

# Annexure A

## A study of correlation between input parameters GHI and GTI (Global Tilted Irradiation) and their impact on neural network-based forecasts

### A.1 INTRODUCTION

It is known in neural network literature that correlation among input variables should be considered while normalization of the input data. In this study it is expected that GHI and GTI inputs may be correlated strongly with each other. Hence a detailed study to find out the impact of using one or both of these components of solar irradiation for forecasting is studied in this annexure.

### A.2 PROPOSED MODEL

The three options considered here as shown in Table A.1:

Table A.1: Parameters for proposed model

S. No.	Models	Parameters
1	Model-1	GHI+ Ambient Temp. + Module Temp. + Sun Availability
2	Model-2	GTI + Ambient Temp. + Module Temp. + Sun Availability
3	Model-3	GHI+ GTI+ Ambient Temp. + Module Temp. + Sun Availability

The two components of solar radiation GHI and GTI are as shown in Figure A.1 and a plot of correlation between them is shown in Figure A.2.

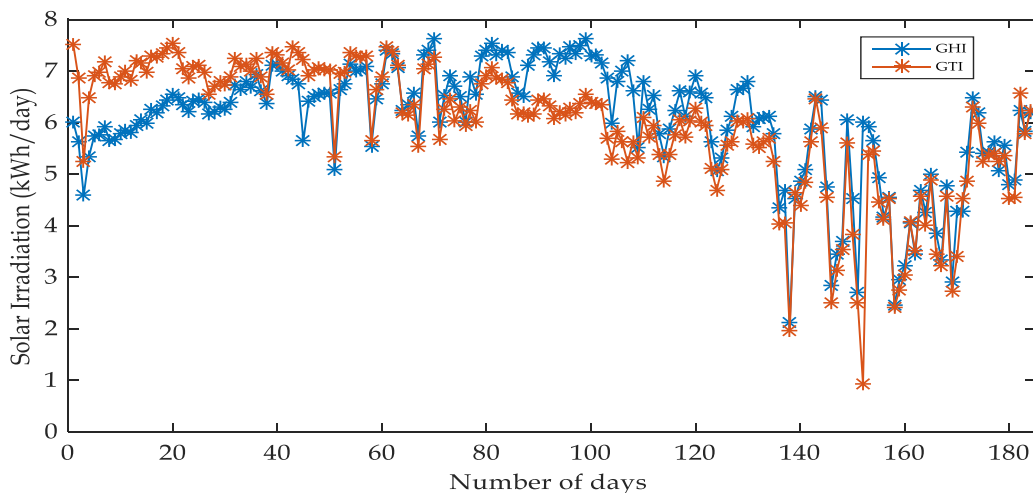


Figure A.1: Variation in daily averaged GHI and GTI

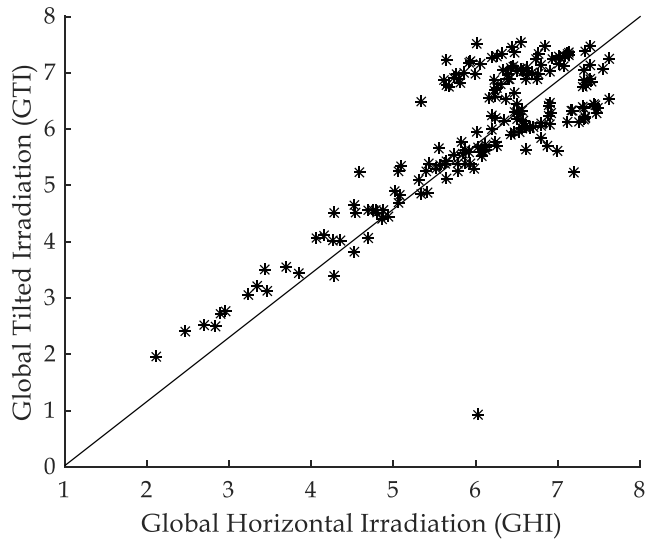
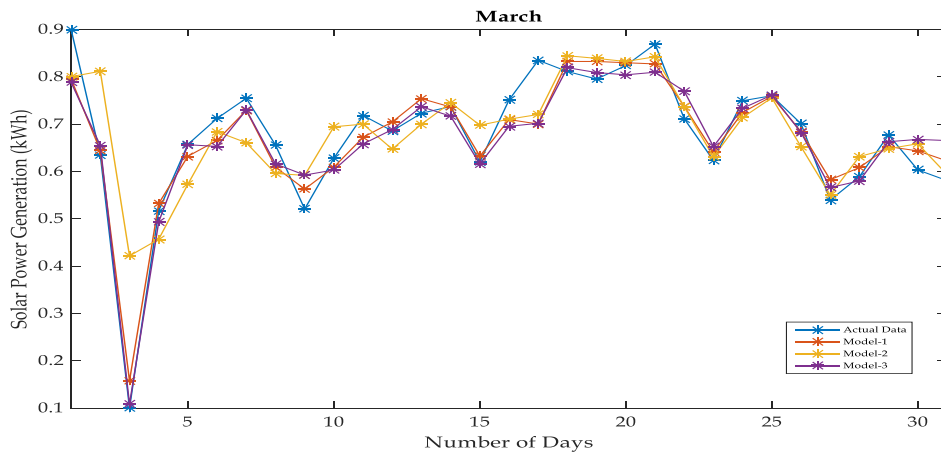


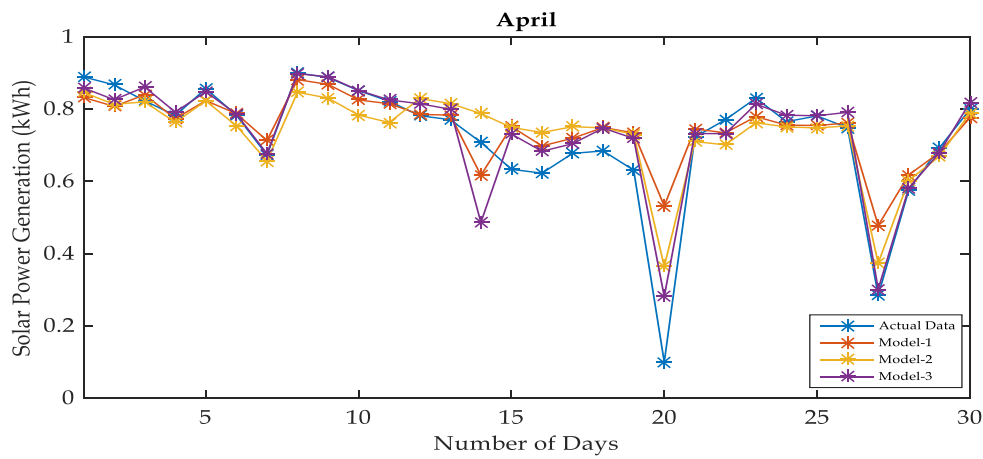
Figure A.2: correlation in between GHI and GTI

### A.3 RESULTS

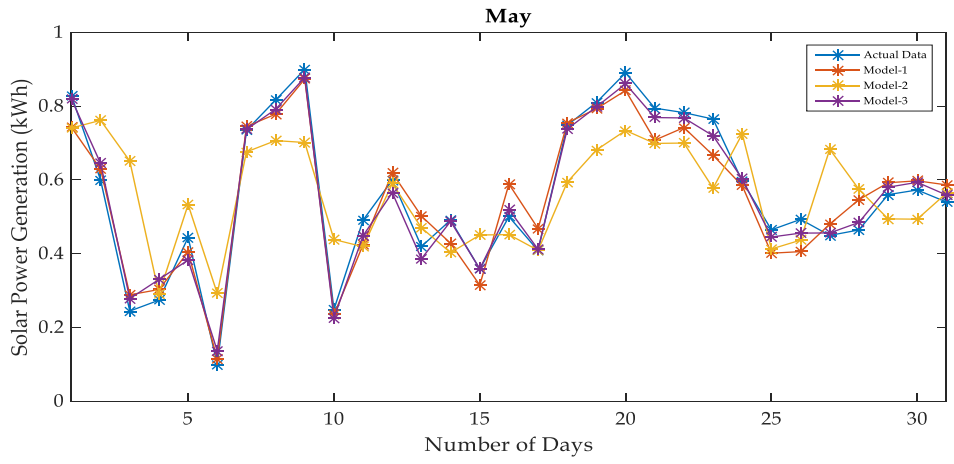
The forecast of ANN with the three models shown in Table A.1 are presented in Figures A.3 for six month duration for the 5 MW GPCL plant.



