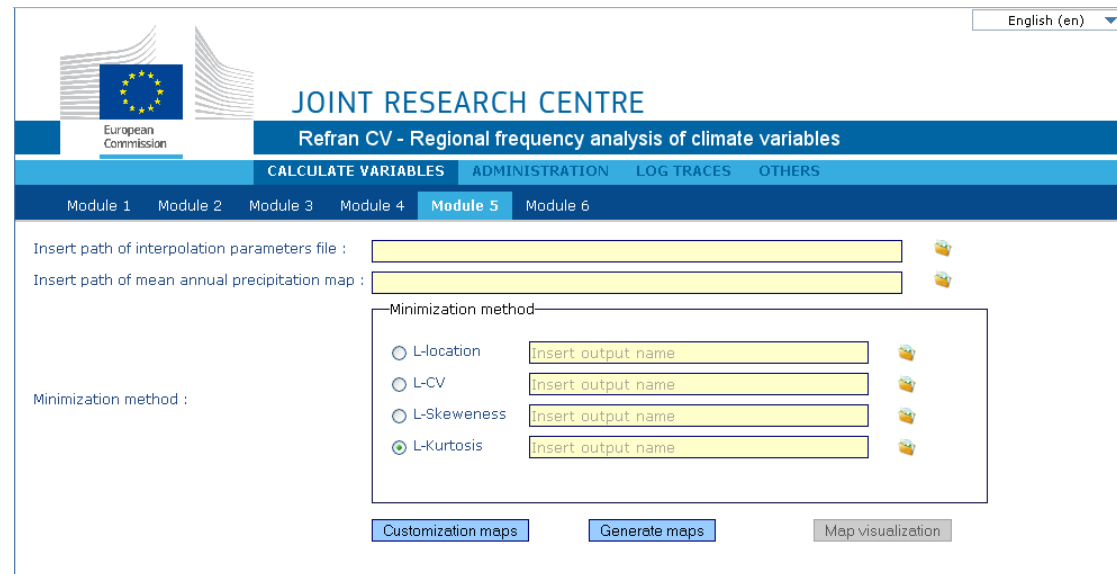
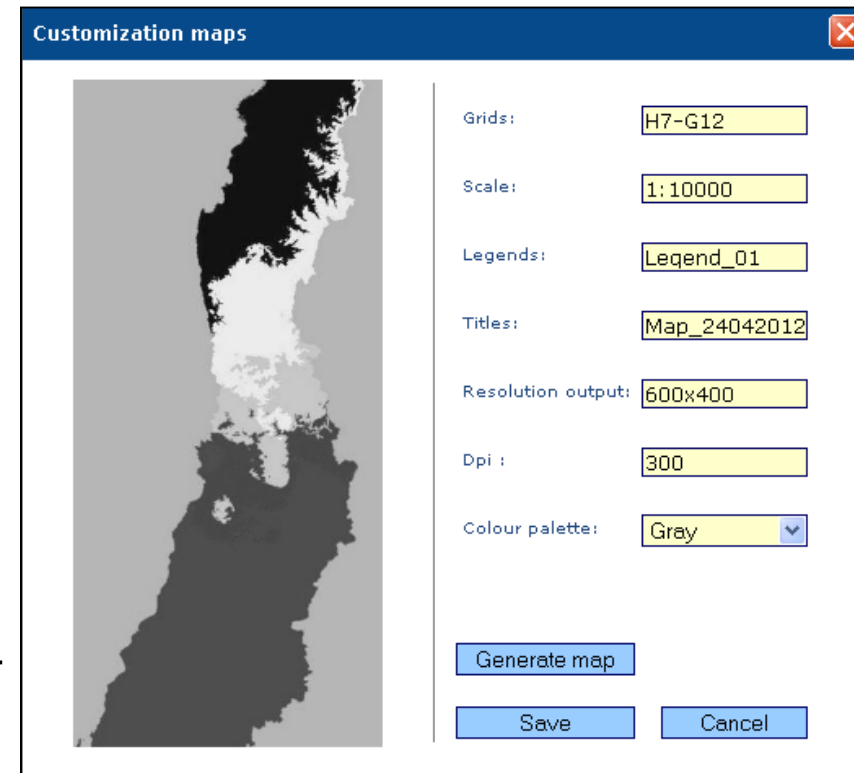


Regional Frequency Analysis of Climate Variables (REFRAN-CV) software



Regional Frequency Analysis of Climate Variables (REFRAN-CV)

- Web-based or standalone tool for calculating L-moments and return periods of extreme climate events (temperature or rainfall)
- Developed using open source R statistical software
- With the contribution from CAZALAC (Chile), CIIFEN (Ecuador), UNAL-IDEA (Colombia), CAALCA (México), INSMET (Cuba)



