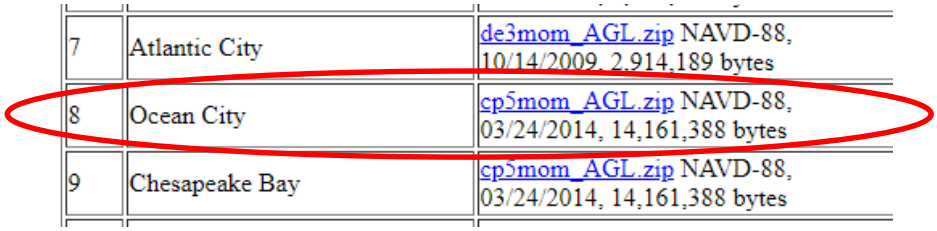
Lab 5: Point Pattern Analysis

Today we want to continue working with the property data we used last week and start to understand the environmental impact on observed home values in the Ocean City, MD area. For today's lab, we want to download and sample data from NOAA's SLOSH hurricane surge estimates and then produce clustering statistics to see if homes at risk of different hurricane classifications (C1 – C4) are clustered in geographic space (we'd expect that they are given coastal proximity, but let's test anyway).

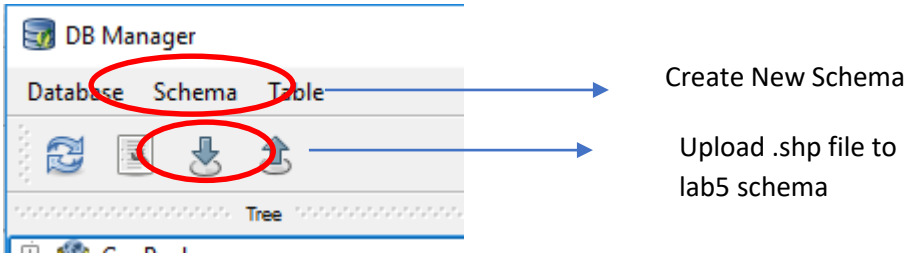
To download the NOAA data go to: https://slosh.nws.noaa.gov/sdp/ and enter the following credentials → User: Gustav2008, Password: Ike2008

Scroll to the bottom of the page and select the shapefile download for the "MOM Above Ground Level Page"

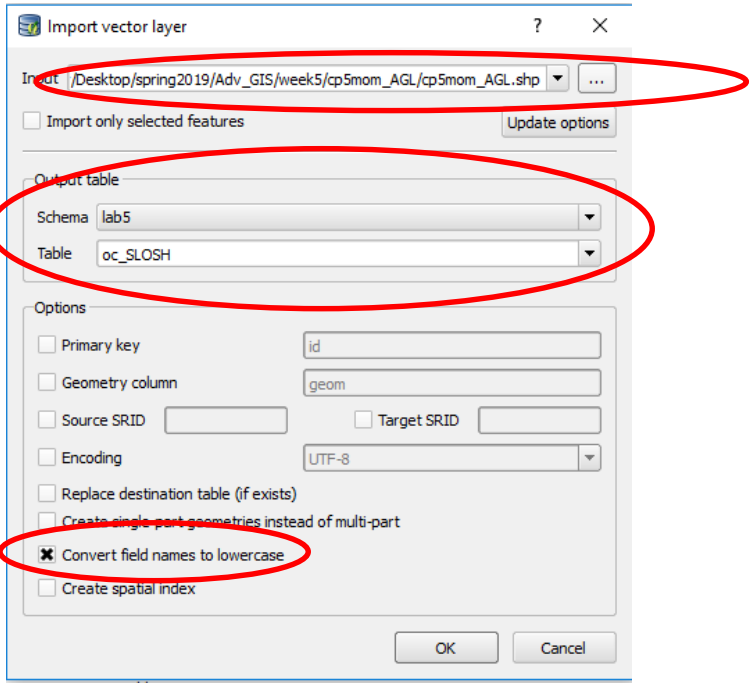
On the next page, scroll down to the ocean city MD file and download the .zip file (cp5mom_AGL.zip).



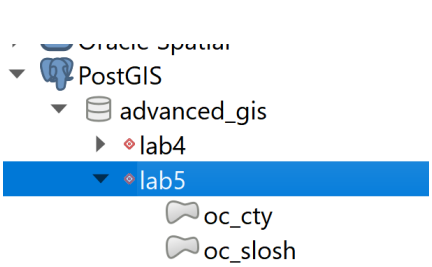
This .zip file contains the spatial coverage of NOAA's estimation of hurricane impacts for the Ocean City, MD region. Let's un-sip the file and upload it to a new schema thought the "schema" menu in QGIS… name the new schema "lab5" and then upload the shapefile to the "lab5"schema.

