

# Solar Forecast Arbiter

## An open source evaluation framework for solar forecasting



Sandia  
National  
Laboratories



ELECTRIC POWER  
RESEARCH INSTITUTE



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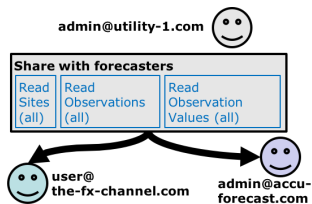
Office of **ENERGY EFFICIENCY  
& RENEWABLE ENERGY**

[solarforecastarbiter.org](https://solarforecastarbiter.org)

Standardized  
Objective  
Open source

GitHub

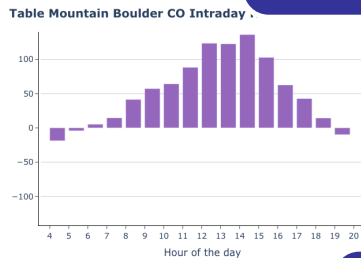
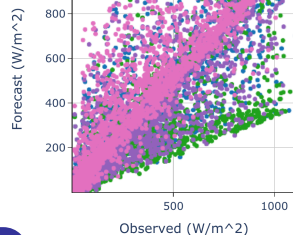
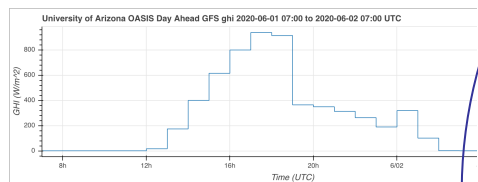
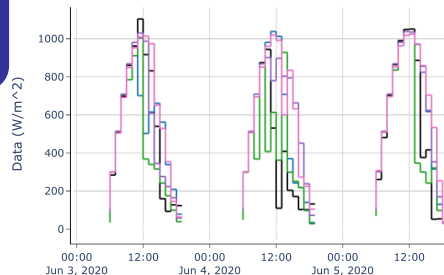
Free!  
Available now!



Safe, secure,  
private  
Data rights  
management



Stakeholder  
Informed

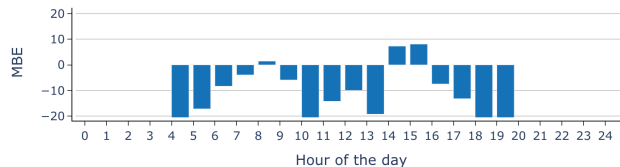


Solar Forecast Arbiter API

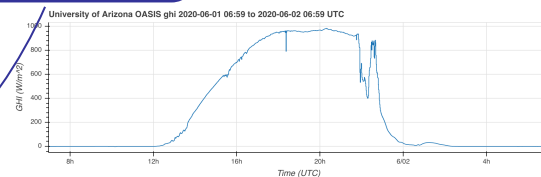
Download OpenAPI specification: [Download](#)

Graphical  
reporting  
Automated  
workflow

Table Mountain Boulder CO Current Day NAM ghi MBE

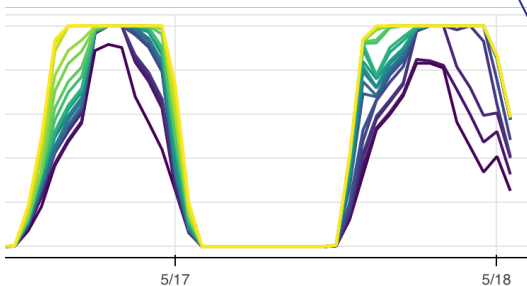
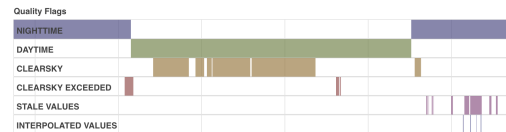


Many-vendor trial  
Anonymization  
Realtime and  
retroactive



Deterministic  
Event  
Probabilistic

Data quality  
control  
Reference data  
& forecasts



# How do I use the Solar Forecast Arbiter?

1. Define site, observation and/or forecast metadata
2. Upload observation and/or forecast data
3. Optional: grant another user access to your metadata/data
4. Run analysis report

