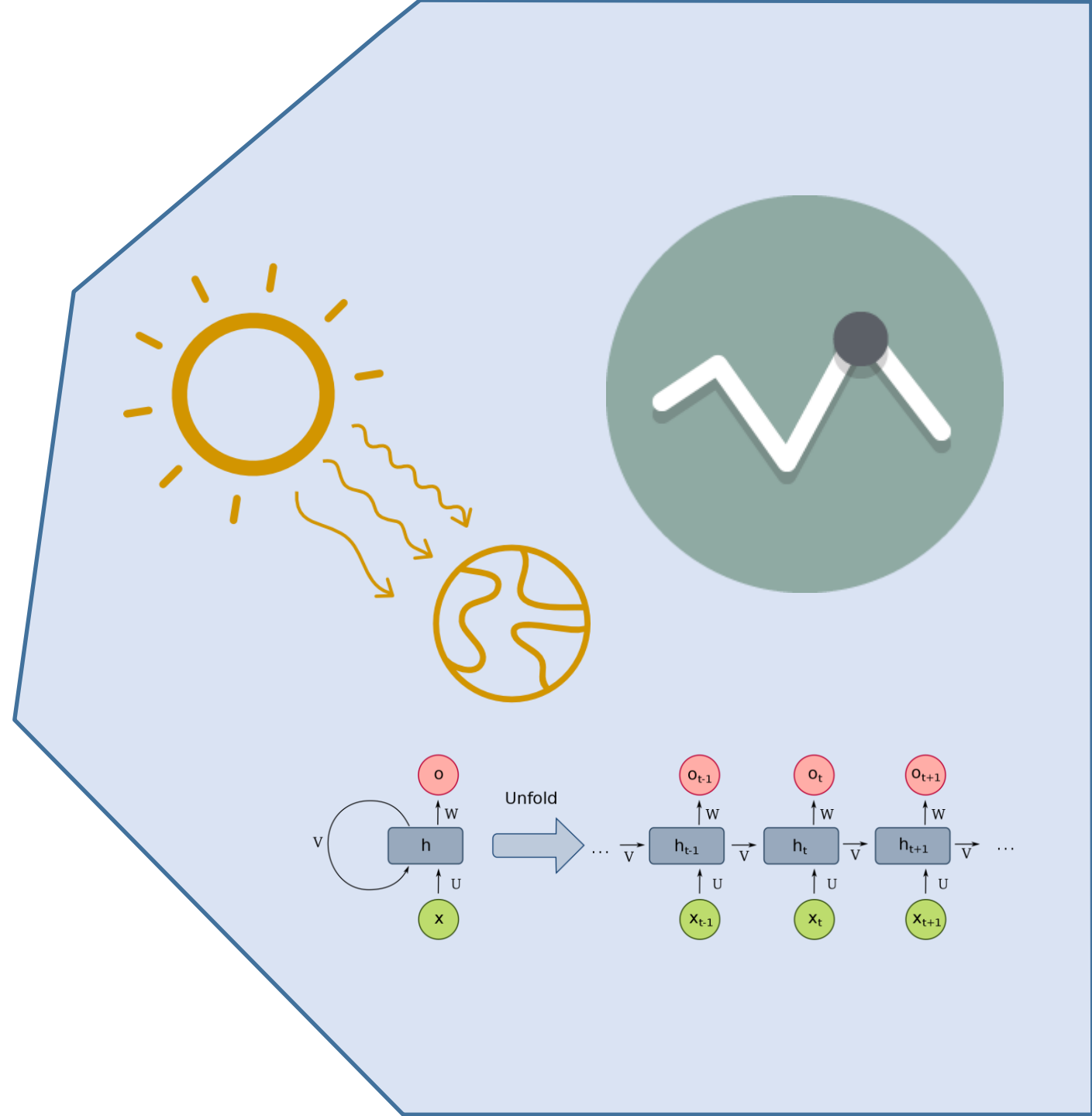


Forecasting solar radiation using a Long-Term Memory Neural Network

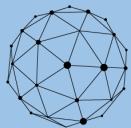
Andersson André Romero Deza
Andrei Abdyl Guevara Bravo

13 / may / 2021

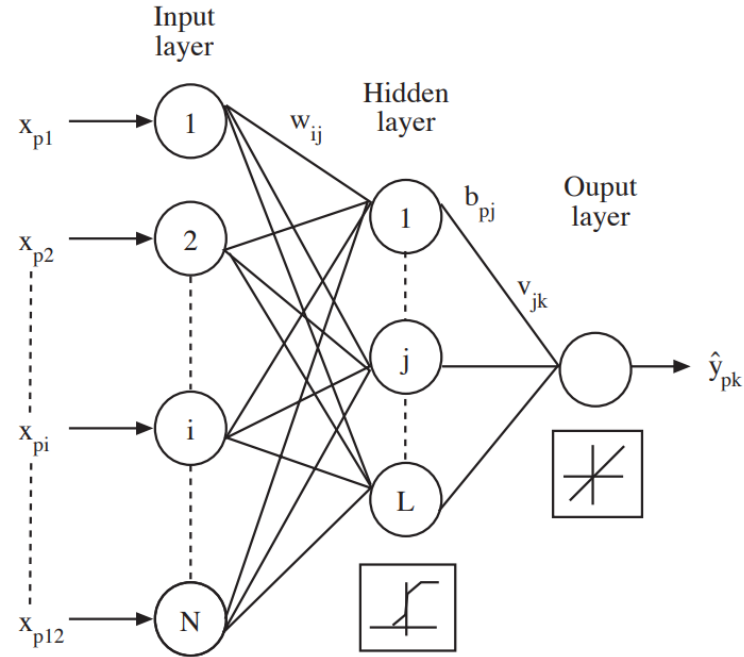


1

INTRODUCTION



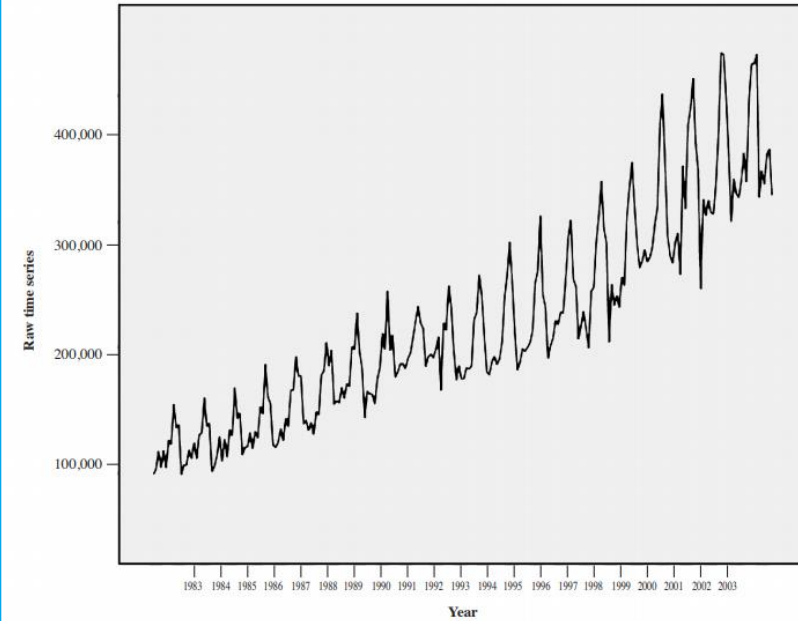
1



Neural Network (Moreno J., 2011)

$$y_i = f\left(\sum w_{ij}x_j - \theta_i\right)$$

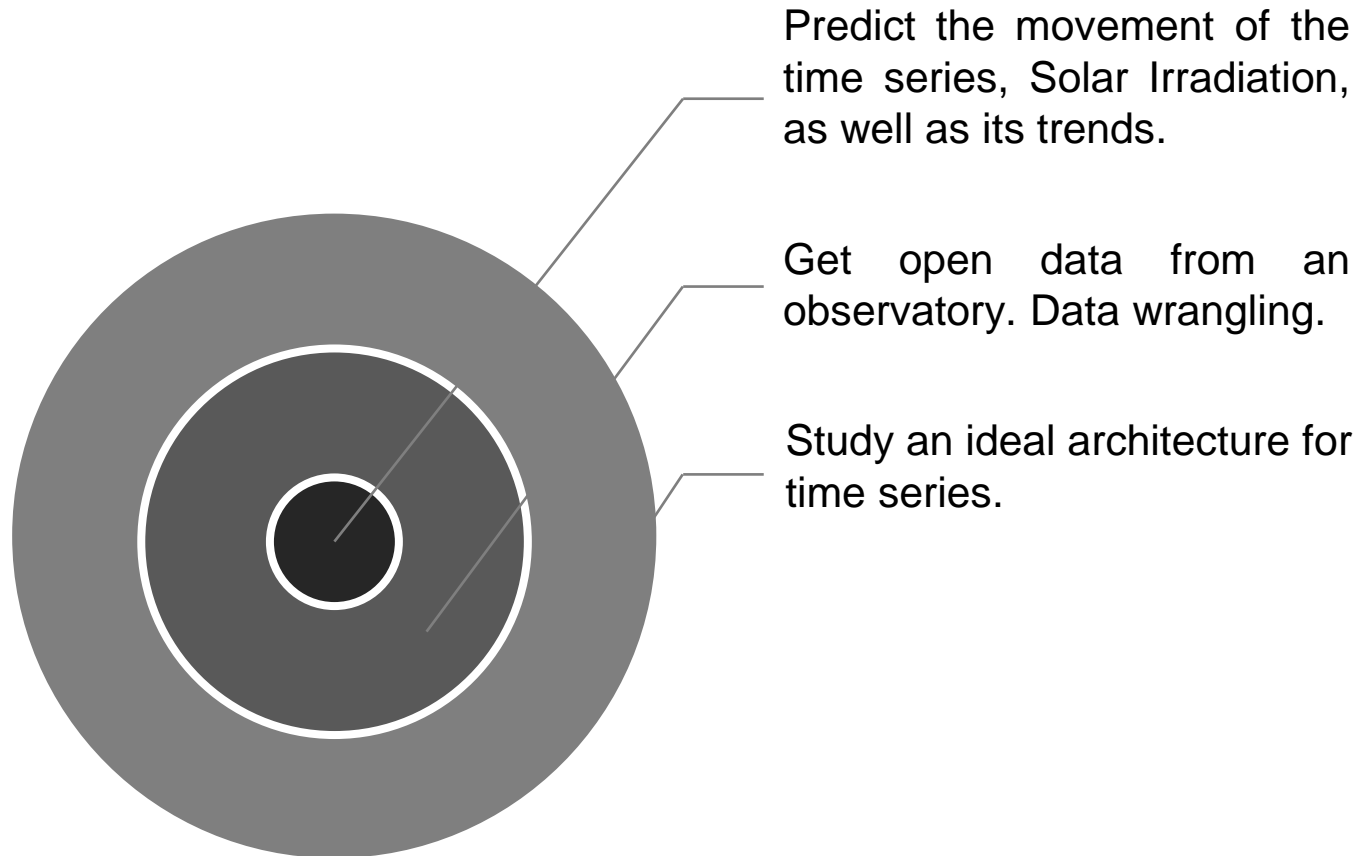
2



Time Series (Moreno J., 2011)

