

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

Trabajo de Fin de Grado

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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

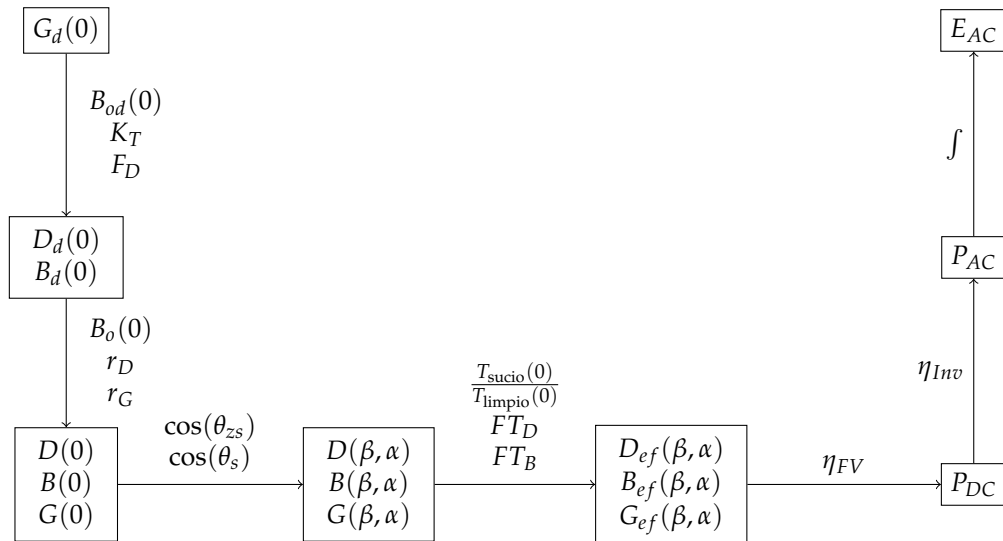
③ Marco teórico

④ Desarrollo del código

⑤ Ejemplo práctico de aplicación

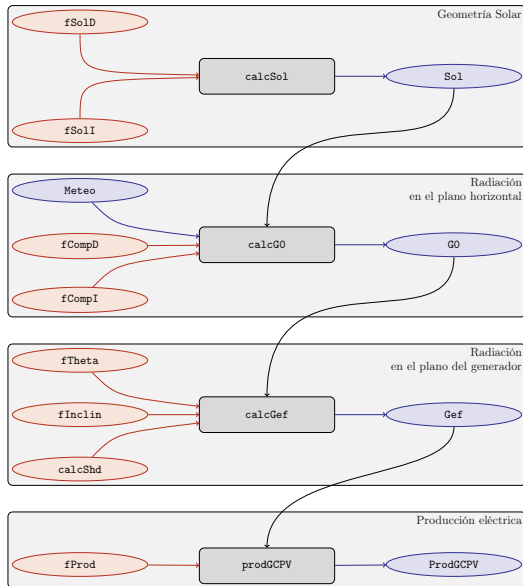
⑥ Conclusiones

Procedimiento de cálculo

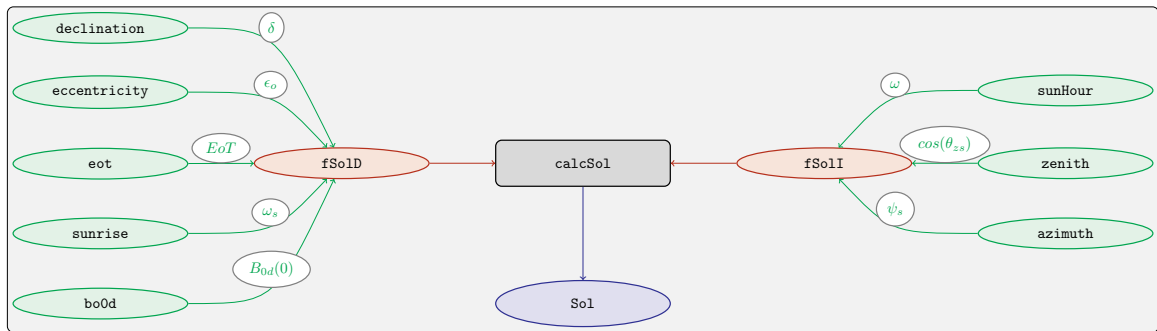


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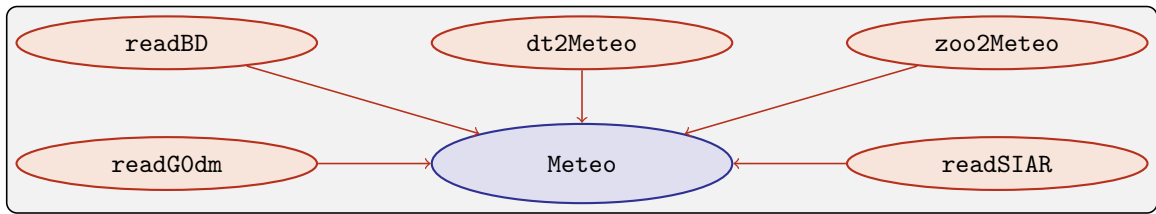
Algoritmo de cálculo



