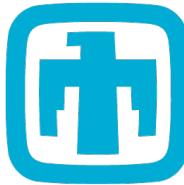


Solar Forecast Arbiter

An open source evaluation framework for solar forecasting



Sandia
National
Laboratories



ELECTRIC POWER
RESEARCH INSTITUTE

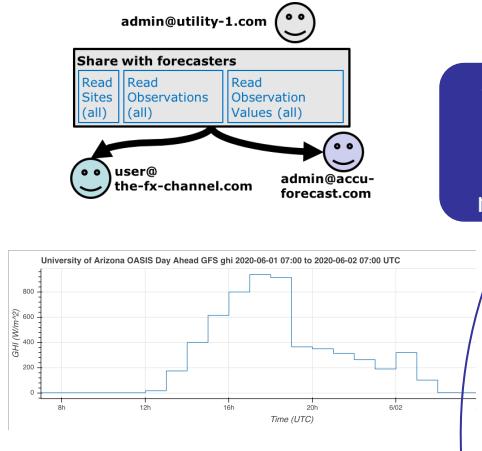


William F. Holmgren, Clifford W. Hansen, Aidan Tuohy, Justin Sharp, Antonio T. Lorenzo, Leland J. Boeman, Adam Wigington, David P. Larson, Qin Wang, Anastasios Golnas



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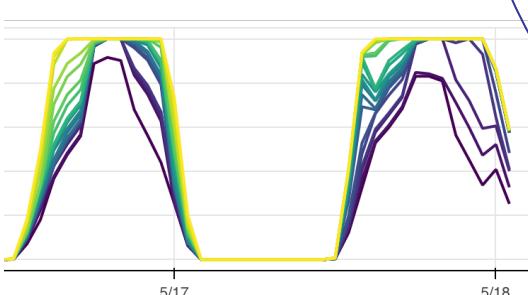
solarforecastarbiter.org



Solar Forecast Arbiter API

Download OpenAPI specification: [Download](#)

Graphical reporting
Automated workflow

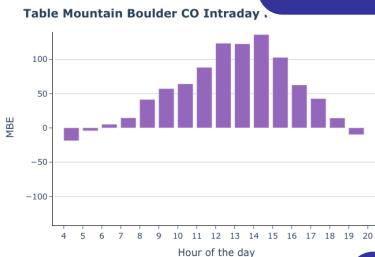
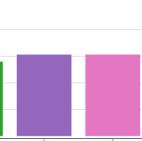


Deterministic
Event
Probabilistic

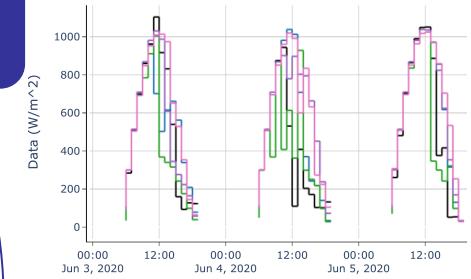
Standardized
Objective
Open source

GitHub

Free!
Available now!

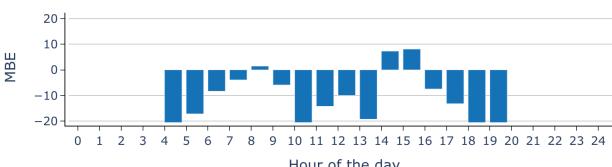


Stakeholder
Informed

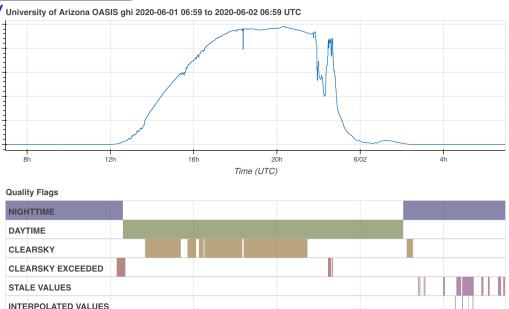


Many-vendor trial
Anonymization
Realtime and
retroactive

Table Mountain Boulder CO Current Day NAM ghi MBE



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: 43.73401 °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

 GHI (W/m²)

Issue time of day

 00 : 00 UTC

Lead time to start

 Minute

Run length/Issue frequency

 Minute

Interval length

 Minute

Interval Label

 Beginning

Interval Value Type

 Mean

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

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: [Download](#)

Solar Forecast Arbiter Team: info@solarforecastarbiter.org

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

The backend RESTful API for Solar Forecast Arbiter.

