Dear anonymous Referee1:

I am very happy to receive your recommendation and very grateful for your advice. We have followed your comments to revise this manuscript. Then, due to the stupid organization and poor English make readers' understand difficulty, we have made efforts to revise and hope that you could be satisfied. In the resubmitted paper, new text is emphasised as red text. The Referee Comments is abbreviated to “RC”, and the Authors’ Response is abbreviated to “AR”.

The following are the responses to each major comment:

RC 1:

The language used in many cases is really bad and confusing to the reader. Please take careful care of the syntax and rewrite the manuscript where needed. I have also pointed out several cases in the attached pdf file.

AR 1:

I agree with the advice and have revised this problem in my manuscript. We will call for a professional company to polish the manuscript before formal publication.

RC 2:

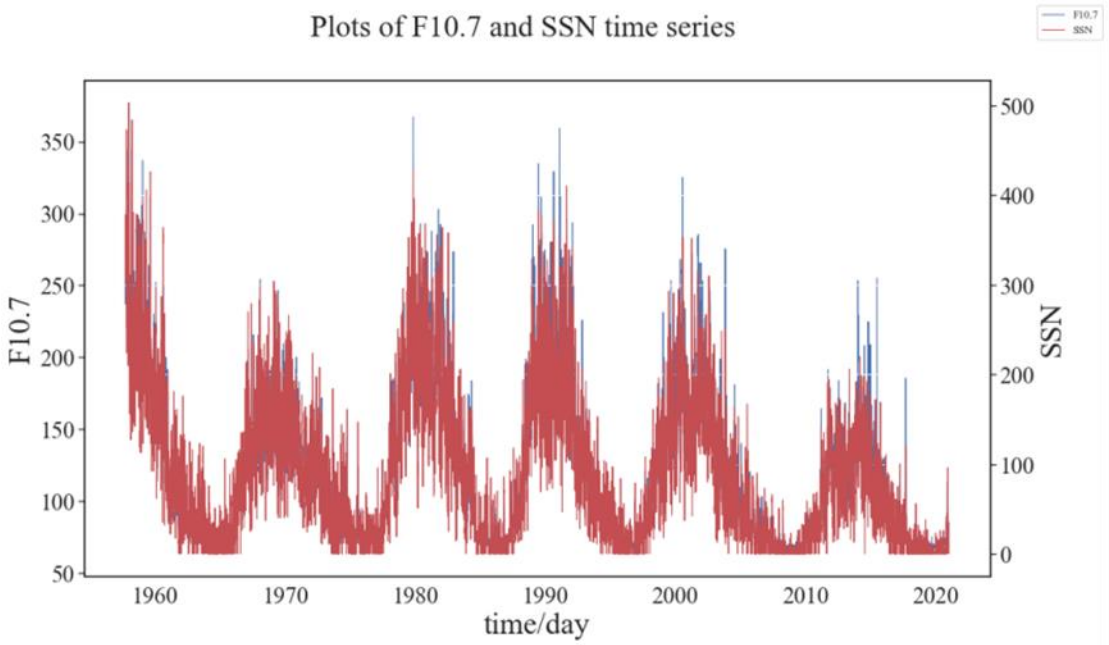
The authors use approximately 4 solar cycles for the training of the ML scheme and 1 solar cycle (solar cycle 24) as a test dataset. Even though this is a pretty usual technique to validate a model, it can potentially lead to significant misconceptions. This is because the solar cycle 24 is quite weak compared to previous cycles (this is also something that is not discussed in the text at all). A more robust technique would be to use an iterative leave-one-out method, which is described in detail in Aminalragia-Giamini et al. 2020 (https://doi.org/10.1051/swsc/2019043). A suggestion could be that the authors leave iteratively one solar cycle out as a test dataset and rerun the model each time (e.g. keep SC23 as test dataset and train the model with the rest SCs, then keep SC22 as test dataset and train the model with the rest SCs, etc.). In the end, they can evaluate the metrics (MAE, RMSE, etc.) using the predictions of all solar cycles

AR 2:

I agree with your advice. Solar cycle 24 is relatively weaker compared to previous cycles, which may lead to smaller errors. Both the control group of our chosen TCN model (forecast results from SWPC and AR models) and the test dataset are within the solar cycle 24. Figures 6 and 7 show that the predictions are not as good as the TCN model. Similarly, we selected the BP model and LSTM model forecasts for the high solar activity year (2003-2004) in solar cycle 23 for comparison. The results show that the TCN model has better forecasts than the BP and LSTM models (as shown in Table 4). However, we didn't consider whether choosing a different dataset would result in a huge difference in model performance. Therefore, we took the advice you gave and used the leave-one-out method to select the test set. The results of the tests are shown in the table 1.

Table.1The prediction errors (MAE, RMSE) and R of the TCN model for the F10.7 data during different solar cycles.