## Create New Forecast

### Site Metadata

Name: Power Plant 1  
Latitude: 43.73403 °N  
Longitude: -96.62328 °E  
Timezone: Etc/GMT+6  
Elevation: 786.0 m

### Modeling Parameters:

AC Capacity: 0.015 MW  
DC Capacity: 0.015 MW  
AC Loss Factor: 0.0 %  
DC Loss Factor: 0.0 %  
Temperature Coefficient: -0.002 1/C  
Tracking Type: fixed  
Surface Tilt: 45.0 °  
Surface Azimuth: 180.0 °

### Name

### Variable

### Issue time of day

 :  UTC

### Lead time to start

 Minute

### Run length/Issue frequency

 Minute

### Interval length

 Minute

### Interval Label

### Interval Value Type

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My data is formatted in:

☒ CSV ☐ JSON

Forecast data in CSV format should follow the formatting of the example below.

```
# optional header, ignored by Solar Forecast Arbiter
timestamp,value
2018-11-22T12:00:00Z,10.23
2018-11-22T12:05:00Z,10.67
```

No file selected.

Solar Forecast Arbiter API (1.0beta3+1.g)

Download OpenAPI specification:

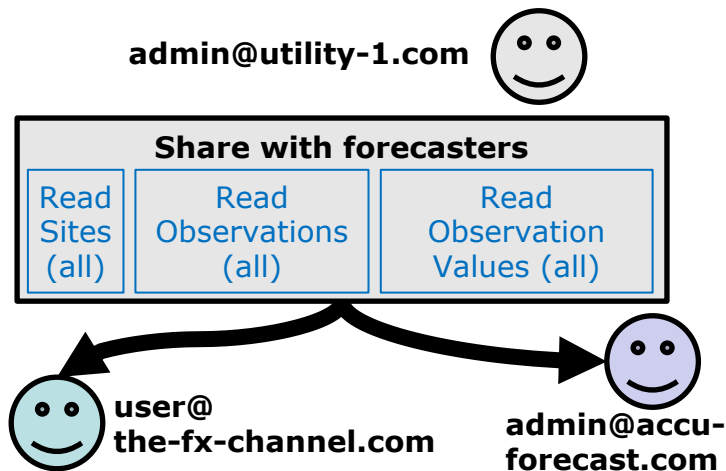
Solar Forecast Arbiter Team: [info@solarforecastarbiter.org](mailto:info@solarforecastarbiter.org)

URL: <https://github.com/solararbiter/solarforecastarbiter-api> | License: MIT

The backend RESTful API for Solar Forecast Arbiter.

# How do I use the Solar Forecast Arbiter?

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3. **Optional: grant another user access to your metadata/data**
4. Run analysis report



# How do I use the Solar Forecast Arbiter?

1. Define site, observation and/or forecast metadata
2. Upload observation and/or forecast data
3. Optional: grant another user access to your metadata/data
4. **Run analysis report**

## Create New Report

Name

Test report

Start (UTC):

2019-08-01T07:00Z

End (UTC)

2019-12-31T03:00Z

## Observation, Forecast pairs

Forecasts

Table Mountain Boulder CO Day Ahead GFS

Desert Rock NV Day Ahead GFS ghi

[Create Forecast Evaluation pairs](#)

Observations/Aggregates

Table Mountain Boulder CO ghi

Desert Rock NV ghi

Metrics

- ☒ MAE
- ☒ MBE
- ☒ RMSE
- ☐ MAPE
- ☐ NMAE
- ☐ NMSE
- ☒ NRMSE
- ☐ r
- ☐ R<sup>2</sup>
- ☐ CRMSE
- ☐ KSI
- ☐ OVER
- ☐ CPI

Categories

- ☒ Total
- ☒ Year
- ☒ Month of the year
- ☒ Hour of the day
- ☒ Date
- ☒ Day of the week

Submit

# Example Report

## 2020 NOAA SURFRAD Table Mountain Boulder CO GHI

This report of solar forecast accuracy was automatically generated using the [Solar Forecast Arbiter](#). Please see our GitHub repository for [known issues](#) with the reports or to create a new issue.

