Memo installation Water Accounting Toolbox and downloading ETensemble data

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The water accounting toolbox is a set of open access functions that can be used to collect data and to create the water accounting maps, csv, and sheets. This memo describes first how to install the water accounting toolbox. Hereafter some functions to collect CHIRPS data and ETensemble data will be described.

Installation of the Water accounting Toolbox
The water accounting toolbox is programmed by using python 2.7 version. Therefor it is highly recommended to install the same installation files as the programmers are using. By doing this proper operation of the toolbox is more certain, because malfunctioning due to differences between versions is excluded.
To install the program by yourself you can read the manual on the water accounting toolbox github (https://github.com/wateraccounting/wa/blob/master/docs/ManualWA.md), but all the installation files are also located on our FTP server, so they can also be downloaded and installed from here. This manual will describe the latter option.

To install the water accounting toolbox the following steps are needed:

- Step 1: Install Anaconda (64 bits and python 2.7 version)
- Step 2: Install all the python modules
- Step 3: Install Inkscape, 7zip, and GDAL
- Step 4: Get the Water Accounting Toolbox from Github
- Step 5: Set the environment variables

The steps mentioned above will be described one by one below.

Step 1: Install Anaconda
The installation executable can be found on the WA Guest FTP server. The address, username, and password is shown below:

Adress: **ftp.wateraccounting.unesco-ihe.org**
Username: **wateraccountingguest**
Password: **W@t3r@ccounting**

Go to /WaterAccounting_Guest/Programs/WA_Toolbox/Anaconda. Here you can find two executable files. One for a 32-bits computer (Anaconda2-4.3.1-Windows-x86.exe) and one for a 64-bits computer (Anaconda2-4.3.1-Windows-x86_64.exe). It is recommended to use the 64-bits version if possible.

Install this anaconda executable (recommended to install this directly in the C: folder, the executable will create a map called C:/Anaconda2).

Step 2: Install all the python modules
Anaconda already includes a lot of different python modules, but not all the modules that are needed to run the water accounting toolbox are installed as default. Therefore, some modules need to be installed manually. Of course it is possible to install them one by one by using the “pip” or “conda” command in the conda prompt (more information how to do this can be found in the manual on github), but it is easier to replace the “Lib” and the “Script” folder. **This will only work if you installed the 64 bits executable that is described in step 1**, because those folders do have the

same module structure that is based on this specific version of Anaconda. If another version or executable is used it is better to install all the missing python modules manually as described in the manual.

If the same version is installed, the “C:/Anaconda2/Lib” and “C:/Anaconda2/Scripts” can be removed and be replaced by the “Lib” and “Script” folder that is stored on the WA Guest FTP server. The two folders can be found here “WaterAccounting_Guest/Programs/Python_modules”. Download those folders and put those in the “C:/Anaconda2” folder.

Step 3: Install InkScape, 7zip, and GDAL
To create the Water Accounting sheets a program called InkScape is needed. This can be downloaded here: https://inkscape.org/en/release/0.92.2/windows/. The executable can also be found on the WA Guest FTP server. Download the 64-bits executable (Inkscape-0.92.1-x64-1.exe) or 32-bits executable (inkscape-0.92.2-x86.exe), which can be found here “WaterAccounting_Guest/Programs/WA_Toolbox/Inkscape”. After downloading, install the executable on your computer.

The 7zip executables can be found here “WaterAccounting_Guest/Programs/WA_Toolbox/7zip”. For a 32-bits computer download and install “7z1604.exe” and for a 64-bits computer download and install “7z1604-x64.exe”

The GDAL program is also included in QGIS. So if QGIS is already installed on your computer there is no need to install GDAL. If not, QGIS can be installed or only the GDAL program can be installed. For QGIS go to “http://www.qgis.org/en/site/forusers/download.html”.

