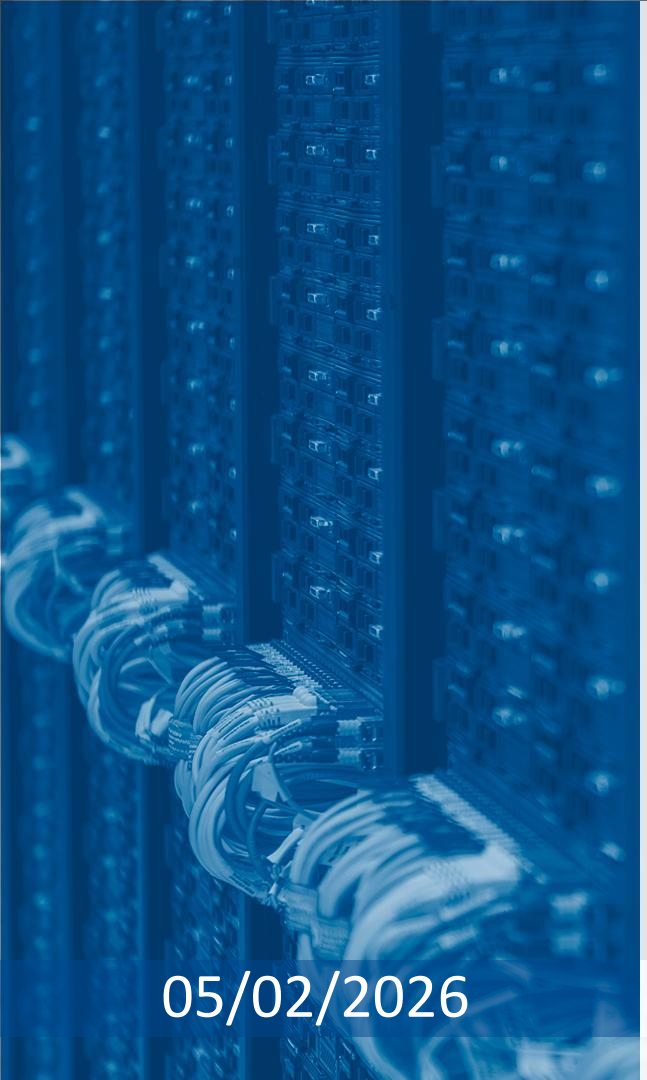

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Centro Nacional de Supercomputación

R user meeting

05/02/2026

Victòria A., Ariadna B., Theertha K.

Agenda

1. Ice-breaker: CRAN Task Views
2. News
    - General
    - s2dv
    - CSTools
    - CSIndicators
    - esviz
    - SUNSET
3. User presentation: Alberto Bojaly
4. Q&A

Ice-breaker:
How do you find R packages?:
CRAN Task Views

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How do you find R packages?

Question 1: How do you find new R packages to use?

- Google/another search engine
- I ask Generative AI for recommendations
- I ask my colleagues for recommendations
- Other: …

Question 2: Do you know about CRAN Task Views?

CRAN Task Views

CRAN Task Views are online repositories which compile lists of CRAN R packages. They “aim to provide guidance which packages on CRAN are relevant for tasks related to a certain topic”.

CRAN Task Views are available online through the CRAN website, and also on the terminal via the dedicated “ctv” R package:

```
install.packages("ctv")
ctv::install.views("Econometrics") # Installs all packages in the “Econometrics” view
ctv::update.views("Econometrics") # Updates packages in the “Econometrics” view
ctv::ctv("Econometrics") # Gives information about the “Econometrics” view
ctv::available.views() # Shows all available task views
```

CRAN Task Views

Each task view is a document containing different subtopics, which sentences briefly explaining how each package relates to them.

Task views are not only helpful for finding new functions; they can also give your package greater visibility and support! They are hosted on GitHub and accept contributions from the community:

- You can propose to add new packages to existing task views.
- You can create and propose new task view topics.

General

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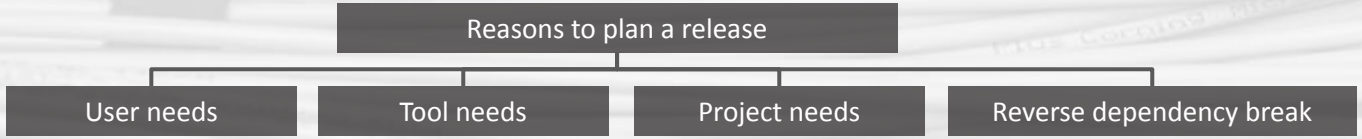
R TOOLS ROADMAP 2026



	General Direction	Q1 2026	Q2 2026	Q3 2026	Long term
s2dv (v2.2.1)	Enhance statistical methods	Include new statistical methods and improve the existing ones			Efficiency improvement
startR (v3.0.0)	- Maintain the flexibility while improving user experience - Focus on expanding and improving the documentation	- Update use cases and documentation - Improve dependencies	- Improve the use of Compute() - Explore GRIB loading		- Load and interpolate irregular grid - Multiple steps - Code refactoring
CSTools (v5.3.0)	Increase the general methods and enhance the relevance of the s2dv_cube	- Include new methods for s2dv_cube - Improve forecast calibration methods		- Enhance unit tests - Add new use cases	Convert s2dv_cube to xarray/other objects
CSIndicators (v1.1.3)	Facilitate the calculation of new indicators through existing functionalities	- Health Indicators integration - Add use cases	Add new functions and vignettes for bioclimatic and drought indicators		Improve existing methods and metadata handling
esviz (v0.0.1)	Add new features and improve package maintainability	- Reduce external dependencies - Add new types of visualization	- Reduce device dependency - Improve handling of shapefiles		- Improve different projections - Explore ggplot2 integration
ClimProjDiags **multiApply** **easyNCDF**	No planned development. Only maintenance.	New documentation, use cases and training materials to help users and developers			
General	User meetings, user support, shiny server maintenance While developing the packages for SUNSET or any specific project, it's important to keep the packages as general and individual as possible.				

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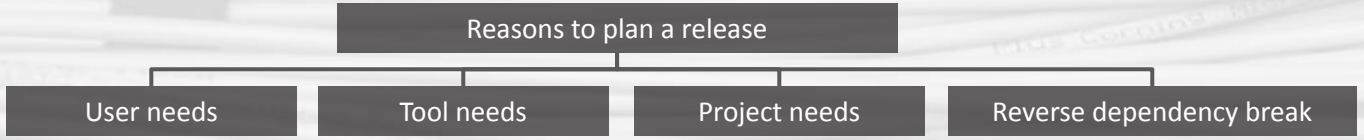
Victoria Agudetse, Ariadna Batalla, Theertha Kariyathan (Dec. 2024)

R TOOLS ROADMAP 2026



	General Direction	Q1 2026	Q2 2026	Q3 2026	Long term
CSDownscale (v0.0.1)	Ensure the package includes state-of-the-art downscaling methods	- Improvements needed for the SUNSET Downscaling module, such as multiple predictor variables	- Add new vignettes - Improve existing downscaling methods	Include more downscaling methods	

General	User meetings, user support, shiny server maintenance While developing the packages for SUNSET or any specific project, it's important to keep the packages as general and individual as possible.

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R TOOLS ROADMAP 2026

Reasons to plan a release

- User needs
- Tool needs
- Project needs
- Reverse dependency break

	General Direction	Q1 2026	Q2 2026	Q3 2026	Long term
GHRexplore	Extend package capabilities and improve code structure	Add epiweeks functions and refactoring	Add animation and cross-correlation functions	Add time series decomposition functions	Expand according to the group needs
GHRmodel	Extend package capabilities and improve code structure	Code refactoring and bug fixes	Add functions for semi-supervised model selection	Add support for binomial and gaussian distributions	Support for projections and attribution
GHRpredict	Publish on CRAN and test in several use cases	Finish development, code review and publishing	Fix post-release bugs and roadmap for future development	Test in several use cases across different projects	Expand cross-validation strategies
data4health	First publication on CRAN, implementing new features based on first users, extend package capabilities	Finish development, code review and publishing	Fix post-release bugs and roadmap for future development	Add vignettes for new use cases, prepare teaching material	Expand capabilities based on feedback in Peru
clim4health	Publish on CRAN and test in several use cases	Finish development, code review and publishing	Fix post-release bugs and define roadmap for future development	Test in several use cases across different projects, prepare teaching material	Expand data sources according to group needs

Unified **dissemination strategy**: webinars, youtube videos, website, workshops

s2dv

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New function: DieboldMarianoTest()

- Compares the skill of two forecasts (A vs B) over time with respect to a common observational reference.
- Based on Diebold and Mariano (2012). Developed by Núria Pérez-Zanón.

Inputs:

- `skill_A` , `skill_B` : arrays of the time series of the scores
- `time_dim` : Dimension along which the test is applied.
- `test.type` :
  - `"two.sided"` : any significant difference.
  - `"one.sided"` : A significantly better than B.
- `alpha` : any significant difference: significance level (default: 0.05).
- `N.eff` : Effective sample size.

Output: Logical array indicating the statistically significant differences.

merge request : https://gitlab.earth.bsc.es/es/s2dv/-/merge_requests/203
status: in branch dev_diebold

CSTools

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Bugfix in CST_BindDim()

- In the output of CST_BindDim, the metadata in attrs was removed.
- The time_bounds are not bound along the specified dimension, when using the time_bounds stored in the attrs of an s2dv_cube (data$attrs$time_bounds).
- The function now checks whether the s2dv_cubes have time_bounds in attrs and checks whether it includes the target dimension. If so, binds the time_bounds along the dimension stored in the attrs of an s2dv_cube.

merge request : https://gitlab.earth.bsc.es/external/cstools/-/merge_requests/234
status: in branch CSTBindDim_attr

New function CST_ReorderDims()

- CST_ReorderDims(), is a new function to act as an s2dv_cube wrapper for the function s2dv::Reorder().

- It reorders the dimensions of an s2dv_cube. The order can be provided either as indices or the dimension names.

merge request : https://gitlab.earth.bsc.es/external/cstools/-/merge_requests/235
status: in branch dev-cst_reorderdims

CSIndicators

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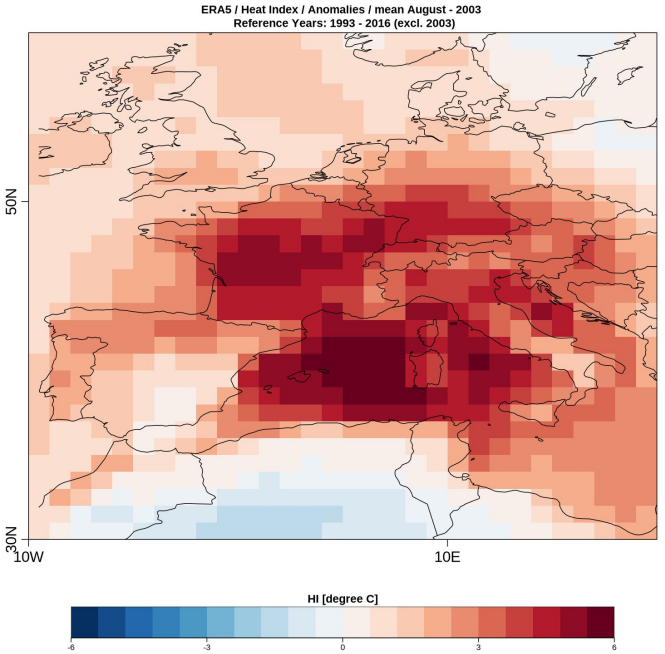
Vignette for the HeatIndex function

- Heat Index computes the perceived temperature resulting from the combined effects of air temperature and relative humidity.

- Vignette shows:
  - Quick temperature overview
  - Heat Index computation
  - Visualisation



issue: https://gitlab.earth.bsc.es/es/csindicators/-/issues/58
status: in master

esviz

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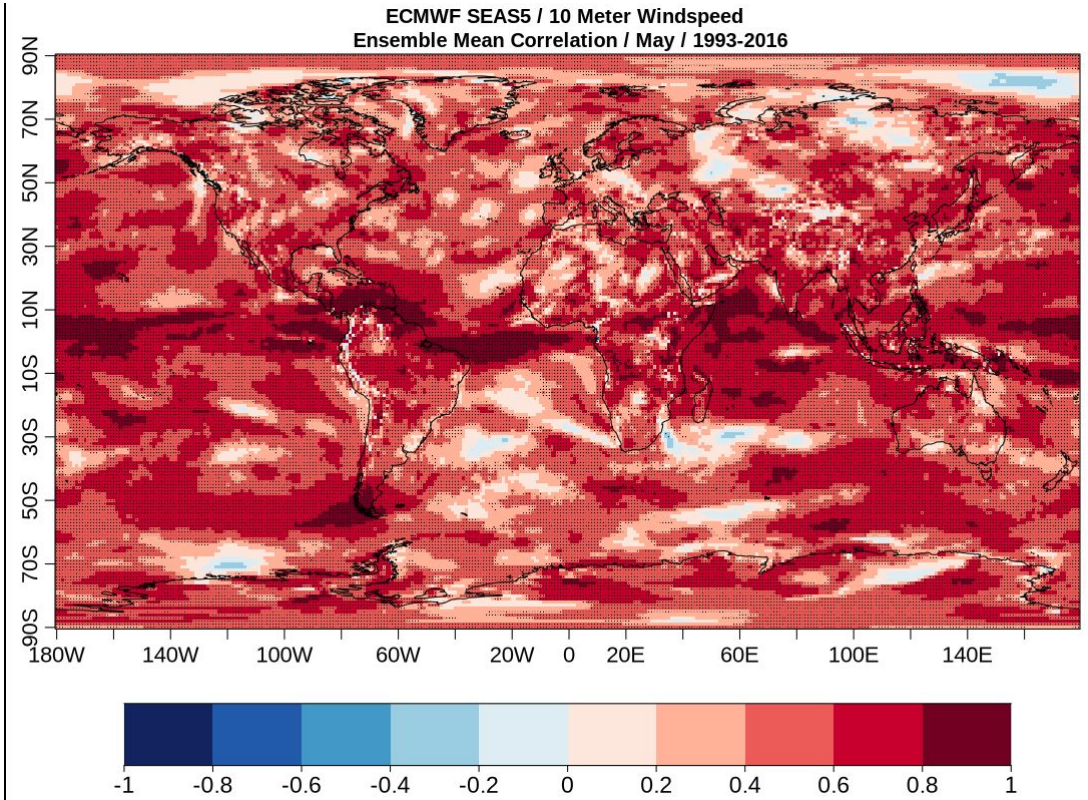
First release v0.0.1

- R plotting package for climate science and services. It includes maps, time series, scorecards and diagnostic plots.
  - Functions adapted and extended from s2dv and CSTools.
- First public release: **esviz/0.0.1** is installed on all BSC machines.
- Minor release: **esviz/0.0.2** is already on CRAN and will be soon installed on all BSC machines.
  - Reduced dependencies.
  - Bugfix in BarPlotCat().

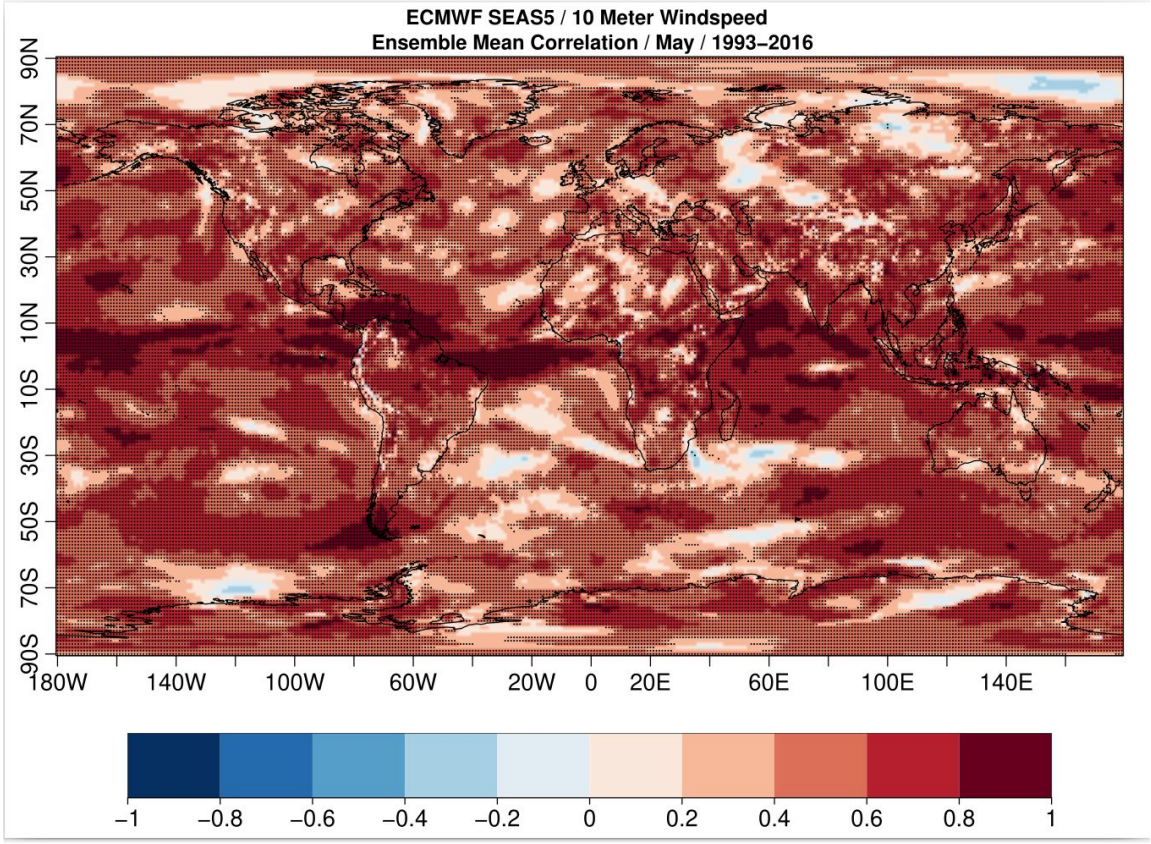
Display of points in bitmap-type images

Long-term known issue: distortion in PNG and JPEG plots with dense points, where some of the points become transparent.



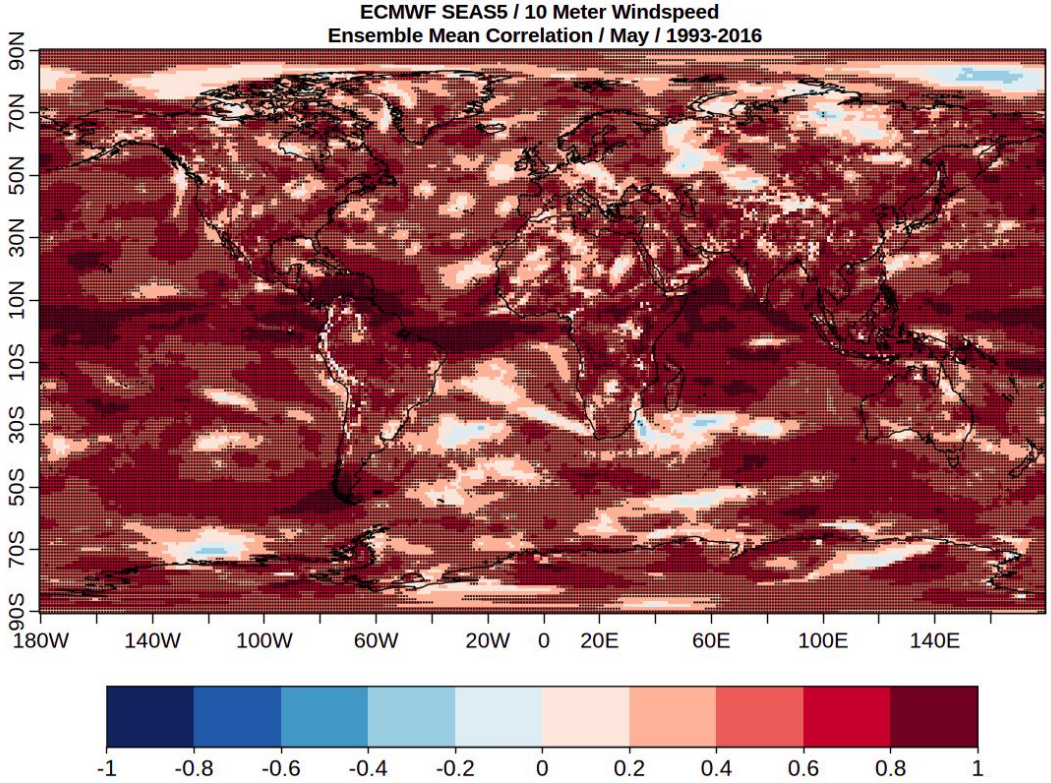
Display of points in bitmap-type images

Vector-type image formats, such as PDF, don't have this issue:



Display of points in bitmap-type images

We can solve this problem by changing the device used by esviz from `png()` to `CairoPNG()` from the `cairo` package for better results:



Display of points in bitmap-type images

However, the results from `Cairo*()` are not always exactly the same as the ones in the original devices; things like dot size and other settings could change.

Options:

- ★ Replace current bitmap devices (`png()`, `jpeg()`) with cairo devices.
- ★ Add a new parameter `antialiasing = TRUE/FALSE`, to let the user use the Cairo device for high-density plots with aliasing problems.
- ★ Add a new parameter to let the user choose the device for problematic cases.

status: discussion
issue: https://gitlab.earth.bsc.es/es/esviz/-/issues/34

SUNSET

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New release 3.1.0

A new release of SUNSET (v3.1.0) was merged to the production branch on January 27th. This version includes, among other features:

- ★ An updated conda environment with R/4.4.3 and CDO/2.5.0
- ★ Adjustment of seasonal daily metadata upon loading
- ★ Probabilities accept absolute threholds. The threshold probabilities are visualized by extreme probabilities code
- ★ Bugfixes in NA handling and recipe splitting
- ★ … and many more!

status: in production
release notes: https://gitlab.earth.bsc.es/es/sunset/-/releases/v3.1.0

Visualization: crosses/dots on non-significant grid

- New recipe parameters to configure grid-point marking, with caption support for single-panel plots.

