

annual_pp

November 1, 2019

1 Annual primary productivity from latitude, longitude and year

```
[1]: lat=71  
     lon=-125  
     year=2009
```

lat=-90+180/1080/2+(1079-fakeDim0)*180/1080

```
[2]: fakeDim0=-(lat+90-180/1080/2)/180*1080+1079  
     fakeDim0=round(fakeDim0)  
     print(fakeDim0)
```

114

lon=-180+360/2160/2+360/2160*fakeDim1

```
[3]: fakeDim1=(lon+180-360/2160/2)/360*2160  
     fakeDim1=round(fakeDim1)  
     print(fakeDim1)
```

330

```
[4]: import wget  
  
url='http://orca.science.oregonstate.edu/data/1x2/8day/vgpm.r2018.m.chl.m.sst/  
     ↳hdf/vgpm.m.'+str(year)+'.tar'  
print(url)  
wget.download(url)
```

http://orca.science.oregonstate.edu/data/1x2/8day/vgpm.r2018.m.chl.m.sst/hdf/vgpm.m.m.2009.tar

```
[4]: 'vgpm.m.2009 (1).tar'
```

See <https://docs.python.org/3.6/library/tarfile.html>

```
[5]: import os.path  
     import tarfile
```

```

archive_name=os.path.basename(url)
tar=tarfile.open(archive_name)
tar.extractall()
tar.close()
print( 'archive_name: {}'.format(archive_name) )

```

archive_name: vgpm.m.2009.tar

See <http://xahlee.info/python/gzip.html>

```

[6]: import gzip
import os

for file_in in os.listdir('.'):
    if file_in.endswith('.gz'):
        print( 'file_in: {}'.format(file_in) )
        input=gzip.GzipFile(file_in, 'rb')
        s=input.read()
        input.close()
        file_out,file_extension=os.path.splitext(file_in)
        output=open(file_out, 'wb')
        output.write(s)
        output.close()
        print( 'file_out: {}'.format(file_out) )
        os.remove(file_in)

```

```

file_in: vgpm.2009185.hdf.gz
file_out: vgpm.2009185.hdf
file_in: vgpm.2009089.hdf.gz
file_out: vgpm.2009089.hdf
file_in: vgpm.2009097.hdf.gz
file_out: vgpm.2009097.hdf
file_in: vgpm.2009265.hdf.gz
file_out: vgpm.2009265.hdf
file_in: vgpm.2009241.hdf.gz
file_out: vgpm.2009241.hdf
file_in: vgpm.2009353.hdf.gz
file_out: vgpm.2009353.hdf
file_in: vgpm.2009033.hdf.gz
file_out: vgpm.2009033.hdf
file_in: vgpm.2009121.hdf.gz
file_out: vgpm.2009121.hdf
file_in: vgpm.2009017.hdf.gz
file_out: vgpm.2009017.hdf
file_in: vgpm.2009009.hdf.gz
file_out: vgpm.2009009.hdf
file_in: vgpm.2009105.hdf.gz

