geotopbricks

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Who am I?

- Environmental engineer with hydraulic and hydrological background (more deterministic and physicall-based than statics!)
- Some skills in programming and a R entusiast which I use to work with hydro-climatic data.
- Find me as @ecor on GitHub
- I'm self-employed and freelancer as www.rendena100.eu .
- Author of several R-packages and p

Who are the other authors?

- Hydrologist „, BLA
- Author of several packages, including `geotop`,. . .

Hydrology

Scientific study of the movement, distribution, and quality of water on Earth water cycle, water resources and environmental watershed sustainability.

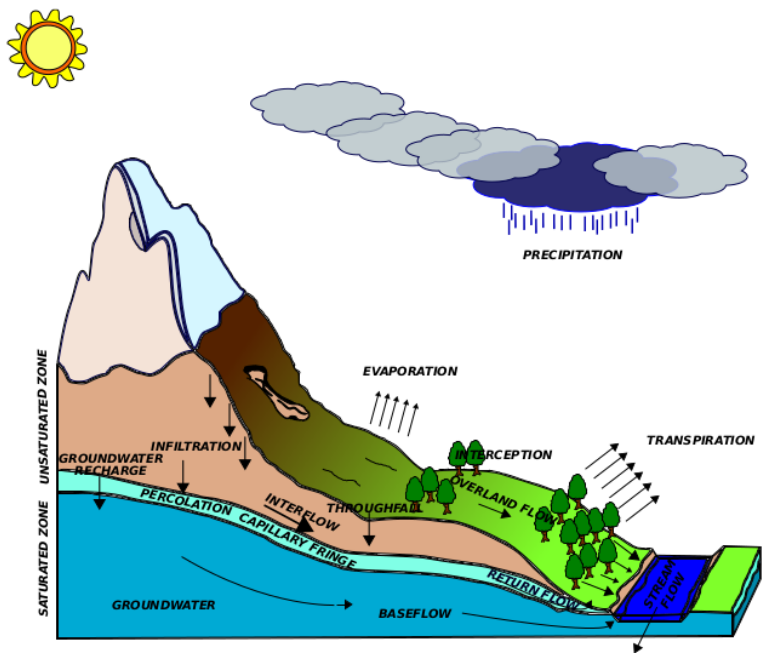


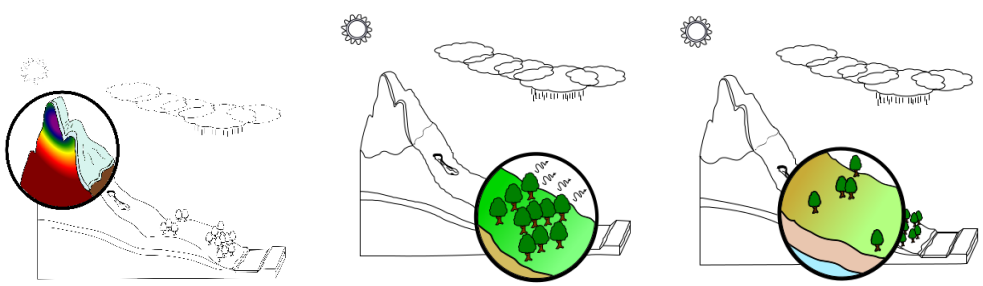
Figure 1: image

Soil Water Balance

GEOtop Hydrological Model

