

Desarrollo de una herramienta software para la simulación de sistemas fotovoltaicos con R

Trabajo de Fin de Grado

Francisco Delgado López

Universidad Politécnica de Madrid

① Introducción

② Soluciones actuales

③ Marco teórico

④ Desarrollo del código

⑤ Ejemplo práctico de aplicación

⑥ Conclusiones

Objetivo principal

Desarrollo de un paquete en R

```
library(solaR2)
```

Objetivos secundarios

GNU Emacs

- ▶ Org mode
- ▶ ESS

Paquetes de R

- ▶ solaR
- ▶ zoo
- ▶ data.table
- ▶ microbenchmark
- ▶ profvis
- ▶ lattice

L^AT_EX

- ▶ Documento
- ▶ Presentación

Energía Solar Fotovoltaica

ENERGÍA SOLAR
Fotovoltaica

OSCAR PERPIÑÁN LAMIGUEIRO

DICIEMBRE DE 2013



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Soluciones actuales

PVsys



SISIFO



PVGIS



System
Advisor Model



Funcionamiento

- ▶ Geometría solar
- ▶ Datos meteorológicos
- ▶ Radiación en el plano horizontal
- ▶ Radiación en el plano del generador
- ▶ Simulación de SFCR
- ▶ Simulación de SFB
- ▶ Optimización de distancias
- ▶ Métodos de visualización

Carencias

- ▶ Modularidad
- ▶ Eficiencia y rendimiento
- ▶ Escalabilidad
- ▶ Manipulación de datos

