_loss: 0.4425
Epoch 76/100
50/50 [==============================] - 5s 95ms/step - loss: 0.2064 - val_loss: 0.8399
Epoch 77/100
50/50 [==============================] - 5s 95ms/step - loss: 0.2748 - val_loss: 0.5209
Epoch 78/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2077 - val_loss: 0.4401
Epoch 79/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2048 - val_loss: 0.4307
Epoch 80/100
50/50 [==============================] - 5s 95ms/step - loss: 0.2028 - val_loss: 0.4263
Epoch 81/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2031 - val_loss: 0.4426
Epoch 82/100
50/50 [==============================] - 5s 94ms/step - loss: 0.3229 - val_loss: 0.7429
Epoch 83/100
50/50 [==============================] - 5s 96ms/step - loss: 0.3271 - val_loss: 0.4495
Epoch 84/100
50/50 [==============================] - 5s 94ms/step - loss: 0.2303 - val_loss: 0.4399
Epoch 85/100
50/50 [==============================] - 5s 95ms/step - loss: 0.2124 - val_loss: 0.4154
Epoch 86/100
50/50 [==============================] - 5s 94ms/step - loss: 0.2075 - val_loss: 0.4146
Epoch 87/100
50/50 [==============================] - 5s 94ms/step - loss: 0.2030 - val_loss: 0.4058
Epoch 88/100
50/50 [==============================] - 5s 95ms/step - loss: 0.2031 - val_loss: 0.4110
Epoch 89/100
50/50 [==============================] - 5s 95ms/step - loss: 0.2023 - val_loss: 0.4161
```

```
Epoch 90/100
50/50 [==============================] - 5s 95ms/step - loss: 0.2002 - val_loss: 0.4161
Epoch 91/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2011 - val_loss: 0.4286
Epoch 92/100
50/50 [==============================] - 7s 136ms/step - loss: 0.1998 - val_loss: 0.4312
Epoch 93/100
50/50 [==============================] - 5s 95ms/step - loss: 0.2002 - val_loss: 0.4232
Epoch 94/100
50/50 [==============================] - 5s 95ms/step - loss: 0.1988 - val_loss: 0.4185
Epoch 95/100
50/50 [==============================] - 5s 93ms/step - loss: 0.1991 - val_loss: 0.4370
Epoch 96/100
50/50 [==============================] - 5s 95ms/step - loss: 0.2823 - val_loss: 0.4839
Epoch 97/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2176 - val_loss: 0.4575
Epoch 98/100
50/50 [==============================] - 5s 95ms/step - loss: 0.2032 - val_loss: 0.4199
Epoch 99/100
50/50 [==============================] - 5s 94ms/step - loss: 0.2004 - val_loss: 0.4100
Epoch 100/100
50/50 [==============================] - 5s 94ms/step - loss: 0.1989 - val_loss: 0.3996
```


Multi-Step Training and validation loss for WI_1

Multi_step LSTM for WI_1

Tail of Multi_step LSTM for WI_1
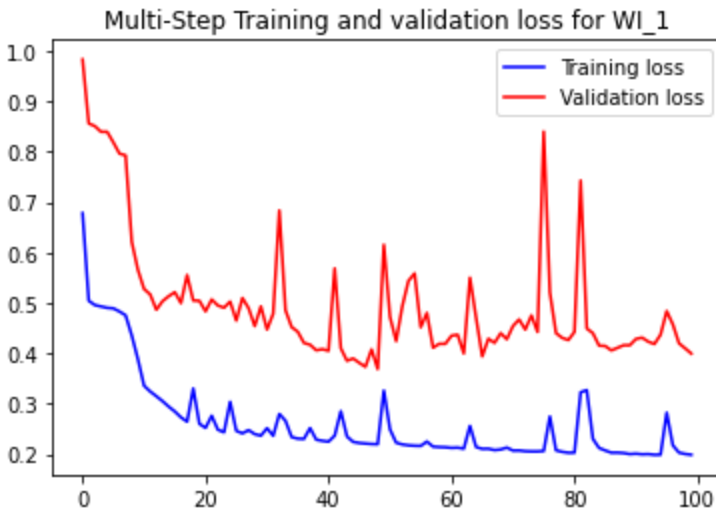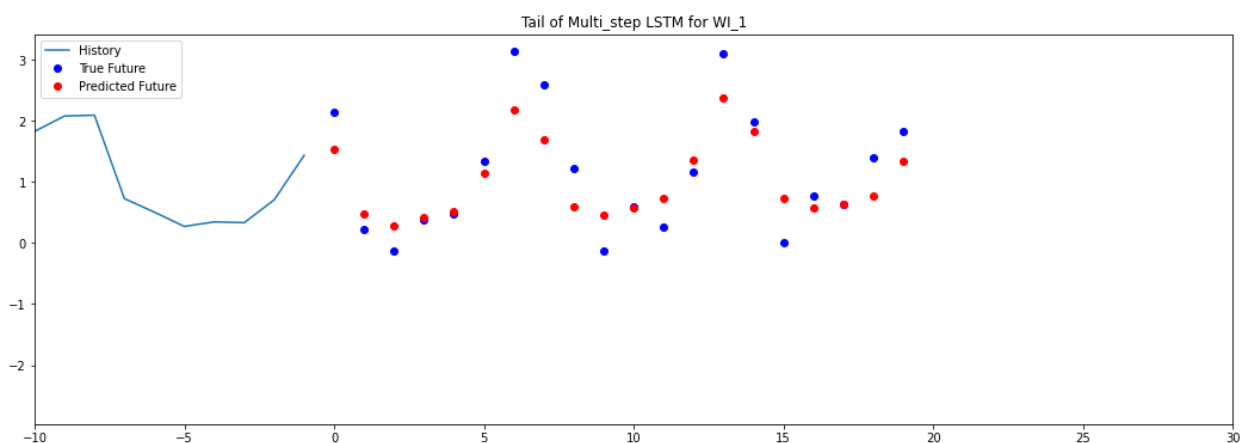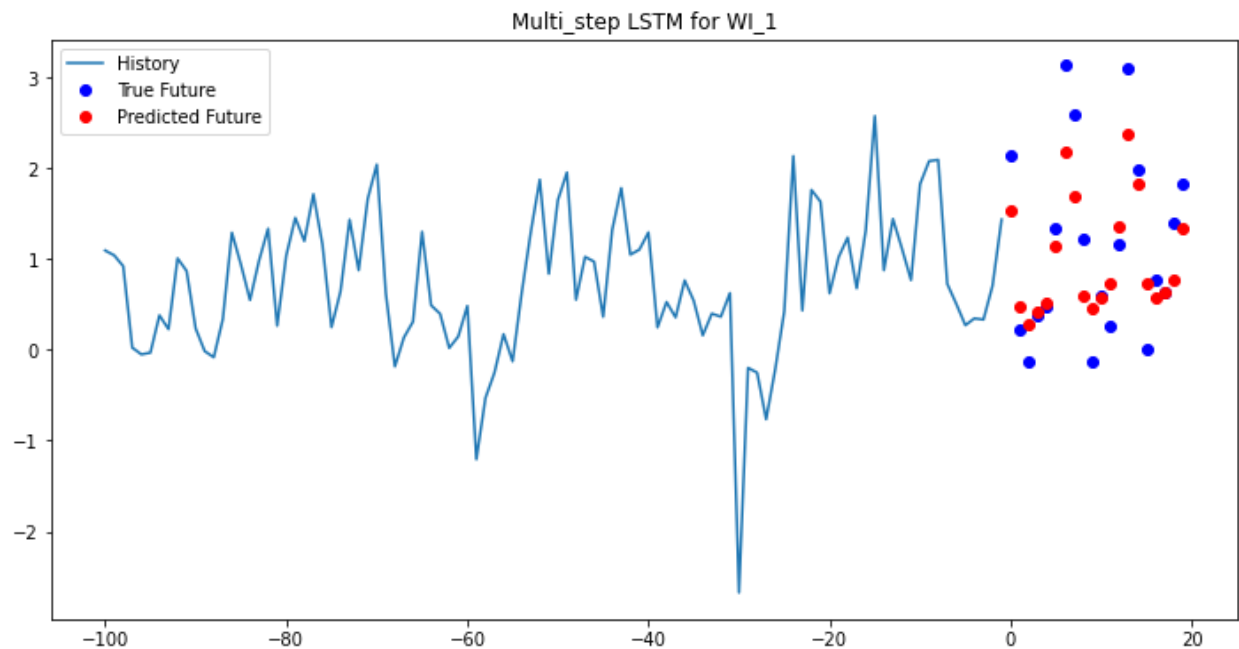