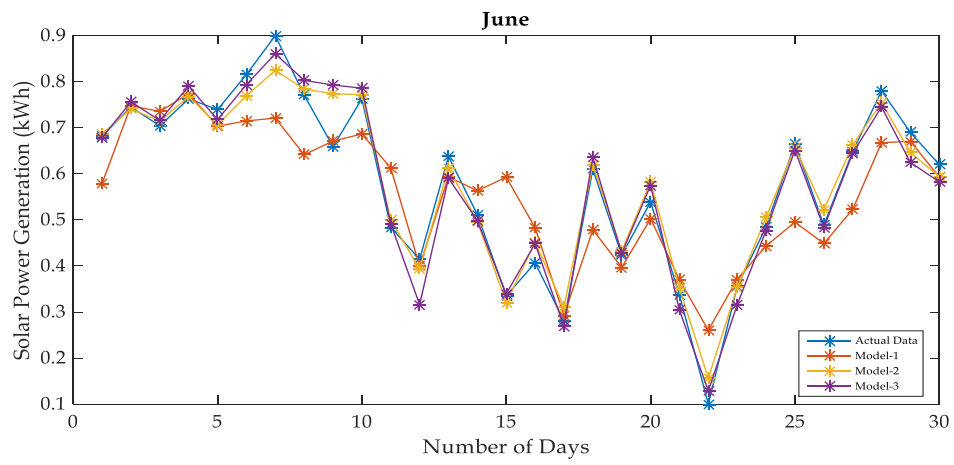
(a)



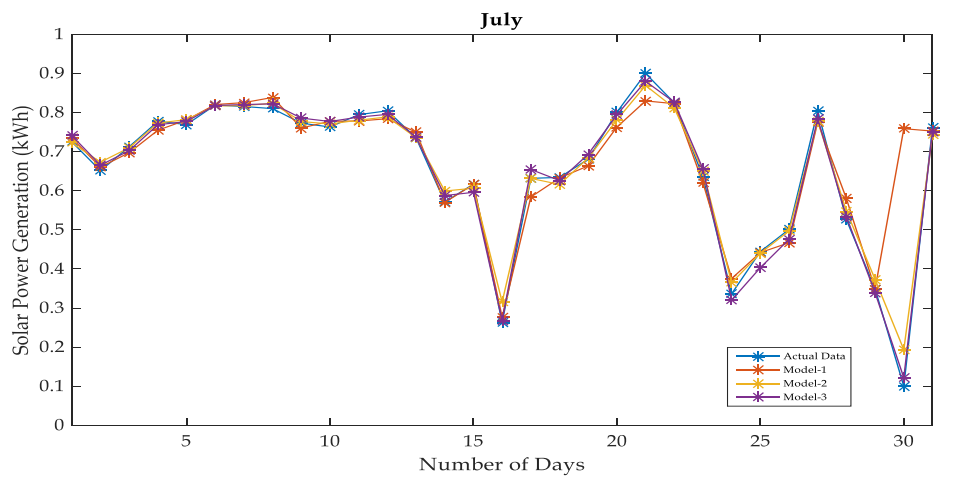
(b)