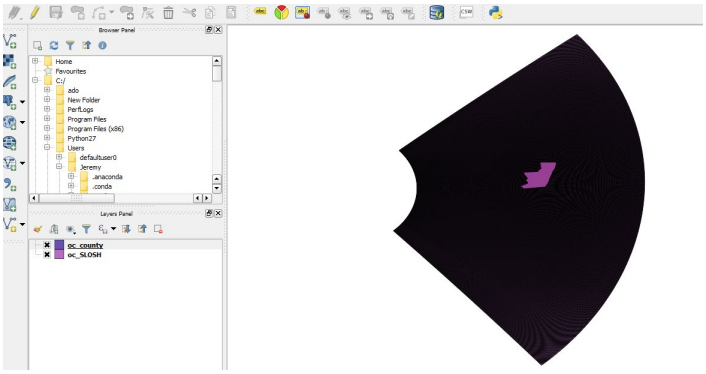


To upload the shapefile into our Postgres Database, let's 1) search for the file (make sure you select the .shp file), 2) indicate the schema you would like to upload the file too (lab5), 3) rename the table to something meaningful to you (in the lab I'm going to refer to it as "oc_SLOSH"), and 4) check the box to convert all field names to lowercase. It will take a couple of minutes to upload (you will see a "Import Successful" notification after it uploads). After it uploads, let's also upload the "oc_county.shp" into the same schema. I gave it the table name of 'oc_cty.



Now in your lab5 schema, you should see the oc_slosh, bounds, and oc_cty shapefiles. If you right-click on the file, you can "add to canvas". Let's add all of them now…

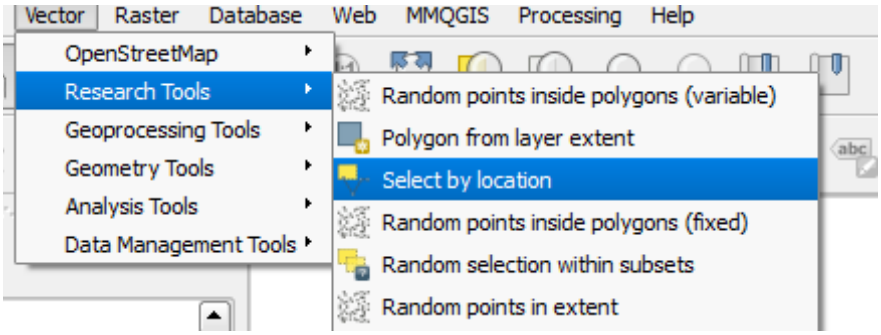




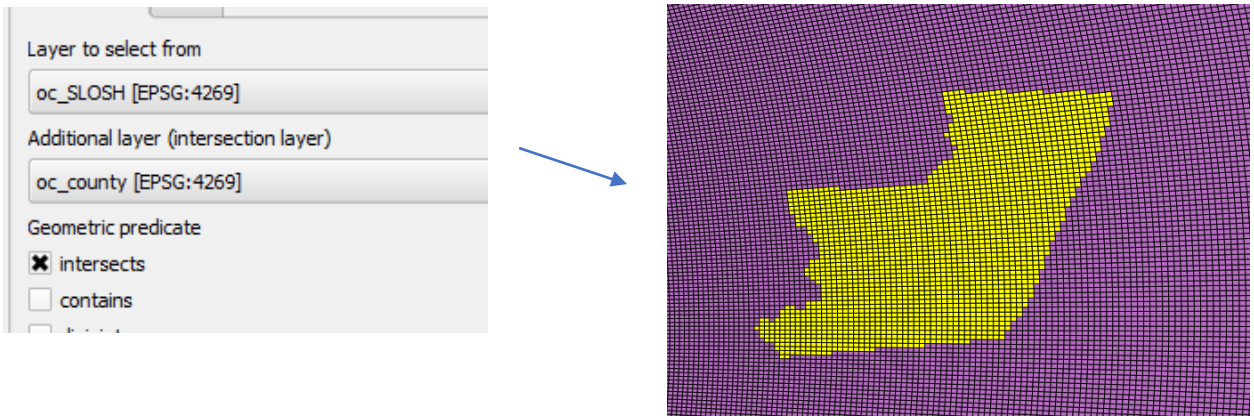
Now in your QGIS canvas, you should see the NOAA SLOSH basin for the Ocean City, MD area along with the boundary for the oc_county.shp file.