WI_1 - True Future: [4600. 2798. 2466. 2937. 3036. 3845. 5538. 5034. 3740. 2460. 3135. 2831.
 3676. 5516. 4461. 2597. 3313. 3180. 3899. 4308.]
WI_1 - Model Prediction: [4035.622 3027.9575 2855.7202 2975.3342 3076.564 3659.1821
4638.3267
 4178.2593 3147.9824 3018.0608 3123.5542 3281.7046 3858.5981 4823.4243
 4310.326 3273.9634 3118.6543 3181.0361 3307.6006 3855.559]
WI_1 - Model Percentage Error: [12.26908543 8.21863901 15.80373945 1.30521718 1.33609897
4.83271446
 16.24545576 16.99921976 15.82934701 22.68539801 0.36509731 15.92033168
  4.96730535 12.55575931 3.37757965 26.06713049 5.86615464 0.03258279
 15.16797676 10.50234257]%
WI_1 - Model Mean Percentage Error: 10.51735877977507%
===================================
===================================
Training for WI_3

```
Single window of past history : (100, 3)
(72, 20)
Epoch 1/100
50/50 [==============================] - 5s 104ms/step - loss: 0.7825 - val_loss: 1.0640
Epoch 2/100
50/50 [==============================] - 5s 95ms/step - loss: 0.7461 - val_loss: 1.0254
Epoch 3/100
50/50 [==============================] - 5s 95ms/step - loss: 0.7038 - val_loss: 0.9937
Epoch 4/100
50/50 [==============================] - 5s 94ms/step - loss: 0.6813 - val_loss: 0.9792
Epoch 5/100
50/50 [==============================] - 5s 96ms/step - loss: 0.6457 - val_loss: 0.8511
Epoch 6/100
50/50 [==============================] - 5s 96ms/step - loss: 0.6236 - val_loss: 0.8661
Epoch 7/100
50/50 [==============================] - 5s 95ms/step - loss: 0.6085 - val_loss: 0.8241
Epoch 8/100
50/50 [==============================] - 5s 95ms/step - loss: 0.5898 - val_loss: 0.7648
Epoch 9/100
50/50 [==============================] - 5s 96ms/step - loss: 0.5288 - val_loss: 0.7414
Epoch 10/100
50/50 [==============================] - 5s 95ms/step - loss: 0.4775 - val_loss: 0.6833
Epoch 11/100
50/50 [==============================] - 5s 97ms/step - loss: 0.4369 - val_loss: 0.6285
Epoch 12/100
50/50 [==============================] - 5s 98ms/step - loss: 0.4285 - val_loss: 0.5921
Epoch 13/100
50/50 [==============================] - 5s 97ms/step - loss: 0.4207 - val_loss: 0.6046
Epoch 14/100
50/50 [==============================] - 5s 98ms/step - loss: 0.4174 - val_loss: 0.6076
Epoch 15/100
50/50 [==============================] - 5s 97ms/step - loss: 0.4092 - val_loss: 0.5686
Epoch 16/100
50/50 [==============================] - 5s 97ms/step - loss: 0.4033 - val_loss: 0.5832
Epoch 17/100
50/50 [==============================] - 5s 96ms/step - loss: 0.3984 - val_loss: 0.5339
Epoch 18/100
50/50 [==============================] - 5s 97ms/step - loss: 0.3915 - val_loss: 0.5386
Epoch 19/100
50/50 [==============================] - 5s 95ms/step - loss: 0.3878 - val_loss: 0.5091