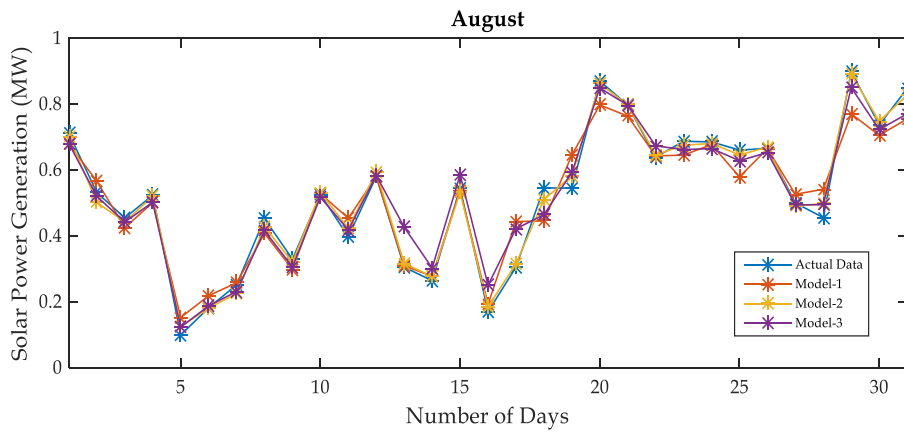
(c)



(d)

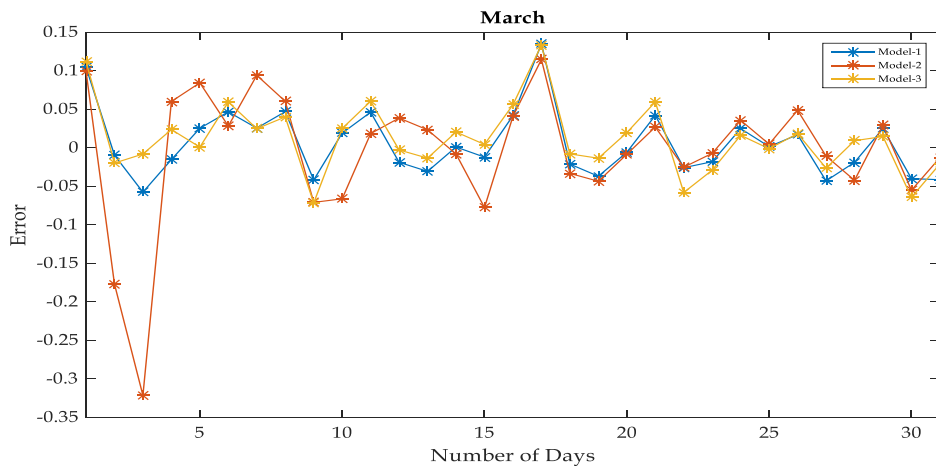


(e)

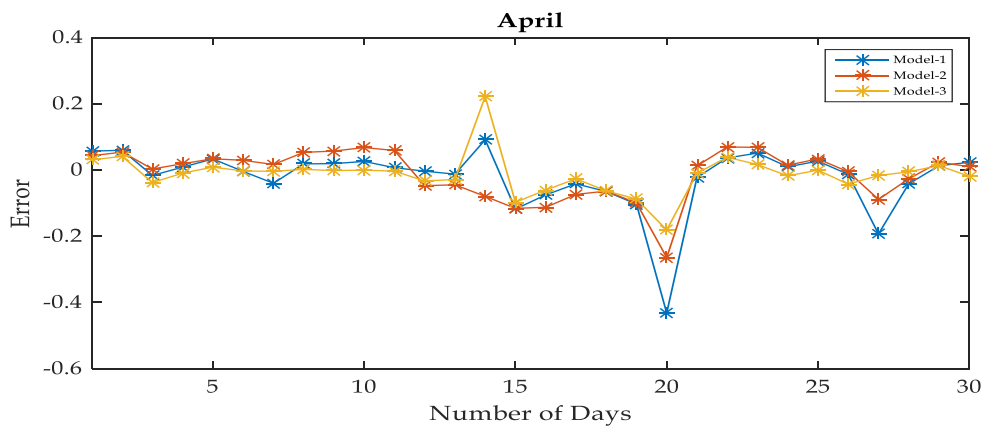


(f)