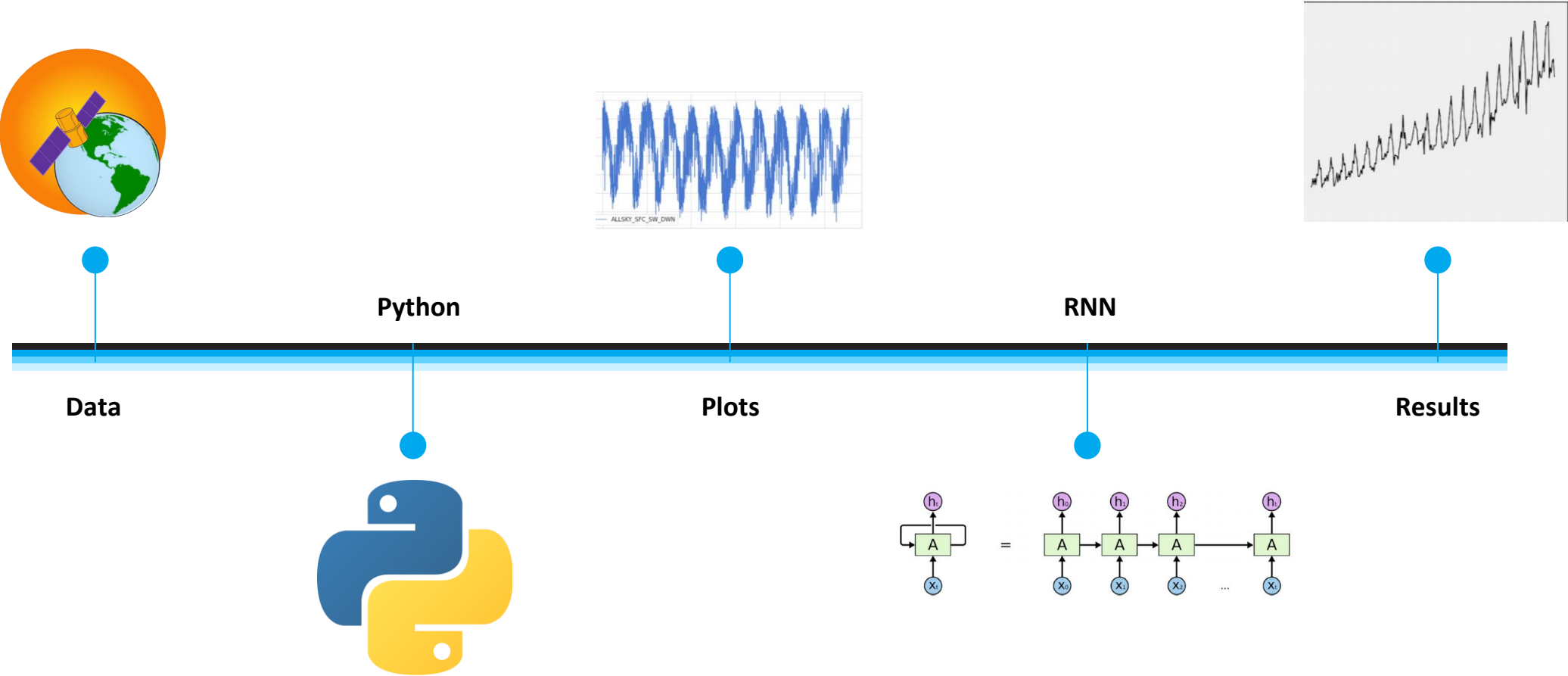
2 OBJECTIVES

OBJECTIVES



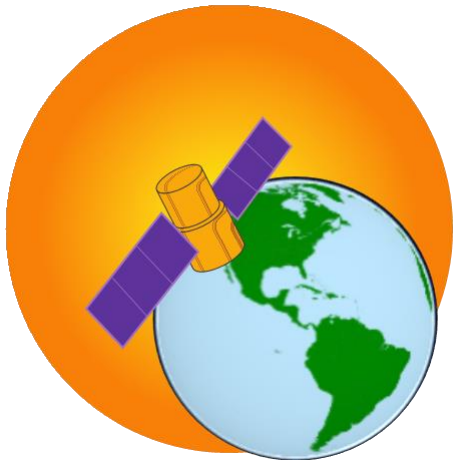
3 METHODOLOGY

METHODOLOGY

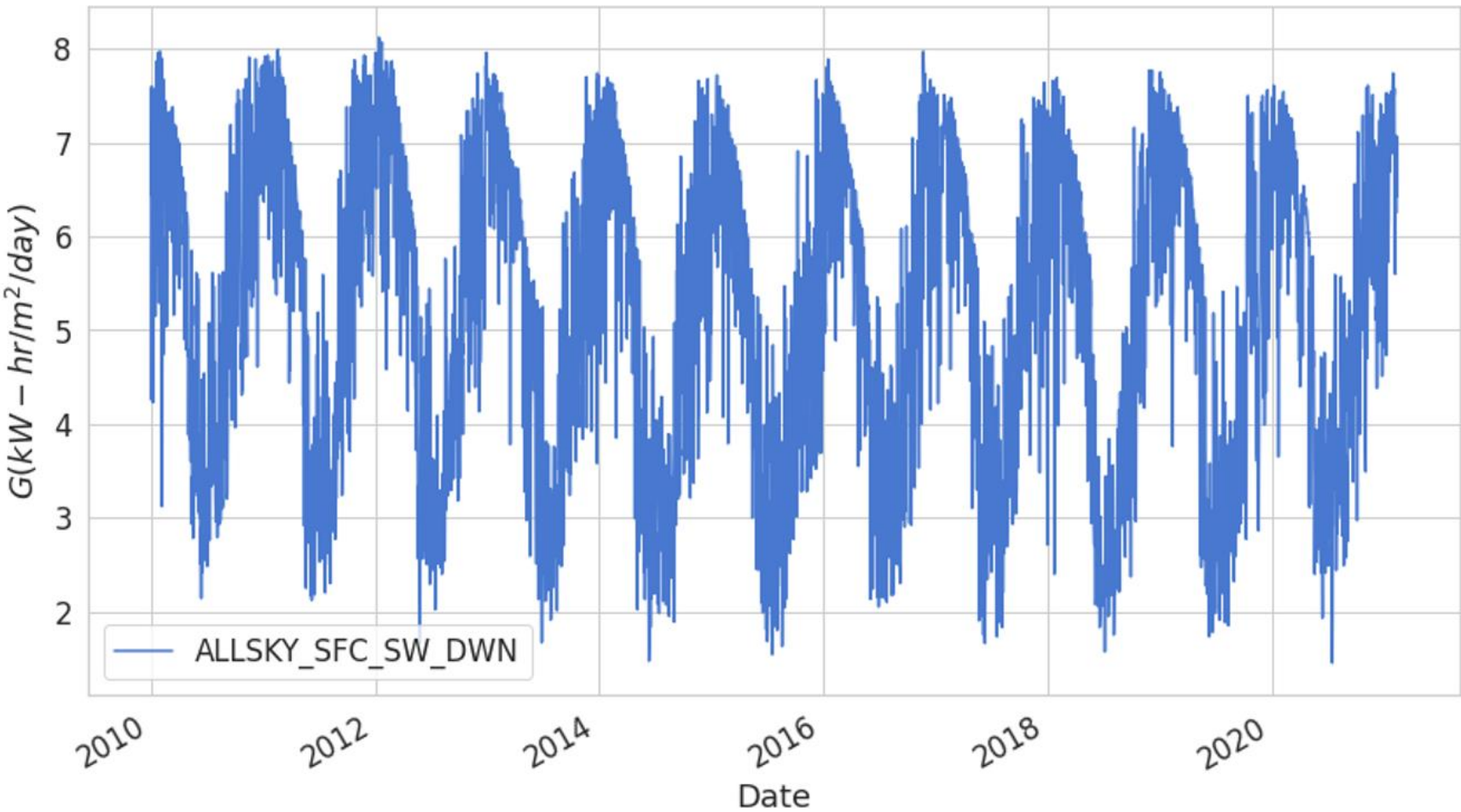


4 DATA

DATA

