RegionalExport

February 17, 2016

1 Generating Regional Export table (t/y)

```
In [14]: # Some steps required until these Python modules are properly installed...
         import sys
         sys.path.append('../Modules')
         sys.path.append('../../../../veneer-py')
         %pylab inline
```

Populating the interactive namespace from numpy and matplotlib

```
In [2]: # Get the Source scripting components (veneer) and GBR specific stuff
        import veneer
        import gbr
```

```
In [3]: # Point the system at a particular output directory...
        gbr.init('D:/Beckers/outputs/Scenario 1/')
```

```
In [4]: # See available runs
        gbr.available()
```

```
Out[4]: ['Beta3815',
         'Beta3815_PREC_PARAC_PARAN',
         'Beta3815_test_all_go_fasts',
         'Beta3815_test_parallel_reporting',
         'RUN_CHANGED_PCTIM',
         'RUN_FROM_IRONPYTHON_0',
         'RUN_FROM_IRONPYTHON_1',
         'RUN_FROM_IRONPYTHON_2',
         'RUN_ORIGINAL_PCTIM',
         'TEST_ALL_SPEEDUPS',
         'TEST_DEFAULT',
         'TEST_DEFAULT2',
         'TEST_DEFAULT3',
         'TEST_DELETE_TEMP_ARRAYS',
         'TEST_DUMMY',
         'TEST_PARAC',
         'TEST_PRE',
         'TEST_PRE_PARAC',
         'TEST_REARRANGE_PARALLEL',
         'TEST_REPORTING',
         'TEST_REPORTING_SPEED',
         'TEST_SPEEDUP_REGIONAL_REPORTING',
         'TEST_WITHOUT_REPORTING_SPEEDUPS',
         'TIMING_WITHOUT_PARAC_WITHOUT_PARAN_WITHOUT_PRERUN',
```

```
        'TIMING_WITHOUT_PARAC_WITHOUT_PARAN_WITH_PRERUN',
        'TIMING_WITHOUT_PARAC_WITH_PARAN_WITHOUT_PRERUN',
        'TIMING_WITHOUT_PARAC_WITH_PARAN_WITH_PRERUN',
        'TIMING_WITH_PARAC_WITHOUT_PARAN_WITHOUT_PRERUN',
        'TIMING_WITH_PARAC_WITHOUT_PARAN_WITH_PRERUN',
        'TIMING_WITH_PARAC_WITH_PARAN_WITHOUT_PRERUN',
        'TIMING_WITH_PARAC_WITH_PARAN_WITH_PRERUN']
```

In [5]:
```
# Get a results set
results = gbr.Results('Beta3815')
```

In [6]:
```
# Run a basic query (built by Joel)
regional = results.queries.regional_export('t/y')
regional
```

Out[6]:
```
SummaryRegion            agbot          agmid          agtop
Constituent
Ametryn           0.000000e+00   0.000000e+00   0.000000e+00
Atrazine          0.000000e+00   0.000000e+00   0.000000e+00
Flow              5.618641e+08   4.826120e+08   2.044276e+08
N_DIN             1.076096e+05   9.206070e+04   3.776663e+04
N_DON             1.076096e+05   9.206070e+04   3.776663e+04
N_Particulate     5.590488e+05   3.949711e+05   2.687237e+05
P_DOP             9.987315e+04   8.674313e+04   3.633789e+04
P_FRP             9.987315e+04   8.674313e+04   3.633789e+04
P_Particulate              NaN   2.748961e+05   1.606461e+05
Sediment - Coarse 0.000000e+00   0.000000e+00   0.000000e+00
Sediment - Fine   4.943001e+06   3.917739e+06   2.476492e+06
Tebuthiuron       0.000000e+00   0.000000e+00   0.000000e+00
```

In [7]:
```
# Save to CSV
regional.to_csv('D:/beckers_regional_export.csv')
```

In [ ]:

In [18]:

In [ ]:

In [17]:
```
# How its done...

# 1) Load the regional summary table
allRegional = results.get('RegionalSummaryTable')
allRegional
```