General structure of the software

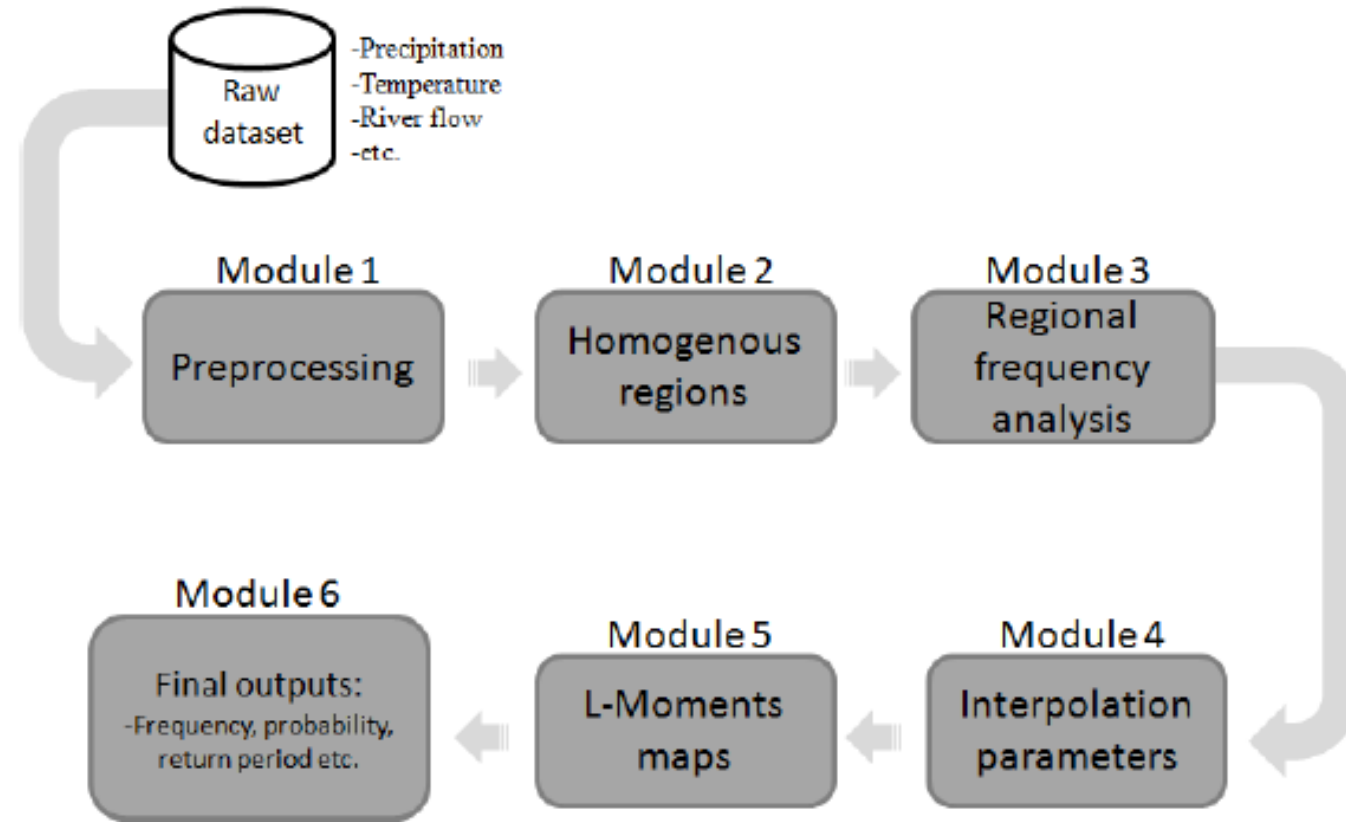
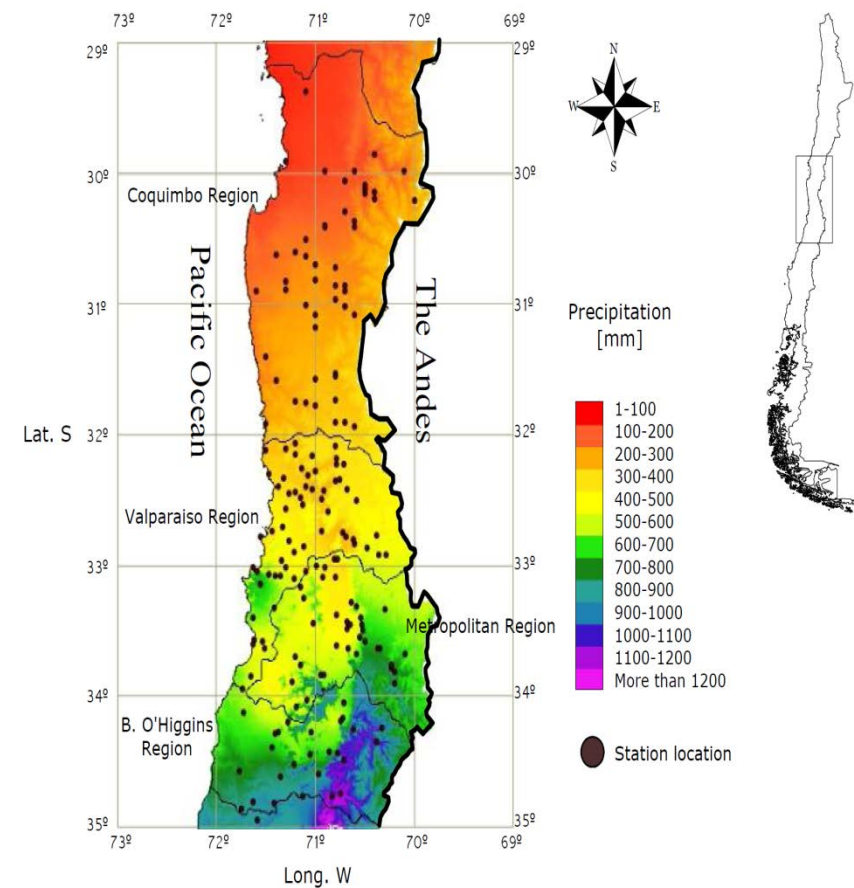
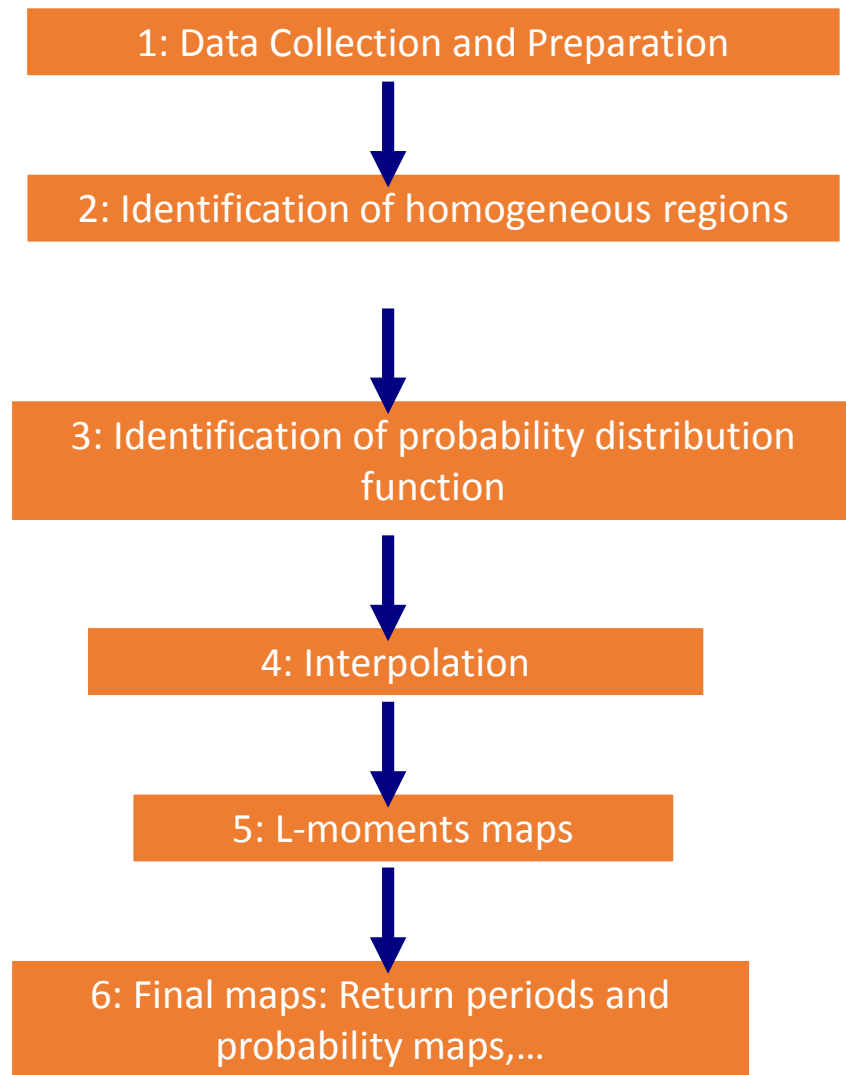


Figure 1. General structure of the software functionalities.

