**PyGTide – A Python module to generate gravitational tides on Earth**

**A Python wrapper for ETERNA PREDICT 3.4 by Prof. Wenzel (1996)**

Includes updates to implement the latest tidal catalogue by Kudryevtsev (2004)

The original Fortran code can be found at: <http://igets.u-strasbg.fr/soft_and_tool.php>

Tested with ***SimplyFortran*** compiler. Changes were tested by comparing the output against the original code and produced the exact same results.

**Updates to external files:**

* File “etddt.dat” was updated with leap seconds and is now valid until end of year 2018
* File “etpolut1.dat” was updated (September 2017) with new file from <http://hpiers.obspm.fr/iers/eop/eopc04/>.
* Fortran code ‘iers1.f90’ was updated and revised to work properly with the new file format.

**Modifications to the original Fortran code aimed at a successful compile using f2py:**

* Paths to external files were made relative (now uses subdirectory ‘commdat’ where executable resides)
* The code was changed from fixed format (file extension .f) to free format (file extension .f90)
* COMMON blocks were changed to modules
* Continuous lines were adapted to the F90 standard
* The main program was put into a subroutine called ‘PREDICT(ARGS)’ where ‘ARGS’ is an array of size 17 containing the control parameters handed over from Python
* The calculated data is stored in an internal array called ‘ETPDATA’ in the module ‘OUT’
* Headers are also constructed in the array ‘HEADER’ in the module ‘OUT’
* Screen and file (.prd and .prn) output is muted by default, but can be enabled using flags in ‘ARGS’

**Code enhancements:**

* Moved all constants into module ‘CONSTANTS’ for easy modification. These included numeric as well as file names, output headers, etc.
* Created a parameter for original ‘commdat’ directory, including a path separator variable for different systems
* The data output format for the .prd and .prn files were changed to 6 digits to reflect the improved accuracy of the KSM03 tidal catalogue
* Output times in .prn and .prd files were zero padded for easier handling (if required)
* Changed the record length for the binary file ‘etpolut1.bin’ to 32 bytes (reflecting 4 double reals at 8 bytes each)

**Bug fix:**

* A time bug produced wrong HH:MM:SS format in output due to a rounding error when sampling rate was smaller than 60 seconds. This bug was fixed and the code now works properly with any time resolution.

**References:**

Wenzel, H.-G. (1996), The nanogal software: Earth tide data processing package ETERNA 3.30, *Bull. Inf. Marées Terrestres*, *124*, 9425–9439.

Hartmann, T., and H.-G. Wenzel (1995), The HW95 tidal potential catalogue, *Geophysical Research Letters*, *22*(24), 3553–3556, doi:10.1029/95GL03324.

Kudryavtsev - Journal of Geodesy, S. M., and 2004 (2004), Improved harmonic development of the Earth tide-generating potential, *Springer*.