

# Package: rosettaPTF (via r-universe)

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**Title** R Frontend for Rosetta Pedotransfer Functions

**Version** 0.2.0

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**Description** Access the rosetta-soil Python pedotransfer functions from R. Rosetta is a neural network-based model for predicting unsaturated soil hydraulic parameters from basic soil characterization data (sand, silt, clay, bulk density, and water content). Predictions are made for the van Genuchten unsaturated hydraulic properties model, with uncertainty quantification via bootstrap ensemble. Designed for efficient batch processing of large datasets through vectorized computation and optional parallel processing.

**Config/reticulate** list( packages = list( list(package = ``numpy"),  
list(package = ``rosetta-soil") ) )

**License** GPL (>= 2)

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**LazyData** true

**Roxygen** list(markdown = TRUE)

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**Depends** R (>= 3.5)

**URL** <https://github.com/ncss-tech/rosettaPTF>,  
<https://ncss-tech.github.io/rosettaPTF/>

**BugReports** <https://github.com/ncss-tech/rosettaPTF/issues>

**Imports** parallel, reticulate, terra

**Suggests** litedown, testthat

**VignetteBuilder** litedown

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**Repository** <https://ncss-tech.r-universe.dev>

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| ann_predict | <i>Extended Rosetta Predictions, Parameter Distributions and Summary Statistics after Zhang &amp; Schaap (2017)</i> |
|-------------|---------------------------------------------------------------------------------------------------------------------|

---

**Description**

Extended *Rosetta* Predictions, Parameter Distributions and Summary Statistics after Zhang & Schaap (2017)

**Usage**

```
ann_predict(object, soildata, sum_data = TRUE)

## Default S3 method:
ann_predict(object, soildata, sum_data = TRUE)

## S3 method for class 'Rosetta'
ann_predict(object, soildata, sum_data = TRUE)
```

**Arguments**

|          |                                                                                        |
|----------|----------------------------------------------------------------------------------------|
| object   | <i>Rosetta</i> object containing class instance (e.g. from <code>Rosetta()</code> )    |
| soildata | A list containing vectors; with number of parameters matching the model type of object |
| sum_data | Default: TRUE                                                                          |

**Examples**

```
# ann_predict(Rosetta(), list(c(30, 30, 40, 1.5), c(55, 25, 20, 1.1)))
```

find\_python

*Heuristics to Find Python***Description**

If you are using the {rosettaPTF} package for the first time you will need to have Python installed to obtain the necessary modules. You can set up {reticulate} to install into a virtual or Conda environment. Usually {reticulate} should cover most or all of the setup.

**Usage**

```
find_python(
  envname = NULL,
  pypath = NULL,
  arcpy_path = getOption("rosettaPTF.arcpy_path")
)
```

**Arguments**

|            |                                                                                                                                                                                                                                                                                                                                                            |
|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| envname    | As in <code>reticulate::py_install()</code> : The name, or full path, of the environment in which Python packages are to be installed. When <code>NULL</code> (the default), the active environment as set by the <code>RETICULATE_PYTHON_ENV</code> variable will be used; if that is unset, then the <code>r-reticulate</code> environment will be used. |
| pypath     | Optional: Path to python executable                                                                                                                                                                                                                                                                                                                        |
| arcpy_path | Optional: Path to ArcGIS Pro Python installation. For example: <code>"C:/Program Files/ArcGIS/Pro/bin/Python"</code> . Set as <code>NULL</code> to prevent use of ArcGIS Pro instance.                                                                                                                                                                     |

**Details**

If you have Python set up correctly you should be able to run `reticulate::py_config()` or `reticulate::py_discover_config()` and discover your shared library.

A common problem with {reticulate} is not pointing at the correct (or any) python binary or libpython shared library. Use `reticulate::use_python("/path/to/python", required = TRUE)` to set the path or, alternately, be sure python can be found on your `PATH`. {reticulate} has a preference for Python environments that have numpy installed.

**Windows / Miniconda:**

Use `reticulate::install_miniconda()` if you'd like to install a Miniconda Python environment. Conda is default on Windows.

For devices with limited ability to install new software that have ArcGIS Pro installed (some USDA computers), this method can look for a Python installation in `"C:/Program Files/ArcGIS/Pro/bin/Python/envs/"` and Conda executable in `"C:/Program Files/ArcGIS/Pro/bin/Python/Scripts"`. The base file path to "Python" directory can be customized using the `arcpy_path` argument.

**Linux and OS X:**

On Linux and OS X you can create a virtual environment using `reticulate::virtualenv_create()`. The default environment name will be "r-reticulate".

**Value**

character path to python or NULL if no suitable environment can be found. The result is stored as the package option `rosettaPTF.python_path`.

