Kelsey Walak - November 7, 2022

To do:

* Tests
  + Are test values used for algae and nitrogen appropriate (see excel sheet “Manual Calculations for Algae” and “Manual Calculations for Nitrogen”)?
  + Complete test cases for Phosphorus and Benthic Algae, both set up but not complete (see excel sheet “Manual Calculations for BAlgae” and “Manual Calculations for Phosphorus”)
* Variables
  + Finish filling out the excel sheet “Variables” as constructing the modules. Algae, Benthic Algae, Nitrogen, and Phosphorus complete.
  + Potentially change some global variables to global parameters (like in the FORTRAN code). Some parameters in the FORTRAN code, such as lambda, seem to be calculated in the global parameter script (NSM1/02\_global/nsmi\_global\_params) and then used in multiple modules.
* Modules FORTRAN to Python
  + Convert empty modules from FORTRAN/update call from main
  + SedFlux code is converted from FORTRAN to python but check conversion and formulas with documentation. Address TODO’s and update call from main.

Notes:

* Nitrogen line 287 FORTRAN does not match calculation in documentation (page 34, equation 3.28 Benthic algae respiration). Used equation from documentation in line 234 python.
* Phosphorus (line 19 FORTRAN, 116 python), same conflict as in nitrogen line 287 FORTRAN (page 39 equation 3.35 documentation). Used equation from documentation in python.
* Phosphorus OrgP\_DIP\_decay (line 158 FORTRAN, 104 python). Check added option for if use\_OrgP is TRUE based on documentation.
* Phosphorus python lines 134-140 commented out FORTRAN code related to nGS. Not sure if needed.
* Check phosphorus line 142 python, 223 FORTRAN. Believe DIP = TIP \* fdp not divided.
* Are TOP, TP (phosphorus) and DIN, TON, TKN, TN (nitrogen) supposed to be calculated for the past time step or current time step? As of now they are calculated for past time step and do not take into account changes in phosphorus and nitrogen calculated in current timestep.
* Numba testing: Modules run with dictionaries but much, much slower then without numba. Was unable to speed up the modules.
* Algae split: Thought about splitting the modules into different functions so each variable from the Algae module (ApGrowth, ApRespiration, etc.) could be calculated separately to use independently in other modules. Decided against it because a lot of variables would need to be passed for each calculation and it seemed more streamline to just have one module. If algae variables are used in other modules, the algae module must run anyway. Could potentially create different functions within one module for separate calculations.