```

file_out: vgpm.2009105.hdf
file_in: vgpm.2009249.hdf.gz
file_out: vgpm.2009249.hdf
file_in: vgpm.2009257.hdf.gz
file_out: vgpm.2009257.hdf
file_in: vgpm.2009345.hdf.gz
file_out: vgpm.2009345.hdf
file_in: vgpm.2009273.hdf.gz
file_out: vgpm.2009273.hdf
file_in: vgpm.2009361.hdf.gz
file_out: vgpm.2009361.hdf
file_in: vgpm.2009001.hdf.gz
file_out: vgpm.2009001.hdf
file_in: vgpm.2009113.hdf.gz
file_out: vgpm.2009113.hdf
file_in: vgpm.2009025.hdf.gz
file_out: vgpm.2009025.hdf
file_in: vgpm.2009137.hdf.gz
file_out: vgpm.2009137.hdf
file_in: vgpm.2009129.hdf.gz
file_out: vgpm.2009129.hdf
file_in: vgpm.2009193.hdf.gz
file_out: vgpm.2009193.hdf
file_in: vgpm.2009081.hdf.gz
file_out: vgpm.2009081.hdf
file_in: vgpm.2009233.hdf.gz
file_out: vgpm.2009233.hdf
file_in: vgpm.2009321.hdf.gz
file_out: vgpm.2009321.hdf
file_in: vgpm.2009217.hdf.gz
file_out: vgpm.2009217.hdf
file_in: vgpm.2009209.hdf.gz
file_out: vgpm.2009209.hdf
file_in: vgpm.2009305.hdf.gz
file_out: vgpm.2009305.hdf
file_in: vgpm.2009065.hdf.gz
file_out: vgpm.2009065.hdf
file_in: vgpm.2009169.hdf.gz
file_out: vgpm.2009169.hdf
file_in: vgpm.2009177.hdf.gz
file_out: vgpm.2009177.hdf
file_in: vgpm.2009041.hdf.gz
file_out: vgpm.2009041.hdf
file_in: vgpm.2009153.hdf.gz
file_out: vgpm.2009153.hdf
file_in: vgpm.2009289.hdf.gz
file_out: vgpm.2009289.hdf
file_in: vgpm.2009297.hdf.gz

```

file_out: vgpm.2009297.hdf
file_in: vgpm.2009281.hdf.gz
file_out: vgpm.2009281.hdf
file_in: vgpm.2009201.hdf.gz
file_out: vgpm.2009201.hdf
file_in: vgpm.2009313.hdf.gz
file_out: vgpm.2009313.hdf
file_in: vgpm.2009225.hdf.gz
file_out: vgpm.2009225.hdf
file_in: vgpm.2009337.hdf.gz
file_out: vgpm.2009337.hdf
file_in: vgpm.2009329.hdf.gz
file_out: vgpm.2009329.hdf
file_in: vgpm.2009049.hdf.gz
file_out: vgpm.2009049.hdf
file_in: vgpm.2009057.hdf.gz
file_out: vgpm.2009057.hdf
file_in: vgpm.2009145.hdf.gz
file_out: vgpm.2009145.hdf
file_in: vgpm.2009073.hdf.gz
file_out: vgpm.2009073.hdf
file_in: vgpm.2009161.hdf.gz
file_out: vgpm.2009161.hdf

```

See <https://www.science-emergence.com/Articles/How-to-read-a-MODIS-HDF-file-using-python-/>

```

[7]: import os
import glob
from pyhdf.SD import SD, SDC

annual_primary_productivity=0
for doy in range(1,367,8):
    file_name='vgpm.'+str(year)+str(doy).zfill(3)+'.hdf'
    print('processing {}'.format(file_name) )

    file=SD(file_name,SDC.READ)
    print( 'file.info(): {}'.format(file.info()) )

    # print SDS names
    datasets_dic=file.datasets()
    for idx,sds in enumerate(datasets_dic.keys()):
        print( 'idx,sds: {0},{1}'.format(idx,sds) )

    # get npp
    sds_obj=file.select('npp') # select sds
    npp=sds_obj.get() # get sds data
    print( 'npp:\n{}'.format(npp) )

```

```

one_npp=npp[fakeDim0,fakeDim1]
if(one_npp<0):
    one_npp=0;
print( 'one_npp: {} mg C m-2 d-1'.format(one_npp) )

if(doy==361):
    if (year%4!=0 or (year%100==0 and year%400!=0)): # noleap year
        nb_days=5
    else:
        nb_days=6 # leap year
else:
    nb_days=8
annual_primary_productivity=annual_primary_productivity+one_npp*nb_days

```

```

processing vgpm.2009001.hdf
file.info(): (1, 4)
idx,sds: 0,npp
npp:
[[-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 ...
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]]
one_npp: 0 mg C m-2 d-1
processing vgpm.2009009.hdf
file.info(): (1, 4)
idx,sds: 0,npp
npp:
[[-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 ...
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]]
one_npp: 0 mg C m-2 d-1
processing vgpm.2009017.hdf
file.info(): (1, 4)
idx,sds: 0,npp
npp:
[[-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 ...
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]

```

```

[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]]
one_npp: 0 mg C m-2 d-1
processing vgpm.2009025.hdf
file.info(): (1, 4)
idx,sds: 0,npp
npp:
[[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
...
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]]
one_npp: 0 mg C m-2 d-1
processing vgpm.2009033.hdf
file.info(): (1, 4)
idx,sds: 0,npp
npp:
[[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
...
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]]
one_npp: 0 mg C m-2 d-1
processing vgpm.2009041.hdf
file.info(): (1, 4)
idx,sds: 0,npp
npp:
[[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
...
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]]
one_npp: 0 mg C m-2 d-1
processing vgpm.2009049.hdf
file.info(): (1, 4)
idx,sds: 0,npp
npp:
[[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
...
[-9999. -9999. -9999. ... -9999. -9999. -9999.]