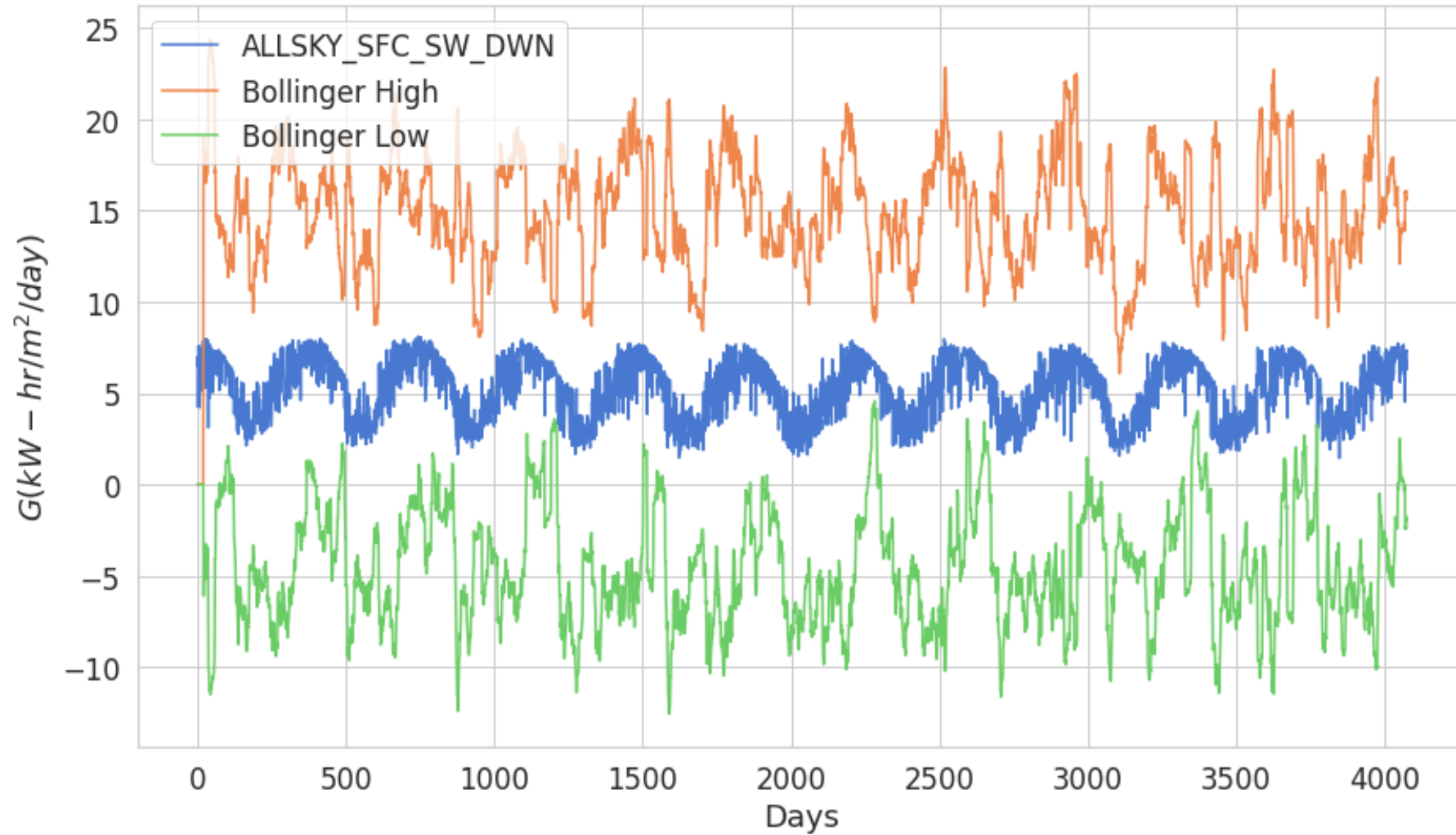


POWER Data Access

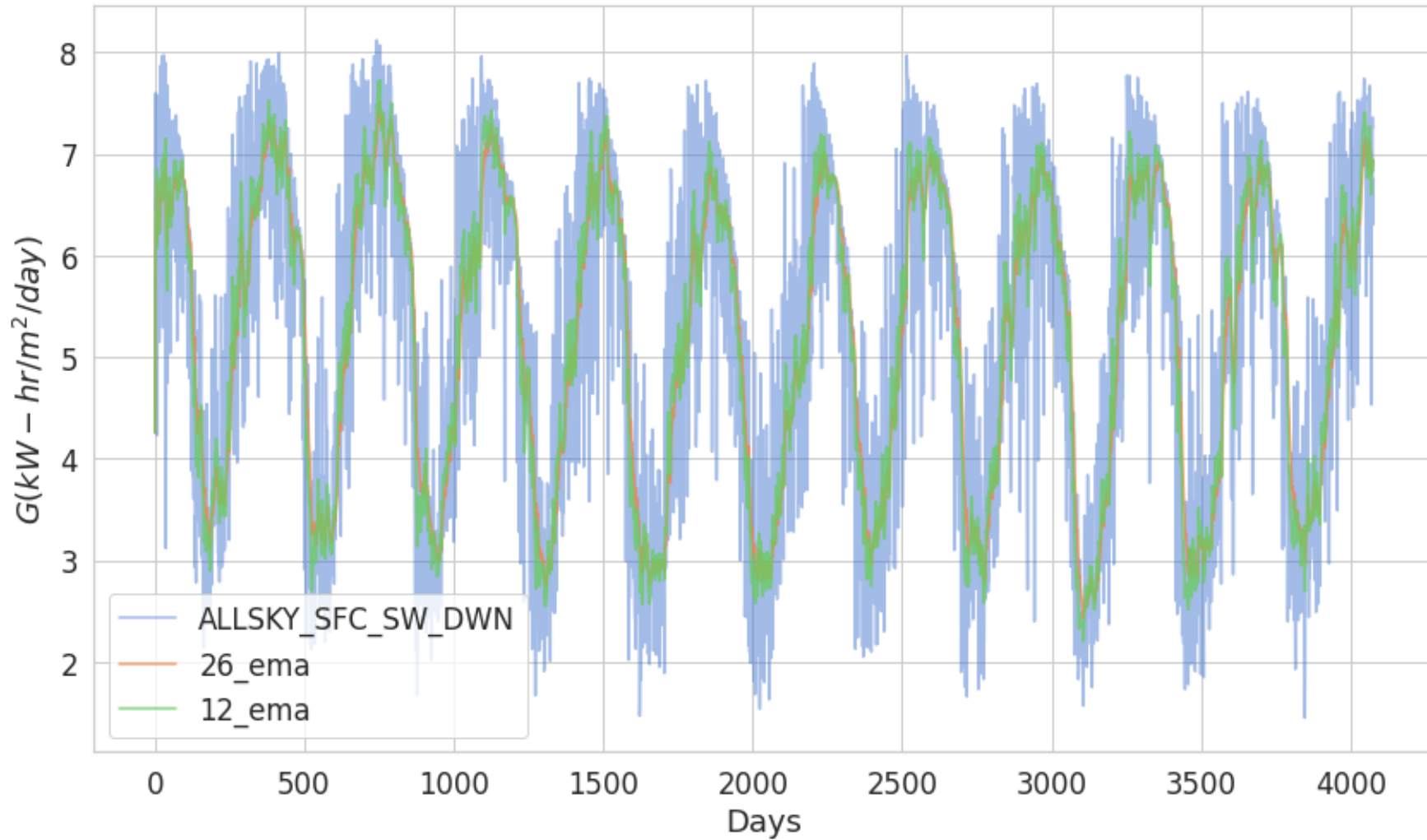


Solar Irradiation (NASA 2021)

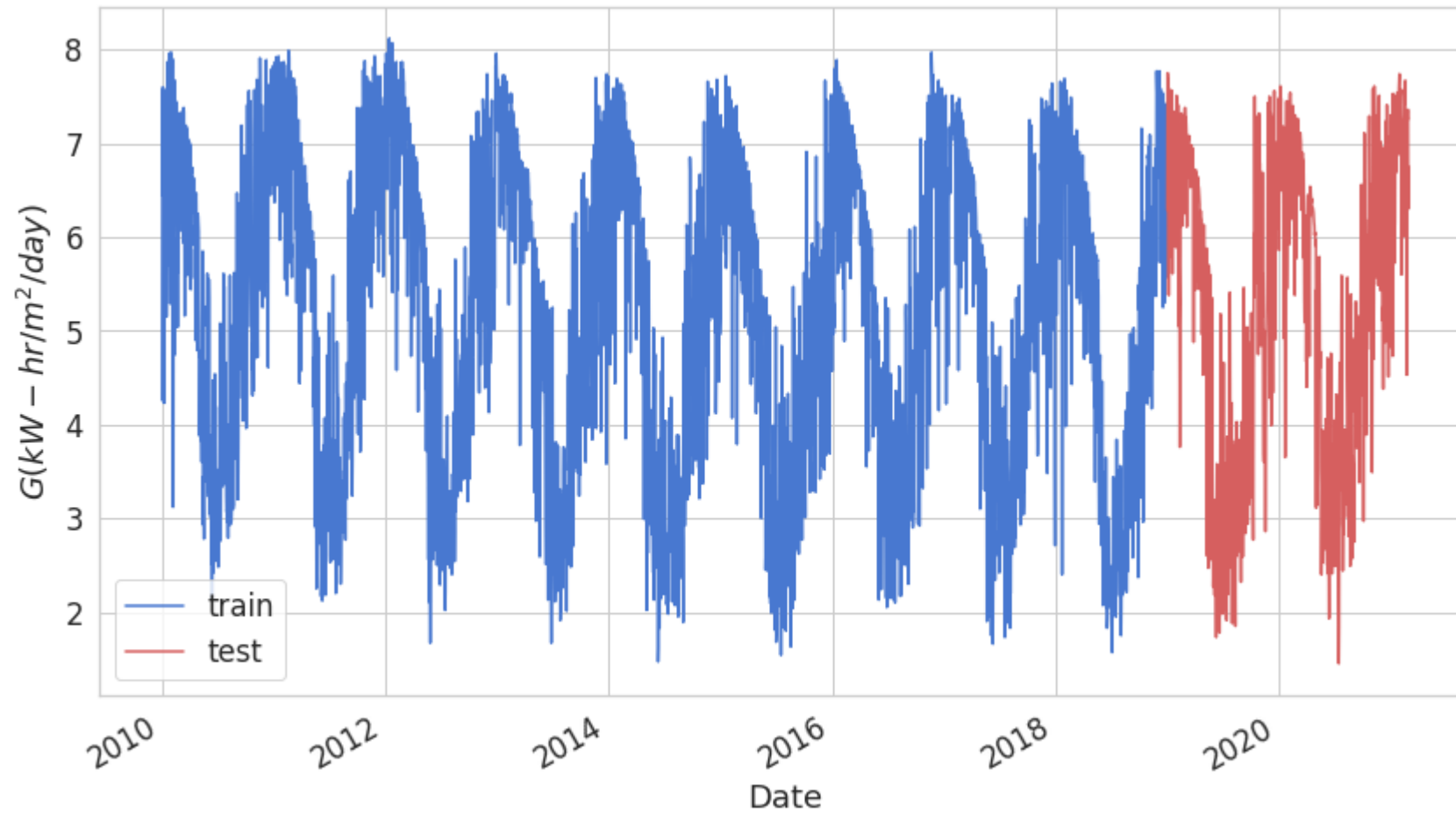
Bollinger Bands



Exponential Moving Average (ema)