① Introducción

② Soluciones actuales

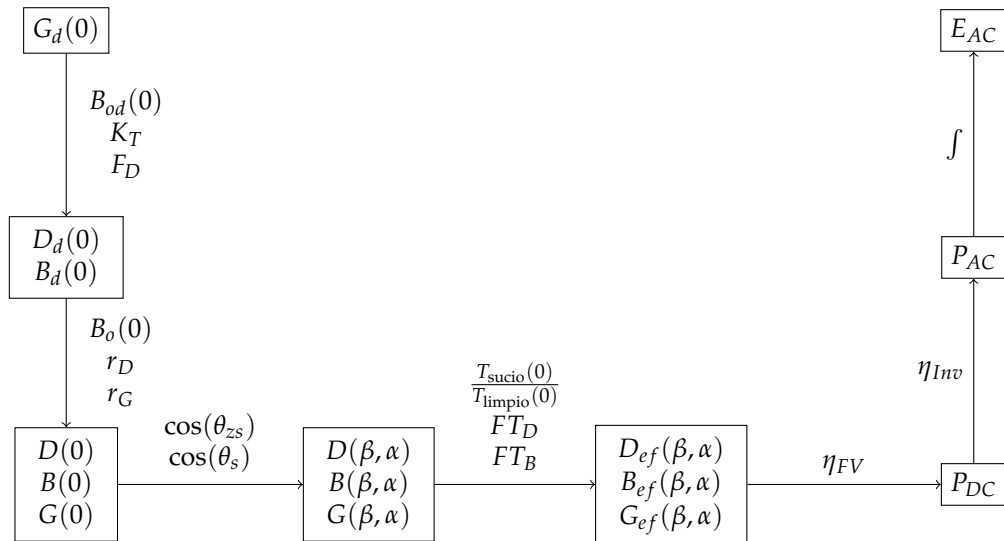
③ Marco teórico

④ Desarrollo del código

⑤ Ejemplo práctico de aplicación

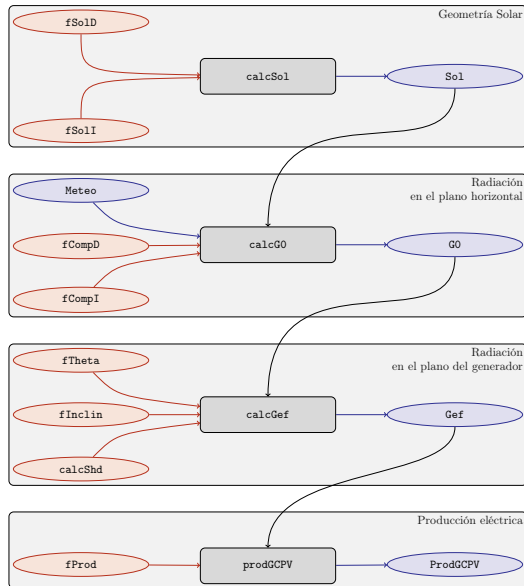
⑥ Conclusiones

Procedimiento de cálculo

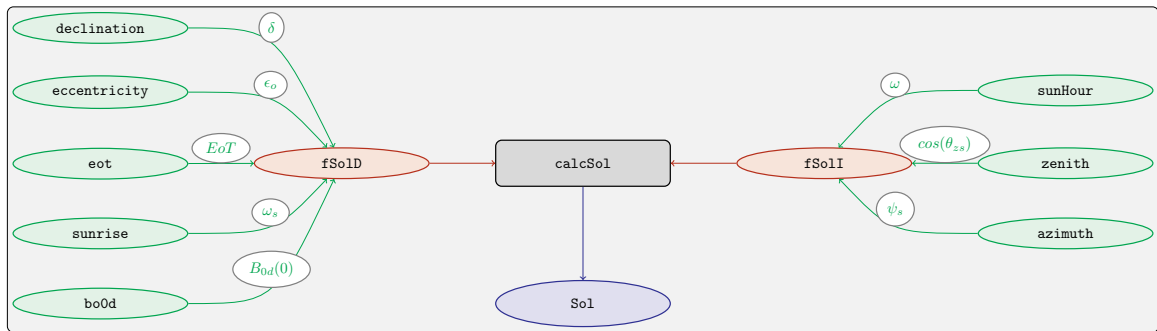


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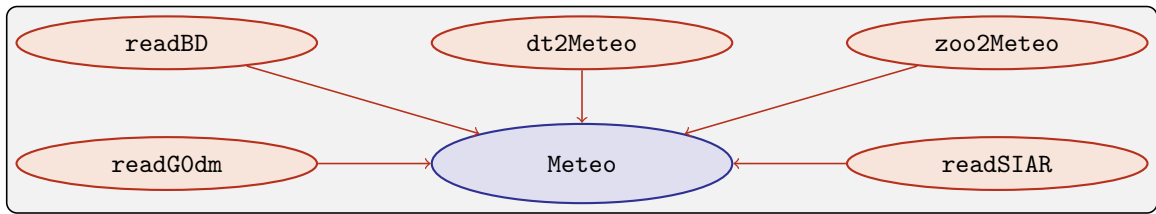
Algoritmo de cálculo