Out[17]:
```
                SummaryRegion MassBalanceElement   Total_Load_in_Kg
Constituent
Flow                    agmid             Supply       3.376009e+12
Flow                    agmid               Loss       3.321738e+11
Flow                    agmid           Residual       1.078629e+11
Flow                    agmid             Export       2.935972e+12
P_Particulate           agmid             Supply       2.317847e+09
P_Particulate           agmid               Loss       5.401221e+08
P_Particulate           agmid           Residual       1.053935e+08
P_Particulate           agmid             Export       1.672332e+09
Ametryn                 agmid             Supply       0.000000e+00
```

```
Ametryn             agmid          Loss     0.000000e+00
Ametryn             agmid      Residual     0.000000e+00
Ametryn             agmid        Export     0.000000e+00
Atrazine            agmid        Supply     0.000000e+00
Atrazine            agmid          Loss     0.000000e+00
Atrazine            agmid      Residual     0.000000e+00
Atrazine            agmid        Export     0.000000e+00
Tebuthiuron         agmid        Supply     0.000000e+00
Tebuthiuron         agmid          Loss     0.000000e+00
Tebuthiuron         agmid      Residual     0.000000e+00
Tebuthiuron         agmid        Export     0.000000e+00
Sediment - Fine     agmid        Supply     2.764518e+10
Sediment - Fine     agmid          Loss     1.578913e+09
Sediment - Fine     agmid      Residual     2.232687e+09
Sediment - Fine     agmid        Export     2.383358e+10
Sediment - Coarse   agmid        Supply     6.728615e+09
Sediment - Coarse   agmid          Loss     6.728615e+09
Sediment - Coarse   agmid      Residual     0.000000e+00
Sediment - Coarse   agmid        Export     0.000000e+00
N_Particulate       agmid        Supply     2.804416e+09
N_Particulate       agmid          Loss     1.565521e+08
...                 ...            ...              ...
Tebuthiuron         agtop      Residual     0.000000e+00
Tebuthiuron         agtop        Export     0.000000e+00
Sediment - Fine     agtop        Supply     3.091611e+10
Sediment - Fine     agtop          Loss     1.585037e+10
Sediment - Fine     agtop      Residual     0.000000e+00
Sediment - Fine     agtop        Export     1.506575e+10
Sediment - Coarse   agtop        Supply     6.333640e+09
Sediment - Coarse   agtop          Loss     6.333640e+09
Sediment - Coarse   agtop      Residual     0.000000e+00
Sediment - Coarse   agtop        Export     0.000000e+00
N_Particulate       agtop        Supply     3.532553e+09
N_Particulate       agtop          Loss     1.897772e+09
N_Particulate       agtop      Residual     0.000000e+00
N_Particulate       agtop        Export     1.634782e+09
N_DIN               agtop        Supply     2.297534e+08
N_DIN               agtop          Loss     0.000000e+00
N_DIN               agtop      Residual     0.000000e+00
N_DIN               agtop        Export     2.297534e+08
N_DON               agtop        Supply     2.297534e+08
N_DON               agtop          Loss     0.000000e+00
N_DON               agtop      Residual     0.000000e+00
N_DON               agtop        Export     2.297534e+08
P_DOP               agtop        Supply     2.210617e+08
P_DOP               agtop          Loss     0.000000e+00
P_DOP               agtop      Residual     0.000000e+00
P_DOP               agtop        Export     2.210617e+08
P_FRP               agtop        Supply     2.210617e+08
P_FRP               agtop          Loss     0.000000e+00
P_FRP               agtop      Residual     0.000000e+00
P_FRP               agtop        Export     2.210617e+08

[144 rows x 3 columns]
```

```python
In [21]: # 2) Filter just the Export values
         regionalExportData = allRegional[allRegional.MassBalanceElement=='Export']
         regionalExportData
```

```
Out[21]:              SummaryRegion MassBalanceElement   Total_Load_in_Kg
         Constituent
         Flow                  agmid             Export       2.935972e+12
         P_Particulate         agmid             Export       1.672332e+09
         Ametryn               agmid             Export       0.000000e+00
         Atrazine              agmid             Export       0.000000e+00
         Tebuthiuron           agmid             Export       0.000000e+00
         Sediment - Fine       agmid             Export       2.383358e+10
         Sediment - Coarse     agmid             Export       0.000000e+00
         N_Particulate         agmid             Export       2.402808e+09
         N_DIN                 agmid             Export       5.600517e+08
         N_DON                 agmid             Export       5.600517e+08
         P_DOP                 agmid             Export       5.277022e+08