Epoch 20/100
50/50 [==============================] - 5s 97ms/step - loss: 0.3796 - val_loss: 0.4926
Epoch 21/100
50/50 [==============================] - 5s 96ms/step - loss: 0.3791 - val_loss: 0.4940
Epoch 22/100
```

```
50/50 [==============================] - 5s 97ms/step - loss: 0.3713 - val_loss: 0.5096
Epoch 23/100
50/50 [==============================] - 5s 97ms/step - loss: 0.3678 - val_loss: 0.5137
Epoch 24/100
50/50 [==============================] - 5s 97ms/step - loss: 0.3653 - val_loss: 0.5119
Epoch 25/100
50/50 [==============================] - 5s 97ms/step - loss: 0.3605 - val_loss: 0.4366
Epoch 26/100
50/50 [==============================] - 5s 96ms/step - loss: 0.3567 - val_loss: 0.4782
Epoch 27/100
50/50 [==============================] - 5s 96ms/step - loss: 0.3590 - val_loss: 0.4815
Epoch 28/100
50/50 [==============================] - 5s 97ms/step - loss: 0.3501 - val_loss: 0.4929
Epoch 29/100
50/50 [==============================] - 5s 98ms/step - loss: 0.3557 - val_loss: 0.4516
Epoch 30/100
50/50 [==============================] - 5s 96ms/step - loss: 0.3437 - val_loss: 0.4499
Epoch 31/100
50/50 [==============================] - 5s 94ms/step - loss: 0.3435 - val_loss: 0.4722
Epoch 32/100
50/50 [==============================] - 5s 97ms/step - loss: 0.3385 - val_loss: 0.4674
Epoch 33/100
50/50 [==============================] - 5s 98ms/step - loss: 0.3398 - val_loss: 0.4715
Epoch 34/100
50/50 [==============================] - 5s 97ms/step - loss: 0.3380 - val_loss: 0.4999
Epoch 35/100
50/50 [==============================] - 5s 96ms/step - loss: 0.3347 - val_loss: 0.4618
Epoch 36/100
50/50 [==============================] - 5s 96ms/step - loss: 0.3329 - val_loss: 0.4607
Epoch 37/100
50/50 [==============================] - 5s 96ms/step - loss: 0.3313 - val_loss: 0.4578
Epoch 38/100
50/50 [==============================] - 5s 97ms/step - loss: 0.3304 - val_loss: 0.4655
Epoch 39/100
50/50 [==============================] - 5s 98ms/step - loss: 0.3303 - val_loss: 0.4606
Epoch 40/100
50/50 [==============================] - 5s 100ms/step - loss: 0.3279 - val_loss: 0.4889
Epoch 41/100
50/50 [==============================] - 5s 99ms/step - loss: 0.3289 - val_loss: 0.4617
Epoch 42/100
50/50 [==============================] - 5s 96ms/step - loss: 0.3258 - val_loss: 0.4513
Epoch 43/100
50/50 [==============================] - 5s 96ms/step - loss: 0.3235 - val_loss: 0.4473
Epoch 44/100
50/50 [==============================] - 5s 96ms/step - loss: 0.3231 - val_loss: 0.4508
```

```
Epoch 45/100
50/50 [==============================] - 5s 96ms/step - loss: 0.3232 - val_loss: 0.4691
Epoch 46/100