**Examples**

```
find_python()
```

---

|                                 |                                            |
|---------------------------------|--------------------------------------------|
| <code>get_rosetta_module</code> | <i>Get Rosetta module object reference</i> |
|---------------------------------|--------------------------------------------|

---

**Description**

Get Rosetta module object reference

**Usage**

```
get_rosetta_module()
```

**Value**

An R object wrapping a Python module. Module attributes can be accessed via the `$` operator, or via `py_get_attr()`.

---

|                              |                                       |
|------------------------------|---------------------------------------|
| <code>install_rosetta</code> | <i>Install Rosetta Python package</i> |
|------------------------------|---------------------------------------|

---

**Description**

Wrapper around `reticulate::py_install()` to install the Rosetta Pedotransfer Function Python package

Usage

```
install_rosetta(  
    envname = NULL,  
    method = "auto",  
    conda = "auto",  
    pip = TRUE,  
    user = FALSE,  
    upgrade = TRUE,  
    system = FALSE,  
    arcpy_path = getOption("rosettaPTF.arcpy_path")  
)
```

Arguments

|            |                                                                                                                                                                                                                                                         |
|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| envname    | The name, or full path, of the environment in which Python packages are to be installed. When NULL (default), the active environment (RETICULATE_PYTHON_ENV variable) will be used; if that is unset, then the "r-reticulate" environment will be used. |
| method     | "auto", "virtualenv", or "conda"; Default: "auto"                                                                                                                                                                                                       |
| conda      | Default: "auto"                                                                                                                                                                                                                                         |
| pip        | <i>logical.</i> Use pip for package installation? Default: TRUE. This is only relevant when Conda environments are used, as otherwise packages will be installed from the Conda repositories.                                                           |
| user       | <i>logical.</i> Default: FALSE. Pass --user flag. This should only be done if other installation methods fail and it is impossible to use a virtual environment.                                                                                        |
| upgrade    | <i>logical.</i> Install latest versions of Python packages by passing --upgrade flag? Default: TRUE.                                                                                                                                                    |
| system     | <i>logical.</i> Default: FALSE. If TRUE, try installing to system (user) site library with system() and set reticulate to use system Python.                                                                                                            |
| arcpy_path | Argument passed to find_python(). Path to ArcGIS Pro Python installation e.g. ". Set as NULL (default) to prevent use of ArcGIS Pro instance.                                                                                                           |

Details

From reticulate::py\_install(): On Linux and OS X the "virtualenv" method will be used by default ("conda" will be used if virtualenv isn't available). On Windows, the "conda" method is always used.

---

|            |                                           |
|------------|-------------------------------------------|
| MUKEY_PROP | Sample SSURGO Mapunit Properties by mukey |
|------------|-------------------------------------------|

---

Description

Sample SSURGO Mapunit Properties by mukey

---

|           |                                                                         |
|-----------|-------------------------------------------------------------------------|
| MUKEY_WCS | <i>Sample SSURGO Mapunit Web Coverage Service Data: matrix of mukey</i> |
|-----------|-------------------------------------------------------------------------|

---

### Description

Sample SSURGO Mapunit Web Coverage Service Data: *matrix* of mukey

---

|                 |                                                                                         |
|-----------------|-----------------------------------------------------------------------------------------|
| predict.Rosetta | <i>Predict Rosetta Parameter Values and Standard Deviations from a Rosetta instance</i> |
|-----------------|-----------------------------------------------------------------------------------------|

---

### Description

Predict Rosetta Parameter Values and Standard Deviations from a *Rosetta* instance

### Usage

```
## S3 method for class 'Rosetta'
predict(object, soildata, ...)
```

### Arguments

|          |                                                                                        |
|----------|----------------------------------------------------------------------------------------|
| object   | <i>Rosetta</i> object containing class instance (e.g. from Rosetta())                  |
| soildata | A list containing vectors; with number of parameters matching the model type of object |
| ...      | not used                                                                               |

### Value

A list containing mean and stdev matrices (one row per sample).

For rosetta-soil >= 0.3, the columns are: theta\_r, theta\_s, alpha, npar, ksats. Note that these parameters are in the scale produced by the underlying model (often log10 for alpha, npar, and ksats).

