RGeostats Manual

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Abstract

This document constitutes the users manual for the package RGeostats. It gives an overall presentation of the package, developed using R language. For a more detailed description of each function, the reader will refer to its on-line documentation. Finally some tutorials are also available in the standard RGeostats distribution which enable the interested user to run some examples on provided data sets. You should refer to the Getting Started manual for installation of RGeostats package.

1 History of the RGeostats package

The Geostatistics Team of Centre de Géosciences of Mines ParisTech spent several years developing different commercial libraries or software in the past. Let us mention:

- *GEOSLIB*: the first geostatistical library in FORTRAN
- *BLUEPACK*: a geostatistical package that lasted over 10 years and was famous in most mining and oil companies over the world
- *SIMPACK*: a package dedicated to geostatistical stochastic simulations
- *HERESIM*: a package, developed jointly with IFPEN, based on the Plurigaussian simulation technique
- *ISATIS*: the geostatistical toolbox, developed jointly and commercialized by Géovariances

It is therefore a tradition for the Centre de Géostatistique to imagine, produce and commercialize the algorithms developed by scientists so that practitioner can apply these fancy techniques to the different fields in their own domain of activity, without having to bother writing lines of code.

However, these packages do not allow the user to modify the code in order to test new ideas or algorithms. This is the reason why, starting in late 1990's,

some researchers started introducing some algorithms in the framework of the R package. This was initiated with the *GEFA* package developed for the fisheries community, which uses geostatistical techniques to forecast the fish density by species and age. The user could benefit from all the advantages due to the large number of contributors of R developers, combined to the procedures established by the researchers of the Centre de Géostatistique.

As usual with writing packages using the R interpreted language, the GEFA package needed to be strongly improved for improving the calculation speed. This usually involves writing pieces of the package in using a compiled language (such as C or C++).

For that reason, the package *RGeoS* was created in the year 2001 containing a set of R objects to manipulate data, parameters and results. The package *RGeoS* is based on a library of geostatistical code written in C (and C++) called *Geoslib*.

Recently, the package *RGeoS* has been renamed ***RGeostats*** during the year 2014 to better explain its contents and avoid conflict with packages with similar names.

The main characteristics of the RGeostats package is to perform geostatistical operations simultaneously on several (p) variables in a space of any dimension (n): we will designate this package as R_n-R_p package. However, some techniques are not defined for any space dimension, nor any number of variables treated simultaneously: a special test restricts their usage.

2 What is RGeostats ?

RGeostats is provided as a binary R package for Windows, Linux and Mac platform . It provides:

- all the R procedures with the corresponding on-line help (use the command *?func_name* to access the on-line help of the function *func_name*)
- the object library of the geostatistical code Geoslib
- some demonstration case studies: the user can run them using the command demo() with the available data sets.

Note that the *source code corresponding to the Geoslib library is not available.*

3 Who can use RGeostats ?

RGeostats can be downloaded by anyone.

RGeostats can be used free of charge in a non-commercial use.

4 The reference to RGeostats

When you use this software for publication, please use the following reference:

Renard D., Bez N., Desassis N., Beucher H., Ors F., Freulon X.
RGeostats: The Geostatistical package [version number].
MINES ParisTech.
Free download from: http://cg.ensmp.fr/rgeostats

5 Where can I find RGeostats ?

The package RGeostats must be downloaded from the web site of the Centre de Géosciences of Mines ParisTech:

`http://cg.ensmp.fr/rgeostats`

This site contains several directories, such as:

- the user community Board where you can:
  - Download RGeostats package (according to the Operating System where you want to use the package): this operation requires that you register to the Board first
  - Ask any question about any issue you may encounter
  - Learn on how to use specific parts of the package by reviewing the corresponding Tutorial
- the Documentation directory where you can find several case studies provided as vignettes
- the Demo directory where you can find several demonstration scripts
- the Function directory where you can find the on-line help for all functions

The package is provided for few platforms. For each platform, RGeostats is provided as a single file in an archive format. The extension of the archive file depends upon the platform:

- *Windows* 32 or 64 bits: file with extension *zip*
- *LINUX 32-bits*: file with extension *linux32.tar.gz*
- *LINUX 64-bits*: file with extension *linux64.tar.gz*
- *Mac*: file with extension *tgz*

6 Installing the RGeostats package

6.1 Installing R

The package R must be installed first. R is a free software environment for statistical computing and graphics. It compiles and runs on a wide variety of UNIX platforms, Windows and MacOS. This package can be downloaded from the site:

```
http://cran.r-project.org
```

If available for your Operating System, it is easier to install directly the dedicated binary version. Otherwise, one can always download the source code, configure it and compile it. Then please follow official information provided on the site.