50/50 [==============================] - 5s 96ms/step - loss: 0.3226 - val_loss: 0.5059
Epoch 47/100
50/50 [==============================] - 5s 97ms/step - loss: 0.3218 - val_loss: 0.4767
Epoch 48/100
50/50 [==============================] - 5s 97ms/step - loss: 0.3188 - val_loss: 0.5149
Epoch 49/100
50/50 [==============================] - 5s 96ms/step - loss: 0.3201 - val_loss: 0.5074
Epoch 50/100
50/50 [==============================] - 5s 97ms/step - loss: 0.3173 - val_loss: 0.4984
Epoch 51/100
50/50 [==============================] - 5s 97ms/step - loss: 0.3151 - val_loss: 0.5127
Epoch 52/100
50/50 [==============================] - 5s 96ms/step - loss: 0.3144 - val_loss: 0.5574
Epoch 53/100
50/50 [==============================] - 5s 96ms/step - loss: 0.3149 - val_loss: 0.5178
Epoch 54/100
50/50 [==============================] - 5s 96ms/step - loss: 0.3135 - val_loss: 0.5440
Epoch 55/100
50/50 [==============================] - 5s 96ms/step - loss: 0.3104 - val_loss: 0.5782
Epoch 56/100
50/50 [==============================] - 5s 97ms/step - loss: 0.3101 - val_loss: 0.5457
Epoch 57/100
50/50 [==============================] - 5s 97ms/step - loss: 0.3087 - val_loss: 0.5960
Epoch 58/100
50/50 [==============================] - 5s 97ms/step - loss: 0.3071 - val_loss: 0.5542
Epoch 59/100
50/50 [==============================] - 5s 97ms/step - loss: 0.3066 - val_loss: 0.5968
Epoch 60/100
50/50 [==============================] - 5s 96ms/step - loss: 0.3053 - val_loss: 0.6277
Epoch 61/100
50/50 [==============================] - 5s 96ms/step - loss: 0.3037 - val_loss: 0.6260
Epoch 62/100
50/50 [==============================] - 5s 97ms/step - loss: 0.3024 - val_loss: 0.6464
Epoch 63/100
50/50 [==============================] - 5s 96ms/step - loss: 0.3018 - val_loss: 0.6742
Epoch 64/100
50/50 [==============================] - 5s 97ms/step - loss: 0.3000 - val_loss: 0.6305
Epoch 65/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2998 - val_loss: 0.6513
Epoch 66/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2980 - val_loss: 0.6368
Epoch 67/100
```

```
50/50 [==============================] - 5s 97ms/step - loss: 0.2980 - val_loss: 0.6730
Epoch 68/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2961 - val_loss: 0.6383
Epoch 69/100
50/50 [==============================] - 6s 123ms/step - loss: 0.2959 - val_loss: 0.6363
Epoch 70/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2966 - val_loss: 0.6728
Epoch 71/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2927 - val_loss: 0.6758
Epoch 72/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2939 - val_loss: 0.6440
Epoch 73/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2914 - val_loss: 0.6574