### Examples

```
# predict(Rosetta(), list(c(30, 30, 40, 1.5), c(55, 25, 20, 1.1)))
```

---

predict.UnsaturatedK    *Predict K0 and L from retention parameters*

---

### Description

Predict K0 and L from retention parameters

### Usage

```
## S3 method for class 'UnsaturatedK'
predict(object, retc_params, ...)
```

### Arguments

|             |                                                                          |
|-------------|--------------------------------------------------------------------------|
| object      | <i>UnsaturatedK</i> object                                               |
| retc_params | A list or matrix of retention parameters (theta_r, theta_s, alpha, npar) |
| ...         | not used                                                                 |

### Value

a data.frame with log10\_K0\_mean, lpar\_mean, log10\_K0\_sd, lpar\_sd

---

rosesoil    *Run rosesoil() from rosetta-soil >= 0.3.0*

---

### Description

Run rosesoil() from rosetta-soil >= 0.3.0

### Usage

```
rosesoil(soildata, rosetta_version = 3, estimate_type = "arith", vars = NULL)
```

### Arguments

|                 |                                                                                                                                                                                                                                                                                                                                                                                                       |
|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| soildata        | A list of numeric vectors or a data.frame (3-6 columns: sand, silt, clay, optionally bulk density, th33, and th1500)                                                                                                                                                                                                                                                                                  |
| rosetta_version | integer, 1-3. Default: 3                                                                                                                                                                                                                                                                                                                                                                              |
| estimate_type   | <i>character</i> . One of "arith" (default), "log", or "geo". Only used if rosetta-soil >= 0.3.1. "log" returns parameters on a logarithmic (log10) scale for alpha, npar, ksats, and k0. "geo" returns the geometric mean of bootstrap estimates (exponent of the mean of log-transformed values). This is often preferred for parameters that vary by orders of magnitude, such as alpha and ksats. |
| vars            | optional column name mapping (same as run_rosetta)                                                                                                                                                                                                                                                                                                                                                    |

**Value**

a data.frame with all RosettaResult fields

---

|         |                                                                     |
|---------|---------------------------------------------------------------------|
| Rosetta | <i>Make a Rosetta object instance for running predict() methods</i> |
|---------|---------------------------------------------------------------------|

---

**Description**

Make a Rosetta object instance for running predict() methods

**Usage**

```
Rosetta(rosetta_version = 3, model_code = 3)
```

**Arguments**

- |                 |                                                                                  |
|-----------------|----------------------------------------------------------------------------------|
| rosetta_version | Default: 3                                                                       |
| model_code      | One of 2, 3, 4, 5, or -1. Corresponding to options described in <i>Details</i> . |

**Details**

**Explanation of Model Codes:**

- 2: sand, silt, clay ("SSC")
- 3: sand, silt, clay + bulk density ("BD")
- 4: sand, silt, clay + bulk density + field capacity water content (1/3 bar or 33 kPa tension)
- 5: sand, silt, clay + bulk density + field capacity water content + wilting point water content (15 bar or 1500 kPa tension)
- -1: no result returned, inadequate or erroneous data

**Value**

an instance of the Rosetta class defined by the Python module; suitable for running predict or ann\_predict methods.

---

rosetta\_module\_available

*Check if Rosetta module is available for import from local Python environment*

---

### Description

Check if Rosetta module is available for import from local Python environment

### Usage

```
rosetta_module_available()
```

### Value

*logical*

---

run\_rosetta.default     *Run rosetta() method from Python module*


---

### Description

Run rosetta() method from Python module

### Usage

```
## Default S3 method:
run_rosetta(
  soildata,
  vars = NULL,
  rosetta_version = 3,
  estimate_type = "log",
  ...
)

## S3 method for class 'data.frame'
run_rosetta(
  soildata,
  vars = NULL,
  rosetta_version = 3,
  estimate_type = "log",
  ...
)

## S3 method for class 'matrix'
```

```
run_rosetta(  
  soildata,  
  vars = NULL,  
  rosetta_version = 3,  
  estimate_type = "log",  
  ...  
)  
  
## S3 method for class 'RasterStack'  
run_rosetta(  
  soildata,  
  vars = NULL,  
  rosetta_version = 3,  
  estimate_type = "log",  
  cores = 1,  
  core_thresh = 20000L,  
  file = paste0(tempfile(), ".tif"),  
  nrows = nrow(soildata)/(terra::ncell(soildata)/core_thresh),  
  overwrite = TRUE  
)  
  
## S3 method for class 'RasterBrick'  
run_rosetta(  
  soildata,  
  vars = NULL,  
  rosetta_version = 3,  
  estimate_type = "log",  
  cores = 1,  
  core_thresh = 20000L,  
  file = paste0(tempfile(), ".tif"),  
  nrows = nrow(soildata)/(terra::ncell(soildata)/core_thresh),  
  overwrite = TRUE  
)  
  
## S3 method for class 'SpatRaster'  
run_rosetta(  
  soildata,  
  vars = NULL,  
  rosetta_version = 3,  
  estimate_type = "log",  
  cores = 1,  
  core_thresh = 20000L,  
  file = paste0(tempfile(), ".tif"),  
  nrows = nrow(soildata)/(terra::ncell(soildata)/core_thresh),  
  overwrite = TRUE  
)
```