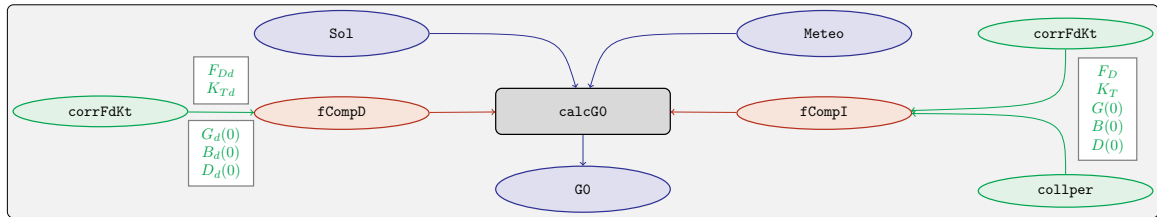
calcSol



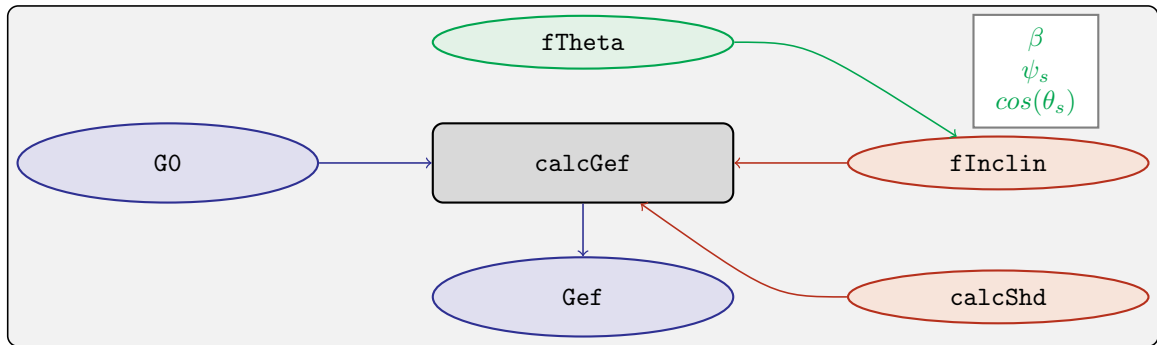
Meteo

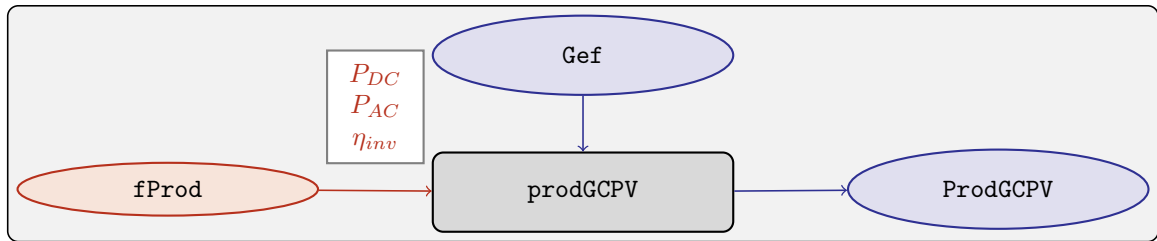


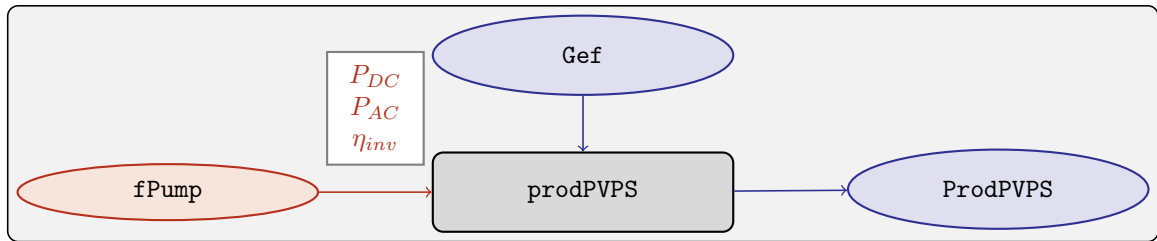
calcG0



calcGef



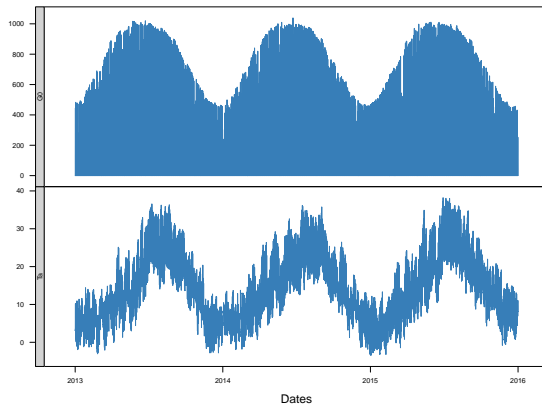




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Información meteorológica

```
etsidi_1315 <- readBDi(file = "TFG/data/PVGIS_1315.csv",  
  lat = 40.4, dates.col = "Dates",  
  format = "%Y-%m-%d %H:%M:%S")
```