This report can be downloaded as a [standalone HTML file](#) or [PDF file](#). The download is a ZIP archive that includes checksums for the report file and a PGP signature that can be used to verify the authenticity of the report. The Solar Forecast Arbiter PGP key ID is [0x22bd497c0930f8b0](#).

- [Report Metadata](#)
- [Data](#)
  - [Observations and Forecasts](#)
  - [Data Validation](#)
- [Metrics](#)
- [Versions](#)

### Report Metadata

- Name: 2020 NOAA SURFRAD Table Mountain Boulder CO GHI
- Start: 2020-01-01 00:00:00+00:00
- End: 2020-12-31 23:59:59+00:00
- Generated at: 2020-06-18 07:15:37+00:00

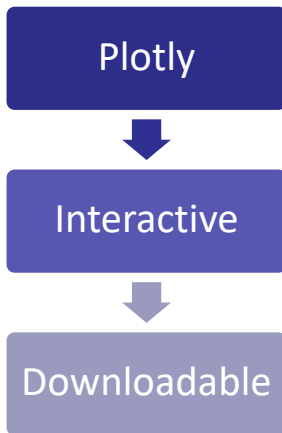
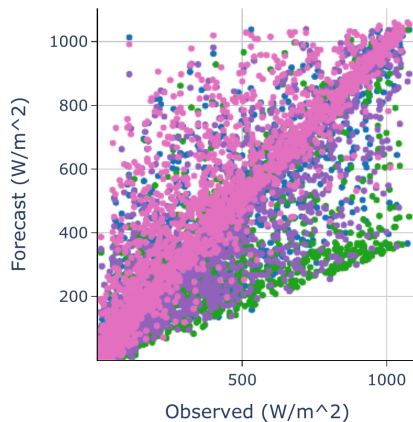
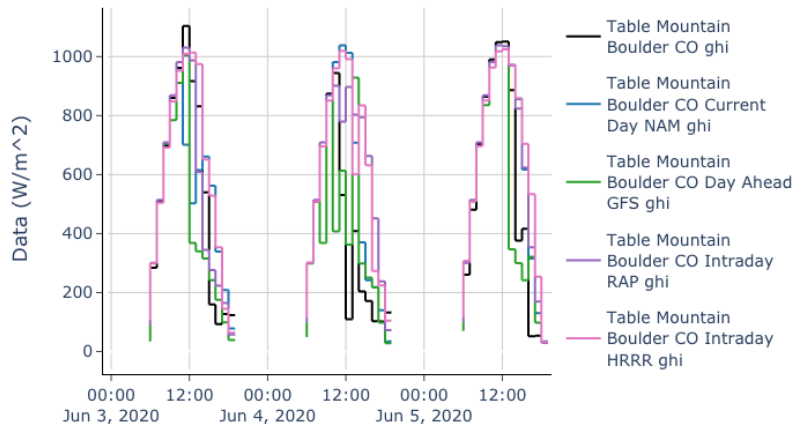
### Data

This report includes forecast and observation data available from 2020-01-01 00:00:00+00:00 to 2020-12-31 23:59:59+00:00.

### Observations and Forecasts

The table below shows the observation, forecast, and reference forecast triplets analyzed in this report. The

## Time series and scatter plots



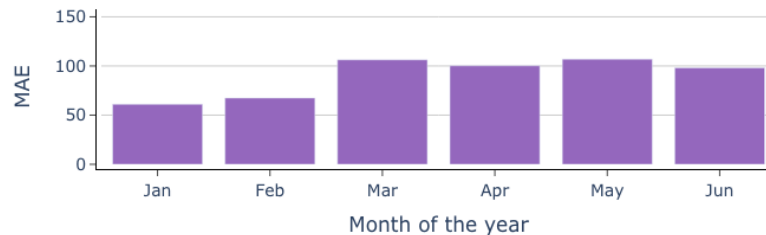
# Example Report

## Metrics Summary Table

Forecast	MBE	MAE	RMSE
Table Mountain Boulder CO Day Ahead GFS ghi	-78.4	124	196
Table Mountain Boulder CO Current Day NAM ghi	-8.33	86.3	140
Table Mountain Boulder CO Intraday HRRR ghi	68.9	92.1	153
Table Mountain Boulder CO Intraday RAP ghi	-21.2	97.7	153