*****The following pages walk through the manual geo-processing of these files to extract and display only the SLOSH grid area within Ocean City, MD. I'll walk through this here, but we are going to use the PostGIS functionality in "lab5_PostgreSQL_Query.sql" to reproduce this output in scripted form***.**

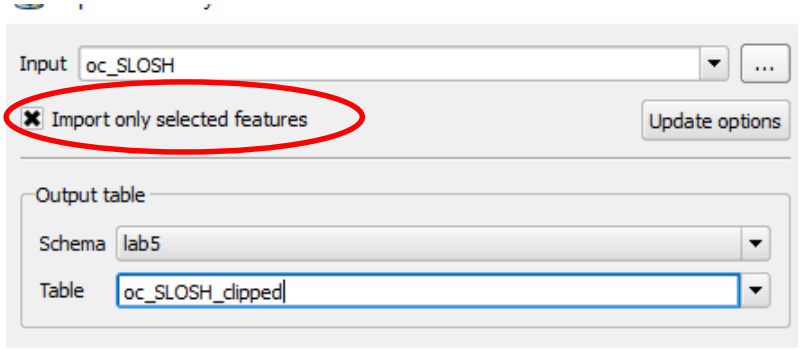
This SLOSH basin includes over 250k grid cells (polygons) with estimate levels of inundation from C1 – C4 hurricanes, but much of that is missing data (coded as 99.9 in the data table). To limit the file to just the grid cells within the oc_county.shp boundary, lets use the Vector→ResearchTools→Select by Location tool.



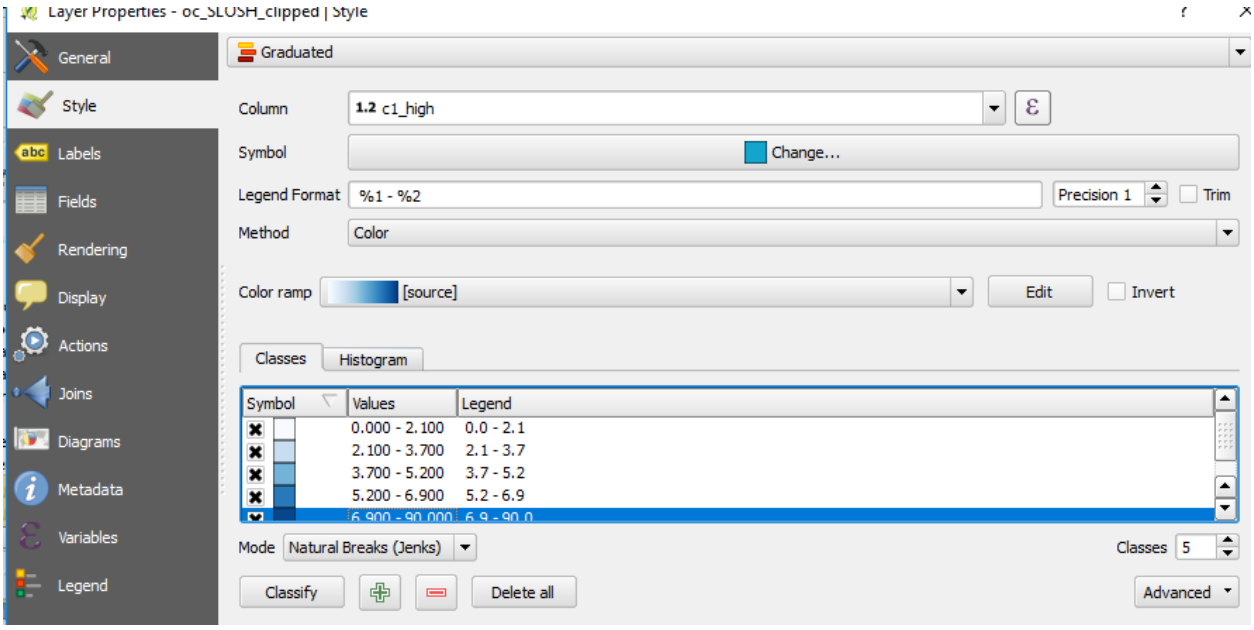
In the selection window, select the oc_SLOSH layer as the layer to select from, the oc_county layer as the additional layer, and instersects as the spatial operation. Once you run the selection, only grid cells that intersect the oc_county layer will be selected.