REFRAN-CV FLOWCHART



Map created by CAZALAC on February 2010
Mean Annual Precipitation Map Source: Morales, L. University of Chile
Geographic Projection: WGS84

Web Application Interface

The screenshot displays the web application interface for 'Refran CV - Regional frequency analysis of climate variables'. The interface includes the European Commission logo, the Joint Research Centre logo, and the EUROCLIMA logo. A language dropdown menu is set to 'English (en)'. The main navigation bar contains 'CALCULATE VARIABLES', 'ADMINISTRATION', and 'LOG TRACES', with 'Funded by the European Commission' on the right. A 'Run by Module' dropdown menu is open, showing options for Module 1 through Module 6, with 'Module 6' selected. The main content area shows a path input field for 'Insert path to L-moment' with the value 'JRC/Data/Output/Maps/'. Below this, there is a section for 'Output maps:' with three rows: 'Frequency', 'Probability', and 'Return period'. Each row has an 'Options' button, an input field for 'Insert output name', a folder icon, and a 'Map visualization' button.

English (en) ▼

European Commission

JOINT RESEARCH CENTRE

EUROCLIMA

Refran CV - Regional frequency analysis of climate variables

CALCULATE VARIABLES ADMINISTRATION LOG TRACES

Funded by the European Commission

Run by Module ▼

- Module 1
- Module 2
- Module 3
- Module 4
- Module 5
- Module 6**



Insert path to L-moment: JRC/Data/Output/Maps/


Output maps:


| | | | |
|---------------|---------|--------------------|-------------------|
| Frequency | Options | Insert output name | Map visualization |
| Probability | Options | Insert output name | Map visualization |
| Return period | Options | Insert output name | Map visualization |

REFRAN-CV Module 0

English (en) ▼

  **JOINT RESEARCH CENTRE**
Regional frequency analysis of climate variables

 **RALCEA** EUROPE LATIN AMERICA

 **EUROCLIMA**

Funded by the European Commission

Run by Module ▼ Run Process

Module 1: Load data and preprocessing << < > >> [REFRAN-CV PDF GUIDE](#) **STOP the application** ?

Configuration parameters for module0


Following information are automatically retrieved from the default configuration file. If default values fit your needs please leave fields empty, otherwise fill the form with new values paying attention to respect the syntax.


List of packages Keep the default choice should be the best solution.


CRAN mirror You can set your preferred CRAN mirror. Keep the default choice could be the best solution.


Reset → Warning! This reset will unset the SESSION variable


This software has been developed in close collaboration with:

 **CAZALAC**
Centro de Agua para Zonas Áridas y Semidesérticas de América Latina y El Caribe

 **Universidad Nacional de Colombia**

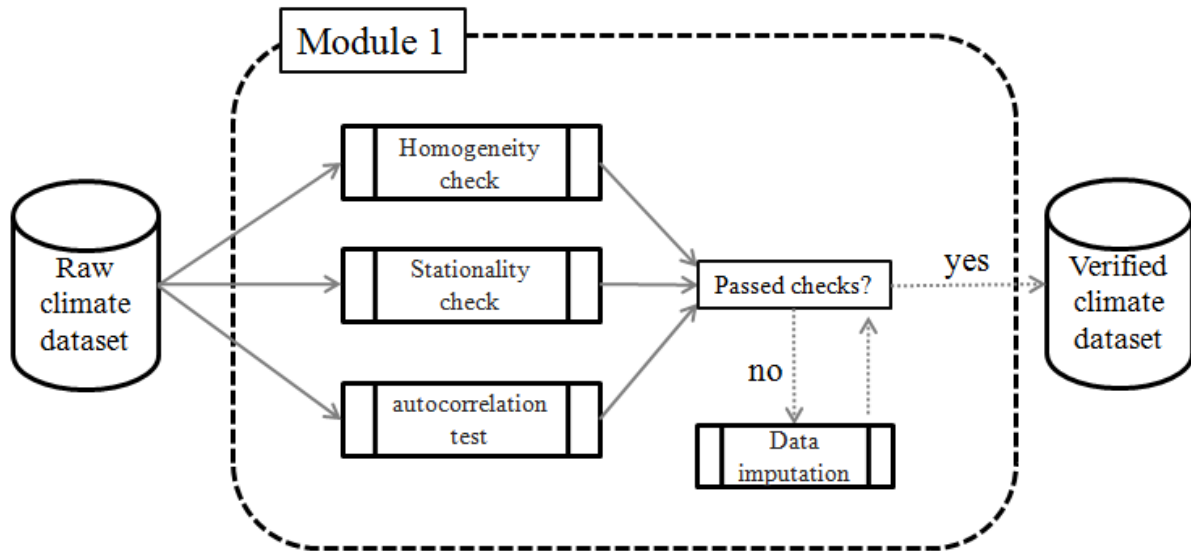
 **CIIFEN**

 **INSMET**
INSTITUTO DE METEOROLOGIA

 **TECNOLÓGICO DE MONTERREY**

REFRAN-CV Module 1

Module 1 performs a quality check in the dataset to verify potential bad values associated with data measurement errors. This module is also responsible for formatting the dataset provided by the user into a standard format to be used by the following modules.