```

```

[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]]
one_npp: 0 mg C m-2 d-1
processing vgpm.2009057.hdf
file.info(): (1, 4)
idx,sds: 0,npp
npp:
[[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
...
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]]
one_npp: 0 mg C m-2 d-1
processing vgpm.2009065.hdf
file.info(): (1, 4)
idx,sds: 0,npp
npp:
[[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
...
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]]
one_npp: 0 mg C m-2 d-1
processing vgpm.2009073.hdf
file.info(): (1, 4)
idx,sds: 0,npp
npp:
[[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
...
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]]
one_npp: 0 mg C m-2 d-1
processing vgpm.2009081.hdf
file.info(): (1, 4)
idx,sds: 0,npp
npp:
[[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
...
[-9999. -9999. -9999. ... -9999. -9999. -9999.]

```

```

[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]]
one_npp: 0 mg C m-2 d-1
processing vgpm.2009089.hdf
file.info(): (1, 4)
idx,sds: 0,npp
npp:
[[-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 ...
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]]
one_npp: 0 mg C m-2 d-1
processing vgpm.2009097.hdf
file.info(): (1, 4)
idx,sds: 0,npp
npp:
[[-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 ...
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]]
one_npp: 0 mg C m-2 d-1
processing vgpm.2009105.hdf
file.info(): (1, 4)
idx,sds: 0,npp
npp:
[[-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 ...
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]]
one_npp: 0 mg C m-2 d-1
processing vgpm.2009113.hdf
file.info(): (1, 4)
idx,sds: 0,npp
npp:
[[-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 ...
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]

```



```

[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]]
one_npp: 0 mg C m-2 d-1
processing vgpm.2009121.hdf
file.info(): (1, 4)
idx,sds: 0,npp
npp:
[[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
...
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]]
one_npp: 0 mg C m-2 d-1
processing vgpm.2009129.hdf
file.info(): (1, 4)
idx,sds: 0,npp
npp:
[[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
...
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]]
one_npp: 0 mg C m-2 d-1
processing vgpm.2009137.hdf
file.info(): (1, 4)
idx,sds: 0,npp
npp:
[[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
...
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]]
one_npp: 0 mg C m-2 d-1
processing vgpm.2009145.hdf
file.info(): (1, 4)
idx,sds: 0,npp
npp:
[[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
...
[-9999. -9999. -9999. ... -9999. -9999. -9999.]

```

```

[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]]
one_npp: 0 mg C m-2 d-1
processing vgpm.2009153.hdf
file.info(): (1, 4)
idx,sds: 0,npp
npp:
[[-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 ...
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]]
one_npp: 0 mg C m-2 d-1
processing vgpm.2009161.hdf
file.info(): (1, 4)
idx,sds: 0,npp
npp:
[[-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 ...
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]]
one_npp: 0 mg C m-2 d-1
processing vgpm.2009169.hdf
file.info(): (1, 4)
idx,sds: 0,npp
npp:
[[-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 ...
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]]
one_npp: 0 mg C m-2 d-1
processing vgpm.2009177.hdf
file.info(): (1, 4)
idx,sds: 0,npp
npp:
[[-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 ...
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]

```

```

[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]]
one_npp: 0 mg C m-2 d-1
processing vgpm.2009185.hdf
file.info(): (1, 4)
idx,sds: 0,npp
npp:
[[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
...
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]]
one_npp: 0 mg C m-2 d-1
processing vgpm.2009193.hdf
file.info(): (1, 4)
idx,sds: 0,npp
npp:
[[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
...
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]]
one_npp: 0 mg C m-2 d-1
processing vgpm.2009201.hdf
file.info(): (1, 4)
idx,sds: 0,npp
npp:
[[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
...
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]]
one_npp: 0 mg C m-2 d-1
processing vgpm.2009209.hdf
file.info(): (1, 4)
idx,sds: 0,npp
npp:
[[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
...
[-9999. -9999. -9999. ... -9999. -9999. -9999.]

```

```

[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]]
one_npp: 824.5983276367188 mg C m-2 d-1
processing vgpm.2009217.hdf
file.info(): (1, 4)
idx,sds: 0,npp
npp:
[[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
...
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]]
one_npp: 456.22998046875 mg C m-2 d-1
processing vgpm.2009225.hdf
file.info(): (1, 4)
idx,sds: 0,npp
npp:
[[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
...
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]]
one_npp: 448.6298828125 mg C m-2 d-1
processing vgpm.2009233.hdf
file.info(): (1, 4)
idx,sds: 0,npp
npp:
[[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
...
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]]
one_npp: 476.419921875 mg C m-2 d-1
processing vgpm.2009241.hdf
file.info(): (1, 4)
idx,sds: 0,npp
npp:
[[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
...
[-9999. -9999. -9999. ... -9999. -9999. -9999.]