Producción de diferentes sistemas

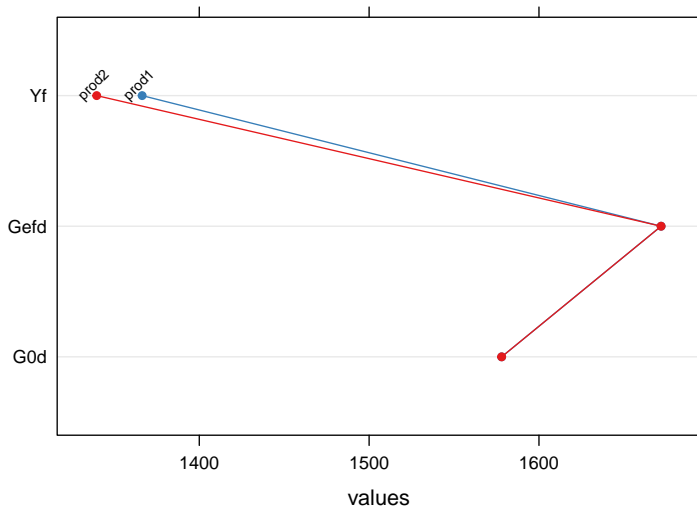
```
prod1 <- prodGCPV(lat = 40.4, modeTrk = 'fixed', modeRad = 'bdI',  
                  dataRad = etsidi_1315, beta = 30, alpha = -19,  
                  module = module1, generator = generator1,  
                  inverter = inverter)  
show(as.data.tableY(prod1))
```

	Dates <int>	Eac <num>	Edc <num>	Yf <num>
1:	2013	1681.077	1757.235	1343.449
2:	2014	1698.613	1775.426	1357.463
3:	2015	1749.536	1828.569	1398.158

```
prod2 <- prodGCPV(lat = 40.4, modeTrk = 'fixed', modeRad = 'bdI',  
                  dataRad = etsidi_1315, beta = 30, alpha = -19,  
                  module = module2, generator = generator2,  
                  inverter = inverter)  
show(as.data.tableY(prod2))
```

	Dates <int>	Eac <num>	Edc <num>	Yf <num>
1:	2013	1451.873	1517.779	1319.225
2:	2014	1464.483	1530.833	1330.683
3:	2015	1506.544	1574.704	1368.901

Comparación de producciones



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solat2 / R / KCompDR

Global variables


10/12/20 2 weeks ago History

```

1 2 weeks ago Global variables 1 1 #title: global variables["lat"]
2 2 2
3 2 months ago improved calcSD 3 #KCompDR <- function(sul, DM, corr = "CPE", F)
4 4 {
5 5 years ago Improve test of daily indexes in ... 4 {
6 6 months ago Update KCompDR 5 #if(isort NULL & !CPE, "Paga", "L2", "WDR", "CLPDR", "WDR", "WDR")[[
7 7 working "wrong descriptor of correlation Po-est. Not CPE."
8 8 corr <- "CPE"
9 9 years ago Improve test of daily indexes in ... 8 }
10 2 months ago Update KCompDR 9 #if(class(sul)[2] != "mat") {
11 11 sul <- sul[, select(sul & unique(sul), DT1 = Dates)]
12 8 years ago Improve test of daily indexes in ... 11 }
13 2 months ago Update KCompDR 12 #if(class(DM)[1] != "matrix") {
14 14 DT <- copy(data.table(DM))
15 15 if(!("Dates" %in% names(DT))) {
16 16 DT[, Dates := index(sul)]
17 17 setcolorder(DT, "Dates")
18 18 setkey(DT, "Dates")
19 19 }
20 20 if(!"lat" %in% names(DT)) {
21 21 latq <- unique(DT$lat)
22 22 DT[, lat := NULL]
23 23 } else { latq <- getlat(sul)
24 24 DM <- DT[DM == latq]
25 5 months ago Update KCompDR 25 }
26 5 months ago Error repaired 26 }
27 5 months ago Update KCompDR 27 stopifnot(index(sul) == index(DM))
28 28 DM <- sul[is.na(DM)]
29 29 DM <- getdata(DM)[DM]
30 5 months ago Error repaired 30
31 5 months ago Update KCompDR 31 is.na(DM) <- (DM == NA)
32 5 months ago Error repaired 32
33 5 months ago Update KCompDR 33 #see the Direct and Diffuse data is not given
34 34 #if(corr != "WDR") {
35 35 PD <- Data2D(corr,
36 36 CPE = F(CPE)(sul, DM),
37 37 Paga = F(Paga)(sul, DM),
38 38 L2 = F(L2)(sul, DM),
39 39 WDR = F(WDR)(sul, DM),
40 40 CLPDR = F(CLPDR)(sul, DM),
41 41 corr = F(sul, DM))
42 42 RT <- F(RT)
43 43 PD <- F(PD)
44 44 DM <- PD + DM
45 45 DM <- DM - DM
46 46 }
47 47 #see the Direct and Diffuse data is given
48 48 else {
49 49 DM <- getdata(DM)[DM]
50 50 DM <- getdata(DM)[["WDR"]]
51 51 DM <- getdata(DM)[["WDR"]]
52 52 PD <- DM[DM]
53 53 RT <- DM[WDR]
54 5 months ago Error repaired 54 }
55 5 months ago Update KCompDR 55
56 5 months ago Update KCompDR 56 result <- data.table(Dates = index(sul), PD, RT, DM + DM, DM, DM)
57 5 months ago Update KCompDR 57 setkey(result, "Dates")
58 8 years ago Improve test of daily indexes in ... 58 result
59 12 years ago Initial impact 59 }