The screenshot shows the web interface for the REFRAN-CV Module 1. At the top, it features logos for the European Commission, JOINT RESEARCH CENTRE, RALCEA EUROPE LATIN AMERICA, and EUROCLIMA. The main header reads 'Regional frequency analysis of climate variables' and 'Funded by the European Commission'. Below this, there's a navigation bar with 'Run by Module' and 'Run Process'. The current page is 'Module 1: Load data and preprocessing', with a 'REFRAN-CV PDF GUIDE' link and a 'STOP the application' button. The main content area is titled 'Configuration parameters for module 1' and includes a warning: 'Following information are automatically retrieved from the default configuration file. If default values fit your needs please leave fields empty, otherwise fill the form with new values paying attention to respect the sintax.' The form contains a 'Country Code' dropdown menu (with options ABW - Aruba, AFG - Afghanistan, AGO - Angola), 'Stations Database (CSV)' and 'Register Database (CSV)' fields with 'Browse...' buttons, and a 'Submit' button. A 'Reset' button is also present with a warning: 'Warning! This reset will unset the SESSION variable'. At the bottom, it lists collaborating institutions: CAZALAC, Universidad Nacional de Colombia, CIIFEN (Version 1.0-alpha2), INSMET INSTITUTO DE METEOROLOGIA, and TECNOLÓGICO DE MONTERREY.

REFRAN-CV Module 2

Module 2 has the objective of clustering stations into homogenous groups. A homogeneous group is defined by stations which data, after rescaling by the at-site mean, can be described by a common probability distribution.

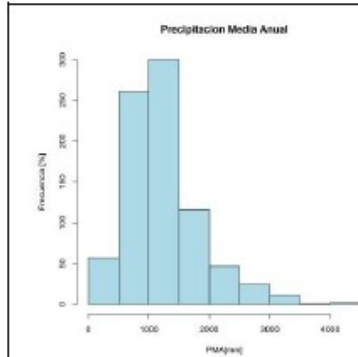
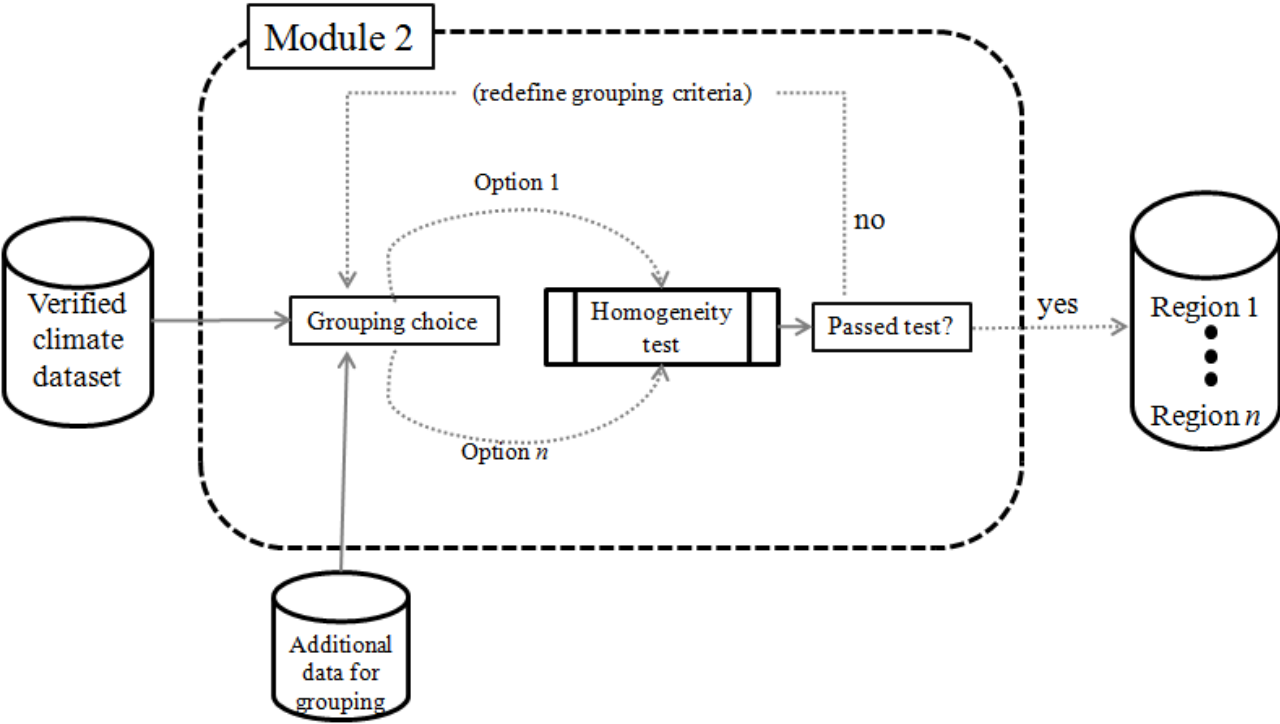