Epoch 74/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2914 - val_loss: 0.6625
Epoch 75/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2903 - val_loss: 0.6735
Epoch 76/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2909 - val_loss: 0.6754
Epoch 77/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2887 - val_loss: 0.6807
Epoch 78/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2876 - val_loss: 0.6835
Epoch 79/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2863 - val_loss: 0.6628
Epoch 80/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2862 - val_loss: 0.6746
Epoch 81/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2853 - val_loss: 0.6778
Epoch 82/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2849 - val_loss: 0.7041
Epoch 83/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2837 - val_loss: 0.6902
Epoch 84/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2824 - val_loss: 0.6989
Epoch 85/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2824 - val_loss: 0.7030
Epoch 86/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2815 - val_loss: 0.6740
Epoch 87/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2813 - val_loss: 0.7143
Epoch 88/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2812 - val_loss: 0.7095
Epoch 89/100
50/50 [==============================] - 5s 95ms/step - loss: 0.2792 - val_loss: 0.7101
```

Epoch 90/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2797 - val_loss: 0.6989
Epoch 91/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2773 - val_loss: 0.7122
Epoch 92/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2803 - val_loss: 0.6942
Epoch 93/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2745 - val_loss: 0.6963
Epoch 94/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2761 - val_loss: 0.6944
Epoch 95/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2746 - val_loss: 0.6739
Epoch 96/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2732 - val_loss: 0.6926
Epoch 97/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2735 - val_loss: 0.6851
Epoch 98/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2728 - val_loss: 0.6911
Epoch 99/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2708 - val_loss: 0.6957
Epoch 100/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2723 - val_loss: 0.6974

Multi-Step Training and validation loss for WI_3

Multi_step LSTM for WI_3

Tail of Multi_step LSTM for WI_3
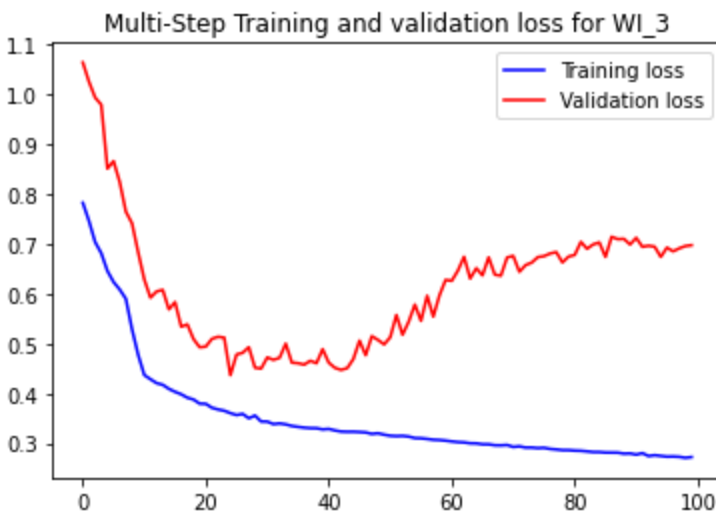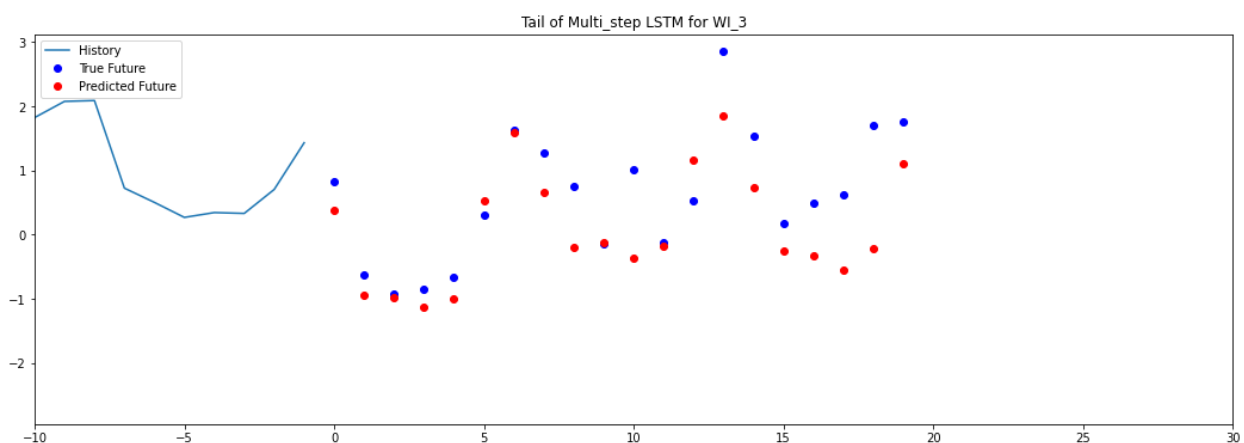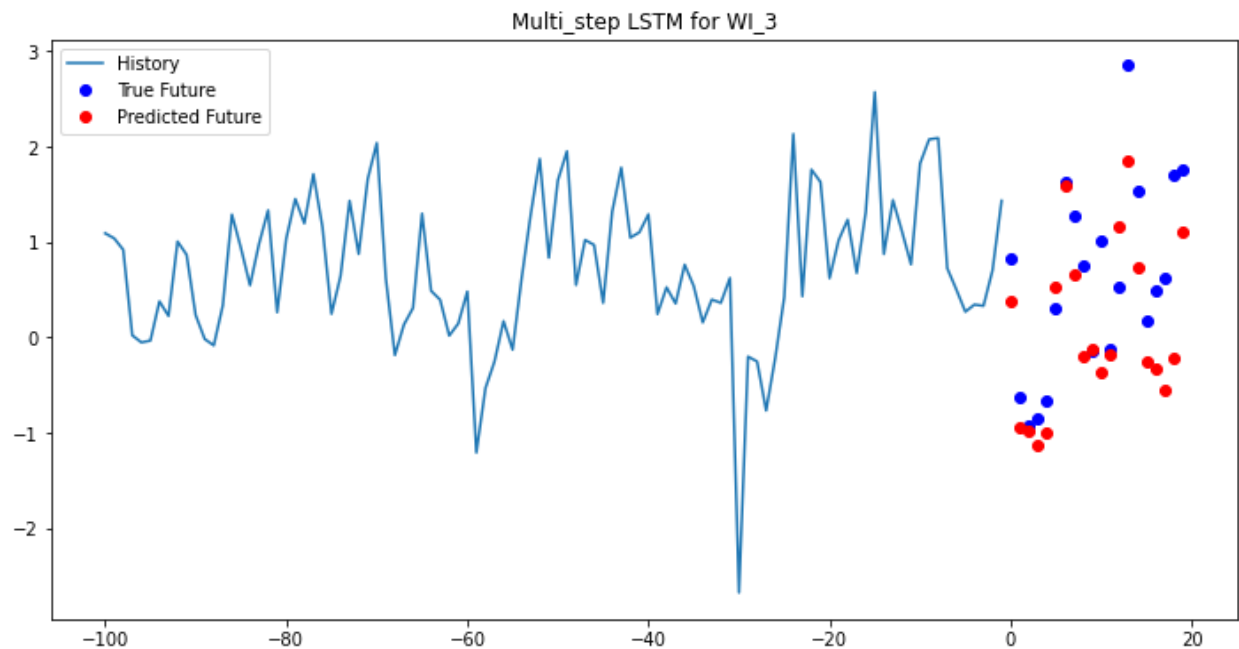
WI_3 - True Future: [3998. 2806. 2564. 2632. 2775. 3580. 4653. 4362. 3938. 3210. 4153. 3219.
 3756. 5657. 4577. 3468. 3728. 3833. 4721. 4759.]