         P_FRP                 agmid             Export       5.277022e+08
         Flow                  agbot             Export       3.418102e+12
         P_Particulate         agbot             Export                NaN
         Ametryn               agbot             Export       0.000000e+00
         Atrazine              agbot             Export       0.000000e+00
         Tebuthiuron           agbot             Export       0.000000e+00
         Sediment - Fine       agbot             Export       3.007077e+10
         Sediment - Coarse     agbot             Export       0.000000e+00
         N_Particulate         agbot             Export       3.400976e+09
         N_DIN                 agbot             Export       6.546436e+08
         N_DON                 agbot             Export       6.546436e+08
         P_DOP                 agbot             Export       6.075787e+08
         P_FRP                 agbot             Export       6.075787e+08
         Flow                  agtop             Export       1.243636e+12
         P_Particulate         agtop             Export       9.772910e+08
         Ametryn               agtop             Export       0.000000e+00
         Atrazine              agtop             Export       0.000000e+00
         Tebuthiuron           agtop             Export       0.000000e+00
         Sediment - Fine       agtop             Export       1.506575e+10
         Sediment - Coarse     agtop             Export       0.000000e+00
         N_Particulate         agtop             Export       1.634782e+09
         N_DIN                 agtop             Export       2.297534e+08
         N_DON                 agtop             Export       2.297534e+08
         P_DOP                 agtop             Export       2.210617e+08
         P_FRP                 agtop             Export       2.210617e+08
```

```python
In [22]: # 3) Pivot the table to be Constituent x Region
         # 3-a) Convert index (Constituent) back to a normal column
         regionalExportData = regionalExportData.reset_index()
         regionalExportData
```

```
Out[22]:         Constituent SummaryRegion MassBalanceElement   Total_Load_in_Kg
         0              Flow         agmid             Export       2.935972e+12
         1     P_Particulate         agmid             Export       1.672332e+09
         2           Ametryn         agmid             Export       0.000000e+00
         3          Atrazine         agmid             Export       0.000000e+00
         4       Tebuthiuron         agmid             Export       0.000000e+00
         5   Sediment - Fine         agmid             Export       2.383358e+10
```

```
6     Sediment - Coarse        agmid         Export    0.000000e+00
7        N_Particulate         agmid         Export    2.402808e+09
8               N_DIN          agmid         Export    5.600517e+08
9               N_DON          agmid         Export    5.600517e+08
10              P_DOP          agmid         Export    5.277022e+08
11              P_FRP          agmid         Export    5.277022e+08
12               Flow          agbot         Export    3.418102e+12
13        P_Particulate        agbot         Export             NaN
14             Ametryn         agbot         Export    0.000000e+00
15             Atrazine        agbot         Export    0.000000e+00
16           Tebuthiuron       agbot         Export    0.000000e+00
17         Sediment - Fine     agbot         Export    3.007077e+10
18       Sediment - Coarse     agbot         Export    0.000000e+00
19        N_Particulate        agbot         Export    3.400976e+09
20              N_DIN          agbot         Export    6.546436e+08
21              N_DON          agbot         Export    6.546436e+08
22              P_DOP          agbot         Export    6.075787e+08
23              P_FRP          agbot         Export    6.075787e+08
24               Flow          agtop         Export    1.243636e+12
25        P_Particulate        agtop         Export    9.772910e+08
26             Ametryn         agtop         Export    0.000000e+00
27             Atrazine        agtop         Export    0.000000e+00
28           Tebuthiuron       agtop         Export    0.000000e+00
29         Sediment - Fine     agtop         Export    1.506575e+10
30       Sediment - Coarse     agtop         Export    0.000000e+00
31        N_Particulate        agtop         Export    1.634782e+09
32              N_DIN          agtop         Export    2.297534e+08
33              N_DON          agtop         Export    2.297534e+08
34              P_DOP          agtop         Export    2.210617e+08
35              P_FRP          agtop         Export    2.210617e+08
```