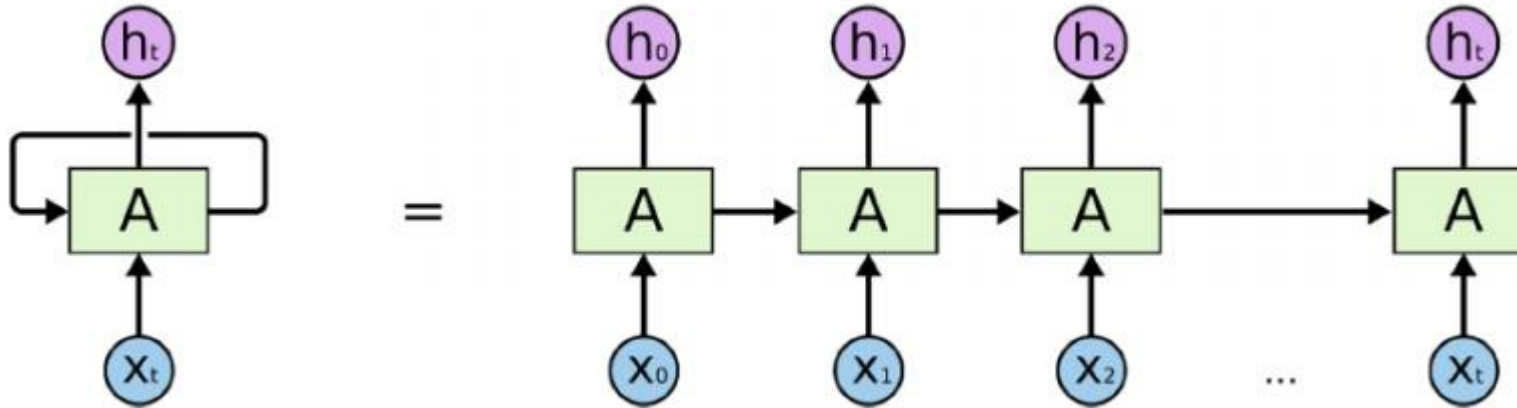


Train/Test



5 ARCHITECTURE

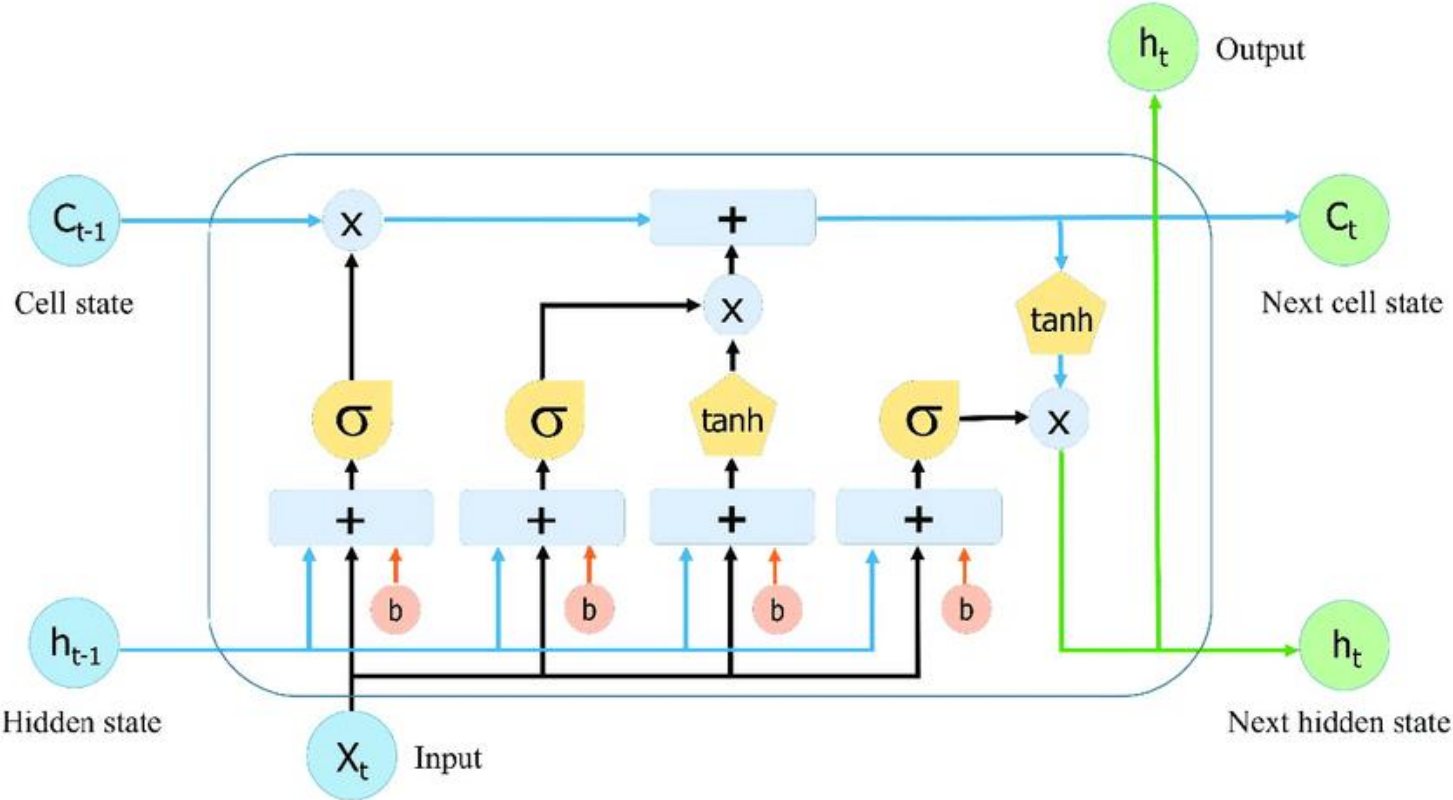
RECURRENT NEURAL NETWORK



Recurrent Neural Network (Le X., 2019)

LSTM

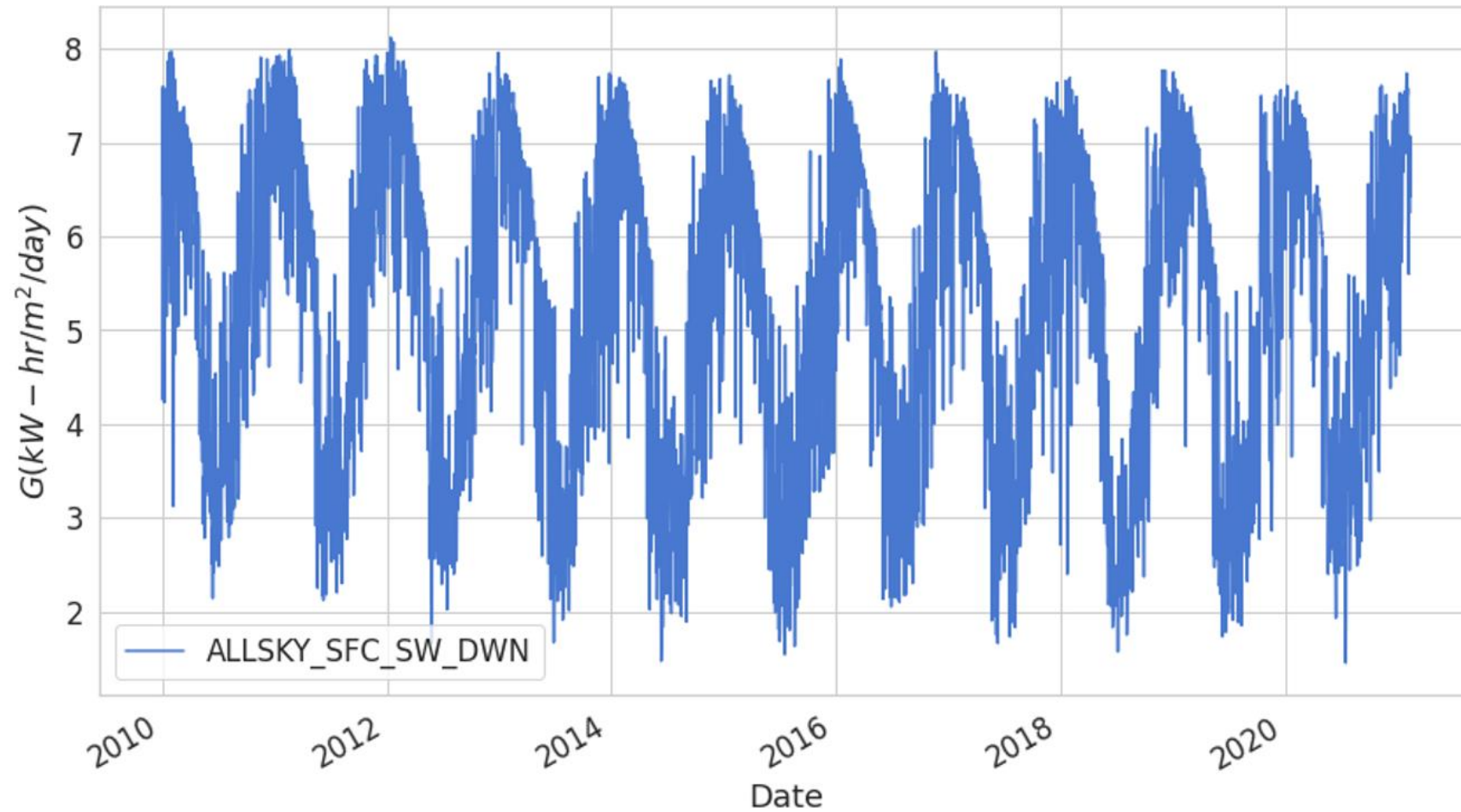
LSTM (Le X., 2019)