Figure 5: Mean Annual Precipitation (MAP) for Venezuela

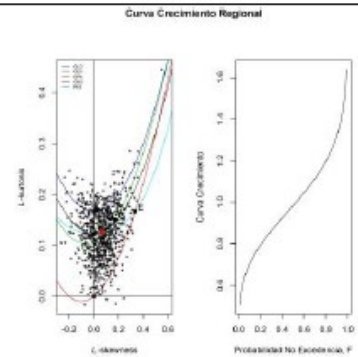


Figure 6: Growth curve

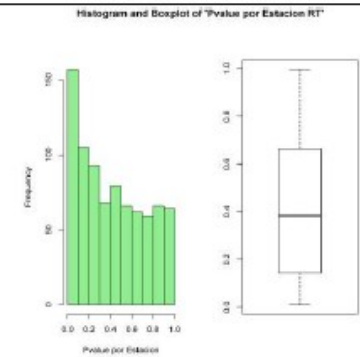


Figure 7: Stations' P-value

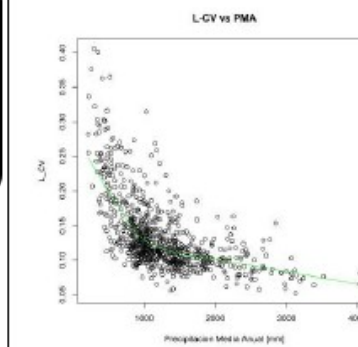


Figure 8: Scale/Dispersion (L-CV) vs. MAP

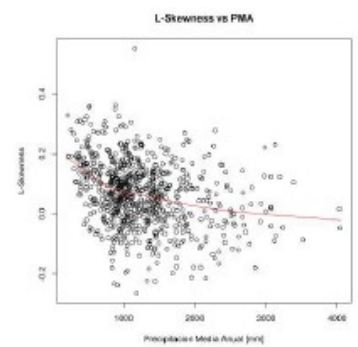


Figure 9: Skewness vs. MAP

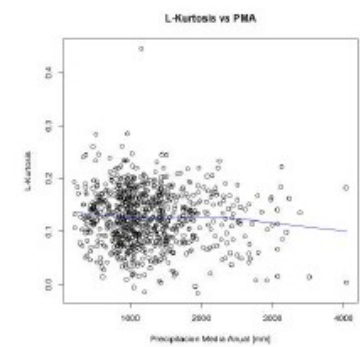
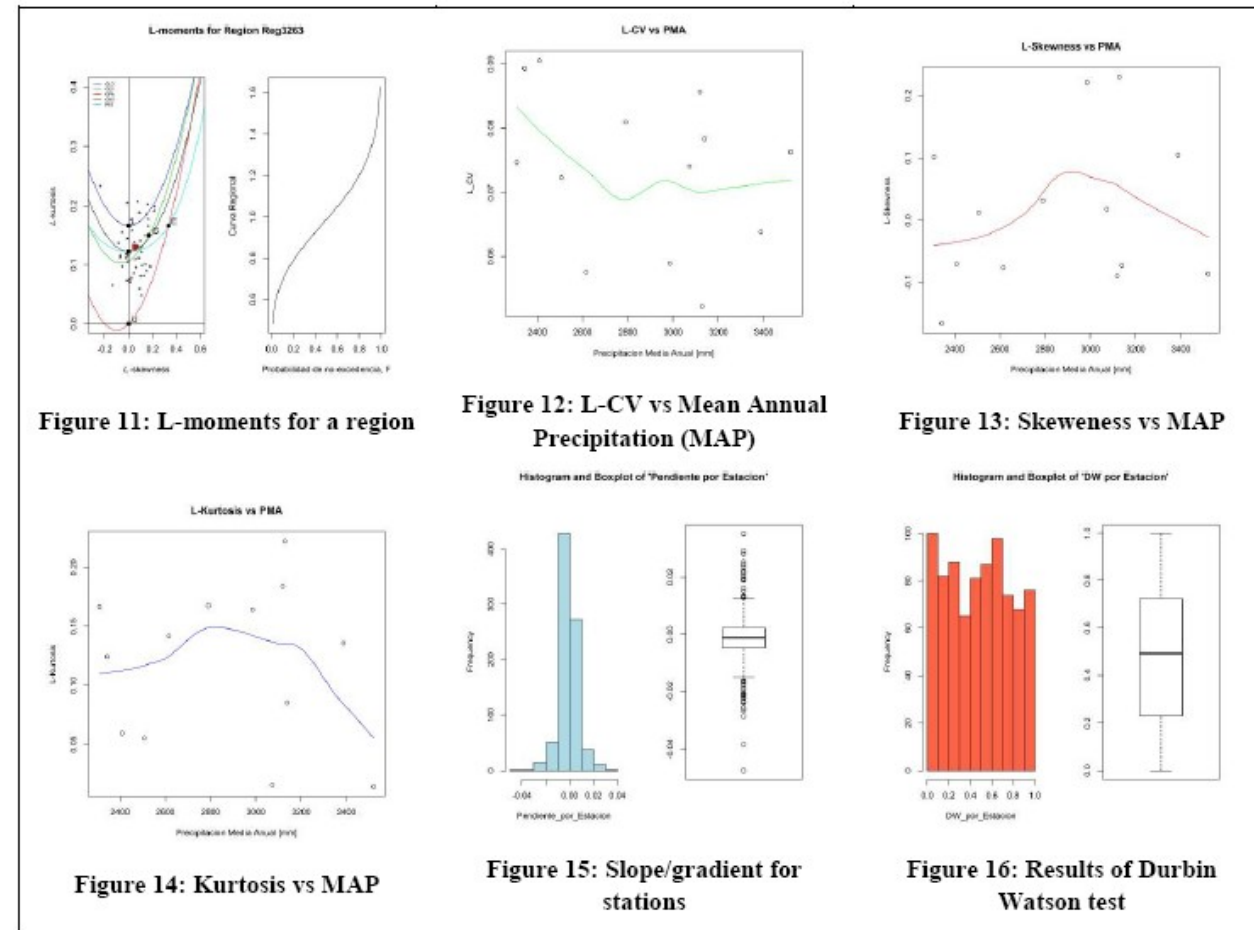
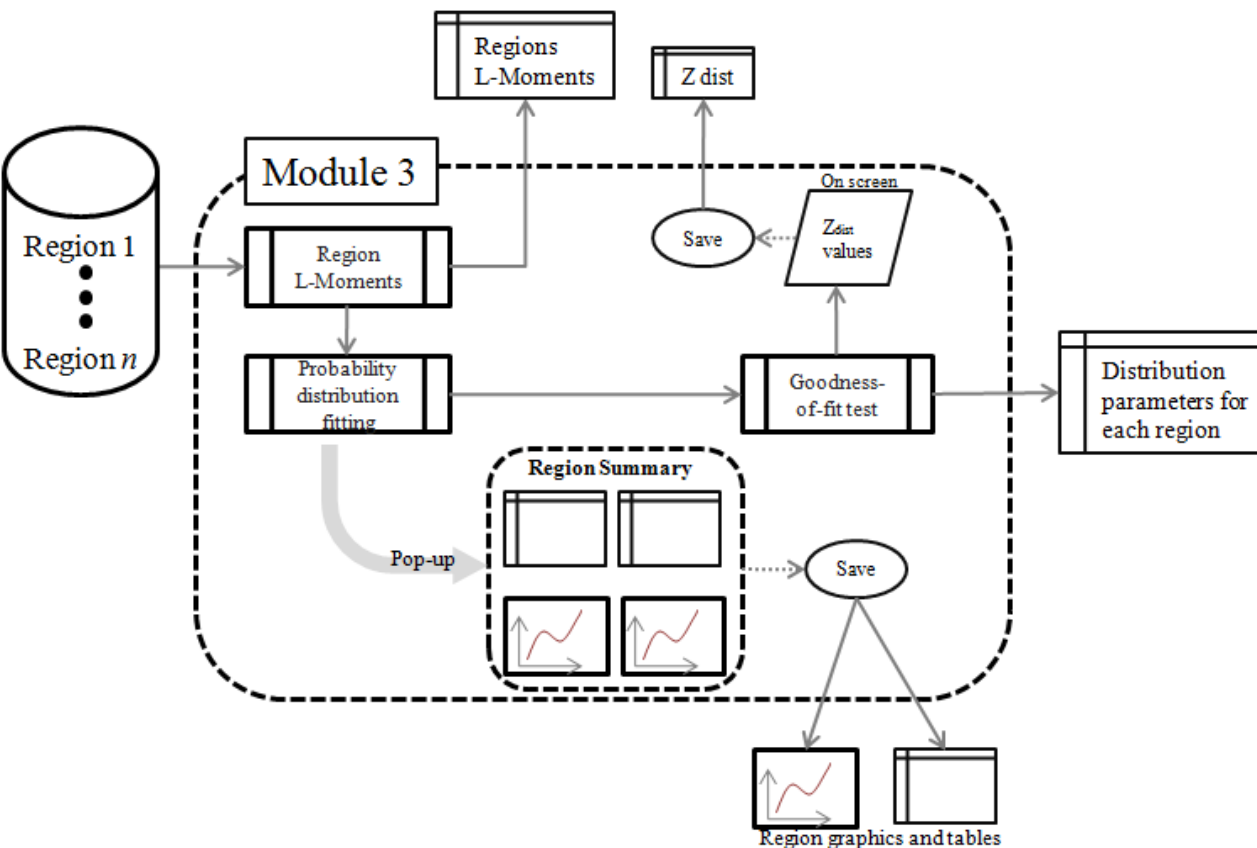