**Arguments**

|                 |                                                                                                                                                                                                                                                                                                                                                                                           |
|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| soildata        | A list of numeric vectors each containing 3 to 6 values: "sand", "silt", "clay", "bulkdensity", "th33", "th1500", a <i>data.frame</i> or <i>matrix</i> with 3 to 6 columns OR a <i>Raster*</i> / <i>SpatRaster</i> object with 3 to 6 layers. Sand, silt, and clay must sum to a total of 100%.                                                                                           |
| vars            | <i>character</i> . Optional: names and order of custom column names if soildata is a <i>data.frame</i> , <i>RasterStack</i> , <i>RasterBrick</i> or <i>SpatRaster</i> . Default NULL assumes input column order follows sand, silt, clay, bulkdensity, th33, th1500 and does not check names.                                                                                             |
| rosetta_version | Default: 3                                                                                                                                                                                                                                                                                                                                                                                |
| estimate_type   | <i>character</i> . One of "log" (default), "arith", or "geo". Only used if rosetta-soil >= 0.3.1. Default "log" preserves logarithmic (log10) scale for alpha, npar, and Ksat. "geo" returns the geometric mean of bootstrap estimates (exponent of the mean of log-transformed values). This is often preferred for parameters that vary by orders of magnitude, such as alpha and Ksat. |
| ...             | additional arguments not used                                                                                                                                                                                                                                                                                                                                                             |
| cores           | number of cores; used only for processing <i>SpatRaster</i> or <i>Raster*</i> input                                                                                                                                                                                                                                                                                                       |
| core_thresh     | Magic number for determining processing chunk size. Default 20000L. Used to calculate default nrows                                                                                                                                                                                                                                                                                       |
| file            | path to write incremental raster processing output for large inputs that do not fit in memory; passed to <code>terra::writeStart()</code> and used only for processing <i>SpatRaster</i> or <i>Raster*</i> input; defaults to a temporary file created by <code>tempfile()</code> if needed                                                                                               |
| nrows           | number of rows to use per block chunk; passed to <code>terra::readValues()</code> and <code>terra::writeValues()</code> ; used only for processing <i>SpatRaster</i> or <i>Raster*</i> inputs. Defaults to the total number of rows divided by the number of cells divided by <code>core_thresh</code> .                                                                                  |
| overwrite       | logical; overwrite file? passed to <code>terra::writeStart()</code> ; defaults to TRUE if needed                                                                                                                                                                                                                                                                                          |

**Details****Performance Note:**

Use cores > 1 with *SpatRaster* or *Raster\** inputs to parallelize processing of cells across multiple cores.

**Value**

A *data.frame* containing mean and stdev for the following columns (parameters for van Genuchten-Mualem equation)

- "theta\_r", residual water content
- "theta\_s", saturated water content
- "alpha", 'alpha' shape parameter (1/cm). Logarithmic (log10) scale if `estimate_type="log"` (default); Geometric mean if `estimate_type="geo"`.

- "npar", 'n' shape parameter. Logarithmic (log10) scale if estimate\_type="log" (default); Geometric mean if estimate\_type="geo".
- "Ksat", saturated hydraulic conductivity (cm/day). Logarithmic (log10) scale if estimate\_type="log" (default); Geometric mean if estimate\_type="geo".
- "K0", unsaturated hydraulic conductivity (cm/day). Only if rosetta-soil >= 0.3.1. Logarithmic (log10) scale if estimate\_type="log" (default); Geometric mean if estimate\_type="geo".
- "lpar", unsaturated hydraulic conductivity exponent. Only if rosetta-soil >= 0.3.1.

If the sum of sand, silt, and clay is not 100%, the parameter value estimates will be NaN.

---

|                   |                                                                  |
|-------------------|------------------------------------------------------------------|
| SoilDataFromArray | <i>Convert list of numeric vectors to SoilData Python object</i> |
|-------------------|------------------------------------------------------------------|

---

## Description

SoilDataFromArray: convert a list of numeric vectors containing soil properties to a rosetta.rosetta.SoilData class. In rosetta-soil >= 0.3, direct list input is preferred.

py\_to\_r(<rosetta.rosetta.SoilData>): Wrapper S3 method for SoilData objects to prevent automatic conversion of SoilData (subclass of "python.builtin.list") to an R "list"

## Usage

```
SoilDataFromArray(x)
```

```
## S3 method for class 'rosetta.rosetta.SoilData'
py_to_r(x)
```

## Arguments

x                      a list of numeric vectors

## Value

an object reference to a Rosetta *SoilData* Python object constructed from x

---

|              |                                             |
|--------------|---------------------------------------------|
| UnsaturatedK | <i>Make an UnsaturatedK object instance</i> |
|--------------|---------------------------------------------|

---

**Description**

UnsaturatedK: Create an instance of the UnsaturatedK class from rosetta-soil  $\geq 0.3$ . This class is used to predict  $K\theta$  and L from retention parameters.

**Usage**

```
UnsaturatedK()
```

**Value**

an instance of the UnsaturatedK class.

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