In [24]: # 3-b) Pivot
```python
regionalExportKg = regionalExportData.pivot('Constituent','SummaryRegion','Total_Load_in_Kg')
# Pivot is called with (index,columns,values),
# so ('Constituent','SummaryRegion', 'Total_Load_in_Kg') means...
# Make Contituent the index (the rows),
# Make SummaryRegion the columns, and
# Use Total_Load_in_Kg as the values
regionalExportKg
```

Out[24]:
SummaryRegion	agbot	agmid	agtop
Constituent			
Ametryn	0.000000e+00	0.000000e+00	0.000000e+00
Atrazine	0.000000e+00	0.000000e+00	0.000000e+00
Flow	3.418102e+12	2.935972e+12	1.243636e+12
N_DIN	6.546436e+08	5.600517e+08	2.297534e+08
N_DON	6.546436e+08	5.600517e+08	2.297534e+08
N_Particulate	3.400976e+09	2.402808e+09	1.634782e+09
P_DOP	6.075787e+08	5.277022e+08	2.210617e+08
P_FRP	6.075787e+08	5.277022e+08	2.210617e+08
P_Particulate	NaN	1.672332e+09	9.772910e+08
Sediment - Coarse	0.000000e+00	0.000000e+00	0.000000e+00
Sediment - Fine	3.007077e+10	2.383358e+10	1.506575e+10
Tebuthiuron	0.000000e+00	0.000000e+00	0.000000e+00

In [25]: # 4) Convert from kg to T/y

```
# 4-a) Kg -> T
regionalExport_T = regionalExportKg / 1000.0
regionalExport_T
```

Out[25]:
SummaryRegion	agbot	agmid	agtop
Constituent			
Ametryn	0.000000e+00	0.000000e+00	0.000000e+00
Atrazine	0.000000e+00	0.000000e+00	0.000000e+00
Flow	3.418102e+09	2.935972e+09	1.243636e+09
N_DIN	6.546436e+05	5.600517e+05	2.297534e+05
N_DON	6.546436e+05	5.600517e+05	2.297534e+05
N_Particulate	3.400976e+06	2.402808e+06	1.634782e+06
P_DOP	6.075787e+05	5.277022e+05	2.210617e+05
P_FRP	6.075787e+05	5.277022e+05	2.210617e+05
P_Particulate	NaN	1.672332e+06	9.772910e+05
Sediment - Coarse	0.000000e+00	0.000000e+00	0.000000e+00
Sediment - Fine	3.007077e+07	2.383358e+07	1.506575e+07
Tebuthiuron	0.000000e+00	0.000000e+00	0.000000e+00

In [26]:
```
# 4-b) Calculate Simulation Length
simulationLength = results.runDetails.end - results.runDetails.startRecording
simulationLength
```

Out[26]: datetime.timedelta(2222, 660)

In [27]:
```
# 4-c) Simulation length in years
years = simulationLength.days / 365.25
years
```

Out[27]: 6.083504449007529

In [28]:
```
# 4-d) Convert T->T/y
regionalExport_T_y = regionalExport_T/years
regionalExport_T_y
```

Out[28]:
SummaryRegion	agbot	agmid	agtop
Constituent			
Ametryn	0.000000e+00	0.000000e+00	0.000000e+00
Atrazine	0.000000e+00	0.000000e+00	0.000000e+00
Flow	5.618641e+08	4.826120e+08	2.044276e+08
N_DIN	1.076096e+05	9.206070e+04	3.776663e+04
N_DON	1.076096e+05	9.206070e+04	3.776663e+04
N_Particulate	5.590488e+05	3.949711e+05	2.687237e+05
P_DOP	9.987315e+04	8.674313e+04	3.633789e+04
P_FRP	9.987315e+04	8.674313e+04	3.633789e+04
P_Particulate	NaN	2.748961e+05	1.606461e+05
Sediment - Coarse	0.000000e+00	0.000000e+00	0.000000e+00
Sediment - Fine	4.943001e+06	3.917739e+06	2.476492e+06
Tebuthiuron	0.000000e+00	0.000000e+00	0.000000e+00

In [29]:
```
# 5) Export to ___
regionalExport_T_y.to_csv('D:/beckers_regional_export.csv')
regionalExport_T_y.to_excel('D:/beckers_regional_export.xlsx')
```

In [ ]:

In [ ]: