Mapping at Mapzen

Adventures in OpenGL

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Bubble Wrap cartography

Introduced 2016.03.24, used in Eraser Map, Mapzen’s privacy focused Android app (in private beta)
CHAIR LIFTS, GONDOLAS AND SKI RUNS
Sprite sheet
Terrain

diving back in
**Terrarium:** raw elevation PNG tiles

Terrarium format PNG tiles contain raw elevation data in meters. All values are positive with a 32,768 offset, split into the red, green, and blue channels, with 16 bits of integer and 8 bits of fraction.
decoded to full elevation range

Decoding Terrarium tiles:
(red * 256 + green + blue / 256) - 32768
basic colouring applied
client-side WebGL contours (animated!)
**Normal**: processed elevation PNG tiles

Normal format PNG tiles are processed elevation data with the the **red**, **green**, and **blue** values corresponding to the direction the pixel “surface” is facing (its XYZ vector).

The **alpha** channel contains quantized elevation data with values suitable for common hypsometric tint ranges. *High alpha channel values indicate lower elevation values (below sea level), making them more opaque.*
Normal format alpha values are counted in (floored) elevation increments.

Below sea level they start at -11,000 meters (Mariana Trench) and range to -1,000 meters in 1,000 meter increments, with more detail on the coastal shelf at -100, -50, -20, -10 and -1 meters and finally 0 (intertidal zone). Values above sea level are reported in 20 meter increments to 3,000 meters, then 50 meter increments until 6,000 meters, and then 100 meter increments until 8,900 meters (Mount Everest).
Using the Normal values and vertical “exaggeration” applied
ridges & valleys
conventional hillshade

Using the Normal values
conventional hillshade

Using the Normal values & vertical “exaggeration” applied
Sphere Maps

With this technique, a source image is “stretched” over an infinitely large hemisphere covering the scene. Then, each face of the 3D geometry (or each pixel in the normal map) is assigned a new color according to which part of the source image it “faces.”

The effect is of a strongly colored sky casting light on the scene, which can produce striking results with relatively little calculation. For our
Upper-left illumination
1. **High** relief
2. **Mid** relief
3. **Low** relief

*Upper-left* illumination
1. High relief
2. Mid relief
3. Low relief

Upper-left illumination

vertical exaggeration
Outdoor Experiments

sphere maps, oh my!
-- returns TRUE if the given way ID (osm_id) is part of a path route relation,
-- or NULL otherwise.
-- This function is meant to be called for something that we already know is a path.
-- Please ensure input is already a path, or output will be undefined.

```
CREATE OR REPLACE FUNCTION mz_calculate_path_major_route(osm_id BIGINT)
RETURNS SMALLINT AS $$
BEGIN
  RETURN (
    SELECT
      MIN(
        CASE WHEN hstore(tags)->'network' IN ('iwn', 'nwn', 'icn', 'ncn') THEN 11
        WHEN hstore(tags)->'network' IN ('rwn', 'rcn') THEN 12
        WHEN hstore(tags)->'network' IN ('lwn', 'lcn') THEN 13
        ELSE NULL
        END)
    AS p
  FROM planet_osm_rels
  WHERE
    parts && ARRAY[osm_id] AND
    parts[way_off+1:rel_off] && ARRAY[osm_id] AND
    mz_is_path_major_route_relation(hstore(tags))
  );
END;
$$ LANGUAGE plpgsql STABLE;
```
Outdoor style

¡¡¡alpha!!!
References

Tile endpoints:

- https://terrain-preview.mapzen.com/terrarium/{z}/{x}/{y}.png
- https://terrain-preview.mapzen.com/normal/{z}/{x}/{y}.png
- https://terrain-preview.mapzen.com/geotiff/{z}/{x}/{y}.tif

Blog posts:

- https://mapzen.com/blog/mapping-mountains/
- https://mapzen.com/blog/bubble-wrap-carto/
¿Questions?

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