Lab 07: Raster processing

By completing this lab, you will:

* Understand fundamental raster processing in PostGIS SQL.
* Learn to clip raster by using existing boundaries or ST\_MakeEnvelope()
* Using ST\_AddBand to form multiband rasters from single-band rasters
* Conduct raster statistics functions

Total points: 9pts

Please submit the lab in word or PDF format, with pasted (don’t screenshot) commands and screenshotted results.

Data Instruction

Massachusetts (roughly (41.67° N, 73.15° W) to (42.80° N, 70.70° W))

SHP: Massachusetts\_shapefile (SRID: 4326)

A green outline of a state

AI-generated content may be incorrect.

Exercise 1 (1pt):

Clip raster (prec) by using Massachusetts\_shapefile and store the result as a table (prec\_mass)

-- WHERE ST\_Intersects(rast,geom);

DROP TABLE IF EXISTS ch10.prec\_mass;

-- save result to raster table

-- Step 1: Create a new raster table

CREATE TABLE ch10.prec\_mass (

id SERIAL PRIMARY KEY,

rast raster,

filename TEXT,

month INTEGER

);

-- Step 2: Insert the raster result into the new table

INSERT INTO ch10.prec\_mass (rast, filename, month)

SELECT

ST\_Union(ST\_Clip(rast, geom)) AS rast,

filename,

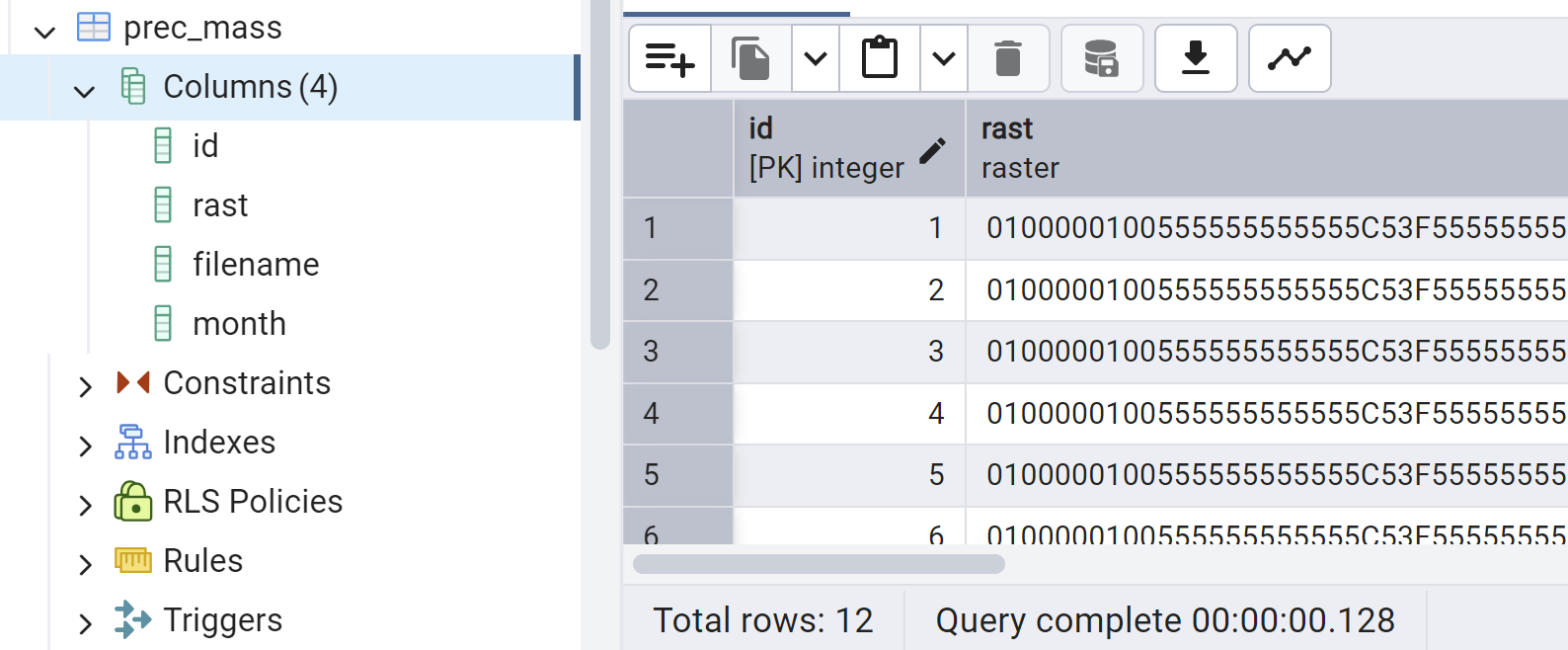
month

FROM ch10.prec

CROSS JOIN ch10.mass\_shp AS geom

WHERE ST\_Intersects(rast, geom)

GROUP BY filename, month;



Exercise 2: calculate mean precipitation by each month for prec\_class (1pt)

SELECT

month,

(stats).mean AS mean\_precipitation

FROM (

SELECT

month,

ST\_SummaryStatsAgg(rast, 1, TRUE) AS stats -- Extracting summary statistics for Band 1