- **skill_metrics**:
  - significance: 'dots' # Type of mark for statistical non-significance/significance in plot_metrics.
  - dots_on_points_significance: "non-significant" # Which grid points to dot in skill_metrics, if dots are requested. Either 'significant' or 'non-significant'. Requires 'significance' to be 'dots' or 'both'. Default is 'non-significant'.
- **forecast_map**:
  - mask_ens: no # Whether to mask the negatively correlated points in the forecast_map mean plot. yes/true, no/false or 'both'. Default is no/false. (Optional, str).
  - dots_ens: no # Whether to dot the negatively/positively correlated points in the forecast_map plot. yes/true, no/false or 'both'. Default is no/false. (Optional, str)
  - dots_on_points_ens: "negative" # Which grid points to dot by ensemble correlation in forecast_map. Either 'negative' or 'positive'. Requires 'dots_ens' to be true.
- **most_likely_terciles** and **extreme_probabilities**:
  - mask_rpss: no # Whether to mask the negative rpss points in the most_likely_tercile and extreme_probabilities plots. yes/true, no/false or 'both'. Default is no/false. (Optional, str)
  - dots_rpss: yes # Whether to dot the negative/positive rpss points in the most_likely_tercile and extreme_probabilities plots. yes/true, no/false or 'both'. Default is no/false. (Optional, str).
  - dots_on_points_rpss: "negative" # Which grid points to dot by rpss in most_likely_terciles and extreme_probabilities. Either 'negative' or 'positive'. Requires 'dots_rpss' to be true.

Visualization: crosses/dots on non-significant grid

- **skill_metrics**:
  - significance: 'dots' # Type of mark for statistical non-significance/significance in plot_metrics.
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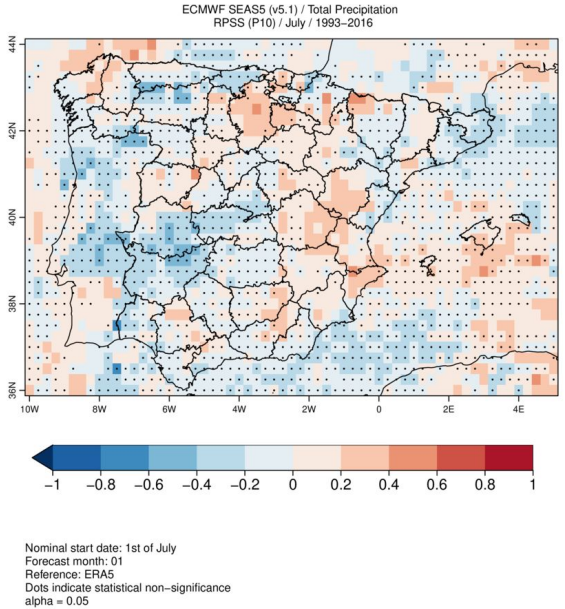
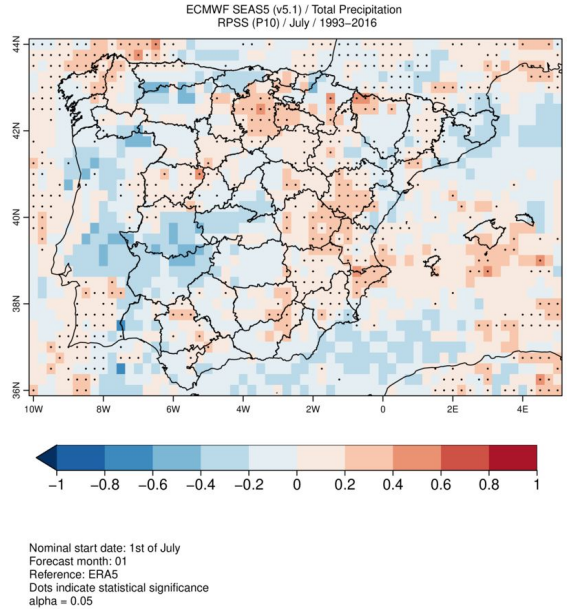
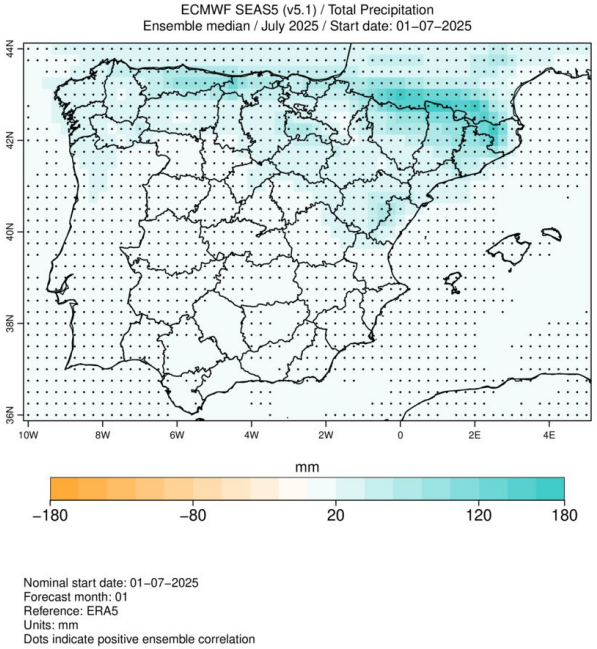
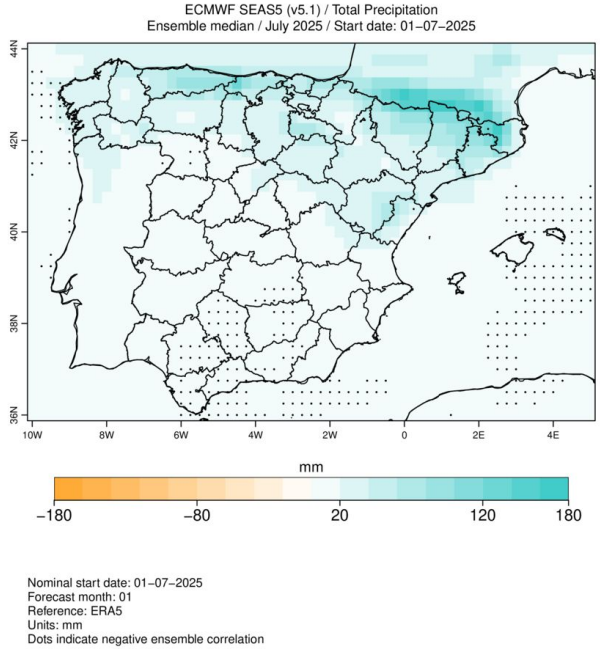