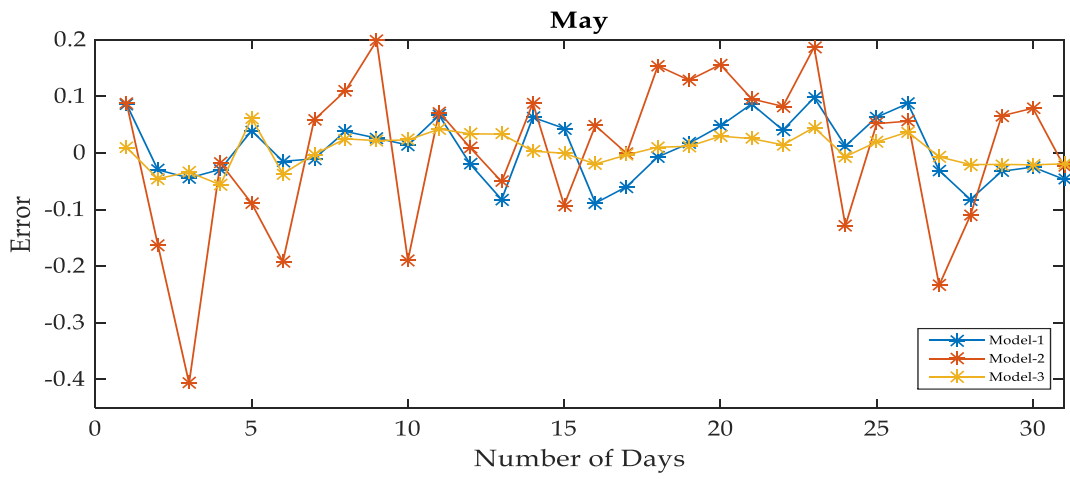
Figure A.3: Solar power generation for the month of (a) March (b) April (c) May (d) June (e) July and (f) August



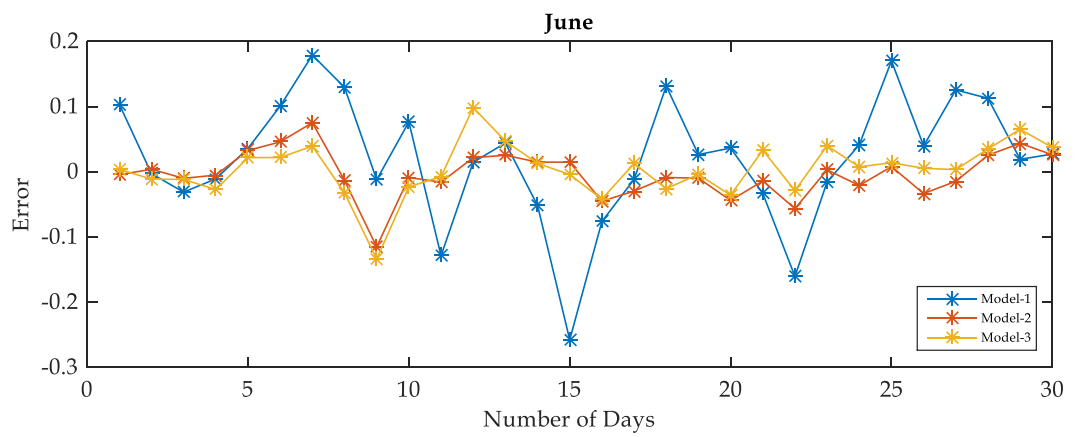
(a)