FROM ch10.prec\_mass

GROUP BY month

) AS subquery

ORDER BY month;

A screenshot of a computer

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Exercise 3: list out all statistical summary for prec\_class by month (1pt)

SELECT

month,

(stats).\*

FROM (

SELECT

month,

ST\_SummaryStatsAgg(rast, 1, TRUE) AS stats -- Compute summary statistics for Band 1

FROM ch10.prec\_mass

GROUP BY month

) AS subquery

ORDER BY month;

A screenshot of a computer

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On Your Own:

Task 1: clip elev (elevation) and tmean (temperature) by using Massachusetts\_shapefile and store the result as tables (elev\_mass, temp\_mass); plot the result in QGIS and paste the screenshots here (1pt).

-- WHERE ST\_Intersects(rast,geom);

DROP TABLE IF EXISTS ch10.elev\_mass;

-- save result to raster table

-- Step 1: Create a new raster table

CREATE TABLE ch10.elev\_mass (

id SERIAL PRIMARY KEY,

rast raster,

filename TEXT

);

-- Step 2: Insert the raster result into the new table

INSERT INTO ch10.elev\_mass (rast, filename)

SELECT

ST\_Union(ST\_Clip(rast, geom)) AS rast,

filename

FROM ch10.elev

CROSS JOIN ch10.mass\_shp AS geom

WHERE ST\_Intersects(rast, geom)

GROUP BY filename;







Task 2: combine temp\_mass, elev\_mass, and prec\_mass into a multiband raster (name it: t\_p\_e\_mass) and create the index idx\_t\_p\_e\_mass\_rast\_gist (1pt)

-- working with band

CREATE TABLE ch10.t\_p\_e\_mass (

rid serial primary key,

rast raster,

filename\_tmean text,

filename\_prec text,

filename\_elev text,

month smallint

);

INSERT INTO ch10.t\_p\_e\_mass(rast, filename\_tmean, filename\_prec, filename\_elev, month)

SELECT

ST\_AddBand(ST\_AddBand(t.rast, p.rast), e.rast) As rast,

t.filename As filename\_tmean,

p.filename As filename\_prec,

e.filename AS filename\_elev,

t.month

FROM ch10.temp\_mass As t

INNER JOIN ch10.prec\_mass As p

ON t.rast ~= p.rast AND t.month = p.month

INNER JOIN ch10.elev\_mass AS e

ON t.rast ~= e.rast;

CREATE INDEX idx\_t\_p\_e\_mass\_rast\_gist

ON ch10.t\_p\_e\_mass

USING gist (ST\_ConvexHull(rast));

A person holding a blue object

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Task 3: list out the mean, max, min, and standard deviation of temperature by month for table t\_p\_e\_mass using ST\_SummaryStatsAgg() function (1pt).

SELECT

t.month,

(stats\_t).mean AS t\_mean,

(stats\_t).max AS t\_max,

(stats\_t).min AS t\_min,

(stats\_p).mean AS p\_mean,

(stats\_p).max AS p\_max,

(stats\_p).min AS p\_min

FROM (

SELECT

month,

ST\_SummaryStatsAgg(rast, 1, TRUE) AS stats\_t

FROM ch10.t\_p\_e\_mass

GROUP BY month

) AS t

JOIN (

SELECT

month,

ST\_SummaryStatsAgg(rast, 2, TRUE) AS stats\_p

FROM ch10.t\_p\_e\_mass

GROUP BY month

) AS p

ON t.month = p.month

ORDER BY t.month;

A screenshot of a computer

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Task 4: query temperature and precipitation at point (71.8W, 42.2N) (Worcester) between January and September on table t\_p\_e\_mass using ST\_Value() function (1pt)

-- raster statistics

SELECT month, ST\_Value(rast, 1, pt) AS t, ST\_Value(rast, 2, pt) AS p

FROM ch10.tmean\_prec INNER JOIN

ST\_SetSRID(ST\_Point(-71.8, 42.2), 4326) AS pt

ON (MONTH BETWEEN 1 AND 9 AND ST\_Intersects(rast, pt));

Task 5: extract elevation and clip them based on the point (71.8W, 42.2N) with 0.01 degree buffer, save the result as a vector table and plot it in QGIS (2pt)

DROP TABLE IF EXISTS ch10.raster\_result;

CREATE TABLE ch10.raster\_result AS

SELECT

CAST((gval).val AS FLOAT) AS val,

ST\_Union((gval).geom) AS geom

FROM (

SELECT ST\_Intersection(ST\_Clip(t.rast, ST\_Envelope(buf.geom)), 3, buf.geom) AS gval

FROM ch10.t\_p\_e\_mass AS t

INNER JOIN LATERAL (

SELECT ST\_Buffer(ST\_Transform(ST\_GeomFromText('POINT(-71.8 42.2)', 4326), ST\_SRID(t.rast)), 0.3) AS geom

) AS buf ON ST\_Intersects(t.rast, buf.geom)

) AS foo

GROUP BY (gval).val

ORDER BY (gval).val;