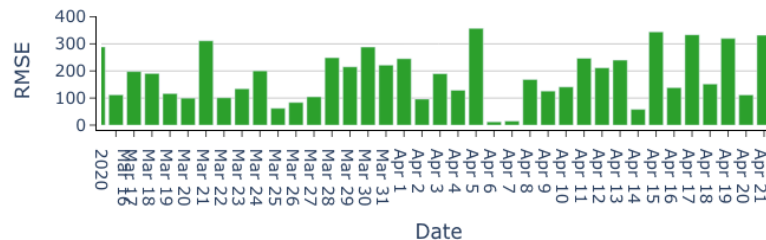
- + Forecast skill
- + Normalization
- + Deadband

Table Mountain Boulder CO Intraday HRRR ghi MAE



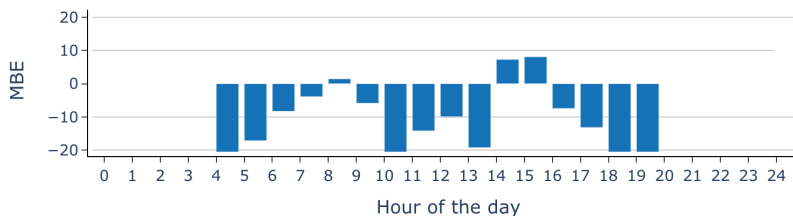
By month

Table Mountain Boulder CO Day Ahead GFS ghi RMSE



By date

Table Mountain Boulder CO Current Day NAM ghi MBE



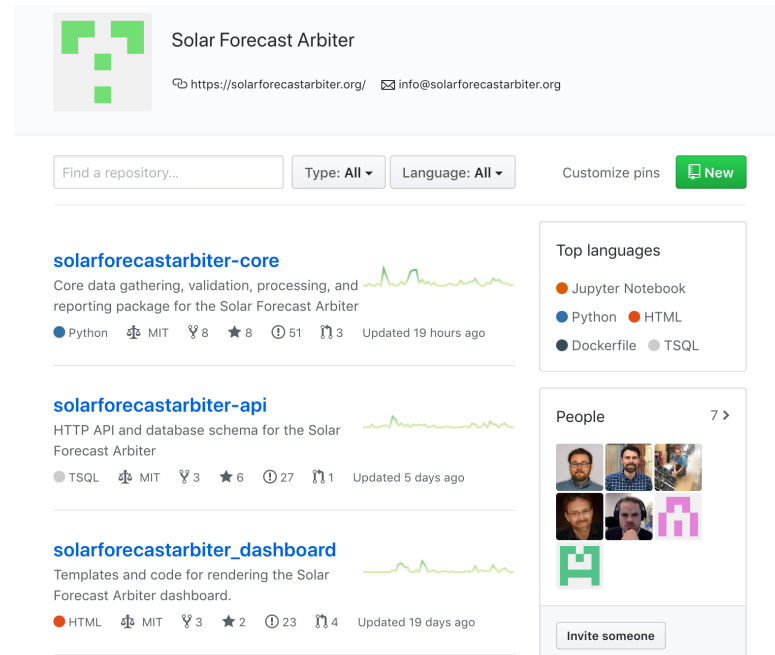
By hour



# Solar Forecast Arbiter Components

## Tool for analyzing accuracy of solar forecasts

- Web-based user interface
- Web-based API for scripting
- Python software package for analysis
- Scripts to redeploy entire software stack
- Detailed supporting documents
- Supported by stakeholder input, feedback