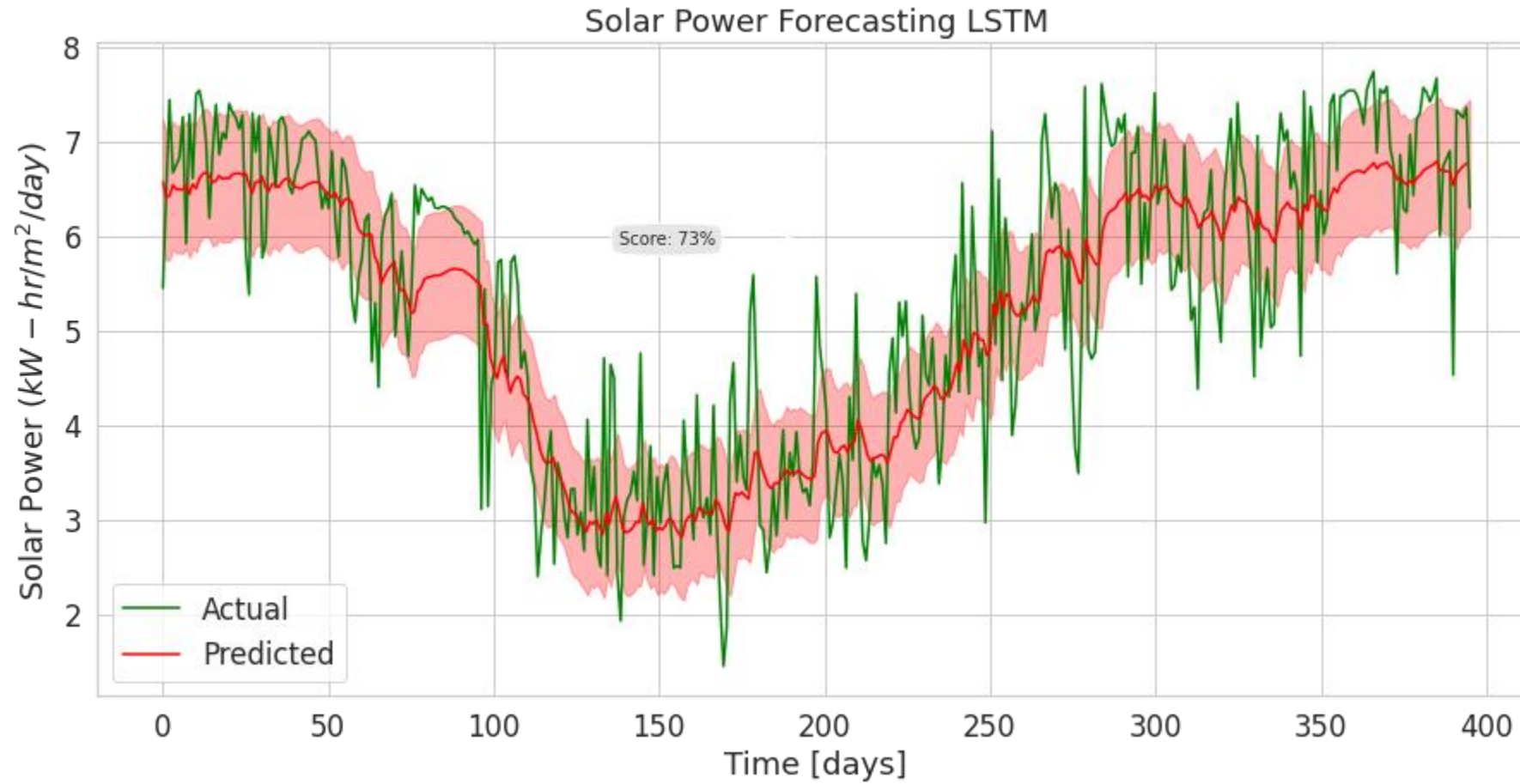
Inputs:	Outputs:	Nonlinearities:	Vector operations:
x_t Current input	c_t New updated memory	σ Sigmoid layer	\times Scaling of information
c_{t-1} Memory from last LSTM unit	h_t Current output	\tanh Tanh layer	$+$ Adding information
h_{t-1} Output of last LSTM unit		b Bias	