```


Blame

2 weeks ago	 Global variables		1	<code>utils::globalVariables('lat')</code>
			2	
2 months ago	 improved calcG0		3	<code>fCompD <- function(sol, G0d, corr = 'CPR', f)</code>
8 years ago	 Improve test of daily indexes in ...		4	<code>{</code>
5 months ago	 Update fCompD.R		5	<code>if(!(corr %in% c('CPR', 'Page', 'LJ', 'EKd', 'CLIMEd', 'user', 'none'))){</code>
			6	<code>warning('Wrong descriptor of correlation Fd-Ktd. Set CPR.')</code>
			7	<code>corr <- 'CPR'</code>
8 years ago	 Improve test of daily indexes in ...		8	<code>}</code>
2 months ago	 Update fCompD.R		9	<code>if(class(sol)[1] != 'Sol'){</code>
			10	<code>sol <- sol[, calcSol(lat = unique(lat), BTi = Dates)]</code>
8 years ago	 Improve test of daily indexes in ...		11	<code>}</code>
2 months ago	 Update fCompD.R		12	<code>if(class(G0d)[1] != 'Meteo'){</code>
last month	 updated dt2meteo		13	<code>dt <- copy(data.table(G0d))</code>
			14	<code>if(!('Dates' %in% names(dt))){</code>
			15	<code>dt[, Dates := indexD(sol)]</code>
			16	<code>setcolorder(dt, 'Dates')</code>
			17	<code>setkey(dt, 'Dates')</code>
			18	<code>}</code>
			19	<code>if('lat' %in% names(dt)){</code>
			20	<code>latg <- unique(dt\$lat)</code>
			21	<code>dt[, lat := NULL]</code>
			22	<code>}else{latg <- getLat(sol)}</code>

Contributors Beta [Give feedback](#)

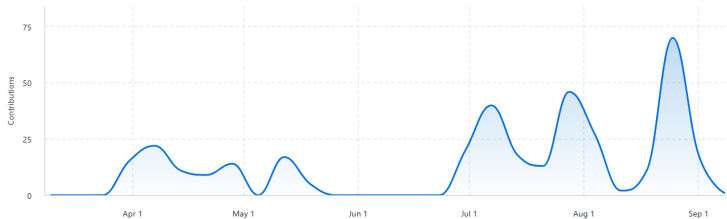
Period: Last 6 months ▾

Contributions: Commits ▾

Contributions per week to master, excluding merge commits

Commits over time

From 10 mar 2024 to 8 sept 2024



fdelgadol

355 commits 34.171 ++ 11.671 --

#1

...



oscarperpinan

4 commits 22 ++ 95 --

#2

...



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
Desarrollo a futuro

- ▶ Interfaz de usuario
- ▶ Mejora de funciones
- ▶ Toma de datos
- ▶ Uso de paquete especializados en datos espaciales
 - ▶ terra

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Implementd the link to the index

2413e46 · 2 hours ago

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📁 .github/workflows	Moving from Travis to GitHub Actions	4 years ago
📁 R	CRAN corrections	3 days ago
📁 data	create dataset SIAR	2 months ago
📁 docs	Implementd the link to the index	2 hours ago
📁 inst	Updated citation	2 weeks ago
📁 man	CRAN corrections	3 days ago
📁 tests	Actualizado fProd	last week
📄 .Rbuildignore	Moving from Travis to GitHub Actions	4 years ago
📄 .gitignore	Zero instead of NA in flinclin	10 years ago
📄 DESCRIPTION	CRAN corrections	3 days ago
📄 LICENSE	Initial commit	11 years ago
📄 NAMESPACE	Update NAMESPACE	3 weeks ago
📄 README.md	Update README.md	5 months ago

📖 README

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✎

To Be Completed...