WI_3 - Model Prediction: [3628.2563 2554.1724 2522.8389 2397.7036 2509.8376 3755.5461
4629.1797
 3869.7686 3155.3516 3215.9094 3025.91   3173.1272 4281.1177 4836.6133
 3929.1682 3112.2446 3056.652 2874.1138 3139.398 4230.9395]
WI_3 - Model Percentage Error: [9.24821542 8.97461286 1.60534839 8.9018384   9.55540013
4.90352354
  0.5119345 11.28453566 19.874262   0.1840942 27.13917862 1.42506377
 13.98076879 14.50215165 14.15407007 10.25822869 18.00825913 25.01659876
 33.50142027 11.09604007]%
WI_3 - Model Mean Percentage Error: 12.20627724506946%
===================================
===================================
Training for WI_2

Single window of past history : (100, 3)
(72, 20)
Epoch 1/100
50/50 [==============================] - 5s 103ms/step - loss: 0.6684 - val_loss: 1.1916
Epoch 2/100
50/50 [==============================] - 5s 96ms/step - loss: 0.4813 - val_loss: 5.9478
Epoch 3/100
50/50 [==============================] - 5s 96ms/step - loss: 0.4621 - val_loss: 1.0525
Epoch 4/100
50/50 [==============================] - 5s 96ms/step - loss: 0.4265 - val_loss: 1.1403
Epoch 5/100
50/50 [==============================] - 5s 96ms/step - loss: 0.3949 - val_loss: 1.0525
Epoch 6/100
50/50 [==============================] - 5s 96ms/step - loss: 0.3818 - val_loss: 1.0299
Epoch 7/100
50/50 [==============================] - 5s 93ms/step - loss: 0.3750 - val_loss: 0.9745
Epoch 8/100
50/50 [==============================] - 5s 93ms/step - loss: 0.3688 - val_loss: 0.8520
Epoch 9/100
50/50 [==============================] - 5s 93ms/step - loss: 0.3656 - val_loss: 0.8143
Epoch 10/100
50/50 [==============================] - 5s 94ms/step - loss: 0.3624 - val_loss: 0.7943
Epoch 11/100
50/50 [==============================] - 5s 98ms/step - loss: 0.3590 - val_loss: 0.7861
Epoch 12/100
50/50 [==============================] - 5s 96ms/step - loss: 0.3563 - val_loss: 0.7639
Epoch 13/100
50/50 [==============================] - 6s 111ms/step - loss: 0.3517 - val_loss: 0.7426
Epoch 14/100
50/50 [==============================] - 6s 118ms/step - loss: 0.3488 - val_loss: 0.7920
Epoch 15/100
50/50 [==============================] - 5s 95ms/step - loss: 0.3445 - val_loss: 0.7244
Epoch 16/100
50/50 [==============================] - 5s 96ms/step - loss: 0.3383 - val_loss: 0.7551
Epoch 17/100
50/50 [==============================] - 5s 95ms/step - loss: 0.3348 - val_loss: 0.7377
Epoch 18/100
50/50 [==============================] - 5s 97ms/step - loss: 0.3314 - val_loss: 0.7629
Epoch 19/100
50/50 [==============================] - 5s 96ms/step - loss: 0.3242 - val_loss: 0.7448
Epoch 20/100
50/50 [==============================] - 5s 97ms/step - loss: 0.3209 - val_loss: 0.7488
Epoch 21/100
50/50 [==============================] - 5s 96ms/step - loss: 0.3174 - val_loss: 0.7398
Epoch 22/100

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50/50 [==============================] - 5s 95ms/step - loss: 0.3108 - val_loss: 0.7514
Epoch 23/100
50/50 [==============================] - 5s 96ms/step - loss: 0.3089 - val_loss: 0.7351
Epoch 24/100
50/50 [==============================] - 5s 96ms/step - loss: 0.3036 - val_loss: 0.7585
Epoch 25/100
50/50 [==============================] - 5s 98ms/step - loss: 0.3029 - val_loss: 0.7629
Epoch 26/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2995 - val_loss: 0.7130
Epoch 27/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2966 - val_loss: 0.7265
Epoch 28/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2938 - val_loss: 0.7254
Epoch 29/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2917 - val_loss: 0.7125
Epoch 30/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2900 - val_loss: 0.6913