Solar activity cycle	1-Day ahead			2-Days ahead			3-Days ahead		
	MAE (sfu)	RMSE (sfu)	R	MAE (sfu)	RMSE (sfu)	R	MAE (sfu)	RMSE (sfu)	R
19	4.35	9.03	0.9880	4.29	7.84	0.9908	4.42	8.51	0.9897
20	3.35	5.16	0.9924	3.86	5.76	0.9928	3.40	5.37	0.9926
21	4.59	7.51	0.9921	4.48	7.16	0.9927	4.65	7.45	0.9930
22	4.71	7.89	0.9908	5.36	8.57	0.9908	4.75	8.05	0.9903
23	3.76	6.46	0.9917	4.30	7.01	0.9915	3.91	6.73	0.9912
24	3.03	5.60	0.9846	2.78	5.49	0.9833	3.23	5.52	0.9850
Mean	3.97	6.94	0.9899	4.18	6.97	0.9903	4.06	6.94	0.9903



Combined with the variation of sunspot number vs. F10.7 in the above figure. Cycles with stronger solar activity are found to have relatively poor model forecast errors. For cycles with weaker solar activity, the results are relatively better. Solar cycles 20 and 24 have about the same intensity of solar activity and are both weaker. The model forecasts are relatively better, Solar cycles 21 and 22 have about the same intensity of solar activity and are both stronger. The model forecasts are relatively poorer. However, the overall average prediction results do not change much compared to solar cycle 24. Therefore, the TCN model does not affect the final F10.7 forecasts due to the specific properties of the data. I think this is an excellent suggestion. We have revised this problem in my manuscript. You can see more detailed information **in lines 189-199.**

RC3:

Line 72, the“processed data”.What do you mean by processed? If you have indeed processed the dataset used you have to explain how.

AC3:

Line 72, I am sorry for not explaining the process of processing the data, I would add the following. “The 10.7 cm daily solar flux data were obtained from the website of the National Oceanic and Atmospheric Administration. Three flux determinations are made each day. Each 10.7cm Solar Flux measurement is expressed in three values: the observed, adjusted, and URSI Series D values(absolute values). The observed value is the number measured by the solar radio telescope. This is modulated by two quantities: the level of solar activity and the changing distance between the Earth and Sun. Since it is a measure of the emissions due to solar activity hitting the Earth, this is the quantity to use when terrestrial phenomena are being studied(Tapping, 1987). When studying the Sun, it is undesirable to have the annual modulation of the 10.7cm Solar Flux caused by the changing distance between the Earth and the Sun. However, during the ephemeris calculations required for the solar flux monitors to accurately acquire and track the Sun, one of the byproducts obtained is the distance between the Sun and the Earth. Therefore, we generate an additional value called the adjusted value, which takes into account the variations in the Earth-Sun distance and represents the average distance. Absolute measurements of flux density are quite difficult. Astronomers attempt to match the solar flux density data at various frequencies with a frequency spectrum by applying a scale factor. By combining each wavelength with the calibrated spectrum, a series of D Flux is obtained, where D Flux equals 0.9 multiplied by the adjusted flux(Tanaka et al.,1973).

Between March and October measurements are made at 1700, 2000 (local noon) and 2300UT. However, the combination of location in a mountain valley and a relatively high latitude makes it impossible to maintain these times during the rest of the year. Consequently, from November through February, the flux determination times are changed to 1800, 2000, and 2200, so that the Sun is high enough above the horizon for a good measurement to be made. Therefore, we chose the adjusted flux value of F10.7 measured at 8:00 p.m. UT (local noon).”I agree with your advice and have revised this problem in my manuscript. You can see more detailed information **in lines 69-90**.

Lines 11-14, the sentence“The F10.7 series from 1957 to 2019 are used, which the datasets from 1957 to 2008 are used for training and the datasets from 2009 to 2019 are used for testing. The results show that the TCN model of prediction F10.7 with a root mean square error (RMSE) from 5.03 to 5.44sfu and correlation coefficients (R) as high as 0.98 during solar cycle 24.” is replaced by“The F10.7 series from 1957 to 2019 are used. The data during 1957–1995 are adopted as the training dataset, the data during 1996–2008 (solar cycle 23) are adopted as the validation dataset, and the data during 2009–2019 (solar cycle 24) are adopted as the test dataset. The leave-one-out method is used to group the data set for multiple validations. The prediction results for 1-3 days ahead during solar cycle 24 have a high correlation coefficient (R) of 0.98 and a root mean square error (RMSE) of only 5.03~5.44 sfu.” The sentence has been revised **in lines 12-16.**

Line 28, we have added more recent references to support this idea. The cite “(Swarup et al., 1963; Tapping and DeTracey, 1990; Henney et al., 2012)” is replaced by “(Katsavrias et al.,2021; Simms et al.,2023).” The citation has been revised **in line 31.**

Lines 29-30, the sentence“Time-series data is data where observations of some process are

recorded over the same time interval, and the F10.7 index is a typical type of time-series data'' is removed.