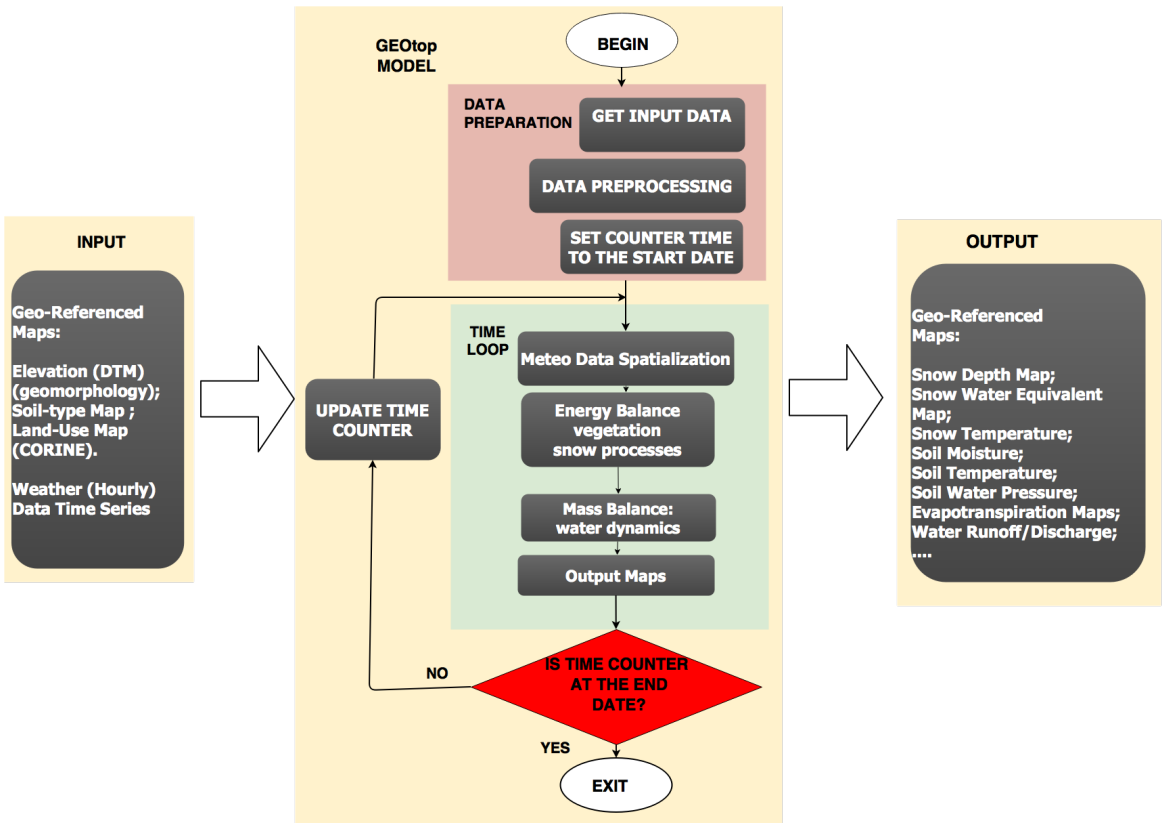
GEOtop is an integrated hydrological model that simulates:

- water flow in the soil $\rightarrow$ Richards' eq (sub) + Kinematic eq (sur)
- energy exchange with the atmosphere $\rightarrow$ full integration of equation



Hydrological Model

- Input: meteo data, elevations, soil parameters
- Output: snow cover, soil temperature, soil moisture



##

GEOtop model}%{Optional Subtitle

Water and energy budgets can be activated :

GEOtop external extensions

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GEOtop

placeholder

GEOtop configuration File (geotop.inpts)

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GEOtop configuration File (geotop.inpts)

A GEOtop simulation is organized in a set of files within a directory. This directory contains:

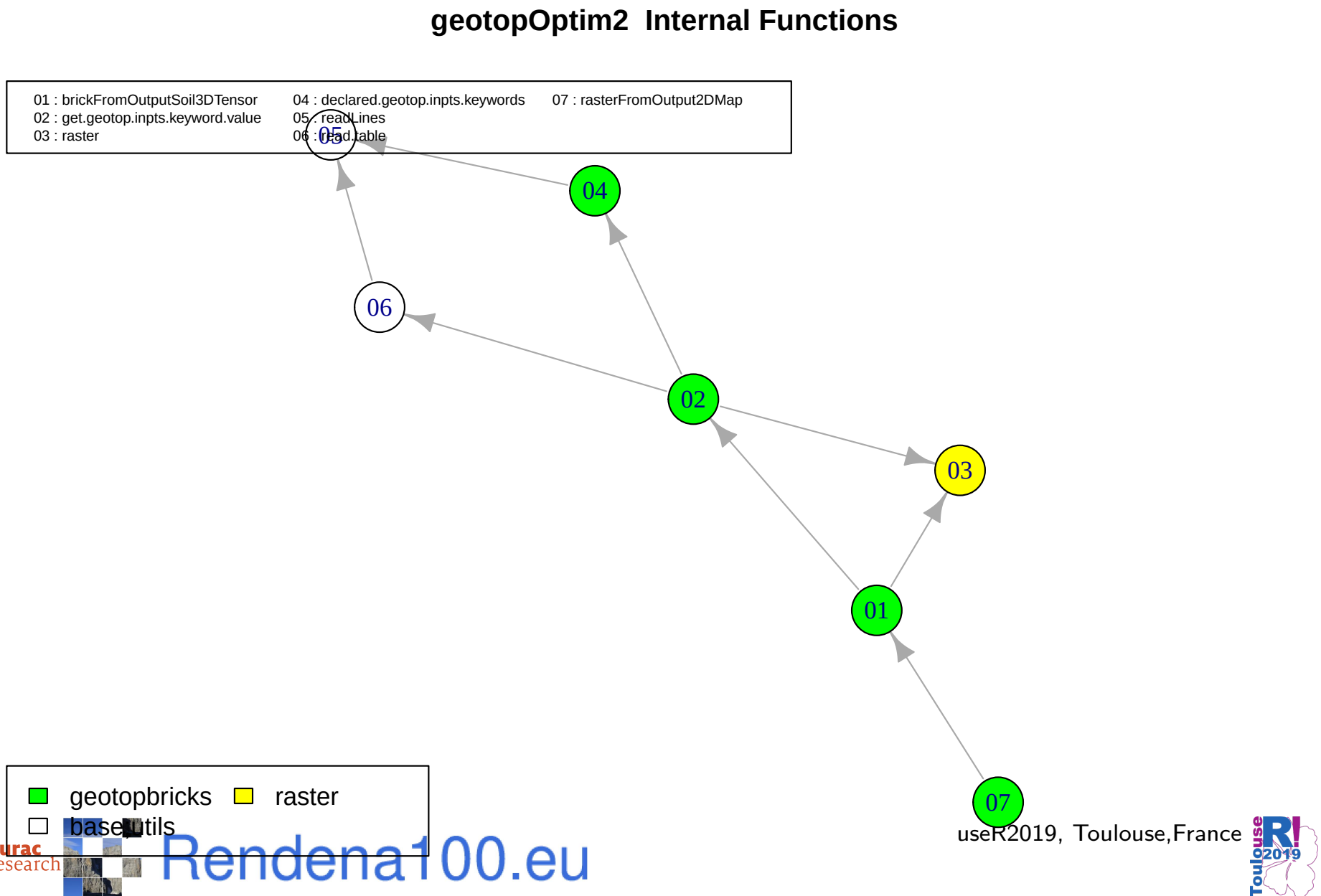
-**input files** (meteorological forcings, topography, land-use, soil-type maps, initial conditions); **target information** (which results are requested) ; - **observations**. Allthese information are written in a file called `geotop.inpts`, which is a list of **keyword-value** pairs:

```
InitDateDDMMYYYYhhmm     =   09/04/2014 18:00
EndDateDDMMYYYYhhmm      =   01/01/2016 00:00
[...]
MeteoFile                =   "meteoB2_irr"
PointOutputFile          =   "tabs/point"
```

Simulation of soil water budget in an alpine site

GOtop is applied to estimate soil water content in two soil columns below two hydro-meteorological stations (B2 and P2) located in Val Mazia/Match, Malles Venosta/Mals Vinschgau, in South Tyrol, Italy (LOng Term Reasearch Ecological Area, [http://lter.eurac.edu/en]).