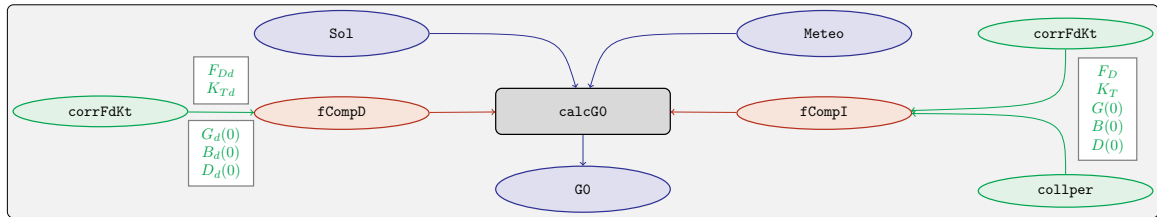
calcSol



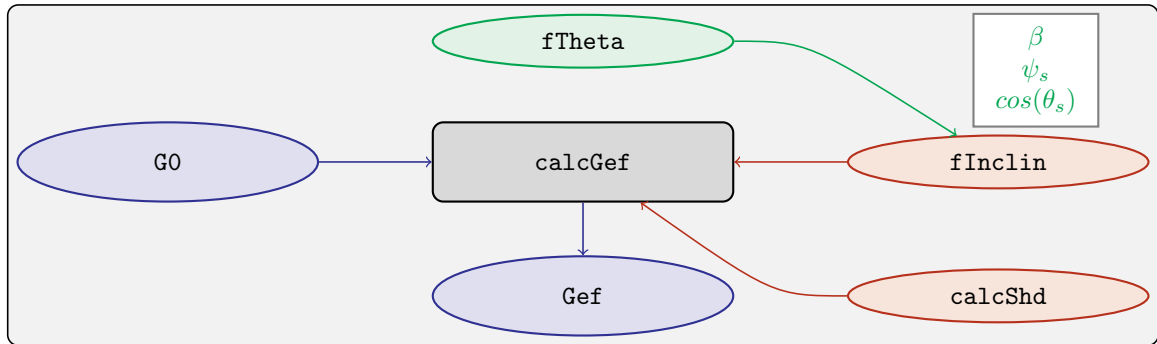
Meteo

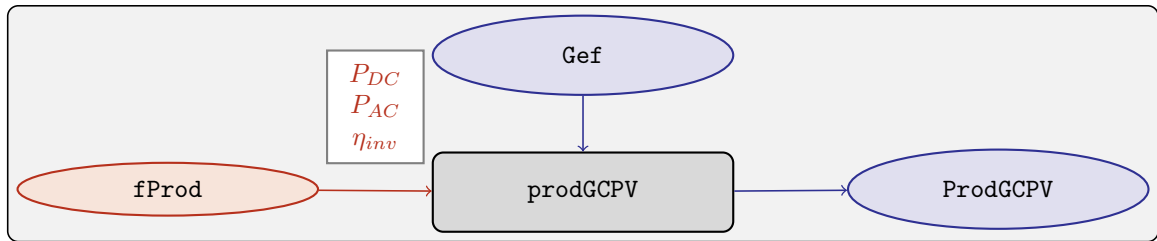


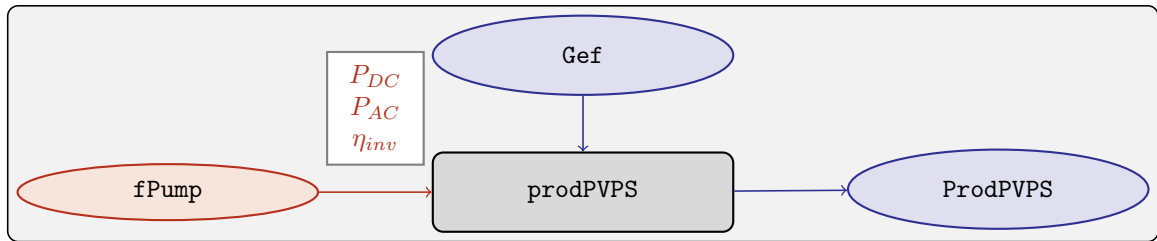
calcG0



calcGef



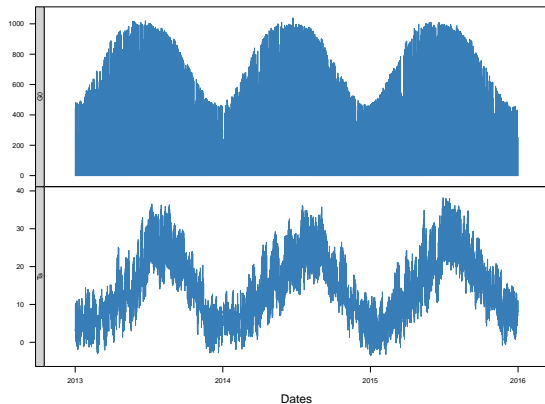




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Información meteorológica

```