6 RESULTS

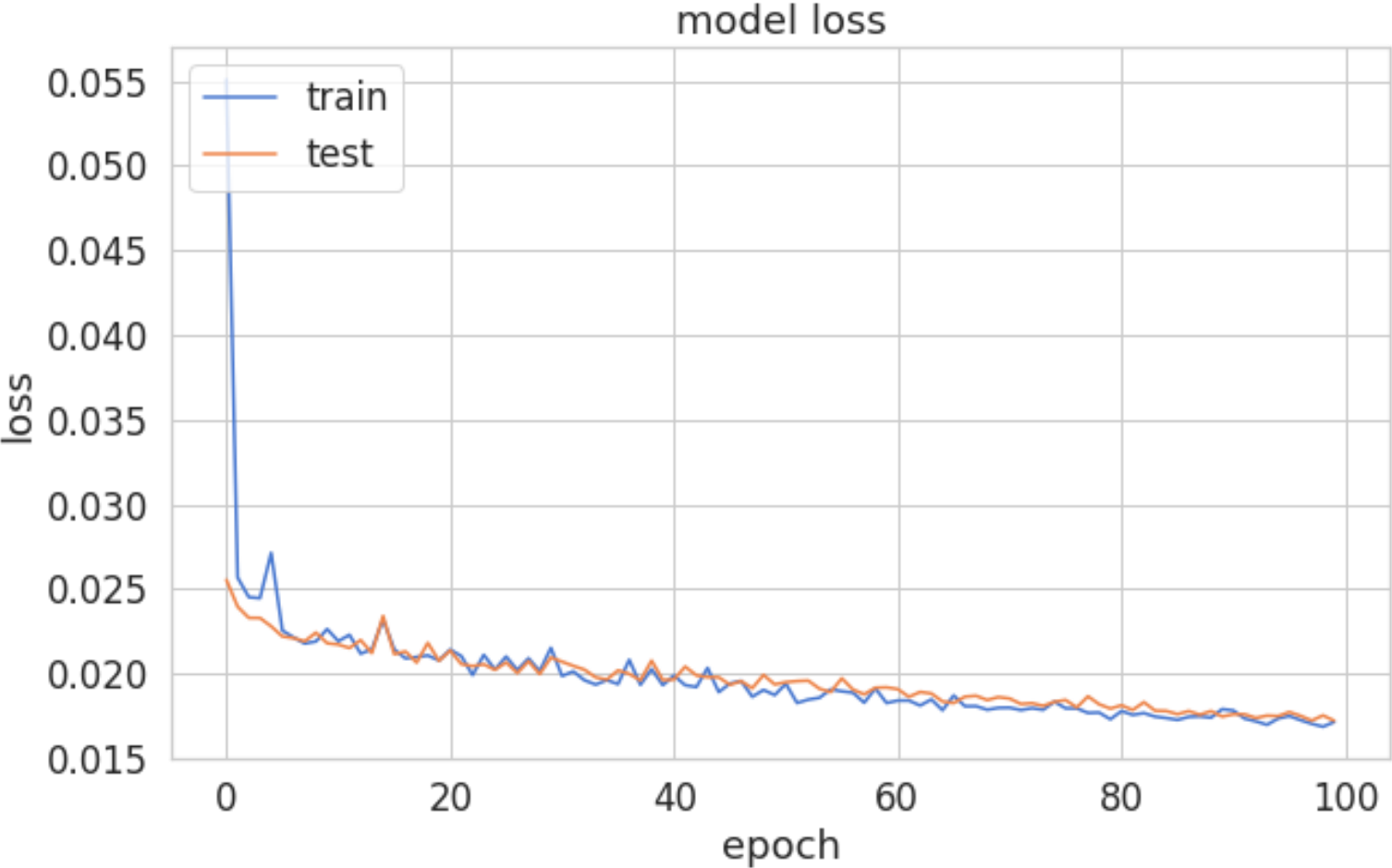
DATA Days



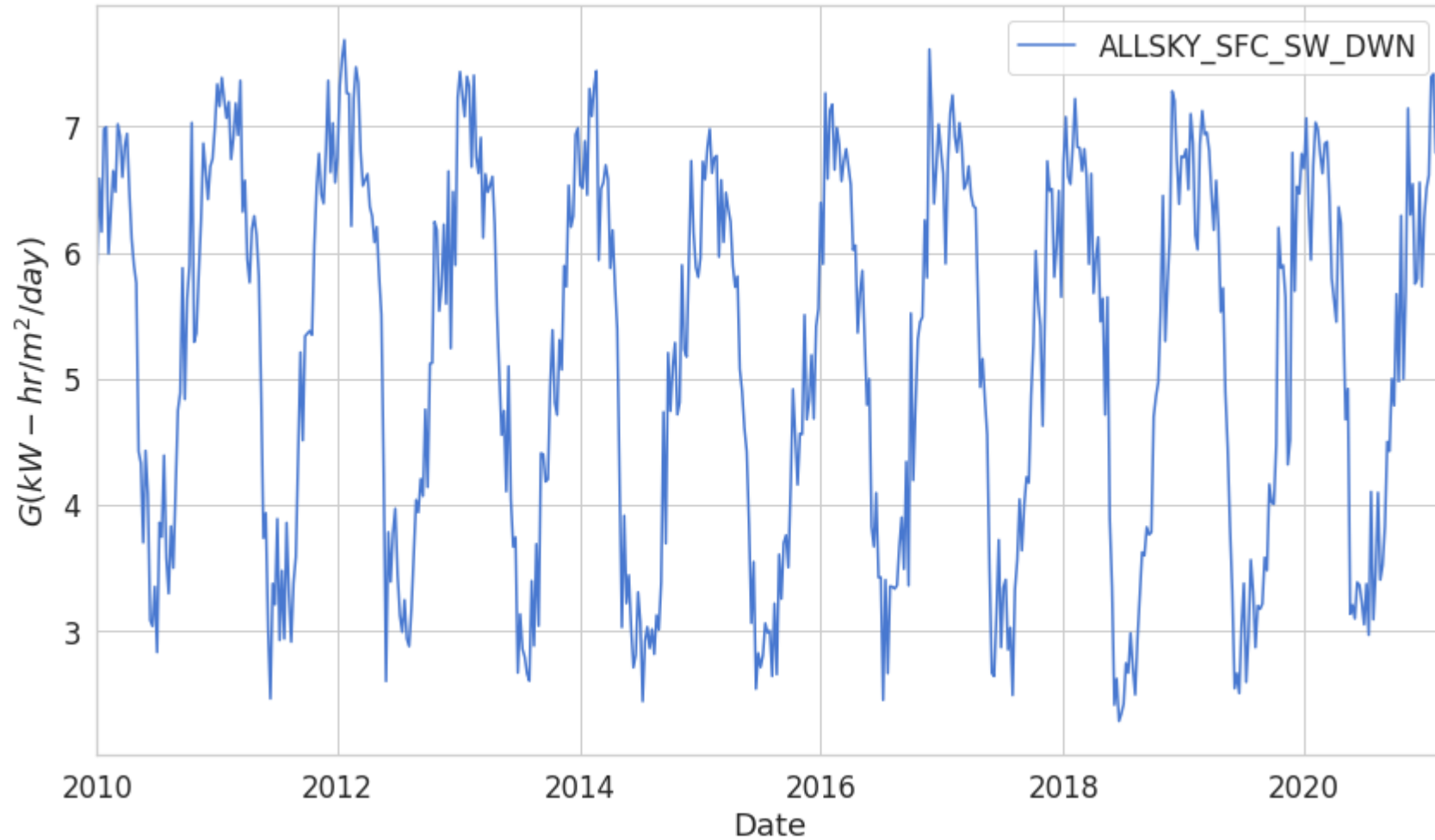
Results Days



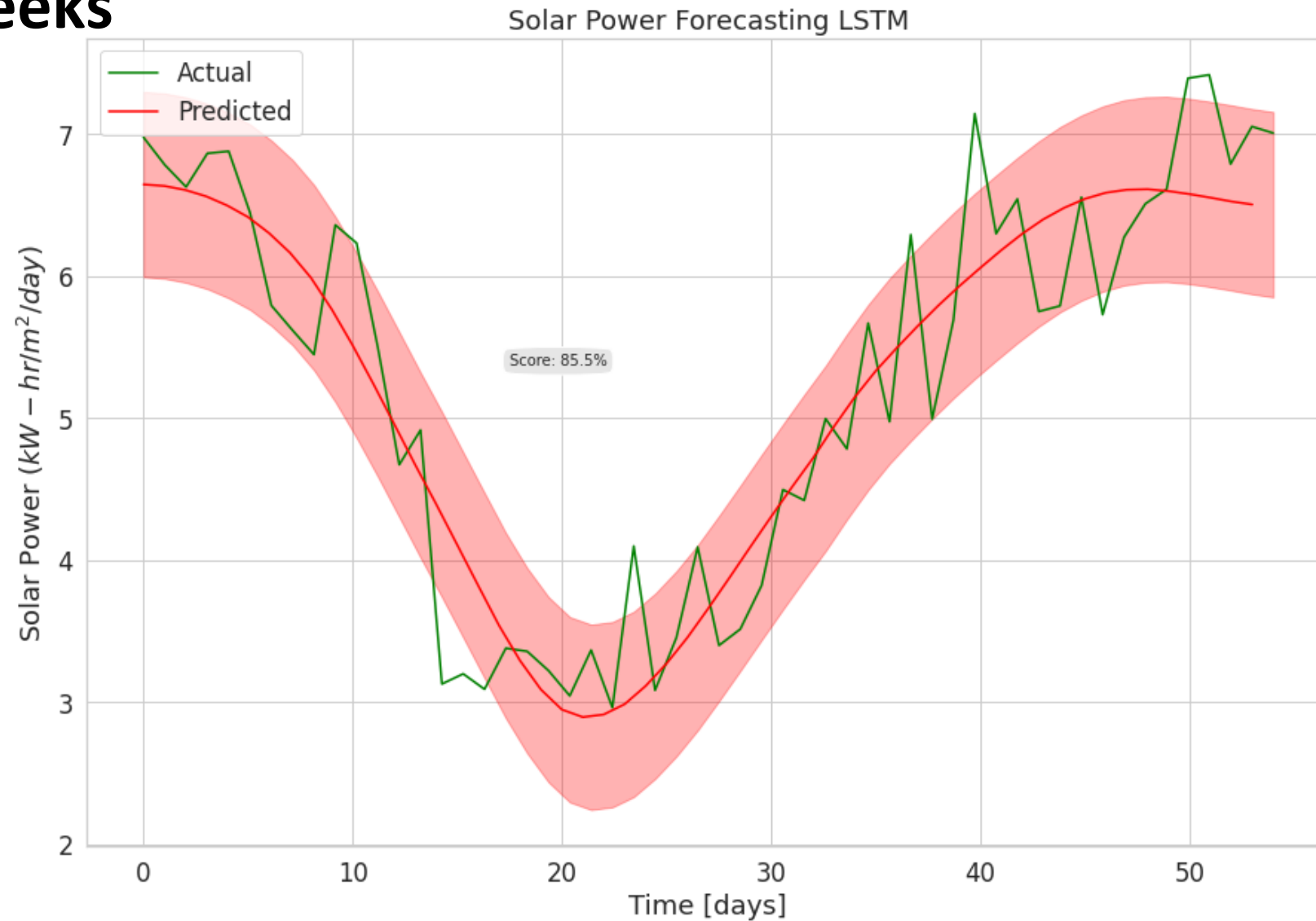
Loss



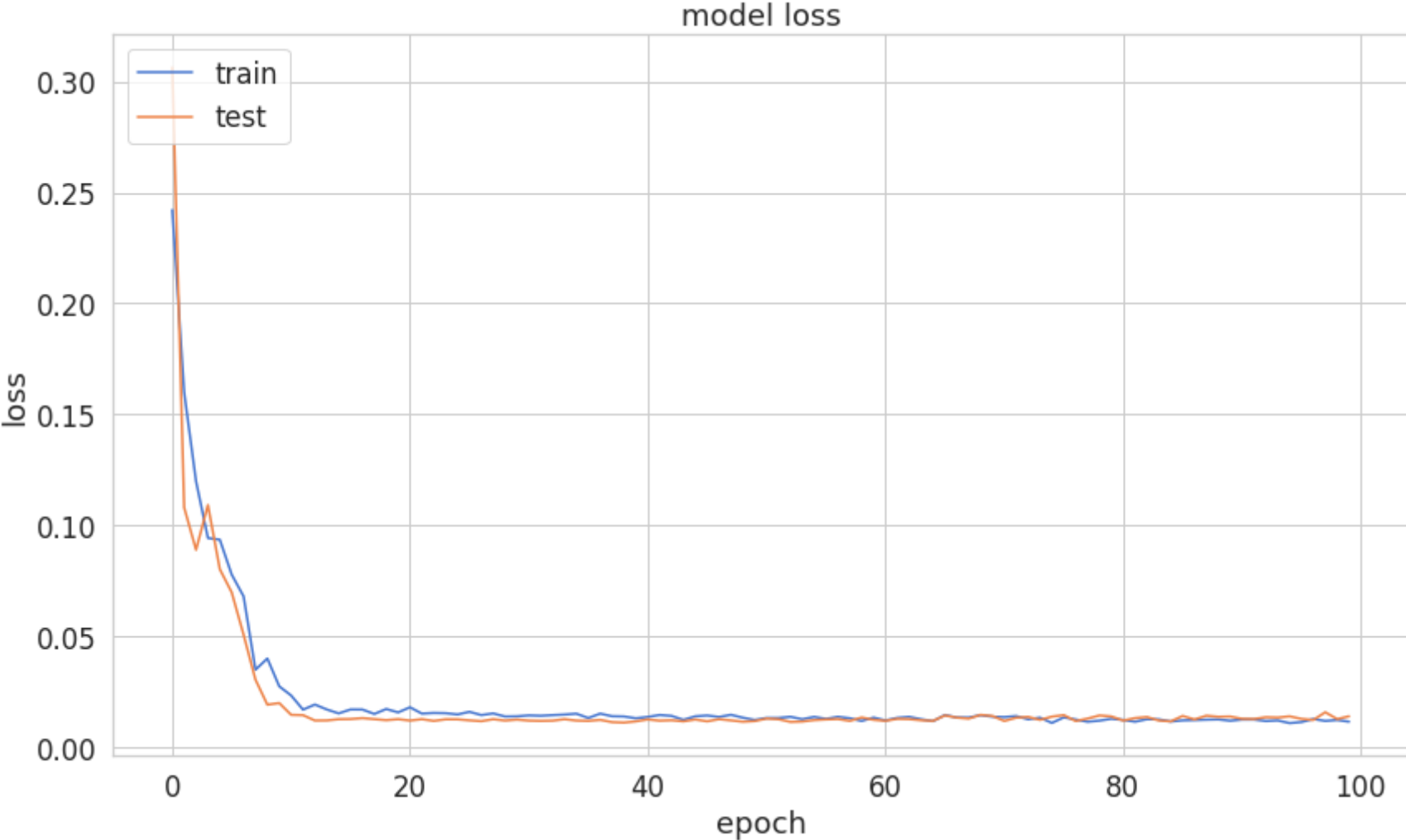
DATA Weeks



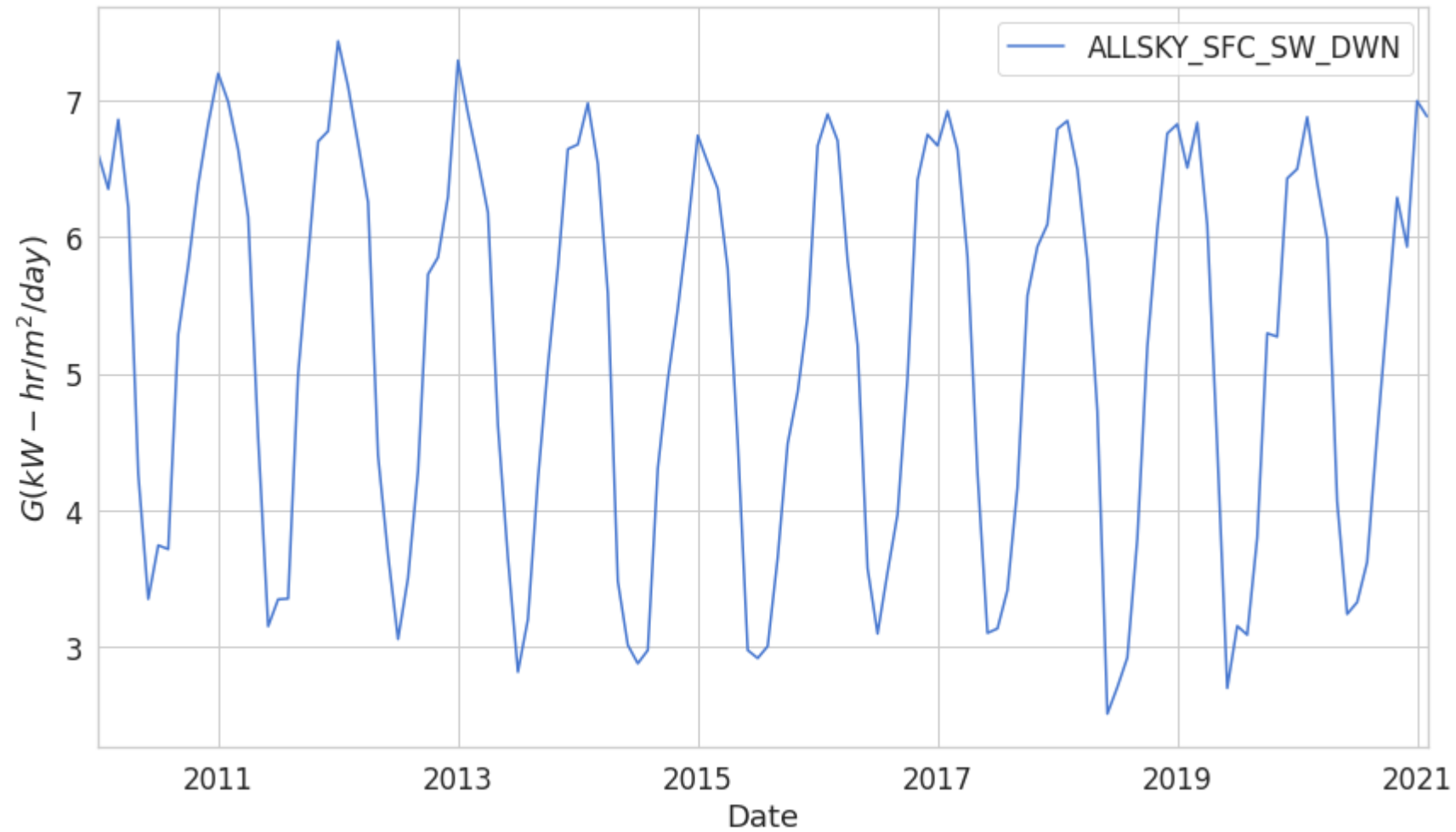
Results Weeks



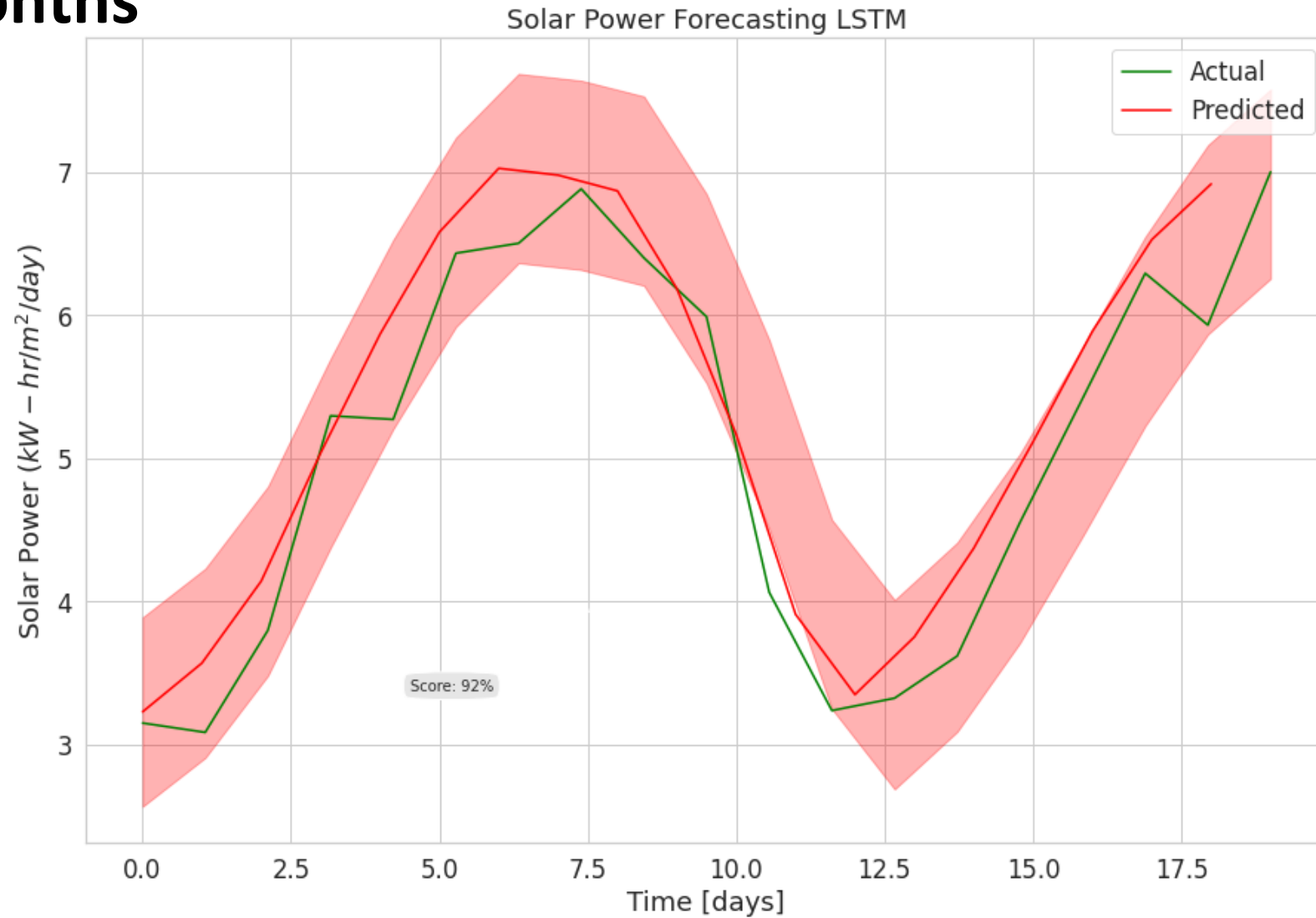
Loss



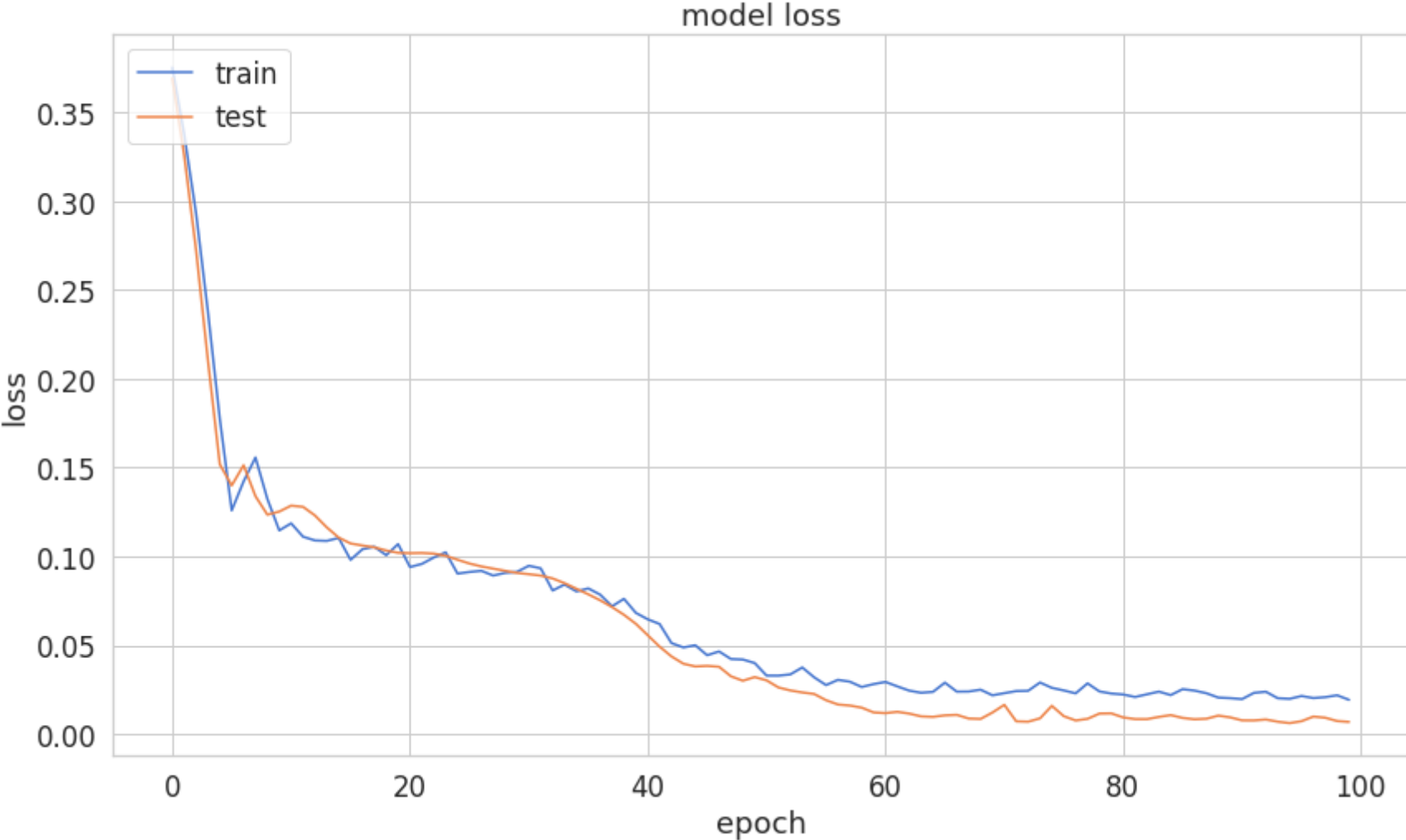
DATA Months



Results Months

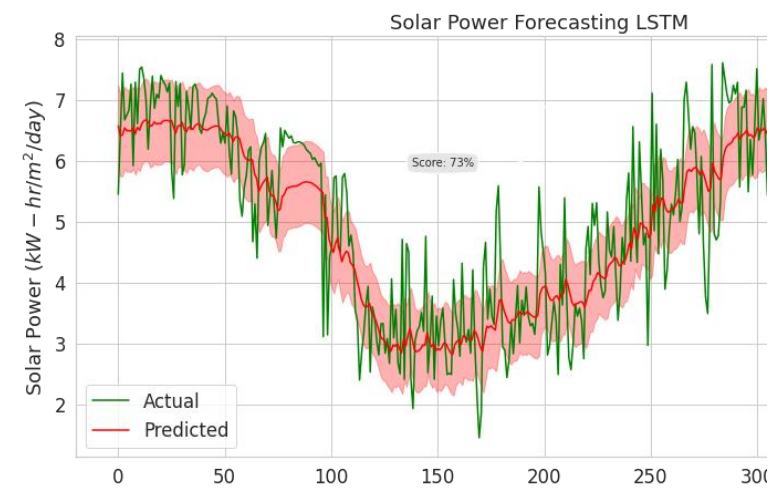


Loss



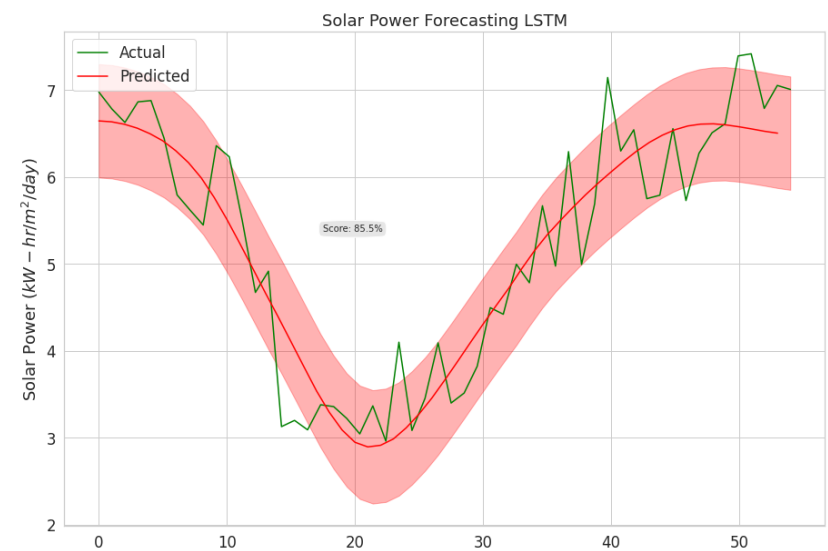
Predictions

Days



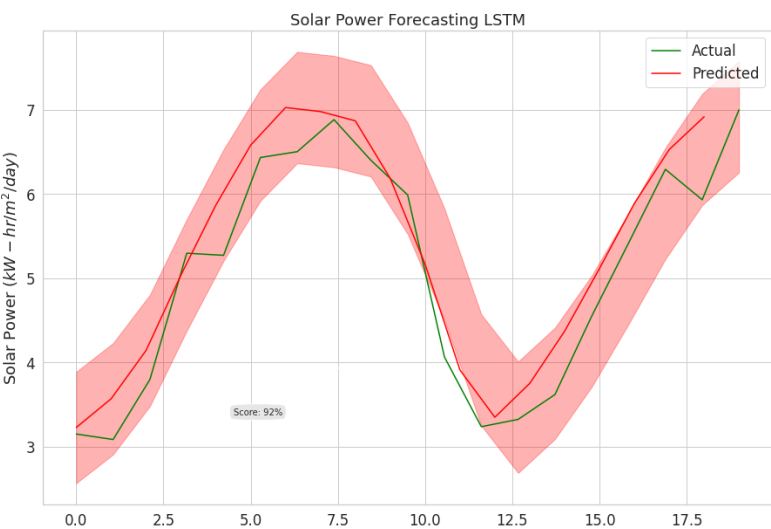
Score: 73%

Weeks



Score: 85.5%

Months



Score: 92%

7 CONCLUSIONS

CONCLUSIONS

A

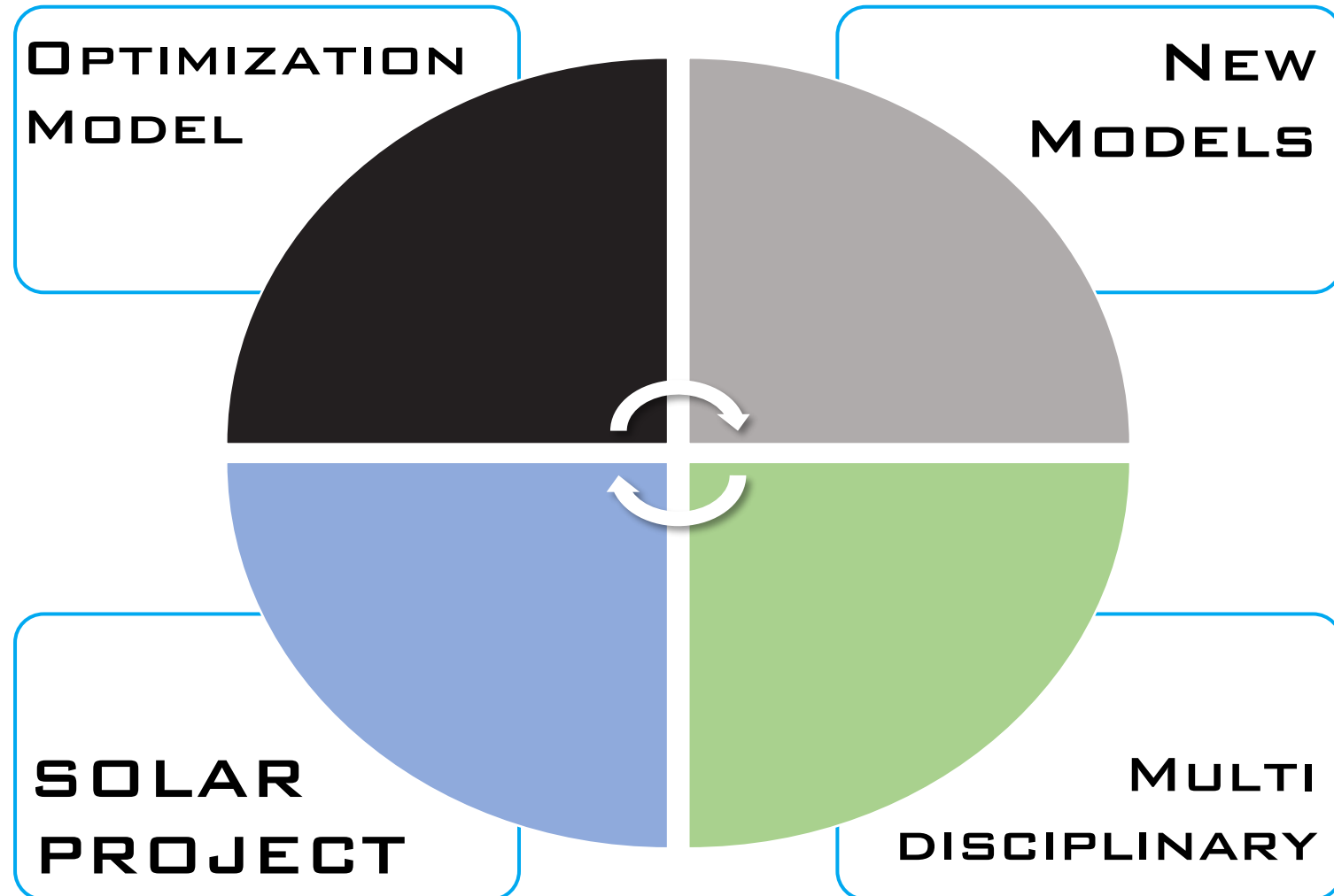