Epoch 31/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2882 - val_loss: 0.6697
Epoch 32/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2847 - val_loss: 0.6885
Epoch 33/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2837 - val_loss: 0.6675
Epoch 34/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2820 - val_loss: 0.6753
Epoch 35/100
50/50 [==============================] - 5s 102ms/step - loss: 0.2796 - val_loss: 0.6485
Epoch 36/100
50/50 [==============================] - 5s 101ms/step - loss: 0.2786 - val_loss: 0.7536
Epoch 37/100
50/50 [==============================] - 5s 101ms/step - loss: 0.2780 - val_loss: 0.6756
Epoch 38/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2771 - val_loss: 0.7400
Epoch 39/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2753 - val_loss: 0.6844
Epoch 40/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2742 - val_loss: 0.6956
Epoch 41/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2735 - val_loss: 0.7347
Epoch 42/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2735 - val_loss: 0.6552
Epoch 43/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2697 - val_loss: 0.6466
Epoch 44/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2705 - val_loss: 0.6227
```

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Epoch 45/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2692 - val_loss: 0.6761
Epoch 46/100
50/50 [==============================] - 5s 95ms/step - loss: 0.2683 - val_loss: 0.6770
Epoch 47/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2667 - val_loss: 0.6780
Epoch 48/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2648 - val_loss: 0.6552
Epoch 49/100
50/50 [==============================] - 5s 102ms/step - loss: 0.2657 - val_loss: 0.6320
Epoch 50/100
50/50 [==============================] - 5s 101ms/step - loss: 0.2645 - val_loss: 0.6376
Epoch 51/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2618 - val_loss: 0.6191
Epoch 52/100
50/50 [==============================] - 5s 95ms/step - loss: 0.2613 - val_loss: 0.6643
Epoch 53/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2603 - val_loss: 0.6504
Epoch 54/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2600 - val_loss: 0.6665
Epoch 55/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2587 - val_loss: 0.6318
Epoch 56/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2571 - val_loss: 0.6546
Epoch 57/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2581 - val_loss: 0.6479
Epoch 58/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2548 - val_loss: 0.6497
Epoch 59/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2557 - val_loss: 0.6410
Epoch 60/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2542 - val_loss: 0.6640
Epoch 61/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2539 - val_loss: 0.6646
Epoch 62/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2530 - val_loss: 0.6639
Epoch 63/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2521 - val_loss: 0.6681
Epoch 64/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2509 - val_loss: 0.6583
Epoch 65/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2513 - val_loss: 0.6492
Epoch 66/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2501 - val_loss: 0.6704
Epoch 67/100
```

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50/50 [==============================] - 5s 98ms/step - loss: 0.2493 - val_loss: 0.6309
Epoch 68/100
50/50 [==============================] - 5s 100ms/step - loss: 0.2488 - val_loss: 0.6657
Epoch 69/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2480 - val_loss: 0.6427
Epoch 70/100
50/50 [==============================] - 5s 100ms/step - loss: 0.2482 - val_loss: 0.6310
Epoch 71/100