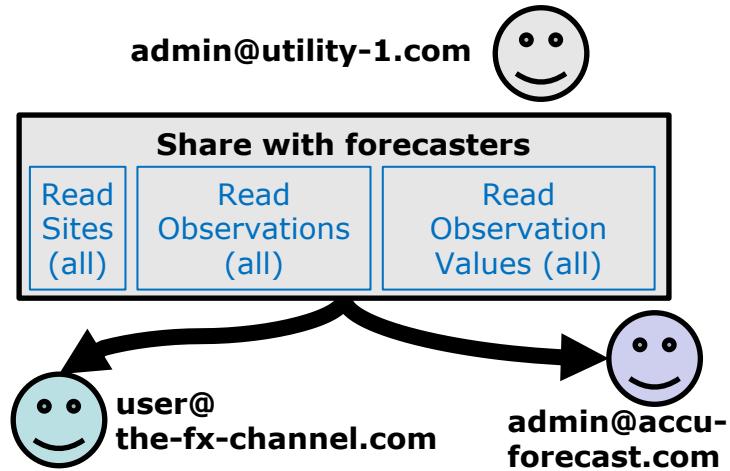


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How do I use the Solar Forecast Arbiter?

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



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

Start (UTC):

End (UTC)

Observation, Forecast pairs

Forecasts

 Table Mountain Boulder CO Day Ahead GFS ghi 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^2
- CRMSE
- KSI
- OVER
- CPI

Categories

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

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

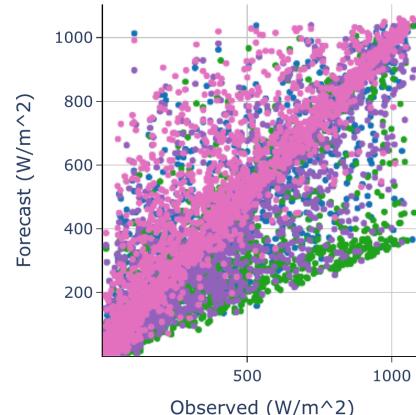
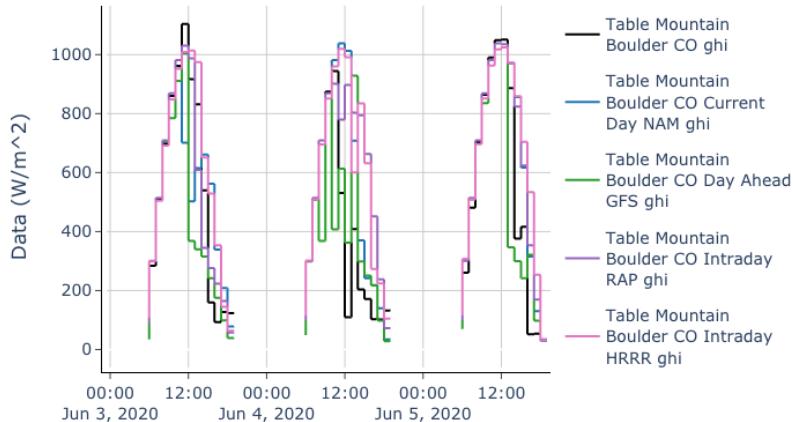
Data

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



Plotly



Interactive



Downloadable



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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

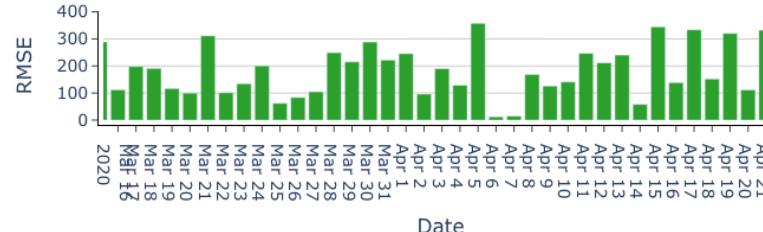
- + Forecast skill
- + Normalization
- + Deadband