Line 55, the unit "sfu'' is the unit of solar flux (F10.7). The quantities are separated by commas. The 10.7cm Solar Flux is given in solar flux units (a sfu = 10^{-22}W m^{-2} Hz^{-1}). We have revised this problem in my manuscript. You can see more detailed information **in line 69.**

Line 59, the"TCN" has already been mentioned in line 10, and where a proper noun is mentioned before, it will be used as an abbreviation afterwards.

Line 62, the "RNN'' means Recurrent Neural Network. I apologise for not giving a definition. I agree with your advice and have revised this problem in my manuscript. You can see more detailed information **in line 62.**

Lines 67-71, the words"radiation''and "download", the sentences"F10.7 is one of the longest-running indices that records the level of solar activity'', " from this URL", "from 1957 to 2019 are used, which the datasets'' and "and the datasets'' are removed. I agree with your advice and have revised this problem in my manuscript. You can see more detailed information **in lines 69-90.**

Line 75, the word "value'' is replaced by "values'' This error has been corrected **in line 91.**

Line 77, I think this table is important, so I'm going to give an explanatory note about the contents of the table. The addition is as follows: "The parameters related to the hardware and software environment for this experiment are shown in Table 1. We build a model through Python and utilize some efficient frameworks including Pandas, Matplotlib, Tensorflow, and Sklearn. Pandas supports us to complete data processing and Matplotlib supports us to display graphics. Tensorflow and Sklearn are essential frameworks for building various prediction models.'' You can see more detailed information **in lines 94-97.**

Lines 80-81, the sentence "some scholars believe it will replace RNN as the king of the temporal prediction field" is replaced by "Some scholars has demonstrated that TCN not only achieve better performance but also reduce the computational cost for training, compared to that of RNN (Lea et al.,2016; Bai et al.,2018; Dieleman et al.,2018)'' As suggested by the reviewer, we have added more references to support this idea(Lea et al.,2016; Bai et al.,2018; Dieleman et al.,2018) The sentence has been revised **in lines 101-103.**

Line 81, the "RNN'' means recurrent neural network and the "CNN''means convolutional neural network. I am sorry for not giving a definition. I agree with your advice and have revised this problem in my manuscript. This error has been corrected **in lines 103-104.**

Line 86 the sentence “Because of its a long sequence can be treated as a whole in TCN” is replaced by “Long input sequences can be processed as a whole in TCN.” The sentence has been revised **in lines 108-109.**

Line 115, the sentence “Figure 3: Expanded causal convolution” is replaced by “Expansion causal convolutional structure diagram.” TCN uses a one-dimensional convolutional network consisting of the expansion causal convolutional and residual modules. Figure 3 represents the expansion convolution of the TCN model, the principle can be found in Bai et al(arXiv:1803.01271v2). The sentence has been revised **in lines 137-138.**

Line 131, the word “Relu” is a commonly used activation function in deep learning and is a nonlinear function. It is defined as $f(x) = \max(0, x)$. I agree with your advice, and have revised this problem in my manuscript. You can see more detailed information **in lines 155-156.**

Line 139, The word“SWPC” is mentioned in line 15 of this article, so the abbreviation is used here. The URL for SWPC is https://www.swpc.noaa.gov/sites/default/files/images/u30/F10.7%20Solar%20Flux.pdf. I agree with your advice and have revised this problem in my manuscript. You can see more detailed information **in line 227.**

Lines 171-172, Fig.5 is intended to represent the difference in the performance of the TCN model in high solar activity years versus low solar activity years. To indicate that even in high solar activity years the TCN model can predict well. Especially during the peak of F10.7, the TCN model's predictions align well with the actual values, and it performs exceptionally well during periods F10.7 of high solar activity. The prediction performance of 1-3 days ahead for each year in solar cycle 24 has been shown in Table 3. Therefore, we do not think it is necessary to show the forecast charts for each year 1-3 days ahead again here. You can see more detailed information **in line 223.**

Line 193, I am very sorry that Figure 6 does not give specific information. Replace the specification of Figure 6 with the following: “Comparison of the prediction performance of SWPC and TCN. Panel (a) is a comparison of the prediction performance of SWPC and TCN 1-day ahead. Panel (b) shows the performance comparison between SWPC and TCN 2-days ahead. Panel (c) shows the performance comparison between SWPC and TCN 3-days ahead.” The sentence has been revised **in lines 246-248.**

Line 203, the sentence “Figure7: Comparison of the prediction performance between AR and TCN” is replaced by “Comparison of the prediction performance of AR and TCN. Panel (a) is a comparison of the prediction performance of AR and TCN 1-day ahead. Panel (b) shows the performance comparison between AR and TCN 2-days ahead. Panel (c) shows the performance comparison between AR and TCN 3-days ahead.” I agree with your advice and have revised this problem in my manuscript. The sentence has been revised **in lines 257-259.**

You can see the detailed changes in the resubmitted manuscript. If you have any problems, please contact me immediately. I am very grateful for your comment. Thank you very much.

Best Regard
LuYao Wang
The 1st author of this manuscript