```

```

[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]]
one_npp: 391.76165771484375 mg C m-2 d-1
processing vgpm.2009249.hdf
file.info(): (1, 4)
idx,sds: 0,npp
npp:
[[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
...
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]]
one_npp: 401.0020751953125 mg C m-2 d-1
processing vgpm.2009257.hdf
file.info(): (1, 4)
idx,sds: 0,npp
npp:
[[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
...
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]]
one_npp: 247.95327758789062 mg C m-2 d-1
processing vgpm.2009265.hdf
file.info(): (1, 4)
idx,sds: 0,npp
npp:
[[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
...
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]]
one_npp: 0 mg C m-2 d-1
processing vgpm.2009273.hdf
file.info(): (1, 4)
idx,sds: 0,npp
npp:
[[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]
...
[-9999. -9999. -9999. ... -9999. -9999. -9999.]

```

```

[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]]
one_npp: 0 mg C m-2 d-1
processing vgpm.2009281.hdf
file.info(): (1, 4)
idx,sds: 0,npp
npp:
[[-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 ...
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]]
one_npp: 0 mg C m-2 d-1
processing vgpm.2009289.hdf
file.info(): (1, 4)
idx,sds: 0,npp
npp:
[[-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 ...
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]]
one_npp: 0 mg C m-2 d-1
processing vgpm.2009297.hdf
file.info(): (1, 4)
idx,sds: 0,npp
npp:
[[-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 ...
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]]
one_npp: 0 mg C m-2 d-1
processing vgpm.2009305.hdf
file.info(): (1, 4)
idx,sds: 0,npp
npp:
[[-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 ...
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]

```

```

[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]]
one_npp: 0 mg C m-2 d-1
processing vgpm.2009313.hdf
file.info(): (1, 4)
idx,sds: 0,npp
npp:
[[-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 ...
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]]
one_npp: 0 mg C m-2 d-1
processing vgpm.2009321.hdf
file.info(): (1, 4)
idx,sds: 0,npp
npp:
[[-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 ...
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]]
one_npp: 0 mg C m-2 d-1
processing vgpm.2009329.hdf
file.info(): (1, 4)
idx,sds: 0,npp
npp:
[[-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 ...
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]]
one_npp: 0 mg C m-2 d-1
processing vgpm.2009337.hdf
file.info(): (1, 4)
idx,sds: 0,npp
npp:
[[-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 ...
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]

```

```

[-9999. -9999. -9999. ... -9999. -9999. -9999.]
[-9999. -9999. -9999. ... -9999. -9999. -9999.]]
one_npp: 0 mg C m-2 d-1
processing vgpm.2009345.hdf
file.info(): (1, 4)
idx,sds: 0,npp
npp:
[[-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 ...
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]]
one_npp: 0 mg C m-2 d-1
processing vgpm.2009353.hdf
file.info(): (1, 4)
idx,sds: 0,npp
npp:
[[-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 ...
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]]
one_npp: 0 mg C m-2 d-1
processing vgpm.2009361.hdf
file.info(): (1, 4)
idx,sds: 0,npp
npp:
[[-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 ...
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]
 [-9999. -9999. -9999. ... -9999. -9999. -9999.]]
one_npp: 0 mg C m-2 d-1

```

```

[8]: print("annual_primary_productivity: {0} mg C m-2 yr-1".
      ↪format(annual_primary_productivity))

```

annual_primary_productivity: 25972.760986328125 mg C m⁻² yr⁻¹

Let's transform it in $mmolCm^{-2}yr^{-1}$.

Conversion of annual primary productivity in $mgCm^{-2}yr^{-1}$ to annual primary productivity in $mmolCm^{-2}yr^{-1}$:

annual primary productivity in $mgCm^{-2}yr^{-1} \times \frac{gC}{1000mgC} \times \frac{molC}{12.011gC} \times \frac{1000mmolC}{molC}$

```
[9]: molar_mass_C=12.011 # g C/ mol C
      annual_primary_productivity_mmol_m2_yr=annual_primary_productivity*(1/1000)*(1/
      ↪molar_mass_C)*(1000/1)
```

```
[10]: print("annual_primary_productivity: {0} mmol C m-2 yr-1".
      ↪format(annual_primary_productivity_mmol_m2_yr))
```

annual_primary_productivity: 2162.414535536436 mmol C m⁻² yr⁻¹