Figure 10: Kurtosis vs. MAP

REFRAN-CV Module 3

Module 3 performs the Regional Frequency Analysis (RFA) using the homogeneous regions, by selecting the probability distribution function for each homogeneous group. The selection of the best function is based on the goodness-of-fit test described by Hosking and Wallis (1997). After the best distribution is defined according to the test result, the user has the option of visualizing a popup window with a summary of the Region.



REFRAN-CV Module 4

In Module 3, the L-moments are defined for each station. In order to create spatially-explicit maps, this information needs to be interpolated to areas where no stations are available in the region. This procedure is done through a relationship between the L-moments and the Mean Annual Precipitation (MAP). Module 4 defines the parameters of the curves defining this relationship which will be used to create L-moment maps in Module 5.

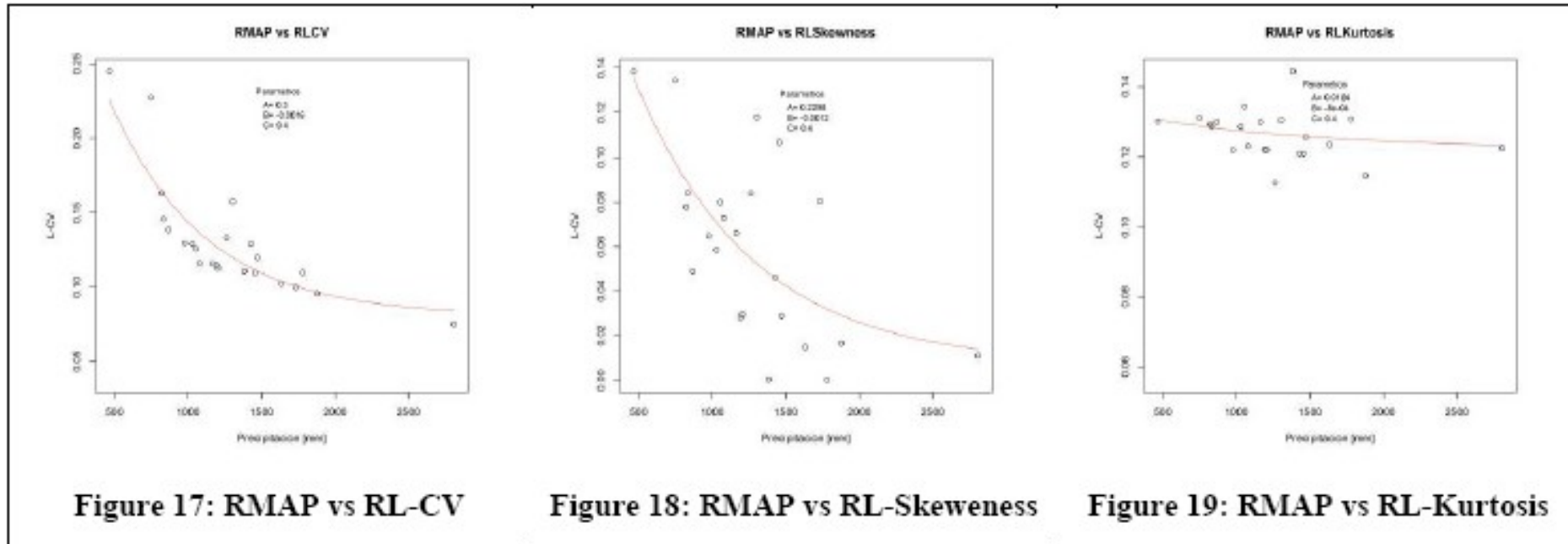
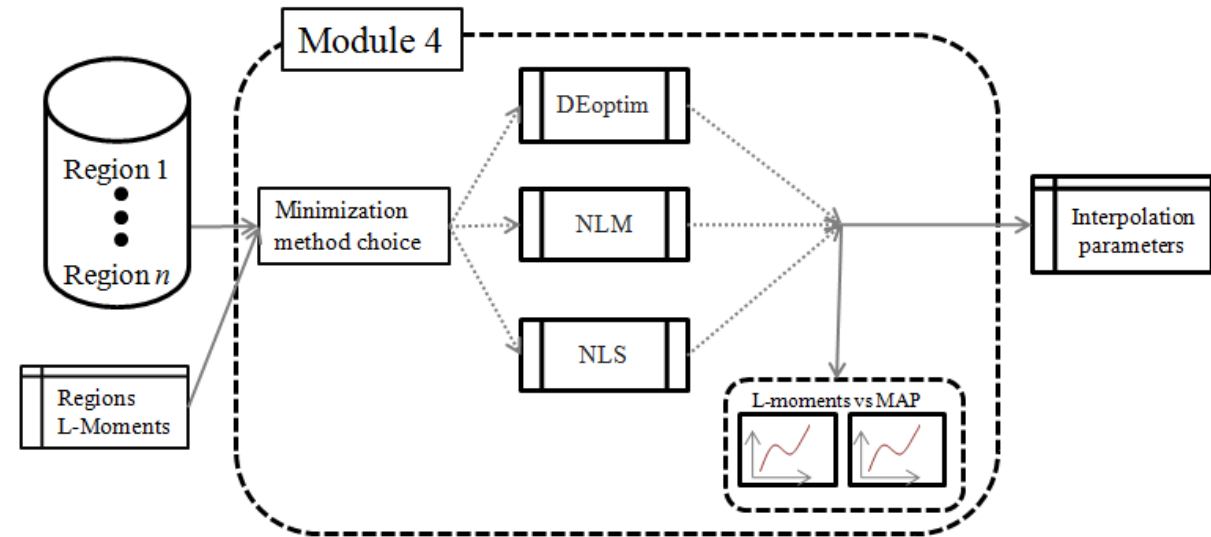


