

## Q & A (2)

shapefile import & plume containment

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CEE 696

1. Integration with ArcGIS and QGIS

# Integration with ArcGIS and QGIS

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# Shapefile

- A popular geospatial vector data format for GIS software
- vector vs. raster
- The shapefile format can spatially describe vector features: points, lines, and polygons, representing, for example, water wells, rivers, and lakes.

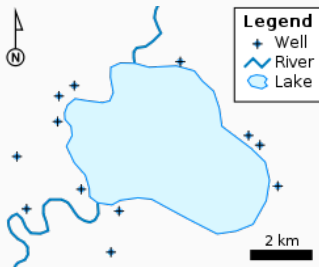


Figure 1: from <https://en.wikipedia.org/wiki/Shapefile>, A vector map, with points, polylines and polygons

## Example

Please download scripts and files from the course website. Unzip shape files in your working folder:

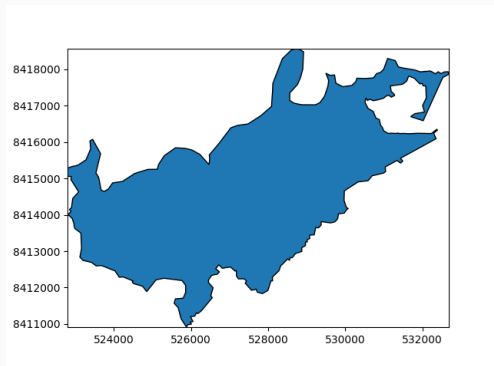


Figure 2: Tutuila island in American Samoa

## Example - plot shapefile contents using Flopy

You need to install (1) `pyshp` package to read shapefile and 2) `descartes` package to plot

```
import shapefile as sf
from flopy.utils.geometry import shape
fname = './Unit_boundaries.shp'
sfobj = sf.Reader(fname)

flopy_geom = shape(list(sfobj.iterShapes())[0])

# plot geometry
flopy_geom.plot()
```

## Example



I set Origin:  $x_{ul} = 522000$  and  $y_{ul} = 8420000$   
and  $L_x = 125000$ ,  $L_y = 10000$

# Example - relevant package installation

You need to install **GISio** ([https://github.com/aleaf/GIS\\_utils](https://github.com/aleaf/GIS_utils)), **fiona**, **pyproj**, **rtree** and **rasterio**

GISio might not be available in common python package list pycharm is using and you have to install it manually..

1. open your Anaconda Prompt
2. conda install **pip** (if you don't have)
3. type “pip install [https://github.com/aleaf/GIS\\_utils/archive/master.zip](https://github.com/aleaf/GIS_utils/archive/master.zip)”

```
(base) C:\Users\Harry>pip install https://github.com/aleaf/GIS_utils/archive/master.zip
Collecting https://github.com/aleaf/GIS_utils/archive/master.zip
  Downloading https://github.com/aleaf/GIS_utils/archive/master.zip
    - 1.8MB 3.9MB/s
Installing collected packages: GIS-utils
  Running setup.py install for GIS-utils ... done
Successfully installed GIS-utils-0.1
```



## Example - create IBOUND array

```
import matplotlib.pyplot as plt
from shapely.geometry import mapping
from rasterio import features
from rasterio import Affine
from GISio import shp2df, get_proj4

# model grid info
xul, yul = 522000., 8420000.
rotation = 0

dx = 250. # cell spacing in meters
dy = 250.
nrow, ncol = 40, 50 # number of rows and columns
```

## Example - cont'd

```
fname = './Unit_boundaries.shp'

df = shp2df(fname)
print(df.geometry[0].bounds) # domain extent

# convert feature to GeoJSON
feature_gj = mapping(df.geometry[0])

# create a list of (feature, number) tuples
# the number for each feature will be assigned to the in
shapes = [(feature_gj, 1)]

# create a rasterio.Affine reference for the grid
trans = Affine(dx, 0, xul,
               0, -dy, yul)
```

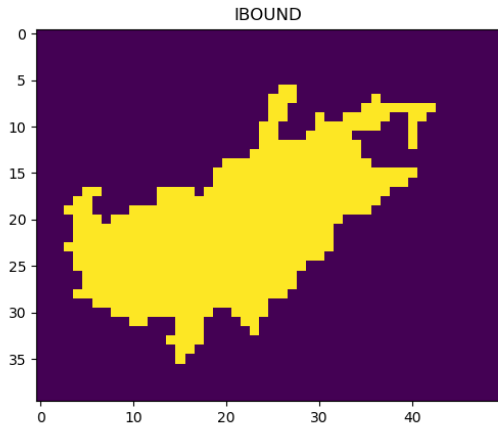
## Example - cont'd

```
# "rasterize" the features to a numpy array
result = features.rasterize(shapes, out_shape=(nrow, ncol))

print(result) # this is your IBOUND for mf

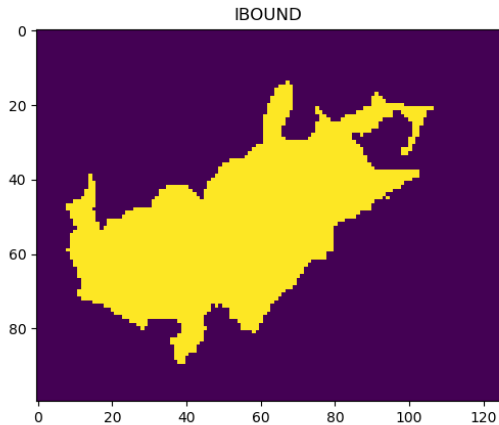
# plot IBOUND array
plt.figure()
plt.imshow(result) # image show
plt.title('IBOUND')
```

## Example - coarse discretization



$dx = 250$ ,  $dy = 250$ .  $nrow = 40$ ,  $ncol = 50$

## Example - fine discretization



$dx = 100$ ,  $dy = 100$ .  $nrow = 100$ ,  $ncol = 125$