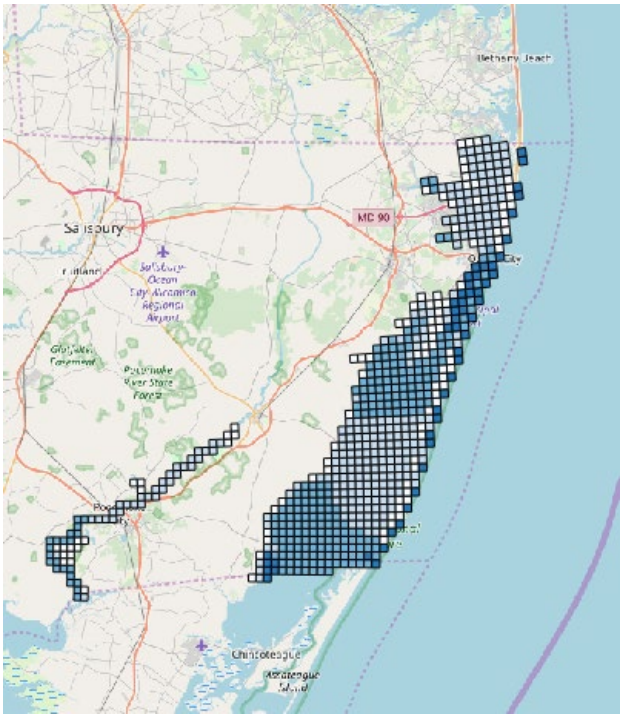
To save the new selected grid cells, go back to the DB manager and import the file. Be sure that when you import the file, you only import selected features, you load it into the lab5 schema, and for convenience I renamed my table as "oc_SLOSH_clipped". Once it is imported, add it to the canvas…. I'm also going to remove the oc_county layer and the oc_SLOSH layer.



You should now only have the SLOSH grid cells for the Ocean City, MD immediate area. I'm going to visualize the data to see hurricane inundation heights for a C1 hurricane in the area. I'm going to map the C1_high variable, using a natural breaks classification scheme, with 5 classes, and a monochromatic scale. I'm also going to manually remove 99.9 as a value because it represents no data (the rest of the numbers indicate the feet above the ground for a hurricane storm surge).



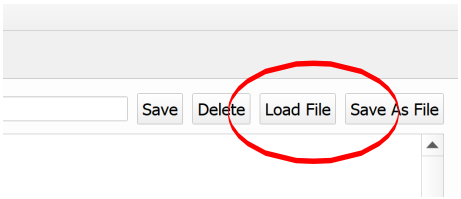
I'm also going to add a background map (use the plugins menu and install the OpenLayers plugin if needed) from my Web menu. In the OpenLayers area, I'm going to add the OpenStreetMap and drag it below the oc_SLOSH_clipped file in the TOC.



The map now shows the inundation in feet of expected storm surge from a C1 hurricane in the Ocean City, MD area.

*****Let's work back through the geoprocessing steps in the last few pages using PostGIS functions*****

To do this, go to the database manager and open the query window select the SQL window icon.



In the SQL window first go to "load file" and add the "lab5_PostgreSQL_Query.sql" script that I gave you with your file materials. The script is commented with /* .... */ to indicate the steps that each of the SQL queries and PostGIS function performs in the steps above (we'll walk through this in class).

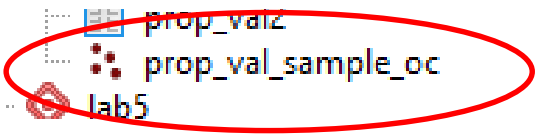
The last two queries actually take our file from lab4 and make it spatial using the following queries.

```
1  Select addgeometrycolumn ('lab4','prop_val_sample_oc','geom',4269,'POINT',2);
```

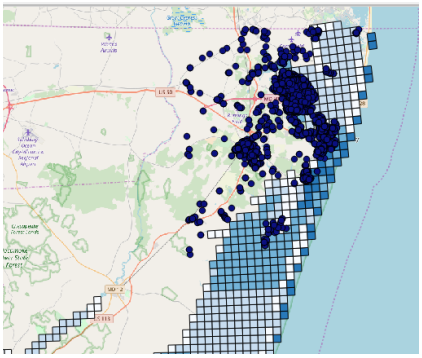
Once the geometry column has been added we can populate it by assigning the POINT a longitude (x) and latitude (y), because the table data are not in the right format we also have to cast the x and y variables as type = double precision. Finally, we set the same CRS (EPSG:4326) that we set in the early statement.

```
1  update lab4.prop_val_sample_oc
2  set geom = ST_setSRID(ST_MakePoint(x::double precision,y::double precision), 4269);
```

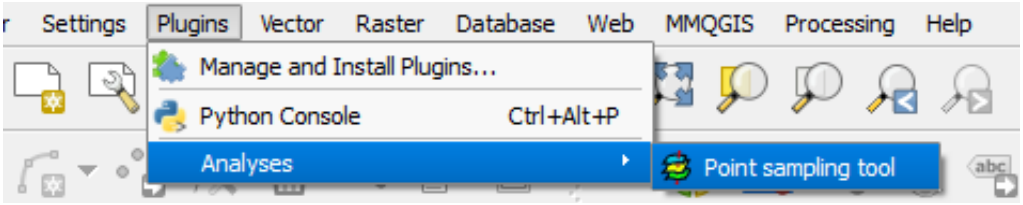
You can also see that our file in the Postgis TOC has been converted to a point file because we have added geography to the file.