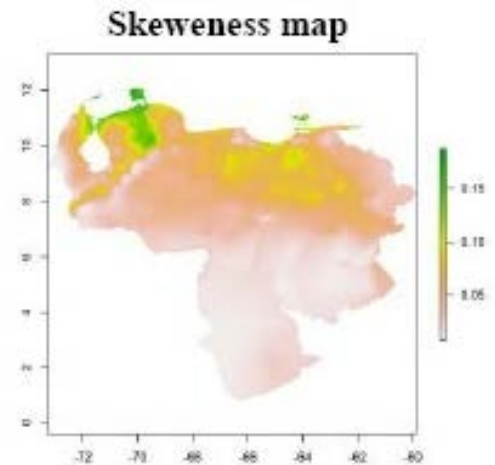
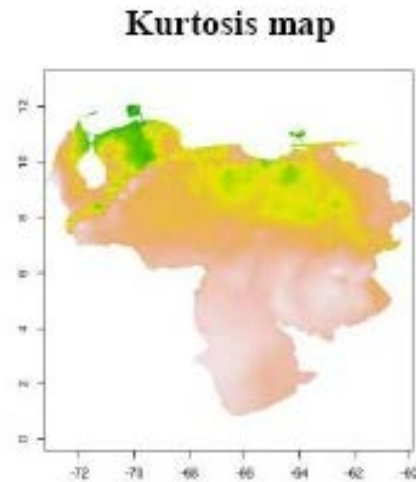
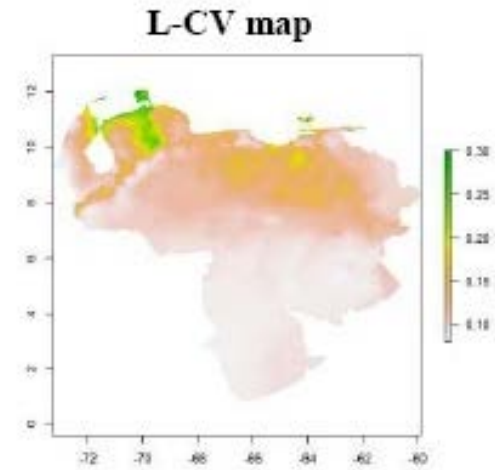
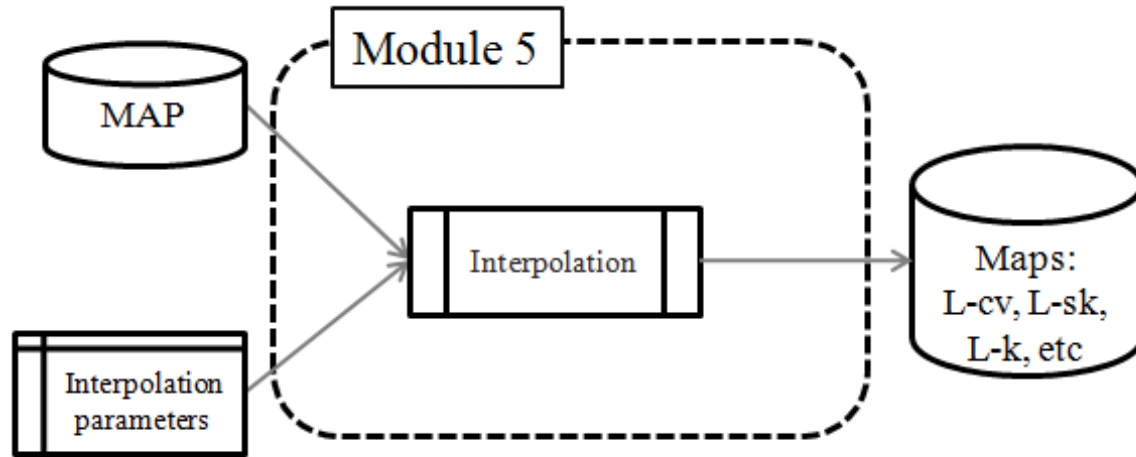
Figure 17: RMAP vs RL-CV

