

TMTplus Introduction to Scientific Programming

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March 2021

Chapter 12

Integrating *gdal* raster and vector data with *numpy*

Ex 12.1

```
from osgeo import ogr, gdal, gdal_array as gdarr
import numpy as np
import os

dataDirectory=r'YOUR_DIRECTORY\data'
os.chdir(dataDirectory)

# subset only Overijssel Temperatures
overTemperatureDs=gdal.Warp('Overijssel_2014.tif', "2014.tif",
    format="GTiff", dstSRS='EPSG:28992',
    cutlineDSName='NL_provinces.shp',
    cutlineWhere="NAME_1=Overijssel",
    dstNodata=-9999,
    cropToCutline = True,
    outputType=gdal.GDT_Float32)
overTemperatureDs=None
```

Ex 12.2

```
from osgeo import ogr, gdal, gdal_array as gdarr
import os

dataDirectory=r'YOUR_DIRECTORY\data'
os.chdir(dataDirectory)

# subset only Overijssel Temperatures to use later as a reference
overTemperatureDs=gdal.Warp('', "2014.tif", format="Mem",
    dstSRS='EPSG:28992', cutlineDSName='NL_provinces.shp',
    cutlineWhere="NAME_1=Overijssel", dstNodata=-9999,
    cropToCutline = True, outputType=gdal.GDT_Float32)
overTempArray=gdarr.DatasetReadAsArray(overTemperatureDs, 0, 0,
    overTemperatureDs.RasterXSize, overTemperatureDs.RasterYSize)

# prepare for Rasterize
memDriver = gdal.GetDriverByName('GTiff')
```

```

roadsRasterDs = memDriver.Create('roads_cars_per_hour.tif',
    overTemperatureDs.RasterXSize,
    overTemperatureDs.RasterYSize,
    1,gdal.GDT_Float32)
roadsRasterDs.SetProjection(overTemperatureDs.GetProjection())
# set projection
roadsRasterDs.SetGeoTransform(overTemperatureDs.GetGeoTransform())
# set geotransform

# create 1 band and set the nodata value
outband1 = roadsRasterDs.GetRasterBand(1)
outband1.SetNoDataValue(0)

roadsVectorDs = ogr.Open("ovRoads.geojson")
roadsLayer = roadsVectorDs.GetLayer()

# Rasterize A1 road in Overijssel
gdal.RasterizeLayer(roadsRasterDs, [1], roadsLayer,
    options=['ATTRIBUTE=vehic_p_hour'])
outband1.FlushCache()
outband1=None
roadsRasterDs=None

```

```

from osgeo import ogr, gdal, gdal_array as gdarr
from matplotlib import pyplot as plt
import numpy as np
import os

dataDirectory=r'YOUR_DIRECTORY\data'
os.chdir(dataDirectory)

# subset only Overijssel Temperatures
overTemperatureDs=gdal.Warp('', "2014.tif",format="Mem",
    dstSRS='EPSG:28992',
    cutlineDSName='NL_provinces.shp',
    cutlineWhere="NAME_1='Overijssel'",
    dstNodata=-9999,cropToCutline = True, outputType=gdal.GDT_Float32)
overTempArray=gdarr.DatasetReadAsArray(overTemperatureDs, 0, 0,
    overTemperatureDs.RasterXSize, overTemperatureDs.RasterYSize)

# prepare for Rasterize Road A1
memDriver = gdal.GetDriverByName('Mem')
roadsRasterDs = memDriver.Create('',overTemperatureDs.RasterXSize,
    overTemperatureDs.RasterYSize,1,gdal.GDT_Float32)
roadsRasterDs.SetProjection(overTemperatureDs.GetProjection())
# set projection

roadsRasterDs.SetGeoTransform(overTemperatureDs.GetGeoTransform())
# set geotransform

# create 1 band and set the nodata value
outband1 = roadsRasterDs.GetRasterBand(1)
outband1.SetNoDataValue(0)