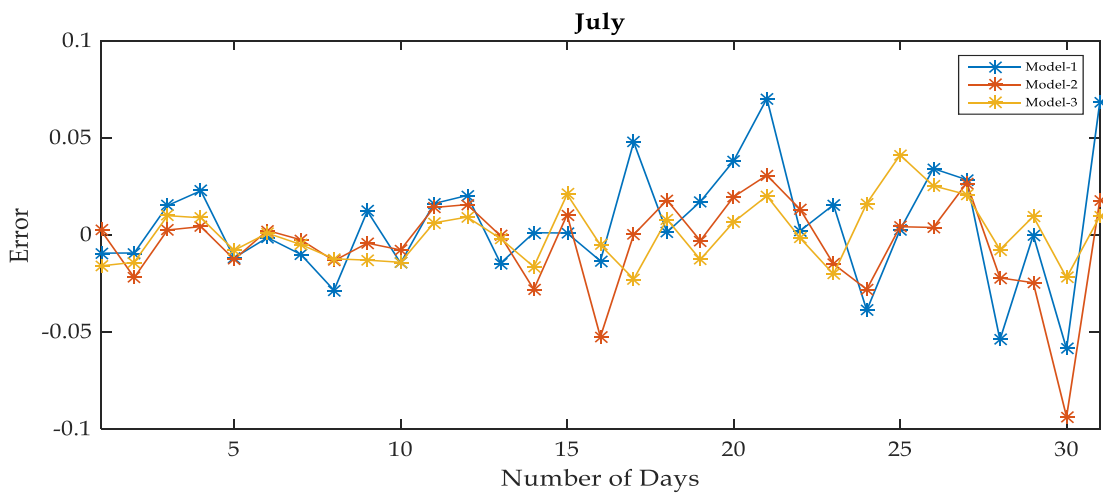
(b)



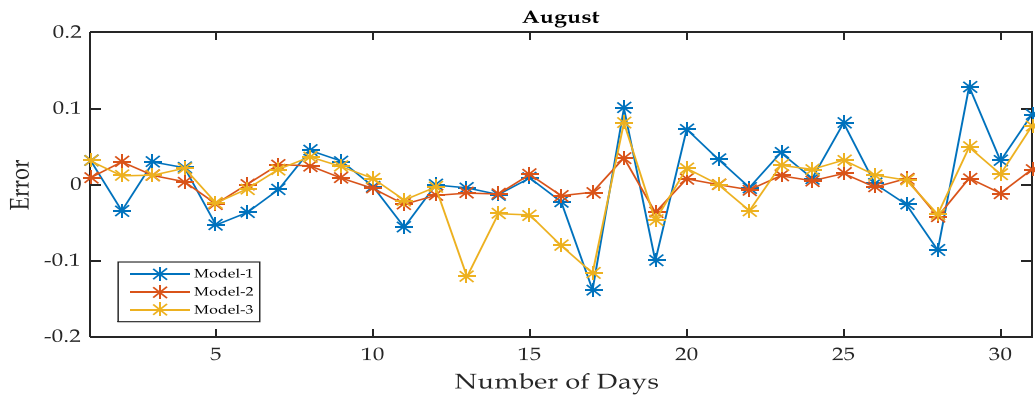
(c)



(d)



(e)



(f)

Figure A.4: The daily forecasting error of three SPF models for the month of (a) March (b) April (c) May (d) June (e) July and (f) August

The error analysis for the above figures is presented in Table A.2

Table A.2: Statistical error metrics of proposed models for solar power generation forecasting

	RMSE			R <sup>2</sup>		
	Model-1	Model-2	Model-3	Model-1	Model-2	Model-3
March	0.16	.15	.24	.95	.81	.94
April	0.70	.04	.42	.89	.65	.96
May	0.23	.19	.16	.96	.69	.98
June	0.62	.35	.53	.86	.93	.97
July	0.50	.14	.06	.76	.99	.99
August	0.17	.01	.11	.96	.99	.96

It can be concluded from this table that the error is minimal when GTI is used as input for all the six months considered in this work. The only exception seems to be  $R^2$  value for the month of August. This calls for proper normalization of the input data for forecasting model development.

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