Visualization: crosses/dots on non-significant grid

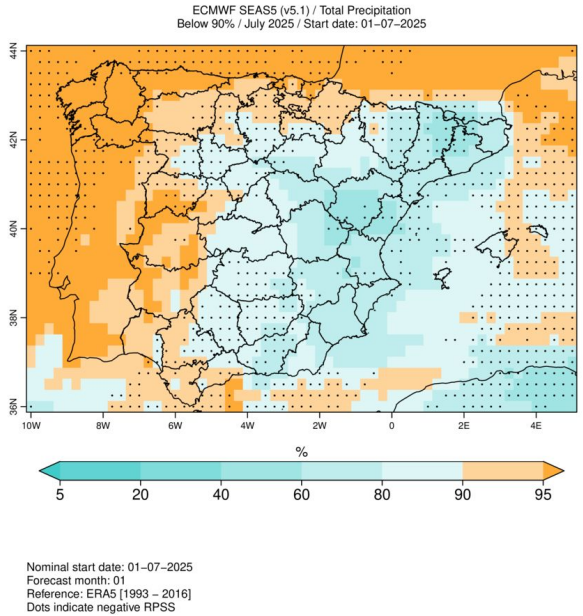
- **forecast_map**:
  - dots_ens: yes # Whether to dot the negatively/positively correlated points in the forecast_map plot. yes/true, no/false or 'both'. Default is no/false. (Optional, str)
  - dots_on_points_ens: **"negative"** # Which grid points to dot by ensemble correlation in forecast_map. Either 'negative' or 'positive'. Requires 'dots_ens' to be yes/true.

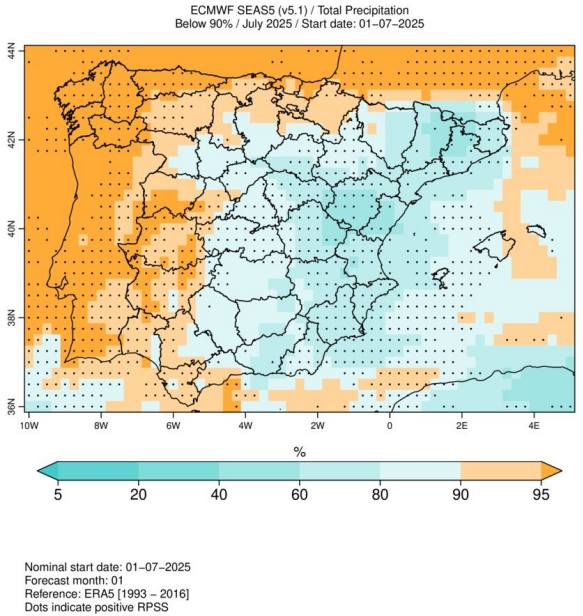




Visualization: crosses/dots on non-significant grid

- **most_likely_terciles** and **extreme_probabilities**:
  - dots_rpss: yes # Whether to dot the negative/positive rpss points in the most_likely_tercile and extreme_probabilities plots. yes/true, no/false or 'both'. Default is no/false. (Optional, str).
  - dots_on_points_rpss: "negative" # Which grid points to dot by rpss in most_likely_terciles and extreme_probabilities. Either 'negative' or 'positive'. Requires 'dots_rpss' to be yes.





Visualization: crosses/dots on non-significant grid

- **most_likely_terciles** and **extreme_probabilities**:
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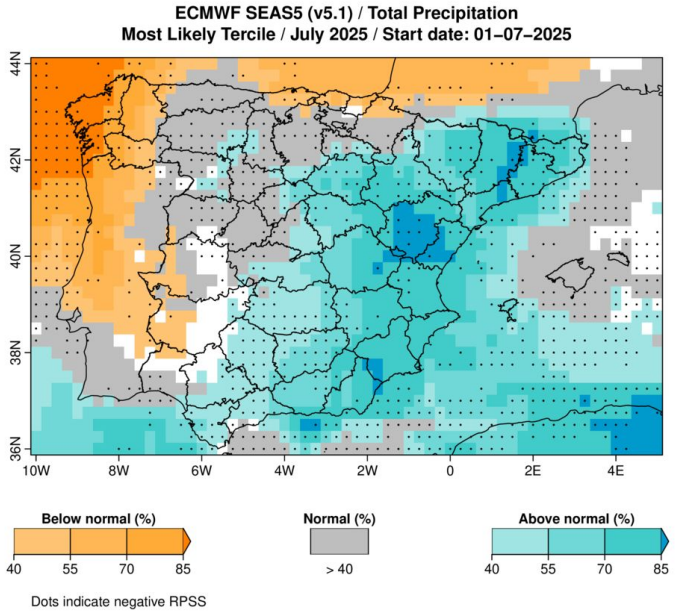

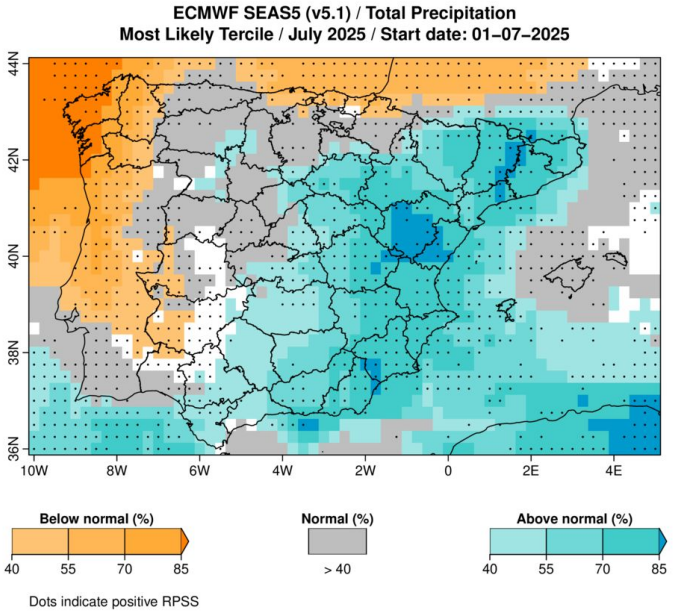

User Presentation (Alberto Bojaly)

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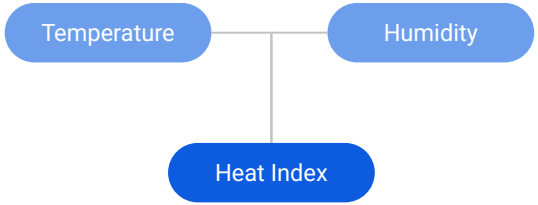
CSIndicators - Heat Index

What is the Heat Index?