Figure 18: RMAP vs RL-Skewness

Figure 19: RMAP vs RL-Kurtosis

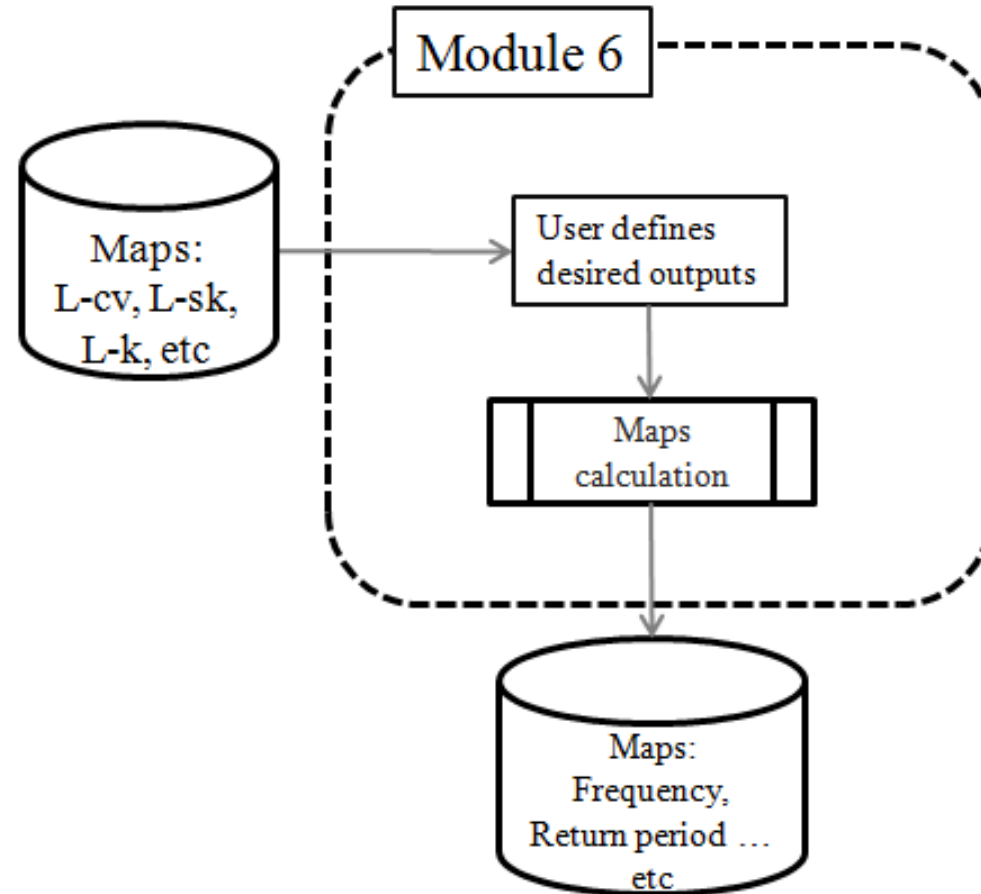
REFRAN-CV Module 5

In Module 5 the interpolation parameters are used to create L-moment maps based on an annual precipitation map provided by the user.



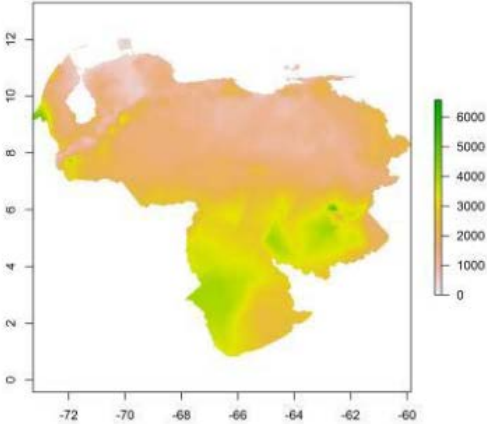
REFRAN-CV Module 6

Module 6 provides the final products of the software, that is to say, maps of precipitation frequency, return period, probability etc. The inputs for this module are basically the L-moment maps obtained from Module 5

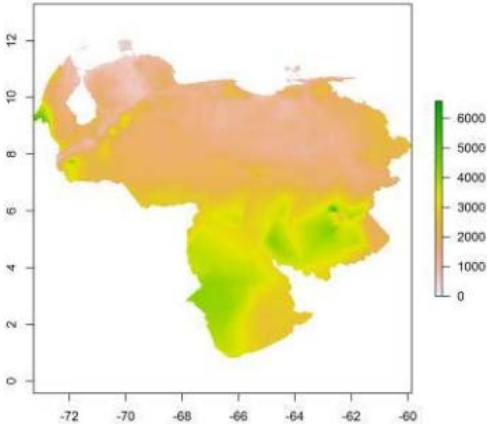


REFRAN-CV Module 6

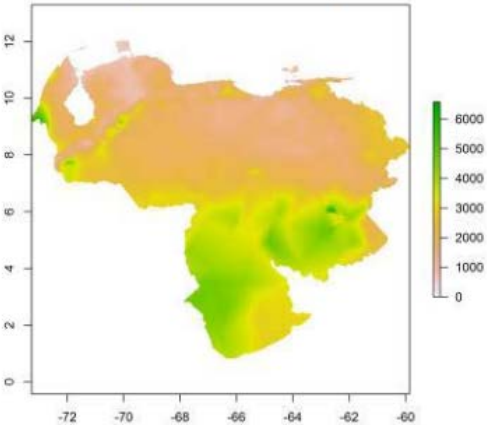
return period of 5 years



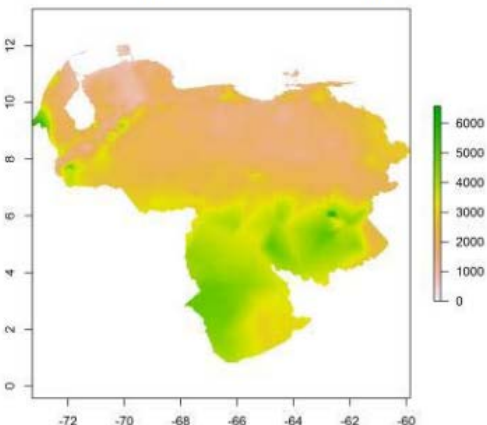
return period of 10 years



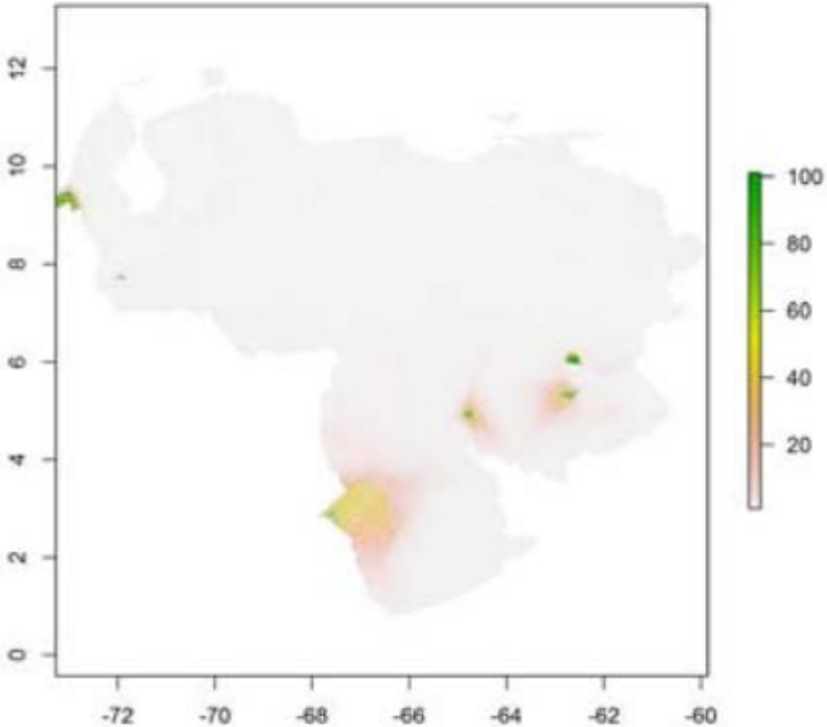
return period of 50 years



return period of 100 years



Return Period for a quantity of rain of 3000mm



Only for Return Period <= 100 years

Advantages of using REFRAN-CV

- User friendly interface design
- Software modularity
- Flexibility (Open source technologies)
- Distributed as Standalone Web Application
- Generation of output maps in different formats