Table Mountain Boulder CO Intraday HRRR ghi MAE



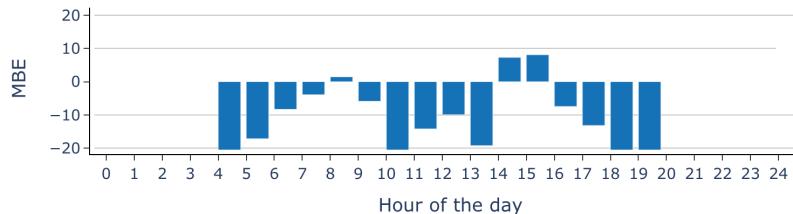
By month

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

The screenshot shows the GitHub repository page for "Solar Forecast Arbiter". The page includes a search bar, filter options for type and language, and a "Customize pins" button. On the right, there's a sidebar for top languages (Jupyter Notebook, Python, HTML, Dockerfile, TSQL) and a "People" section with a grid of profile pictures. Three repository cards are listed:

- solarforecastarbiter-core**: Core data gathering, validation, processing, and reporting package for the Solar Forecast Arbiter. Python, MIT license, 8 stars, 51 forks, 3 issues, updated 19 hours ago.
- solarforecastarbiter-api**: HTTP API and database schema for the Solar Forecast Arbiter. TSQL, MIT license, 3 stars, 27 forks, 1 issue, updated 5 days ago.
- solarforecastarbiter_dashboard**: Templates and code for rendering the Solar Forecast Arbiter dashboard. HTML, MIT license, 3 stars, 23 forks, 4 issues, updated 19 days ago.

Open source. Transparently developed on GitHub

Free!
Available now!

How to get started

1. Make free user account

- 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



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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:

solarforecastarbiter.org



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solarforecastarbiter.org



Solar Forecast Arbiter API

Download OpenAPI specification: [Download](#)

Graphical reporting
Automated workflow

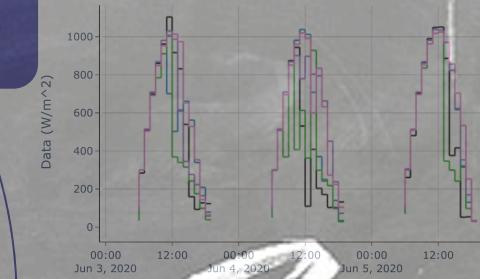
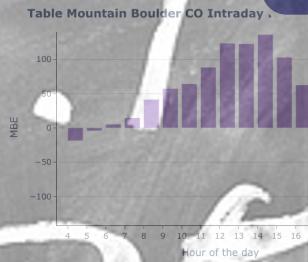
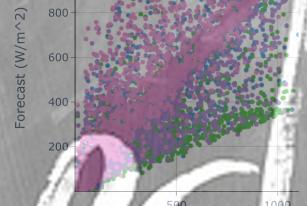
Standardized
Objective
Open source

GitHub

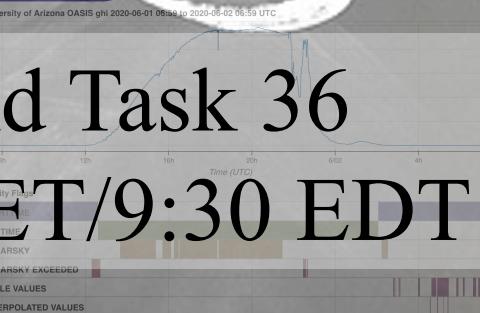
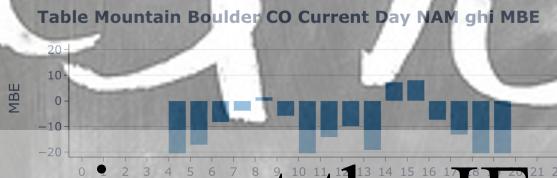
Free!
Available now!

Safe, secure,
private
Data rights
management

Stakeholder
Informed



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