



Validation of reanalysis and satellite imagery based data with four ground stations in Salta-Northern Argentina for a seven-year period

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The geographical area for this study is the province of Salta, located in the northwest of Argentina. The total area of Salta is 155.488 km² and has a total resident population of 1.214.441 inhabitants (population density is 7.8 inhabitants/km²).

Firstly, the importance of the solar energy potential in Salta has been highlighted by the government in its Provincial Renewable energy Plan and by worldwide researchers. Yet solar radiation estimations are available mainly in low spatiotemporal resolutions and studies that characterize the temporal variability are scarce.

Secondly, to design and evaluate solar energy devices is highly-recommended to count with ground measured historical data of global solar radiation from calibrated and maintained meteorological stations. However, high costs of installation, maintenance and communication to centralize the data have promoted the development of different models to estimate the global solar radiation from available data and the use of solar radiation data derived from satellite imagery.

For both reasons, in this work we evaluate global solar radiation from the ERA5 reanalysis data set provided by the European Centre for Medium-Range Weather Forecasts (ECMWF) and the Meteosat second generation derived data set provided by Land Surface Analysis Satellite Applications Facility (LSA-SAF). These are compared with data from four pyranometers distributed around the region in a period of seven years.

ERA5 is a climate reanalysis dataset developed by ECMWF and it covers the period 1950 to present. However, is still in production and is expected to be available for use by early 2019. The first batch of ERA5, covering the period 2010 to 2016, was released in July 2017.

The variable downloaded from the ERA5-ECMWF is Surface Downwelling Shortwave Flux in Air, the values are saved as the amount of solar radiation that reaches the atmosphere, accumulated since the beginning of each prediction period (which corresponds to the calendar days), having a temporal resolution of one hour and approximately 30 kilometers of spatial resolution.

The variable downloaded from LSA-SAF is Down-welling Surface shortwave flux (DSSF), refers to the radiative energy in the wavelength interval [0.3 μ m, 4.0 μ m] reaching the Earth's surface per time and surface unit, it has a temporal resolution of 30 minutes and approximately 4 km of spatial resolution.

The European organization for the Exploitation of Metrological Satellites (EUMETSAT) Satellite Application Facility (SAF) on Land Surface Analysis (LSA) provides value-added products for the meteorological and environmental science communities with applications in the fields of land surface modelling, numerical weather prediction, hydrology, climatology and renewable energy resources assessments.

An analysis of variance (ANOVA) is performed to determine whether there are any statistically significant differences between the means of the three independent data sets. The comparison is performed for monthly accumulated radiation. The results show that there are no statistically significant differences between the sources. However the differences between ERA5 and ground measurements are closer than LSA-SAF data and ground stations.