If you right-click on the new point file, you can now also see it loaded into the QGIS.

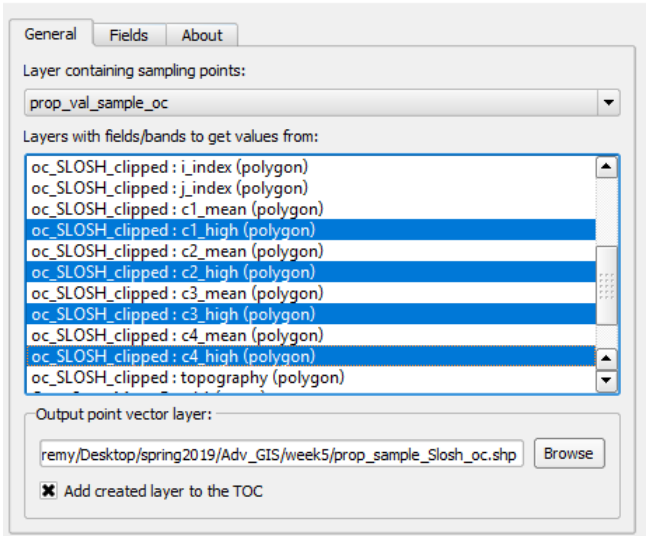


Now that both files are overlaid spatially, lets sample the hurricane risk to each of the properties from the week before. To do this, let's install the plugin "point sampling tool" and then open the tool from the Plugins→Analyses menu.

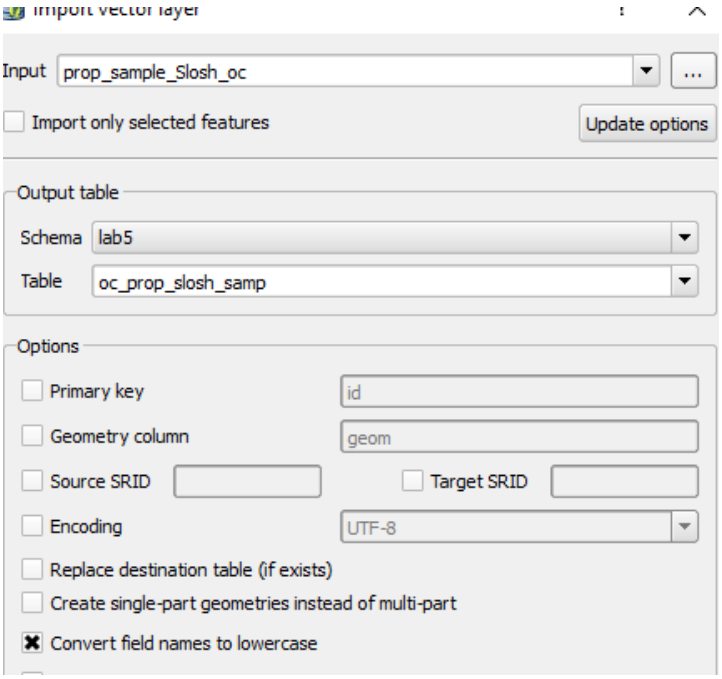


Don't Run this process... it takes a long time and I've given you the file to import in it's place.

In the point sample window, we want to sample to the "prop_val_sample_oc" point file from the "oc_SLOSH_clipped" grids. At this point, let's make sure to sample the c1_high, c2_high, c3_high, and c4_high so that we have all four hurricane types available for this region. Finally, save out the new sampled point file to your week5 lab folder (we will upload it to postgis later).



Once the new file is created, let's import it into our lab5 schema..... the sampling process actually takes a long time so I have given you this file with your lab materials (prop_sample_sloch_oc.shp). Use the file I've given you and import it into the lab5 schema in place of the



Next, I want to bring the data into R and get a feel for the spatial clustering of home locations based on recent property sales and risk of hurricane storm surge inundation

See the accompanying R script ("Lab5_PointPattern_Analysis.R) to continue.