**Table 5.** Performance of LSTM, GRU, RNN, and the voting-ensemble method (21 steps).

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Model** | **Evaluation** | **Days** | **Dataset1** | | | **Dataset2** | | | **Dataset3** | | |
| **Indicator** | **NIPI** | **TCR** | **THQ** | **NIPI** | **TCR** | **THQ** | **NIPI** | **TCR** | **THQ** |
| **LSTM** | RMSE | 7 | 0.0622 | 0.0946 | 0.1220 | 0.1516 | 0.1465 | 0.0543 | 0.1172 | 0.0655 | 0.0739 |
| 14 | 0.1304 | 0.1436 | 0.1207 | 0.1410 | 0.122 | 0.1412 | 0.1297 | 0.0917 | 0.1499 |
| 21 | 0.1623 | 0.1281 | 0.1234 | 0.1451 | 0.1968 | 0.1605 | 0.1444 | 0.1768 | 0.1564 |
| **Avg** | **0.1183** | **0.1221** | **0.1220** | **0.1459** | **0.1551** | **0.1187** | **0.1304** | **0.1113** | **0.1267** |
| MAE | 7 | 0.0499 | 0.0809 | 0.0867 | 0.0961 | 0.0543 | 0.0478 | 0.0968 | 0.0546 | 0.0565 |
| 14 | 0.0976 | 0.0908 | 0.1011 | 0.1068 | 0.0867 | 0.1053 | 0.1111 | 0.0715 | 0.1080 |
| 21 | 0.1240 | 0.0848 | 0.1034 | 0.1215 | 0.1204 | 0.1320 | 0.1260 | 0.1025 | 0.1225 |
| **Avg** | **0.0905** | **0.0855** | **0.0971** | **0.1081** | **0.0871** | **0.095** | **0.1113** | **0.0762** | **0.0957** |
|  |  |  |  |  |  |  |  |  |  |  |  |
| **GRU** | RMSE | 7 | 0.0714 | 0.104 | 0.0902 | 0.1282 | 0.0525 | 0.0730 | 0.0883 | 0.0682 | 0.0763 |
| 14 | 0.0964 | 0.1384 | 0.1010 | 0.1248 | 0.1501 | 0.1493 | 0.0944 | 0.1452 | 0.156 |
| 21 | 0.0945 | 0.1415 | 0.0952 | 0.1270 | 0.1946 | 0.1523 | 0.0875 | 0.1978 | 0.1512 |
| **Avg** | **0.0874** | **0.1280** | **0.0955** | **0.1267** | **0.1324** | **0.1249** | **0.0901** | **0.1371** | **0.1278** |
| MAE | 7 | 0.0657 | 0.0892 | 0.0789 | 0.1107 | 0.0479 | 0.0541 | 0.0758 | 0.0507 | 0.0657 |
| 14 | 0.0747 | 0.0909 | 0.0877 | 0.1047 | 0.1212 | 0.1031 | 0.0751 | 0.1084 | 0.1120 |
| 21 | 0.0737 | 0.1056 | 0.0819 | 0.1096 | 0.1389 | 0.1170 | 0.0717 | 0.1225 | 0.1177 |
| **Avg** | **0.0714** | **0.0952** | **0.0828** | **0.1083** | **0.1027** | **0.0914** | **0.0742** | **0.0939** | **0.0985** |
| **RNN** | RMSE | 7 | 0.0918 | 0.109 | 0.1172 | 0.1926 | 0.0611 | 0.0493 | 0.1133 | 0.0535 | 0.0487 |
| 14 | 0.0883 | 0.1069 | 0.0978 | 0.1400 | 0.0752 | 0.1526 | 0.1158 | 0.0837 | 0.1571 |
| 21 | 0.1164 | 0.0975 | 0.086 | 0.1227 | 0.1336 | 0.1539 | 0.1208 | 0.1653 | 0.1730 |
| **Avg** | **0.0988** | **0.1045** | **0.1003** | **0.1518** | **0.089** | **0.1186** | **0.1166** | **0.1008** | **0.1263** |
| MAE | 7 | 0.0809 | 0.0926 | 0.088 | 0.1263 | 0.0544 | 0.0402 | 0.0835 | 0.043 | 0.0409 |
| 14 | 0.0754 | 0.0897 | 0.0728 | 0.0814 | 0.0681 | 0.1032 | 0.0919 | 0.0667 | 0.1083 |
| 21 | 0.0986 | 0.0827 | 0.0643 | 0.0762 | 0.0887 | 0.118 | 0.1031 | 0.0952 | 0.1365 |
| **Avg** | **0.0850** | **0.0883** | **0.0750** | **0.0946** | **0.0704** | **0.0871** | **0.0928** | **0.0683** | **0.0952** |
| **Voting -ensemble** | RMSE | 7 | 0.0663 | 0.1028 | 0.0908 | 0.1852 | 0.0683 | 0.0498 | 0.0621 | 0.0625 | 0.0662 |
| 14 | 0.0944 | 0.1382 | 0.0998 | 0.1370 | 0.0772 | 0.1496 | 0.0835 | 0.1144 | 0.1510 |
| 21 | 0.0978 | 0.1394 | 0.0936 | 0.1229 | 0.1420 | 0.1538 | 0.0894 | 0.1838 | 0.1495 |
| **Avg** | **0.0862** | **0.1268** | **0.0947** | **0.1484** | **0.0958** | **0.1177** | **0.0783** | **0.1202** | **0.1222** |
| MAE | 7 | 0.0618 | 0.0884 | 0.078 | 0.1205 | 0.0577 | 0.0413 | 0.0479 | 0.0518 | 0.0586 |
| 14 | 0.0731 | 0.0908 | 0.0863 | 0.0822 | 0.0686 | 0.1015 | 0.0665 | 0.0939 | 0.1074 |
| 21 | 0.0774 | 0.1036 | 0.0803 | 0.0818 | 0.0925 | 0.1191 | 0.0769 | 0.1145 | 0.1173 |
| **Avg** | **0.0708** | **0.0943** | **0.0815** | **0.0948** | **0.0729** | **0.0873** | **0.0638** | **0.0867** | **0.0944** |