

HydroGeoSines

How to correct groundwater heads from Earth tides and atmospheric pressure influences

Import HGS

Note: Currently, the HydroGeoSines is not fully implemented as an installable package. Instead, we have to move to the parent directory, to import the package.

```
In [1]: import os
os.chdir("../..")
print("Current Working Directory: ", os.getcwd())
```

Current Working Directory: D:\WORK\GitHub\HydroGeoSines

```
In [10]: # Load the HGS package
import hydrogeosines as hgs
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
```

Import a dataset

Note: This example dataset is based on [Rau et. al. \(2020\)](#):

Import data from a CSV file.

```
In [11]: death_valley = hgs.Site('Death Valley', geoloc=[-116.471360, 36.408130, 688])

death_valley.import_csv('tests/data/death_valley/death_valley.csv',
                        input_category=["GW", "BP", "ET"],
                        unit=["m", "m", "nstr"],
                        utc_offset=0,
                        how="add", check_duplicates=True)
```

Datetime was 'naive'. Localized and converted to UTC!
A new time series was added ...
No duplicates found ...

Just for fun, we invoke [PyGTide](#) to add theoretical Earth tide strains to the dataset:

```
In [12]: death_valley.add_ET(et_comp='nstr')
```

Adding Earth tides using the inbuilt PyGTide package.
Warning: This may take some time ...
ETERNA PREDICT v3.4 (10/02/2013) is calculating, please wait ...
Finished after 3.235 s
Earth tide time series were calculated and added ...

Correcting groundwater hydraulic heads

Now we can correct the groundwater hydraulic heads:

```
In [14]: corrected = hgs.Processing(death_valley).GW_correct(lag_h=8, et_method='hals')
```

Method: GW_correct
 There were no gaps in the data after resampling!
 The groundwater (GW) and BP data is aligned. There is exactly one BP for every GW entry!
 The groundwater (GW) and BP data is aligned. There is exactly one BP for every GW entry!

```
> Correcting GW for location: BLM-1
>> Applying regression deconvolution ...
>> Reference: Method by Rasmussen and Crawford (1997) [https://doi.org/10.1111/j.1745-6584.1997.tb00111.x]
>> Using harmonic least-squares to estimate Earth tide influences ...
```

Exporting and visualising the results

The corrected heads are in the results object:

```
In [15]: hgs.Output(corrected).export(folder="export")
```

Exporting location: BLM-1

This will write a comma separated value (csv) file to the subfolder 'export'.

The results can also be visualised:

```
In [16]: hgs.Output(corrected).plot(folder="export")
```

Plotting location: BLM-1