The Open Data was collected from NASA's geophysical platform and processed correctly using python.

B

We have proposed and validated a model for the study of solar radiation over time. The LSTM Recurrent Neural Network has been used, which is an ideal model to study the weather. Despite not having abundant data, it was enough to be able to train and obtain a good result in the regression. Being 73% for the daily model, 85.5% for the weekly model and 92% for the month model.

8 FUTURE WORK

FUTURE WORK



9 REFERENCES

REFERENCES

- [1] Moreno, J. J. M. (2011). Artificial neural networks applied to forecasting time series. *Psicothema*, 23(2), 322-329.
- [2] Le, X. H., Ho, H. V., Lee, G., & Jung, S. (2019). Application of long short-term memory (LSTM) neural network for flood forecasting. *Water*, 11(7), 1387.
- [3] Nasa (01 de febrero de 2021). *NASA POWER*. POWER Data Access Viewer. [POWER Data Access Viewer \(nasa.gov\)](https://power.larc.nasa.gov/)
- [4] Qing, X., & Niu, Y. (2018). Hourly day-ahead solar irradiance prediction using weather forecasts by LSTM. *Energy*, 148, 461-468.
- [5] Greff, K., Srivastava, R. K., Koutník, J., Steunebrink, B. R., & Schmidhuber, J. (2016). LSTM: A search space odyssey. *IEEE transactions on neural networks and learning systems*, 28(10), 2222-2232.
- [6] Huang, Z., Xu, W., & Yu, K. (2015). Bidirectional LSTM-CRF models for sequence tagging. *arXiv preprint arXiv:1508.01991*.

Thanks

Questions?