The Heat Index is an estimate of the temperature **perceived by the human body**, combining **air temperature** and **relative humidity**. Relative humidity accounts for the reduced efficiency of **evaporative cooling through perspiration**.



Where does it come from?

The Heat Index is developed by the **National Weather Service (NWS)** of the **National Oceanic and Atmospheric Administration (NOAA)**, based on the work of **Robert G. Steadman** and formally implemented in 1990 by **Lans P. Rothfusz**.

CSIndicators - Heat Index

Steadman (1979) → physical & physiological model of perceived temperature
Rothfusz (1990) → regression-based polynomial approximation for operational use

Temperature in degrees **Fahrenheit [°F]**
Relative Humidity in **percent [%]**

Adjustments depending on the values of temperature and relative humidity

if T > 80 [ºF] →HI = - 42.379 + 2.04901523 T + 10.14333127 RH - 0.22475541 T·RH - 0.00683783 T^2 - 0.05481717 RH^2 + 0.00122874 T^2·RH + 0.00085282 T·RH^2 - 0.00000199 T^2·RH^2

if T < 80 [ºF] →HI = 0.5 * {T + 61 + [(T - 68)*1.2] + (RH * 0.094)}

CSIndicators - Heat Index

The Heat Index is a key indicator of heat stress in warm and humid conditions and is used to assess human exposure and health-related risks.

Why use this indicator?

- Effective for public communication
- Directly linked to health risk categories
- Used by the NWS / NOAA for heat warnings

WARNING	HEAT INDEX	HEALTH IMPACT
Safe	< 26	No adverse effects expected due to heat
Caution	27- 32	Fatigue possible with prolonged exposure and/or physical activity
Extreme Caution	33 - 40	Heat stroke, heat cramps or heat exhaustion possible with prolonged exposure and/or physical activity
Danger	41 - 51	Heat cramps or heat exhaustion likely and heat stroke possible with prolonged exposure and/or physical activity
Extreme Danger	52 - 92	Heat stroke highly likely

NOAA national weather service: heat index

Temperature / Relative humidity	80 °F (27 °C)	82 °F (28 °C)	84 °F (29 °C)	86 °F (30 °C)	88 °F (31 °C)	90 °F (32 °C)	92 °F (33 °C)	94 °F (34 °C)	96 °F (36 °C)	98 °F (37 °C)	100 °F (38 °C)	102 °F (39 °C)	104 °F (40 °C)	106 °F (41 °C)	108 °F (42 °C)	110 °F (43 °C)
40%	80 °F (27 °C)	81 °F (27 °C)	83 °F (28 °C)	85 °F (29 °C)	88 °F (31 °C)	91 °F (33 °C)	94 °F (34 °C)	97 °F (36 °C)	101 °F (38 °C)	105 °F (41 °C)	109 °F (43 °C)	114 °F (46 °C)	119 °F (48 °C)	124 °F (51 °C)	130 °F (54 °C)	136 °F (58 °C)
45%	80 °F (27 °C)	82 °F (28 °C)	84 °F (29 °C)	87 °F (31 °C)	89 °F (32 °C)	93 °F (34 °C)	96 °F (36 °C)	100 °F (38 °C)	104 °F (40 °C)	109 °F (43 °C)	114 °F (46 °C)	119 °F (48 °C)	124 °F (51 °C)	130 °F (54 °C)	137 °F (58 °C)	
50%	81 °F (27 °C)	83 °F (28 °C)	85 °F (29 °C)	88 °F (31 °C)	91 °F (33 °C)	95 °F (35 °C)	99 °F (37 °C)	103 °F (39 °C)	108 °F (42 °C)	113 °F (45 °C)	118 °F (48 °C)	124 °F (51 °C)	131 °F (55 °C)	137 °F (58 °C)		
55%	81 °F (27 °C)	84 °F (29 °C)	86 °F (30 °C)	89 °F (32 °C)	93 °F (34 °C)	97 °F (36 °C)	101 °F (38 °C)	106 °F (41 °C)	112 °F (44 °C)	117 °F (47 °C)	124 °F (51 °C)	130 °F (54 °C)	137 °F (58 °C)			
60%	82 °F (28 °C)	84 °F (29 °C)	88 °F (31 °C)	91 °F (33 °C)	95 °F (35 °C)	100 °F (38 °C)	105 °F (41 °C)	110 °F (43 °C)	116 °F (47 °C)	123 °F (51 °C)	129 °F (54 °C)	137 °F (58 °C)				
65%	82 °F (28 °C)	85 °F (29 °C)	89 °F (32 °C)	93 °F (34 °C)	98 °F (37 °C)	103 °F (39 °C)	108 °F (42 °C)	114 °F (46 °C)	121 °F (49 °C)	128 °F (53 °C)	136 °F (58 °C)					
70%	83 °F (28 °C)	86 °F (30 °C)	90 °F (32 °C)	95 °F (35 °C)	100 °F (38 °C)	105 °F (41 °C)	112 °F (44 °C)	119 °F (48 °C)	126 °F (52 °C)	134 °F (57 °C)						
75%	84 °F (29 °C)	88 °F (31 °C)	92 °F (33 °C)	97 °F (36 °C)	103 °F (39 °C)	109 °F (43 °C)	116 °F (47 °C)	124 °F (51 °C)	132 °F (56 °C)							
80%	84 °F (29 °C)	89 °F (32 °C)	94 °F (34 °C)	100 °F (38 °C)	106 °F (41 °C)	113 °F (45 °C)	121 °F (49 °C)	129 °F (54 °C)								
85%	85 °F (29 °C)	90 °F (32 °C)	96 °F (36 °C)	102 °F (39 °C)	110 °F (43 °C)	117 °F (47 °C)	126 °F (52 °C)	135 °F (57 °C)								
90%	86 °F (30 °C)	91 °F (33 °C)	98 °F (37 °C)	105 °F (41 °C)	113 °F (45 °C)	122 °F (50 °C)	131 °F (55 °C)									
95%	86 °F (30 °C)	93 °F (34 °C)	100 °F (38 °C)	108 °F (42 °C)	117 °F (47 °C)	127 °F (53 °C)										
100%	87 °F (31 °C)	95 °F (35 °C)	103 °F (39 °C)	112 °F (44 °C)	121 °F (49 °C)	132 °F (56 °C)										

