TIME SERIES LAB VERSION 2.0

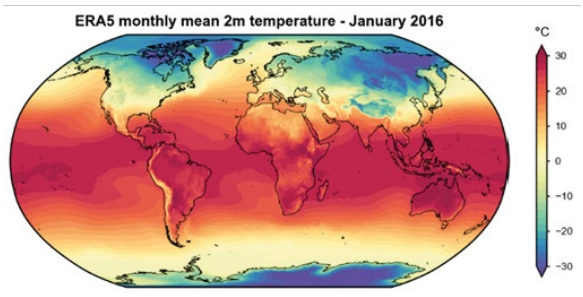
Modeling enhancements

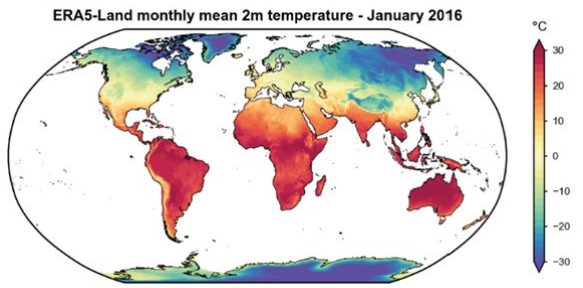
COMPATIBILIZATION WITH ERA5

ERA5 is the latest ECMWF atmospheric reanalysis of the global climate. It provides hourly estimates of many atmospheric, land, and oceanic climate variables, including wind speed, solar irradiation, and temperature, the variables used by Time Series Lab to model renewable production.

Reanalysis combines model data with observations from across the world into a globally complete and consistent dataset using the laws of physics. This principle, called data assimilation, is based on the method used by numerical weather prediction centers, where every so many hours (12 hours at ECMWF), a previous forecast is combined with newly available observations in an optimal way to produce a new best estimate of the state of the atmosphere, called analysis, from which an updated, improved forecast is issued .

Recent studies concluded that, in general, ERA5 outperforms MERRA2 (Gruber et al., 2022). However, this may not always be true depending on the location and variable of interest (wind speed, solar irradiation, and others). The integration between TSL and ERA5 provides a state-of-the-art reanalysis database to model renewable energy sources.





[1]*https://cds.climate.copernicus.eu/cdsapp#!/dataset/reanalysis-era5-single-levels?tab=overview*
[2]*https://www.sciencedirect.com/science/article/pii/S0360544221017680*

AUTOMATIC INTEGRATION WITH GLOBAL REANALYSIS DATABASE

Time Series Lab connects to PSR servers where MERRA2 and ERA5 reanalysis databases are stored. TSL will automatically access the database during the execution of the model and download the necessary data. The tool requires an internet connection, but the user won't need to download the entire reanalysis database as in previous versions.

CONCENTRATED SOLAR POWER

CSP plants use a field of concentrating mirrors to reflect the sunlight onto a receiver which heats a fluid that delivers the heat to a steam turbine that converts the heat into electrical energy. There are several different types of CSP systems, such as "Parabolic trough, " "Power tower, " "Linear Fresnel," and others. TSL models CSPs using optical efficiency tables to represent the solar field, allowing its correct representation for electric power generation.

DOWNSCALING OF WIND SPEED

The currently available reanalysis databases (ERA5 and MERRA2) have a spatial resolution of up to 2500 km², which may not be suitable for modeling renewable production at the site scale. On the other hand, the Global Wind Atlas (GWA)[3] provides mean wind speed data and other statistics worldwide, based on 10 years of mesoscale time-series model simulations covering the globe at 3 km resolution and microscale model calculations at a 250 m grid spacing.

We've implemented a correction methodology that uses the time series from ERA5 or MERRA2 (hourly data since 1980) and adjusts the hourly values so that the time series average matches the GWA mean wind speed.

[3] *https://globalwindatlas.info/about/ReleaseNotes*

For more information contact: timeserieslab@psr-inc.com

USER-DEFINED WIND SPEED HISTORICAL DATA

This new functionality allows the user to input his own wind speed historical data in TSL, which is especially useful when using a different data source. Besides that, it will be possible to define other wind speed points within a wind farm, representing the wake effect phenomena with more details.

OTHER IMPROVEMENTS

- **Air density corrected power curves**
- **Generation of synthetic scenarios equal to the long-term historical average**
- **Representation of photovoltaic system losses**
- **Representation of DC to AC power ratio of PV systems**
- **Integration of the visualization map with generic shapefiles**
- **Minor improvements in the interface and new functionalities in the visualization map**

For more information contact: timeserieslab@psr-inc.com