```

Ex 12.3

```

roadsVectorDs = ogr.Open("ovRoads.geojson")
roadsLayer = roadsVectorDs.GetLayer()
roadsLayer.SetAttributeFilter("id= 'A1'")

# rasterize A1 road in Overijssel
gdal.RasterizeLayer(roadsRasterDs, [1], roadsLayer, burn_values=[1],
options=['ALL_TOUCHED=TRUE'])
roadsArray=gdarr.DatasetReadAsArray(roadsRasterDs, 0, 0,
roadsRasterDs.RasterXSize, roadsRasterDs.RasterYSize)

overTemperatureDs=None
roadsVectorDs=None
roadsRasterDs=None
print('A1_road_shape:', roadsArray.shape)
print('Overijssel_temperature_shape:', overTempArray.shape)

# multiply roads by temperature. The output will be temperatures.
roadsTemperature=roadsArray*overTempArray
print('A1_road_temperatures_shape:', roadsTemperature.shape)

# compute highest temperatures
roadsMaxTemperature=np.max(roadsTemperature, axis=0)
print('A1_highest_temperatures_shape', roadsMaxTemperature.shape)

# removing
roadsMaxTemperature[roadsMaxTemperature <=0 ] = None
minLowerTemp=np.nanmin(roadsMaxTemperature)
maxLowerTemp=np.nanmax(roadsMaxTemperature)
print('Highest_temperatures_recorded_in_2014_in_A1_in_Overijssel
are_between:', minLowerTemp, 'and', maxLowerTemp)

```

Ex 12.4

```

from osgeo import ogr, gdal, gdal_array as gdarr
from matplotlib import pyplot as plt
import numpy as np
import os

dataDirectory=r'YOUR_DIRECTORY\data'
os.chdir(dataDirectory)

#Subset only Overijssel Temperatures
overTemperatureDs=gdal.Warp('', "2014.tif",
format="Mem",
dstSRS='EPSG:28992',
cutlineDSName='NL_provinces.shp',
cutlineWhere="NAME_1='Overijssel'",
dstNodata=-9999,
cropToCutline = True,
outputType=gdal.GDT_Float32)
overTempArray=gdarr.DatasetReadAsArray(overTemperatureDs,
0, 0, overTemperatureDs.RasterXSize,
overTemperatureDs.RasterYSize)

```

```

#Prepare for Rasterize Road A1
memDriver = gdal.GetDriverByName('Mem')
roadsRasterDs = memDriver.Create('',overTemperatureDs.
RasterXSize,overTemperatureDs.RasterYSize,1,
gdal.GDT_Float32)
roadsRasterDs.SetProjection(overTemperatureDs.GetProjection())
# set projection
roadsRasterDs.SetGeoTransform(overTemperatureDs.GetGeoTransform())
# set geotrasform

# create 1 band and set the nodata value
outband1 = roadsRasterDs.GetRasterBand(1)
outband1.SetNoDataValue(0)

roadsVectorDs = ogr.Open("ovRoads.geojson")
roadsLayer = roadsVectorDs.GetLayer()
roadsLayer.SetAttributeFilter("id_ = 'A1'")

# rasterize A1 road in Overijssel
gdal.RasterizeLayer(roadsRasterDs, [1], roadsLayer,
burn_values=[1], options=['ALL_TOUCHED=TRUE'])
roadsArray=gdarr.DatasetReadAsArray(roadsRasterDs, 0, 0,
roadsRasterDs.RasterXSize, roadsRasterDs.RasterYSize)

# multiply roads by temperature. The output will be temperatures.
roadsTemperature=roadsArray*overTempArray

# compute lower temperatures
roadsMaxTemperature=np.max(roadsTemperature, axis=0)

# remove values below 0
roadsMaxTemperature[roadsMaxTemperature <=0 ] = None

# create the new dataset
gtiffDriver = gdal.GetDriverByName('Gtiff')
highestTempRoadsDs = gtiffDriver.Create('roadHighestTemp.tif',
overTemperatureDs.RasterXSize,
overTemperatureDs.RasterYSize,
1,gdal.GDT_Float32)
highestTempRoadsDs.SetProjection(overTemperatureDs.GetProjection())
# set projection
highestTempRoadsDs.SetGeoTransform(overTemperatureDs.GetGeoTransform())
# set geotransform

# create 1 band and set the nodata value
highestTempRoadsband1 = highestTempRoadsDs.GetRasterBand(1)
highestTempRoadsband1.SetNoDataValue(-9999)

#add numpy into the band
highestTempRoadsband1.WriteArray(roadsMaxTemperature)

#clean an close the dataset
highestTempRoadsband1.FlushCache()

```

```
highestTempRoadsDs=None
```