

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

Trabajo de Fin de Grado

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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

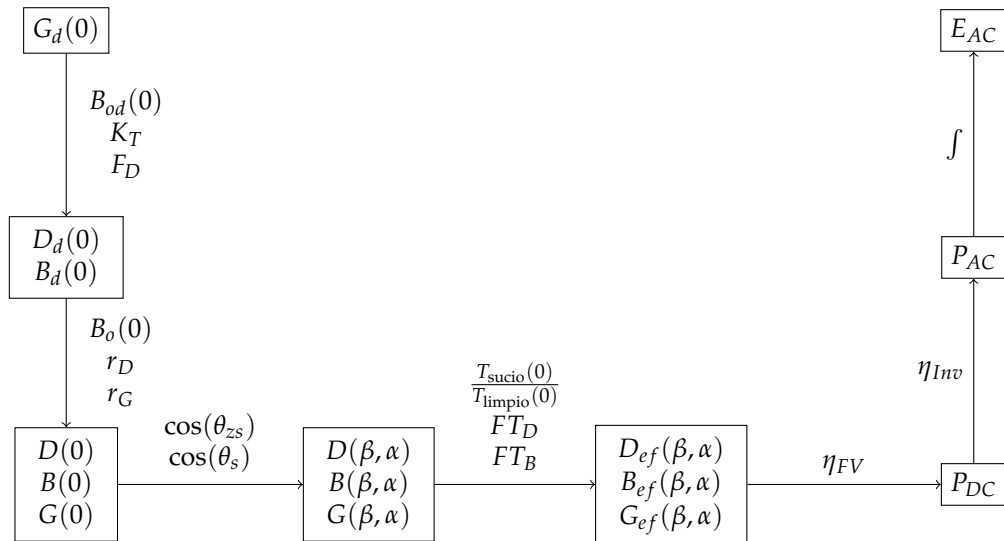
- ▶ Geometría solar
- ▶ Datos meteorológicos
- ▶ Radiación en el plano horizontal
- ▶ Radiación en el plano del generador
- ▶ Simulación de SFCR
- ▶ Simulación de SFB
- ▶ Optimización de distancias
- ▶ Métodos de visualización

Carencias

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

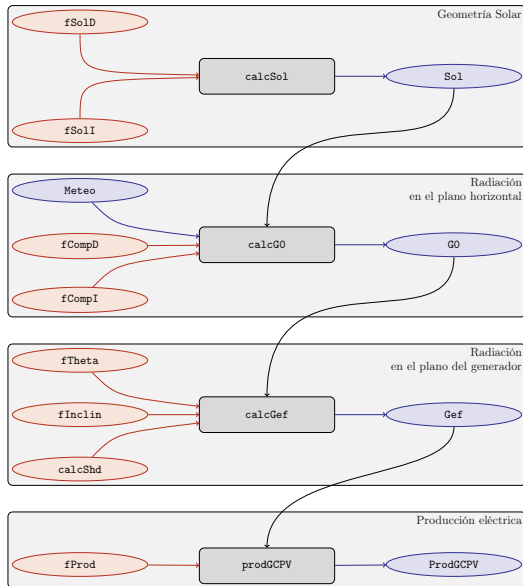
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Procedimiento de cálculo

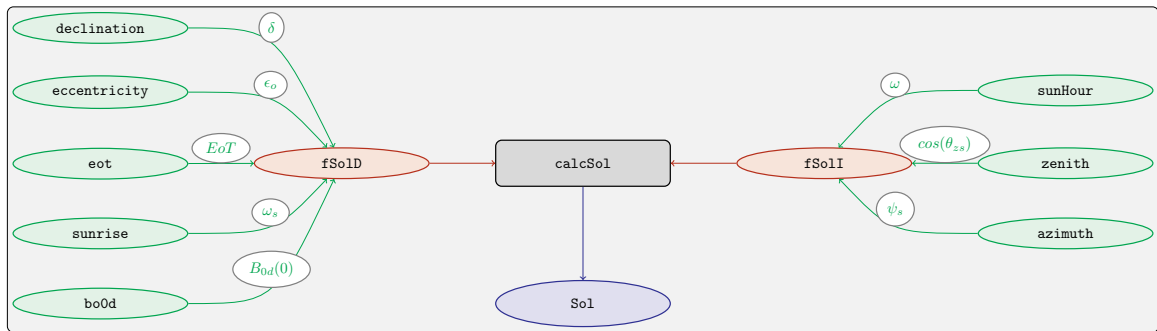


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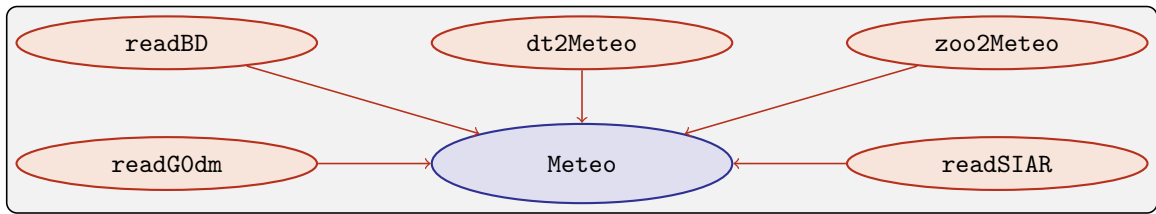
Algoritmo de cálculo



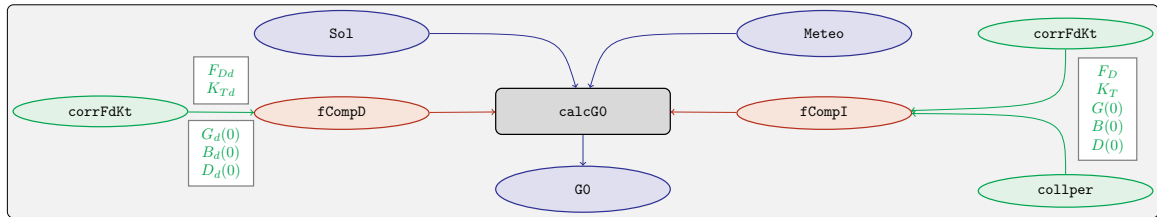
calcSol



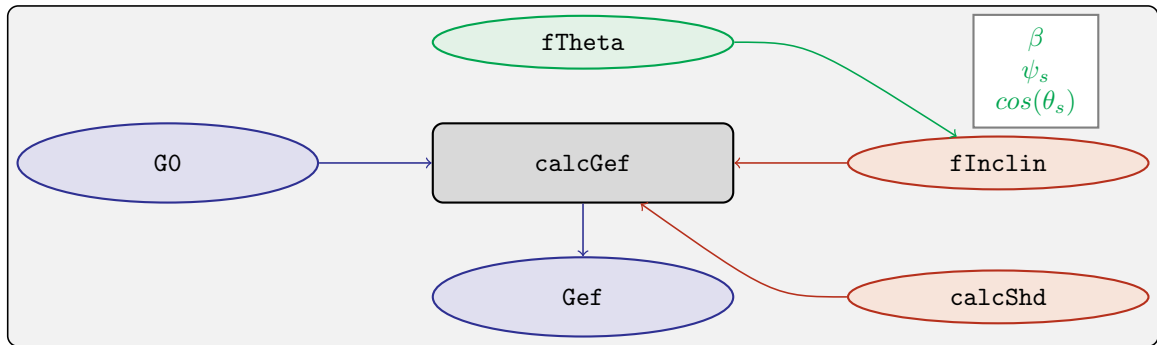
Meteo

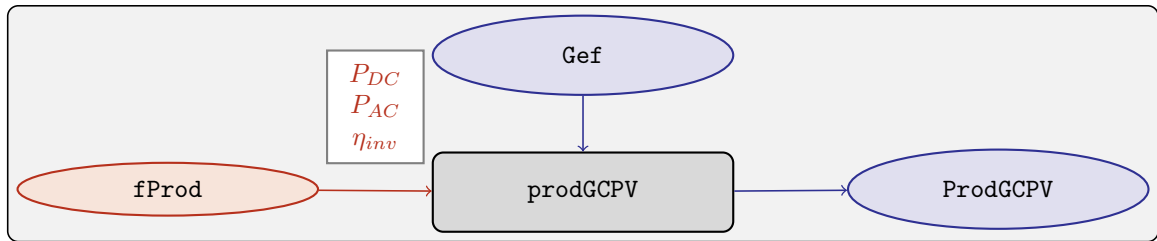


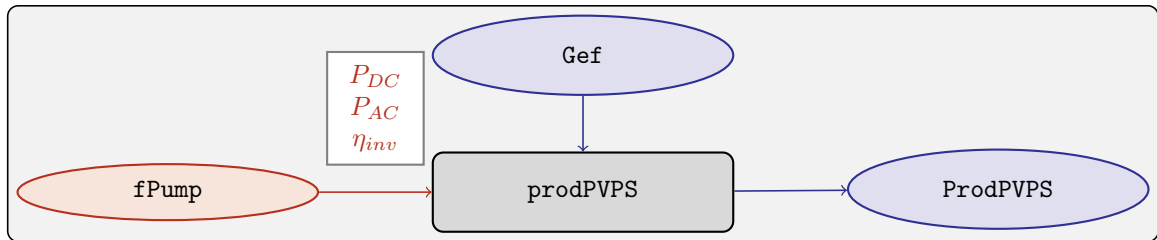
calcG0



calcGef



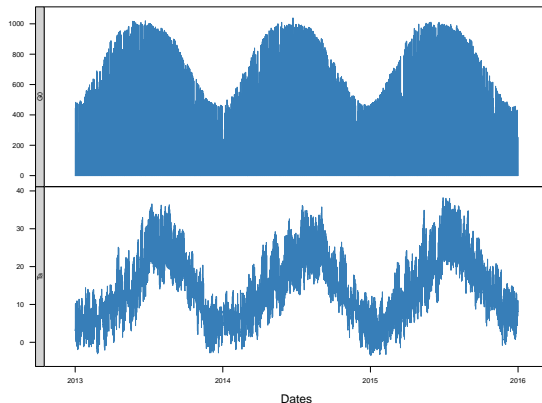




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Información meteorológica

```
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

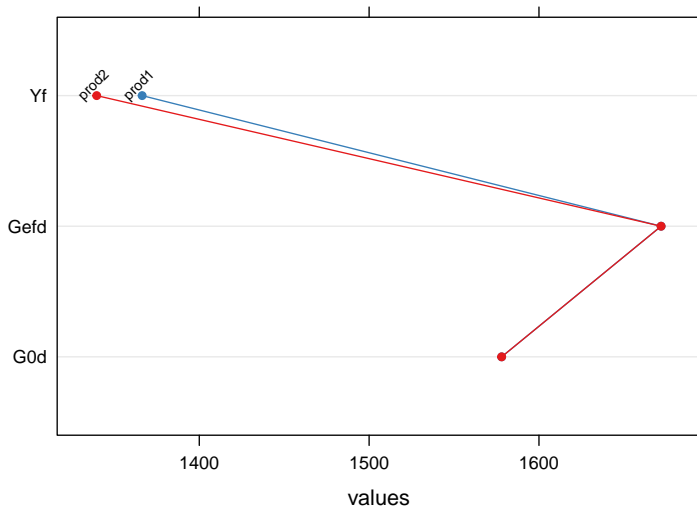
```
prod1 <- prodGCPV(lat = 40.4, modeTrk = 'fixed', modeRad = 'bdI',  
                  dataRad = etsidi_1315, beta = 30, alpha = -19,  
                  module = module1, generator = generator1,  
                  inverter = inverter)  
show(as.data.tableY(prod1))
```

	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			10/12/2020 2 weeks ago	History
2 weeks ago	Global variables	1	utils: global variables ("lat")	
2 months ago	improved calcSD	2	KCompD <- function(sul, DM, corr = "CPE", F)	
9 years ago	improve test of daily indexes in ...	4	{	
9 months ago	update KCompDR	5	if(!query NULL c("CPE", "Page", "L2", "WMD", "CLMWD", "user", "name")){	
		6	warning("wrong descriptor of correlation Po-est. not CPE.")	
		7	corr <- "CPE"	
9 years ago	improve test of daily indexes in ...	8	}	
2 months ago	update KCompDR	9	if(class(sul)[2] != "mat"){	
9 years ago	improve test of daily indexes in ...	10	sul <- sul[, select(sul & unique(lat), DTI = Dates)]	
2 months ago	update KCompDR	11	}	
2 months ago	update KCompDR	12	if(class(DM)[1] != "matrix"){	
last month	updated datasets	13	dt <- copy(data.table(DM))	
		14	if(!("Dates" %in% names(dt))){	
		15	dt[, Dates := index(sul)]	
		16	setcolorder(dt, "Dates")	
		17	setkey(dt, "Dates")	
		18	}	
		19	if("lat" %in% names(dt)){	
		20	latq <- unique(dt\$lat)	
		21	dt[, lat := NULL]	
		22	join(latq <- getlat(sul))	
last month	update datasets	23	DM <- DTMJoin(dt, latq)	
9 months ago	update KCompDR	24	}	
9 months ago	error repaired	25		
9 months ago	update KCompDR	26	stopifnot(index(sul) == index(DM))	
9 months ago	update KCompDR	27	MWD <- sul\$MWD\$MWD	
9 months ago	error repaired	28	DM <- getdata(DM)\$DM	
9 months ago	error repaired	29		
9 months ago	update KCompDR	30	is.na(DM) <- (DM==DM)	
9 months ago	error repaired	31		
9 months ago	update KCompDR	32	and the direct and diffuse data is not given	
		33	if(corr != "user"){	
		34	P4 <- Data2(Corr,	
		35	CPE = F(Corr)(sul, DM),	
		36	Page = F(Corr)(sul, DM),	
		37	L2 = F(Corr)(sul, DM),	
2 weeks ago	update KCompDR	38	MWD = F(Corr)(sul, DM),	
9 months ago	update KCompDR	39	CLMWD = F(Corr)(sul, DM),	
		40	user = F(sul, DM))	
		41	RT <- P4\$RT	
		42	P4 <- P4\$P4	
		43	DM <- P4 + DM	
		44	DM <- DM - DM	
		45	}	
		46	and the direct and diffuse data is given	
		47	else {	
2 weeks ago	update KCompDR	48	DM <- getdata(DM)\$DM	
		49	DM <- getdata(DM)[["WMD"]]	
		50	DM <- getdata(DM)[["WMD"]]	
9 months ago	update KCompDR	51	P4 <- DM\$MWD	
		52	RT <- DM\$WMD	
9 months ago	error repaired	53	}	
9 months ago	update KCompDR	54		
9 months ago	update KCompD, KCompD and ...	55	result <- data.table(Dates = index(sul), P4, RT, DM + DM, DM, DM)	
9 months ago	update KCompDR	56	setkey(result, "Dates")	
9 years ago	improve test of daily indexes in ...	57	result	
12 years ago	initial impact	58	}	

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](#)

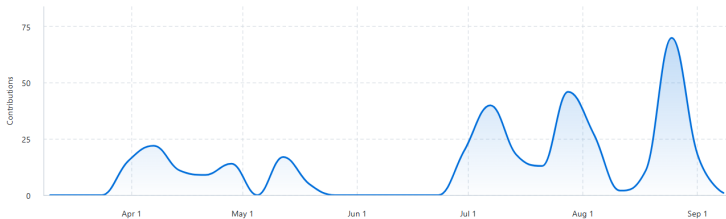
Period: Last 6 months ▾

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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fdekgadol Update README.md6 minutes ago594 Commits

.github/workflows	Moving from Travis to GitHub Actions	4 years ago
R	CRAN corrections	4 days ago
data	create dataset SIAR	2 months ago
docs	Implementd the link to the index	yesterday
inst	Updated citation	3 weeks ago
man	CRAN corrections	4 days ago
tests	Actualizado fProd	2 weeks ago
.Rbuildignore	Moving from Travis to GitHub Actions	4 years ago
.gitignore	Zero instead of NA in flinclin	10 years ago
DESCRIPTION	CRAN corrections	4 days ago
LICENSE	Initial commit	11 years ago
NAMESPACE	Update NAMESPACE	3 weeks ago
README.md	Update README.md	6 minutes ago

READMEGPL-3.0 license

solar2

Cran 0.10Downloads 0/month

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

About

Solar Radiation and Photovoltaic Systems with R

[solarization.github.io/solaR2/](#)

Readme

GPL-3.0 license

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1 watching

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Contributors2

fdekgadolFrancisco Delgado López


oscarperpinanOscar Perpiñán Lamigue...

Languages

R100.0%

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},  
}
```