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

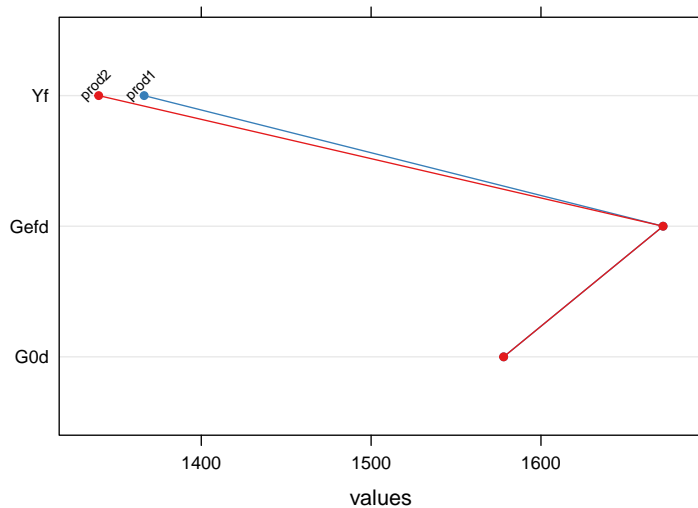
```
prod1 <- prodGCPV(lat = 40.4, modeTrk = 'fixed', modeRad = 'bdI',  
                  dataRad = etsidi_1315, beta = 30, alpha = -19,  
                  module = module1, generator = generator1,  
                  inverter = inverter)  
  