The installation requires the Administrator rights.

6.2 Required package

The package Rcpp is required and can be downloaded from the CRAN web site.

6.3 Additional contributions

Moreover, some additional contributions can be downloaded (from the same site): such as *maps* and *mapproj* which are only necessary in some parts of the package *RGeostats* and will be only needed upon request.

Each extension comes as an archive file.

6.4 Installing an additional contribution

When installing a package, one may choose between:

- installing it as a permanent extension of R: this operation requires the Administrator rights as the RGeostats add-on package is written on the directory where R distribution is installed. The installation is performed by typing:

  ```
  R CMD INSTALL mypack
  ```

- installing it as a personal extension: this is the case when an extension often varies. This installation does not require the Administrator rights. The package is installed on a user's dedicated directory (say *my_dir*) by typing:

  ```
  R CMD INSTALL mypack --library=my_dir
  ```

7 Getting started with RGeostats

7.1 Loading the package

You must first start R in a working directory. You may have one working directory by project. You launch R by typing the corresponding command (or clicking the corresponding icon on Windows for example)

Within the R session, you must load the RGeostats. If RGeostats has been installed in the R distribution directory, simply type:

```
library(RGeostats)
```

Otherwise type:

```
library(RGeostats,lib.loc=/my_dir)
```

This information can be stored in a specific (hidden) file, called *.First*, which is automatically started each time R is loaded in the working directory.

In order to create it, the best solution is to enter the R session and to define it interactively by typing:

```
fix(.First)
```

The previous command launches a text editor. The name of the text editor can also be parametrized in the *.First* file for future use.

The contents of the .First file could be something as :

```
.First
function ()
{
  library(RGeostats,lib.loc="/my_dir")
}
```

7.2 Additional information on RGeostats

When RGeostats is loaded successfully, the user can check the version of the RGeostats package. This information may become useful for further discussion concerning the ability of the package to perform a given task or to describe a mys-functioning:

```
acknowledge("RGeostats")
```

The following message is displayed (which may evolve with time):

```
Package RGeostats (Version:XX.X.X - Date:mm,dd,yy)
==================================================

Geoslib Library (Version:XX.X.X - Date:mm,dd,yy)
Authors:
Didier RENARD      (didier.renard@mines-paristech.fr)
Nicolas BEZ        (nicolas.bez@ird.fr)
Nicolas DESASSIS   (nicolas.desassis@mines-paristech.fr)
Helene BEUCHER     (helene.beucher@mines-paristech.fr)
Fabien ORS         (fabien.ors@mines-paristech.fr)
Xavier FREULON     (xavier.freulon@mines-paristech.fr)
```

Another interesting function (R standard) gives the position where the package has been loaded by typing:

```
search()
```

The following information is obtained in the R session (the contents depends upon the R version, the user's environment and the list of packages already loaded):

```
 [1] ".GlobalEnv"        "package:RGeostats" "package:Rcpp"
 [4] "package:stats"     "package:graphics"  "package:grDevices"
 [7] "package:utils"     "package:datasets"  "package:methods"
[10] "Autoloads"         "package:base"
```

The order of the loaded packages may vary depending on the user's preferences. It is easy to see that here RGeostats is loaded in position 2.

The user can then type the following command in order to get the list of all the procedures included in RGeostats:

```
ls(pos=2)
```

Another way to learn about each command (say my_command) is to ask for its calling arguments by typing:

```
args(my_command)
```

But obviously the best solution is to get the information on the command by typing:

```
?my_command
```

The information can even be displayed in a more sophisticated manner is the user has launched a HTML browser beforehand by typing the following command at least once in the R session:

```
help.start()
```

Have fun !!!.