Solar Radiation and Photovoltaic Systems with R

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🍴 0 forks

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Releases

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
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Packages


No packages published

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Contributors 2

 fdelgadot

Francisco Delgado López

 oscarperpinan

Oscar Perpiñán Lamigue...

Deployments 35


🟢 github-pages

2 hours ago

+ 35 deployments

solaR2: Radiation and Photovoltaic Systems

Provides tools for calculating solar geometry, solar radiation on horizontal and inclined planes, and simulating the performance of various photovoltaic (PV) systems. Supports daily and intraday irradiation data, enabling detailed analysis of grid-connected and water-pumping PV systems, including shading effects and solar angle calculations.

Version: 0.10
Depends: R (\geq 4.0.0), [data.table](#), [lattice](#), [latticeExtra](#)
Imports: [RColorBrewer](#), graphics, grDevices, stats, methods, utils
Suggests: [zoo](#), [sp](#), [raster](#), [rasterVis](#), [tdr](#), [meteoForecast](#), [httr2](#), [jsonlite](#), [testthat](#) (\geq 3.0.0)
Published: 2024-09-16
Author: Oscar Perpiñán-Lamigueiro  [aut], Francisco Delgado-López [aut, cre]
Maintainer: Francisco Delgado-López <f.delgadol at alumnos.upm.es>
BugReports: <https://github.com/solarization/solaR2/issues>
License: [GPL-3](#)
URL: <https://solarization.github.io/solaR2/>
NeedsCompilation: no
Citation: [solaR2 citation info](#)
Materials: [README](#)
CRAN checks: [solaR2 results](#)

Documentation:

Reference manual: [solaR2.pdf](#)

Downloads:

Package source: [solaR2_0.10.tar.gz](#)
Windows binaries: r-devel: [not available](#), r-release: [not available](#), r-oldrel: [not available](#)
macOS binaries: r-release (arm64): not available, r-oldrel (arm64): not available, r-release (x86_64): not available, r-oldrel (x86_64): not available

Linking:

Please use the canonical form <https://CRAN.R-project.org/package=solaR2> to link to this page.

solaR2: Solar Radiation and Photovoltaic Systems with R 2

Introduction

The `solaR2` package allows for reproducible research both for photovoltaics (PV) systems performance and solar radiation. It includes a set of classes, methods, and functions to calculate the sun geometry and the solar radiation incident on a photovoltaic generator, as well as to simulate the performance of various photovoltaic energy applications. This package performs the entire calculation procedure from both daily and intradaily global horizontal irradiation to the final productivity of grid-connected PV systems and water pumping PV systems.

It is designed using a set of S4 classes that handle multivariate time series efficiently and are optimized for high-performance data manipulation. The classes share a variety of methods to access the information and several visualization methods. Additionally, the package provides tools for the visual statistical analysis of the performance of large PV plants composed of multiple systems.

Although `solaR2` is primarily designed for time series associated with a location defined by its latitude/longitude values and temperature and irradiation conditions, it can be easily combined with spatial packages for space-time analysis.

Software

The stable version of `solaR2` is hosted at [CRAN](#). The development version is available at [GitHub](#).

Citation

If you use `solaR2`, please cite it in any publication reporting results obtained with this software:

```
Delgado López, Francisco y Perpiñán Lamigueiro, Oscar (2024).  
solaR2: Radiation and Photovoltaic Systems with R version 2.  
R package version 0.10.  
Disponibile en: https://solarization.github.io/solaR2/
```

A BibTeX entry for LaTeX users is

```
@Manual{,  
  title = {solaR2: Radiation and Photovoltaic Systems with R version 2},  
  author = {Francisco Delgado L{\o}pez and Oscar Perpi{\n}{\a}n Lamigueiro},  
  year = {2024},  
  url = {https://solarization.github.io/solaR2/},  
  note = {R package version 0.10},  
}
```