show(as.data.tableY(prod1))
```

	Dates	Eac	Edc	Yf
	<int>	<num>	<num>	<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	Eac	Edc	Yf
	<int>	<num>	<num>	<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 3 fcomp <- function(sul, DM, corr = "CPE", F)
4 4 {
5 5 years ago Improve test of daily indexes in ... 4 4 {
6 6 6 #if(!any NA in c("CPE", "Pep", "L2", "WDR", "CLIMSD", "WDR", "WDR")){
7 7 7 warning("wrong descriptor of correlation Po-est. Not CPE.")
8 8 8 corr <- "CPE"
9 9 9 }
10 2 months ago Improve test of daily indexes in ... 9 9 #if(class(sul)[2]) != "mat"){
11 2 months ago Update KCompDR 10 10 sul <- sul[, select(sul & unique(lat), DT = Dates)]
12 2 months ago Improve test of daily indexes in ... 11 11 }
13 2 months ago Update KCompDR 12 12 #if(class(DM)[1]) != "matrix" {
14 last month updated datasets 13 13 dt <- copy(data.table(DM))
15 14 14 if(!("Dates" %in% names(dt))){
16 15 15 dt[, Dates := index(sul)]
17 16 16 setcolorder(dt, "Dates")
18 17 17 setkey(dt, "Dates")
19 18 18 }
20 19 19 if("lat" %in% names(dt)){
21 20 20 latq <- unique(dt$lat)
22 21 21 dt[, lat := NULL]
23 22 22 }else{latq <- getlat(sul)}
24 last month Update datasets 23 23 DM <- dplyr::select(dt, latq)
25 5 months ago Update KCompDR 24 24 }
26 5 months ago Error repaired 25 25
27 5 months ago Update KCompDR 26 26 stopifnot(index(sul) == index(DM))
28 5 months ago Update KCompDR 27 27 DM <- sul[is.na(DM)]
29 28 28 DM <- getdata(DM)DM
30 5 months ago Error repaired 29 29
31 5 months ago Update KCompDR 30 30 is.na(DM) <- (DM==DM)
32 5 months ago Error repaired 31 31
33 5 months ago Update KCompDR 32 32 #see the Direct and Diffuse data is not given
34 33 33 #if(corr != "none"){
35 34 34 P <- matrix(NA,
36 35 35 CPE = FCOMP(sul, DM),
37 36 36 Pep = FCOMP(sul, DM),
38 37 37 L2 = FWT(L2(sul, DM),
39 38 38 DM) = FCOMP(sul, DM),
40 39 39 CLIMSD = FWTCLIMSD(sul, DM),
41 40 40 DM = F(sul, DM))
42 41 41 RT <- P%RT
43 42 42 P <- P%P
44 43 43 DM <- P & DM
45 44 44 DM <- DM - DM
46 45 45 }
47 46 46 #see the Direct and Diffuse data is given
48 47 47 else {
49 2 weeks ago Update KCompDR 48 48 DR <- getdata(DM)DM
50 49 49 DM <- getdata(DM)[["WDR"]]
51 50 50 DM <- getdata(DM)[["WDR"]]
52 5 months ago Update KCompDR 51 51 P <- DM%DM
53 52 52 RT <- DR%DM
54 5 months ago Error repaired 53 53 }
55 5 months ago Update KCompDR 54 54
56 5 months ago Update KCompDR, KComp and ... 55 55 result <- data.table(Dates = index(sul), P, RT, DM = DM, DM, DM)
57 5 months ago Update KCompDR 56 56 setkey(result, "Dates")
58 5 months ago Update KCompDR 57 57 result
59 5 years ago Improve test of daily indexes in ... 58 58 }
60 12 years ago initial impact 59 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](#)

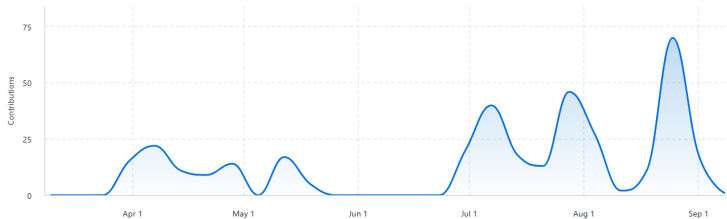
Period: Last 6 months ▾

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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solarization / solarR2

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fdehgadol Implementd the link to the index ✖️2413e46 · 2 hours ago🕒 592 Commits

.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 flincln	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📄 GPL-3.0 license✎

To Be Completed...

About

Solar Radiation and Photovoltaic Systems with R

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fdehgadolFrancisco Delgado López

oscarperpinanOscar 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},  
}
```