Open source. Transparently  
developed on GitHub

# How to get started

*Free!*  
*Available now!*

1. Make free user account
  - [dashboard.solarforecastarbiter.org](https://dashboard.solarforecastarbiter.org)
  - Browse reference data, forecasts
2. If you like it
  - Sign the Use Agreement
  - Experiment with a small problem, upload some test data
3. If you love it
  - Help us test the operational forecast trial feature
  - Spread the word
  - Contribute to the open source code development on GitHub
4. Stay informed
  - [solarforecastarbiter.org/emailist](https://solarforecastarbiter.org/emailist)

# Summary

- Open source, reproducible, transparent framework
- Use cases tailored to needs of forecast stakeholders
- Reference datasets
- Secure, private data upload. Sharing optional.
- Benchmark forecast capability
- Automated reports including bulk metrics, analysis filters
- Use dashboard, sign up for project updates at:

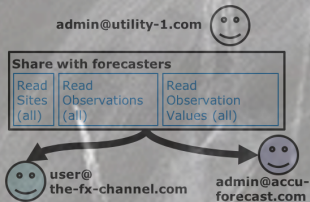
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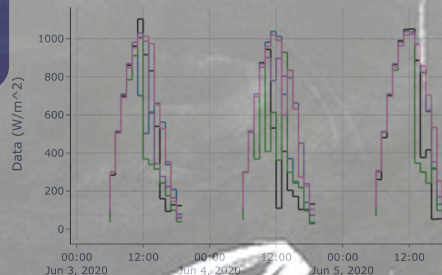
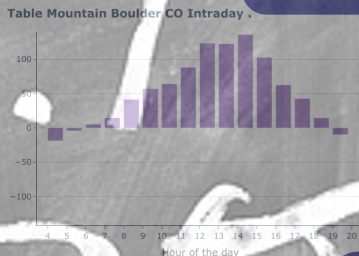
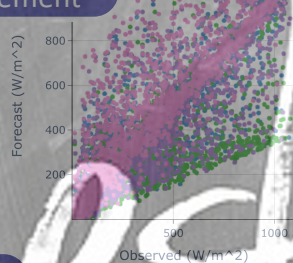
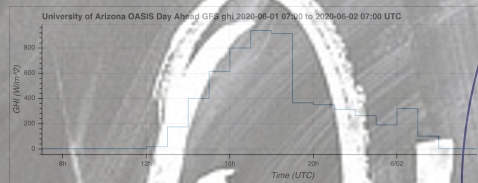
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Data rights  
management



Stakeholder  
Informed

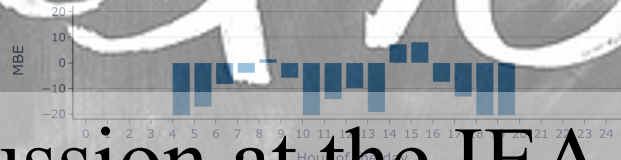


Solar Forecast Arbiter API

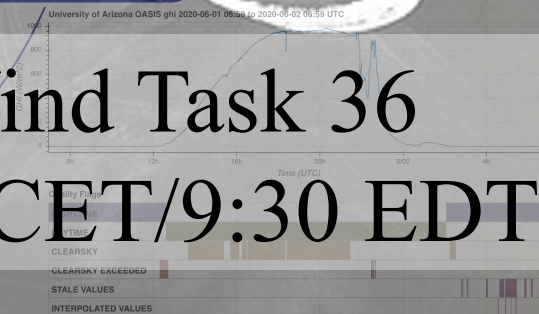
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Graphical  
reporting  
Automated  
workflow

Table Mountain Boulder CO Current Day NAM ghi MBE



Multi-vendor  
trials  
Anonymization  
Realtime and  
Retroactive



Join the discussion at the IEA Wind Task 36  
Meeting on June 24, 2020 at 15:30 CET/9:30 EDT

Deterministic  
Event  
Probabilistic

Data quality  
control  
Reference data  
& forecasts