Geotopbricks Graph



Simulation of soil water budget in an alpine site

Here is the directory containing files of B2 point simulation:

```
library(geotopbricks)

## SET GEOTOP WORKING DIRECTORY
wpath_B2 <- "resources/simulation/Matsch_B2_Ref_007"
##writeLines(list.files(wpath_B2))
```

Getting simulation input data

Meteorological variable time series are imported and saved as 'meteo' variable (class 'zoo'). This variable is retrieved through the GEOtop keyword **MeteoFile** :

```
tz <- "Etc/GMT-1"
meteo <- get.geotop.inpts.keyword.value(
  "MeteoFile",
  wpath=wpath_B2,
  data.frame=TRUE,
  tz=tz)
class(meteo)
```

```
## [1] "zoo"
```

Verifying that import of simulation input data has succeed

Meteorological time series once imported are available in the R environment:

```
head(meteo[12:14,c("Iprec","WindSp","WindDir")])
```

```
##                      Iprec WindSp WindDir
## 2009-10-02 11:00:00     0   3.63  339.75
## 2009-10-02 12:00:00     0   2.75  328.48
## 2009-10-02 13:00:00     0   2.74  311.28
```

```
head(meteo[12:14,c("RelHum","AirT","Swglobal")])
```

```
##                      RelHum  AirT Swglobal
## 2009-10-02 11:00:00  31.45 12.38   396.02
## 2009-10-02 12:00:00  30.50 13.12   500.07
## 2009-10-02 13:00:00  30.20 13.96   564.02
```

Plotting

```
library(ggplot2)
```

Getting output simulation data

Soil Water Content Profile:

```
tz <- "Etc/GMT-1"
SWC_B2  <- get.geotop.inpts.keyword.value(
  "SoilLiqContentProfileFile",
  wpath = wpath_B2,
  data.frame = TRUE,
  date_field = "Date12.DDMMYYYYhhmm.",
  tz = tz,
  zlayer.formatter = "z%04d"
)
help(get.geotop.inpts.keyword.value) ## for more details!
```

P2

The same for P2:

```
wpath_P2 <- "resources/simulation/Matsch_P2_Ref_007"
SWC_P2  <- get.geotop.inpts.keyword.value(
  "SoilLiqContentProfileFile",
  wpath = wpath_P2,
  data.frame = TRUE,
  date_field = "Date12.DDMMYYYYhhmm.",
  tz = "Etc/GMT-1",
  zlayer.formatter = "z%04d")
```

Data Reformatting

```
class(SWC_B2)
```

```
## [1] "zoo"
```

```
SWC_B2 <- cbind(time=index(SWC_B2),as.data.frame(SWC_B2))
class(SWC_B2)
```

```
## [1] "data.frame"
```

```
names(SWC_B2)
```

```
##   [1] "time"   "z0001" "z0002" "z0003" "z0004" "z0006" "z0
##   [9] "z0018" "z0023" "z0028" "z0035" "z0045" "z0055" "z0
## [17] "z0093"
```

```
###knitr::kable(head(SWC_B2))
```

Stuff

Hydrological models are solvers of the differantial equations of water flows and water thermodymanics in the Earth associated to heat transfers between Earth and the low atmosphere. They are a simplification of a real-world system useful to understand, predict, manage water resources. "integrated"

Computation

LOREM IPSUM:

- getting your data in the right shape (e.g. `tidyverse`, `recipes`)
- getting your data in the right shape (e.g. `tidyverse`, `recipes`)
- lorem ipsum

Interested?

www.geotop.org

Thank you for your attention! / Merci pour votre attention!

Addendum

LOREM IPSUM