50/50 [==============================] - 5s 101ms/step - loss: 0.2473 - val_loss: 0.6426
Epoch 72/100
50/50 [==============================] - 5s 100ms/step - loss: 0.2475 - val_loss: 0.6303
Epoch 73/100
50/50 [==============================] - 5s 103ms/step - loss: 0.2463 - val_loss: 0.6499
Epoch 74/100
50/50 [==============================] - 5s 100ms/step - loss: 0.2466 - val_loss: 0.6360
Epoch 75/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2451 - val_loss: 0.6259
Epoch 76/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2449 - val_loss: 0.6195
Epoch 77/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2441 - val_loss: 0.6235
Epoch 78/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2445 - val_loss: 0.6392
Epoch 79/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2434 - val_loss: 0.6240
Epoch 80/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2433 - val_loss: 0.6206
Epoch 81/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2436 - val_loss: 0.6210
Epoch 82/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2430 - val_loss: 0.6240
Epoch 83/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2411 - val_loss: 0.6152
Epoch 84/100
50/50 [==============================] - 5s 96ms/step - loss: 0.2423 - val_loss: 0.6204
Epoch 85/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2412 - val_loss: 0.6382
Epoch 86/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2406 - val_loss: 0.6253
Epoch 87/100
50/50 [==============================] - 5s 95ms/step - loss: 0.2416 - val_loss: 0.6251
Epoch 88/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2411 - val_loss: 0.6253
Epoch 89/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2399 - val_loss: 0.6292
```

```
Epoch 90/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2395 - val_loss: 0.6461
Epoch 91/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2397 - val_loss: 0.6217
Epoch 92/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2389 - val_loss: 0.6293
Epoch 93/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2389 - val_loss: 0.6251
Epoch 94/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2386 - val_loss: 0.6360
Epoch 95/100
50/50 [==============================] - 5s 100ms/step - loss: 0.2378 - val_loss: 0.6126
Epoch 96/100
50/50 [==============================] - 5s 99ms/step - loss: 0.2382 - val_loss: 0.6160
Epoch 97/100
50/50 [==============================] - 5s 98ms/step - loss: 0.2369 - val_loss: 0.6098
Epoch 98/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2367 - val_loss: 0.6166
Epoch 99/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2370 - val_loss: 0.6310
Epoch 100/100
50/50 [==============================] - 5s 97ms/step - loss: 0.2367 - val_loss: 0.6286
```


Multi-Step Training and validation loss for WI_2

Multi_step LSTM for WI_2

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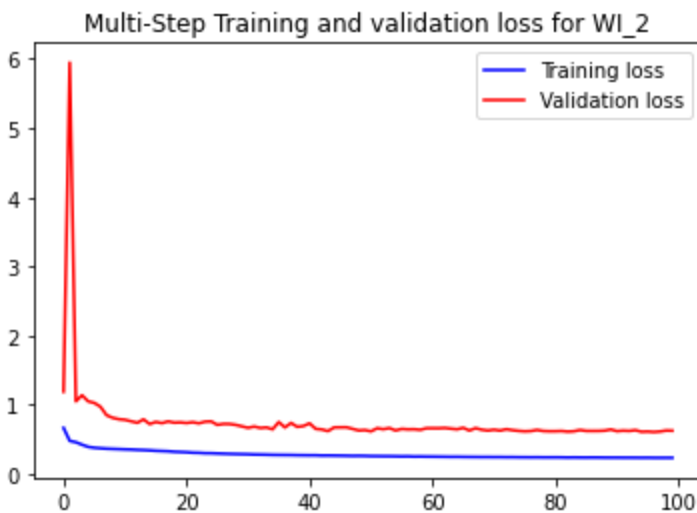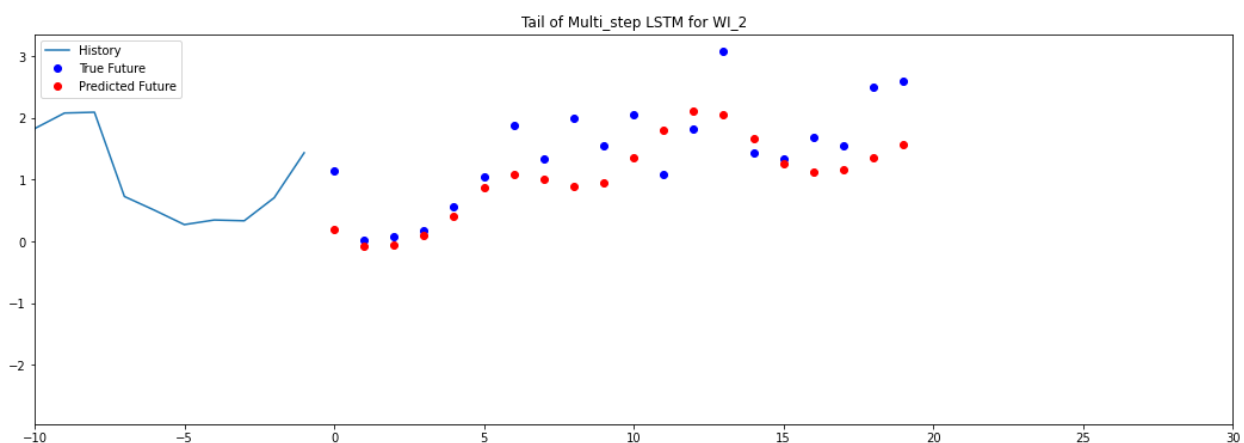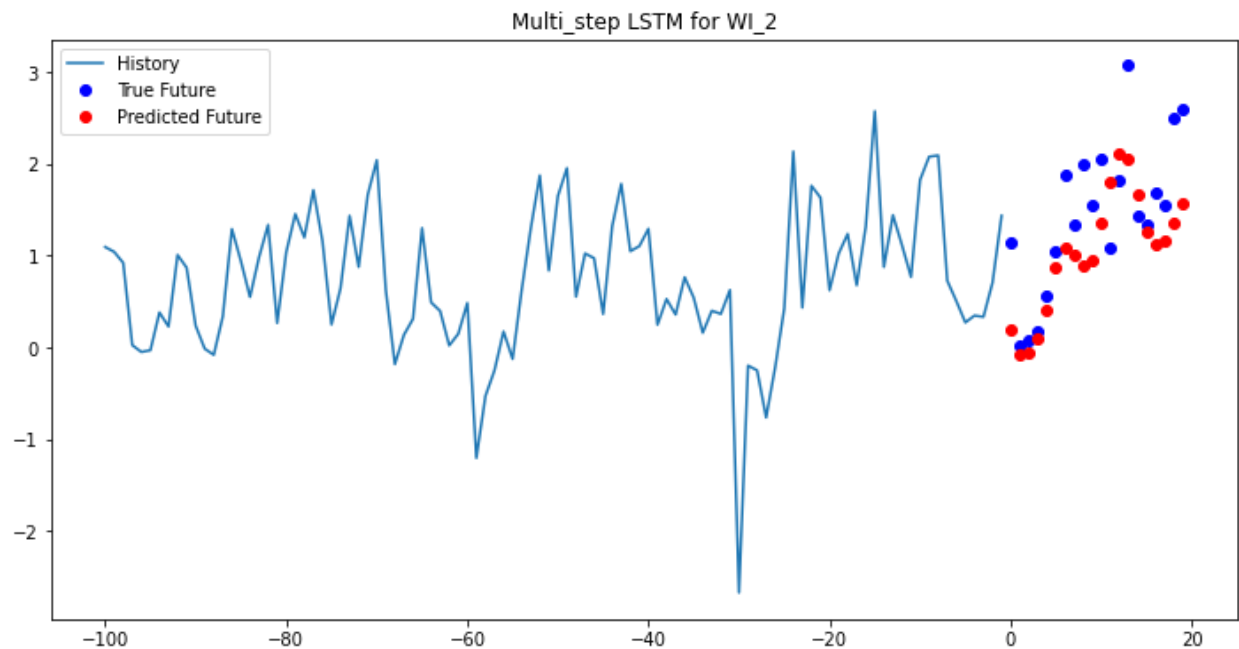
WI_2 - True Future: [4670. 3301. 3386. 3500. 3961. 4569. 5586. 4915. 5718. 5169. 5786. 4607. 5506. 7046. 5046. 4907. 5358. 5180. 6333. 6463.]

WI_2 - Model Prediction: [3505.8467 3187.081 3210.156 3395.2969 3789.12   4341.664 4608.998 4507.517 4380.02   4437.372 4937.8745 5482.611 5865.468 5790.283 5331.3867 4833.823 4666.607 4710.5605 4950.5547 5208.265]

WI_2 - Model Percentage Error: [24.92833662 3.45104348 5.19326622 2.99151786 4.3393053 4.97561693 17.49018892 8.29059838 23.39944002 14.15414838 14.65823519 19.00609594 6.52865553 17.82169737 5.65570192 1.49127283 12.90393928 9.06253771 21.82923279 19.41412445]%

WI_2 - Model Mean Percentage Error: 11.879247755244165%

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