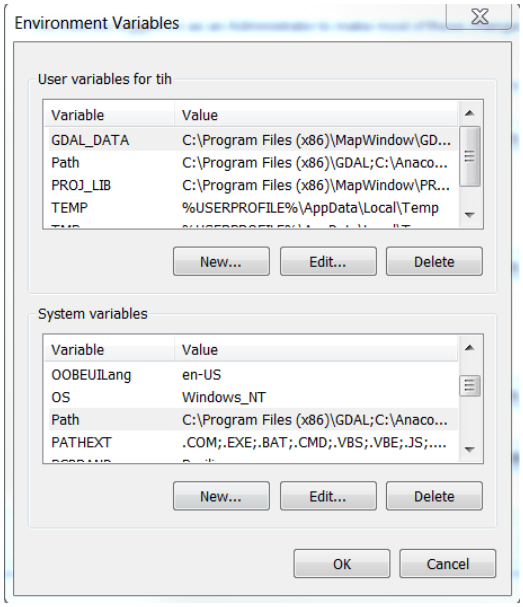
If you do not want to install QGIS you can install GDAL. The GDAL executables can be found on the Guest FTP server (“WaterAccounting_Guest/Programs/WA_Toolbox/GDAL”). Download the core (64-bits: gdal-201-1500-x64-core.msi and 32-bits: gdal-201-1500-core.msi) and the GDAL python executables (64-bits: GDAL-2.1.3.win-amd64-py2.7.msi and 32-bits: GDAL-2.1.3.win32-py2.7.msi). Do first install the core followed by the GDAL python executable.

Step 4: Get the Water Accounting Toolbox from Github
Go to https://github.com/wateraccounting/wa and push the Clone or download button:

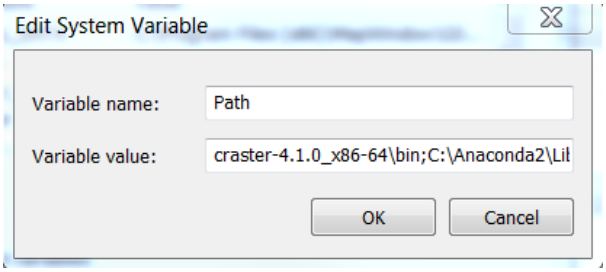
After downloading, subtract the data and change the name from "wa-master" into "wa". Copy and paste the complete "wa" folder in the site-packages location of Anaconda so you have the folder as shown below:

$HOME/Anaconda2/Lib/site-packages/wa

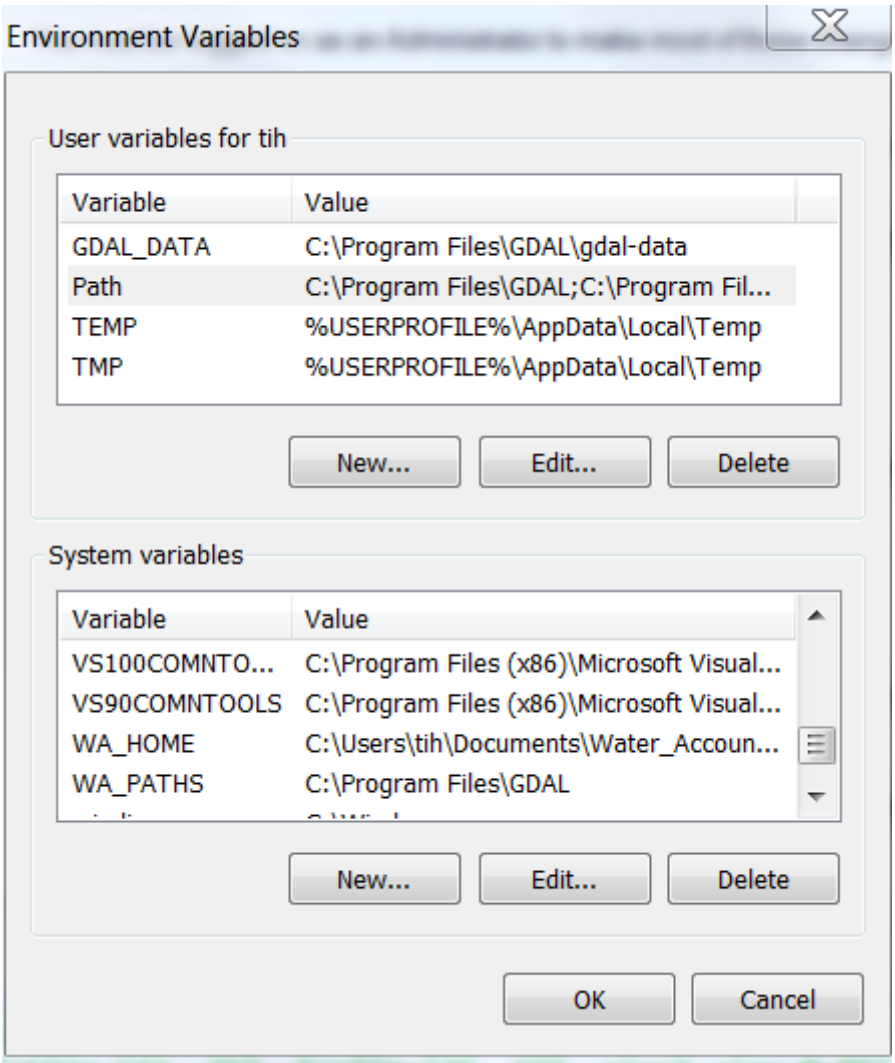
Step 5: Set the environment variables
The last step is to create some environment variables. To add an environment variable, you need to go to the environment variables manager of your computer. For a Windows 7 system go to: Control panel > System and security > System > Advanced system settings > Advanced > Environment variables. This will pops up the environment variables window as shown below.



If an executable cannot be found by the computer, you need to add a directory in the "Path" environment variable. This can be done by clicking on the "Edit" button when the "Path" variable under the system variables box was selected. Add the directory where the executables are located and make sure that you do not remove the original paths in the "Path" environment. You need to separate the paths with a semi-colon (;) sign.

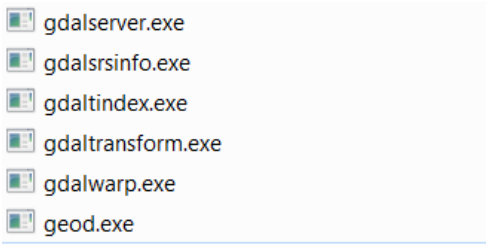


For the WA Toolbox two environment variables needs to be created. This can be done in the environment variables manager and click on "New.." (see figure below).



The 3 environment variables that must be created are the following:

1.
Search for the folder where the GDAL executables like gdalwarp.exe, gdal_translate.exe etc. (see picture on the right) can be found (**Do not use the GDAL executables that are stored in the Anaconda2 folder**). If you installed GDAL you will find those executables somewhere here "C:\Program Files\GDAL", so the following environment variable must be created (see also picture):



Variable name >> Variable Value
WA_PATHS >> C:\Program Files\GDAL

If QGIS is installed the executables can be found somewhere here "C:\Program Files\QGIS 2.18\bin" So create the following variable:

Variable name >> Variable Value
WA_PATHS >> C:\Program Files\QGIS 2.18\bin

<u>Put after the Variable Value a semi-column (;). Because a second path will be added here.</u>

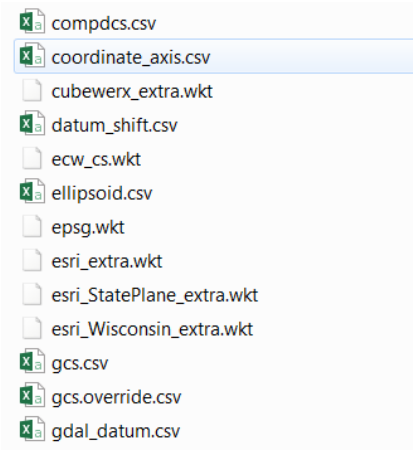
Search now for the Inkscape.exe. This file is stored in the main folder that is created after installing Inkscape. On default this folder can be found here: C:\Program Files\Inkscape.

Add this path as second variable value for the WA_PATHS:
WA_PATHS >> C:\Program Files\QGIS 2.18\bin;C:\Program Files\Inkscape

2.
The calculations of the Water Accounting Toolbox are performed in the Home folder. Here all the output will be stored here and also the input must be stored in this folder. So create a folder somewhere on your computer and define this folder here.

Variable name >> Variable Value
WA_HOME >> $Path_To_Your_WA_HOME_folder

3.
In order to find all the properties of the different projections a third environment variable must be checked and created if needed. Search within the environment variable for the GDAL_DATA variable name. If this is already there you do not need to create this variable. If not, create this variable and search for a folder which consists the files shown on the right.



If GDAL is installed this folder can be found somewhere here "C:\Program Files\GDAL\gdal-data". So create the following environment variable (do not place a semi column at the end of the variable value).

Variable name >> Variable Value
GDAL_DATA >> C:\Program Files\GDAL\gdal-data

If QGIS is installed you can find those files somewhere here “C:\Program Files\QGIS x.xx\share\gdal”. So create the following environment variable (do not place a semi column at the end of the variable value).