Key to colors: Caution · Extreme caution · Danger · Extreme danger

CSIndicators - Heat Index

```
CST_HeatIndex <- function(temp, rh, start = NULL, end = NULL,
                    time_dim = 'time', temp_units_output = "C",
                    fun = mean, ncores = NULL, na.rm = FALSE,...)
```

- **Ready-to-use functions**: `CST_HeatIndex()` & `HeatIndex()`

  Only temperature and relative humidity are required.

- **Automatic unit conversions**: temperature and heat index works with °C, °F and K.

- **Integrated with CSIndicators**: compatible with other climate indicators and functions

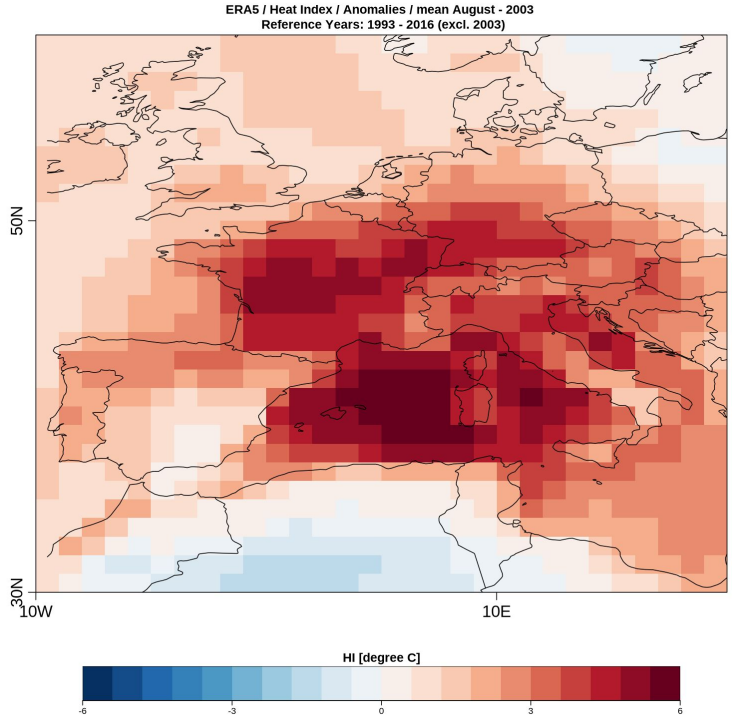
  Example with: *TotalSpellTimeExceedingThreshold.R*

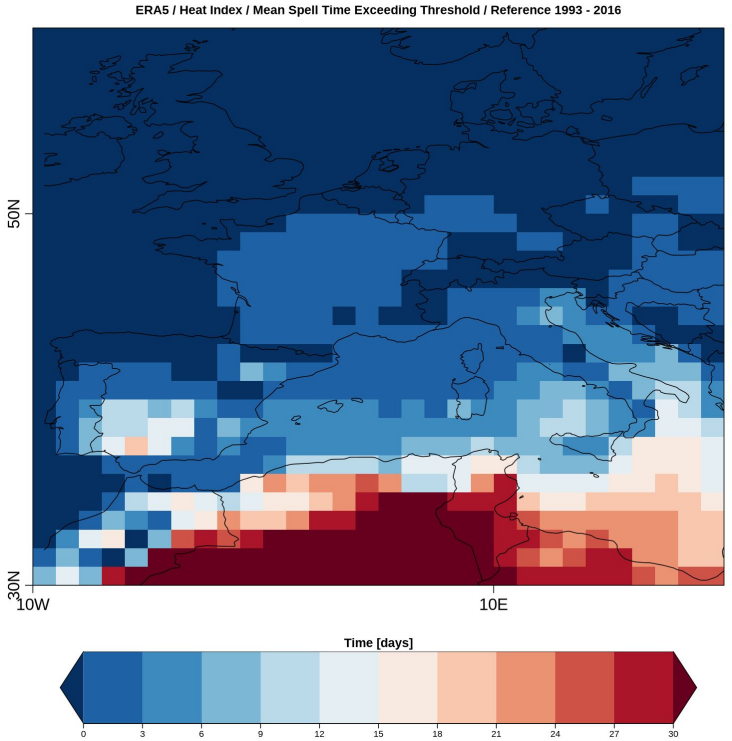
Limitations:

- Not optimal for **low-humidity conditions** (RH < 40%)
- **Does not include other factors** (radiation or wind effects)

CSIndicators - Heat Index

Check the Vignette!





Thanks for joining

Barcelona Supercomputing Center
Centro Nacional de Supercomputación

Next meeting: April 9th