Variable name >> Variable Value
GDAL_DATA >> C:\Program Files\QGIS x.xx\share\gdal

Example download ETensemble and CHIRPS
Now the water accounting toolbox is installed and the functions of this toolbox can be used. For some collect functions an account is needed (MODIS, GLEAM, GLDAS). Those accounts can be filled in the WebAccounts.py which can be found C:\Anaconda2\Lib\site-packages\wa\WebAccounts.py.

Here you can fill in three accounts from NASA, GLEAM, and FTP_WA. The FTP_WA can be filled in by using the username and password as shown in this document. Below you will find the example:

'FTP_WA' : ['wateraccountingguest','W@t3r@ccounting']

The same can be done for the NASA and GLEAM line.

To download ETensemble data or CHIRPS data you need to open Spyder (which is included in Anaconda). In spyder you can write code or run a command using the Python language in the IConsole. Below more information and example about the ETensemble V1.1 and CHIRPS is given.

ETensemble V1.1

	ETensV1.0
Startdate	2003-01-01
Enddate	2014-12-31
Latitude	40 N – 40 S
Longitude	180 W – 180 E
Resolution	0.0025˚

ETensV1.1 is an ensemble evapotranspiration product developed by the WA+ team. The end product combines 7 different ET datasets by removing the outliers for every pixel. The products that are used are ALEXI, CMRSET, ETmonitor, GLEAM, MOD16, SEBS, and SSEBop. The NDVI (MOD13) is used to downscale the product to a 0.0025˚ spatial resolution. The temporal scale is monthly and is available for January 2003 till December 2014. The ETensV1.1 product spans all longitudes and latitudes between 40S and 40N. The ETens module can collect the data automatically from the WA+ FTP Guest server (ftp.wateraccounting.unesco-ihe.org). The username and password must be provided within the WebAccounts.py (FTP_WA), otherwise the tool cannot be used.

Required parameters:

- Dir >> The directory where the ETens data will be stored.
- Startdate >> The start day of the wanted dataset
- Enddate >> The end day of the wanted dataset
- latlim >> latitude limits of the wanted dataset
- lonlim >> longitude limits of the wanted dataset

The latlim and lonlim must always start with the lowest latitude or longitude.

Examples:

```
from wa.Products import ETens
ETens.monthly(Dir = 'C:/Temp', Startdate='2003-01-01',Enddate='2003-04-05',latlim = [0,5],lonlim = [35,40])
```

CHIRPS V2.0

CHIRPS v2.0 rainfall data is downloaded from the ftp://chg-ftpout.geog.ucsb.edu server. There are two functions in the CHIRPS module, namely daily and monthly. The daily or monthly function will download the daily or monthly CHIRPS v.2.0 data, respectively. The outputs are tiff files in WGS84 projection. No account is needed to collect the CHIRPS data.

	CHIRPS v2.0
Startdate	1981-01-01
Enddate	Now
Latitude	50 N – 50 S
Longitude	180 W – 180 E
Resolution	0.05 ˚

Required parameters are:

- Dir >> The directory where the CHIRPS data will be stored.
- Startdate >> The start day of the wanted dataset in the format yyyy-mm-dd
- Enddate >> The end day of the wanted dataset in the format yyyy-mm-dd
- latlim >> latitude limits of the wanted dataset
- lonlim >> longitude limits of the wanted dataset

The latlim and lonlim must always start with the lowest latitude or longitude.

Below is an example:

```
from wa.Collect import CHIRPS
CHIRPS.daily(Dir='C:/Temp/', Startdate='2003-02-01', Enddate='2003-04-22', latlim=[-10, 30], lonlim=[-20, 25])

CHIRPS.monthly(Dir='C:/Temp/', Startdate='2006-06-01', Enddate='2008-07-05', latlim=[40.4, 45.7], lonlim=[-20.3, -17.4])
```

Other Datasets

Other datasets that can be collected by the water accounting toolbox are the following:
For now the Collect and Products functions are:

- CHIRPS
- GLDAS (NASA account required)
- CFSR (NASA account required)
- DEM
- GLEAM (GLEAM account required)
- ECMWF (ECMWF account required)
- RFE
- TRMM
- JRC
- ALEXI (WA_FTP account required)
- TRMM
- MOD13 (NASA account required)
- MOD15 (NASA account required)
- MOD16 (NASA account required)
- MOD17 (NASA account required)

The Products modules are:

- ETref (WA_FTP and NASA account required)
- ETens (WA_FTP account required)

Examples how to run a function can always be found in the _init_.py files which are stored in the wa folder.