

A detailed 3D rendering of a satellite in space, featuring a central body with various instruments and two large, rectangular solar panel arrays extending outwards. The background is a dark, textured blue representing the Earth's surface or atmosphere. A solid red vertical rectangle is positioned in the upper right corner of the image.

3D Reconstruction of Satellite Images

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- ▶ Preprocessing
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Image Format: geoTiff

- ▶ Format combines .tif image and meta data (containing geodata information)
- ▶ In our case: separate files (.tif and .txt)

$$\sum_{i=1}^{20} C_i \cdot \rho_i(P, L, H) =$$

C_1	$+ C_6 \cdot L \cdot H$	$+ C_{11} \cdot P \cdot L \cdot H$	$+ C_{16} \cdot P^3$
$+ C_2 \cdot L$	$+ C_7 \cdot P \cdot H$	$+ C_{12} \cdot L^3$	$+ C_{17} \cdot P \cdot H^2$
$+ C_3 \cdot P$	$+ C_8 \cdot L^2$	$+ C_{13} \cdot L \cdot P^2$	$+ C_{18} \cdot L^2 \cdot H$
$+ C_4 \cdot H$	$+ C_9 \cdot P^2$	$+ C_{14} \cdot L \cdot H^2$	$+ C_{19} \cdot P^2 \cdot H$
$+ C_5 \cdot L \cdot P$	$+ C_{10} \cdot H^2$	$+ C_{15} \cdot L^2 \cdot P$	$+ C_{20} \cdot H^3$

$$r_n = \frac{\sum_{i=1}^{20} \text{LINE_NUM_COEF}_i \cdot \rho_i(P, L, H)}{\sum_{i=1}^{20} \text{LINE_DEN_COEF}_i \cdot \rho_i(P, L, H)} \quad \text{and} \quad c_n = \frac{\sum_{i=1}^{20} \text{SAMP_NUM_COEF}_i \cdot \rho_i(P, L, H)}{\sum_{i=1}^{20} \text{SAMP_DEN_COEF}_i \cdot \rho_i(P, L, H)}$$

```

1 def convert_rcp(filepath: str) -> dict:
2     # Regular expression pattern to extract the RPC values
3     pattern = r'(-?\d+(?:\.\d+)?)'
4
5     # Read the RPC values from the text file
6     with open(filepath, 'r') as file:
7         rpc_values = file.read()
8
9     # Extract the RPC values using the regular expression
10    values = [str(x) for x in re.findall(pattern, rpc_values)]
11
12    (variable) rpc_dict: dict[str, str] and values
13    rpc_dict = {
14        'LINE_OFF': values[0],
15        'SAMP_OFF': values[1],
16        'LAT_OFF': values[2],
17        'LONG_OFF': values[3],
18        'HEIGHT_OFF': values[4],
19        'LINE_SCALE': values[5],
20        'SAMP_SCALE': values[6],
21        'LAT_SCALE': values[7],
22        'LONG_SCALE': values[8],
23        'HEIGHT_SCALE': values[9],
24        'LINE_NUM_COEFF': ' '.join(values[10:30]),
25        'LINE_DEN_COEFF': ' '.join(values[30:50]),
26        'SAMP_NUM_COEFF': ' '.join(values[50:70]),
27        'SAMP_DEN_COEFF': ' '.join(values[70:90]),
28        'MIN_LONG': values[91],
29        'MIN_LAT': values[92],
30        'MAX_LONG': values[93],
31        'MAX_LAT': values[94],
32        'sampleOFFSET': values[95],
33        #'lineOFFSET': values[96],
34    }
35    return rpc_dict

```

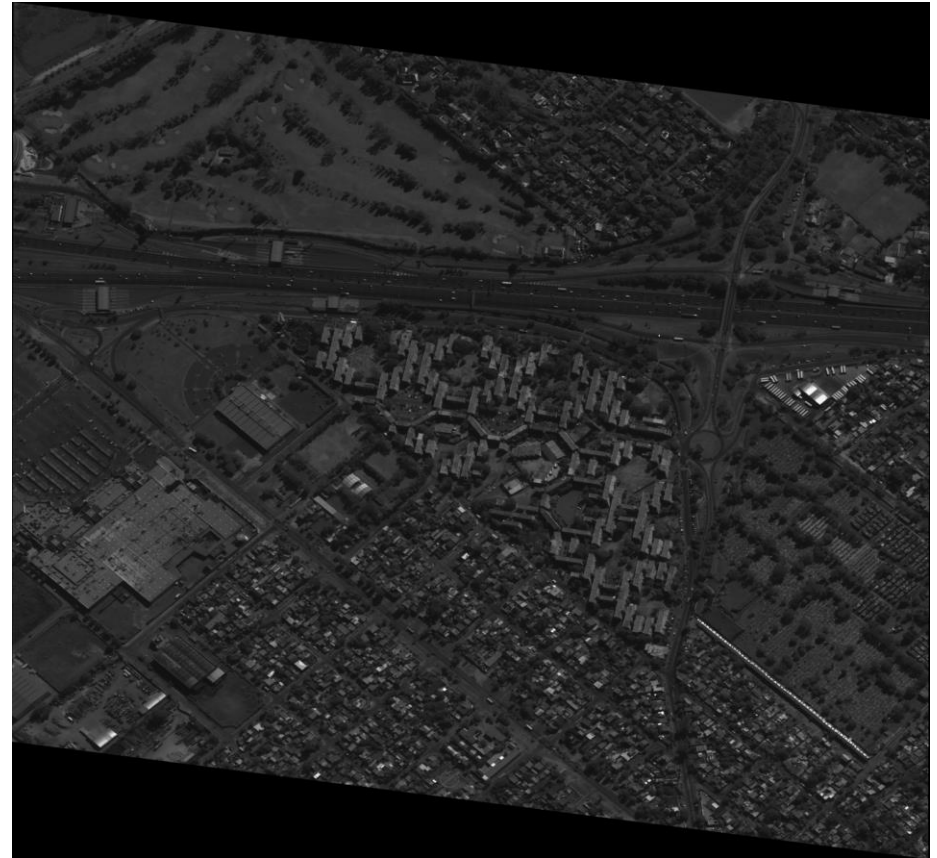
Preprocessing

Warping image to real world coordinates

Before:



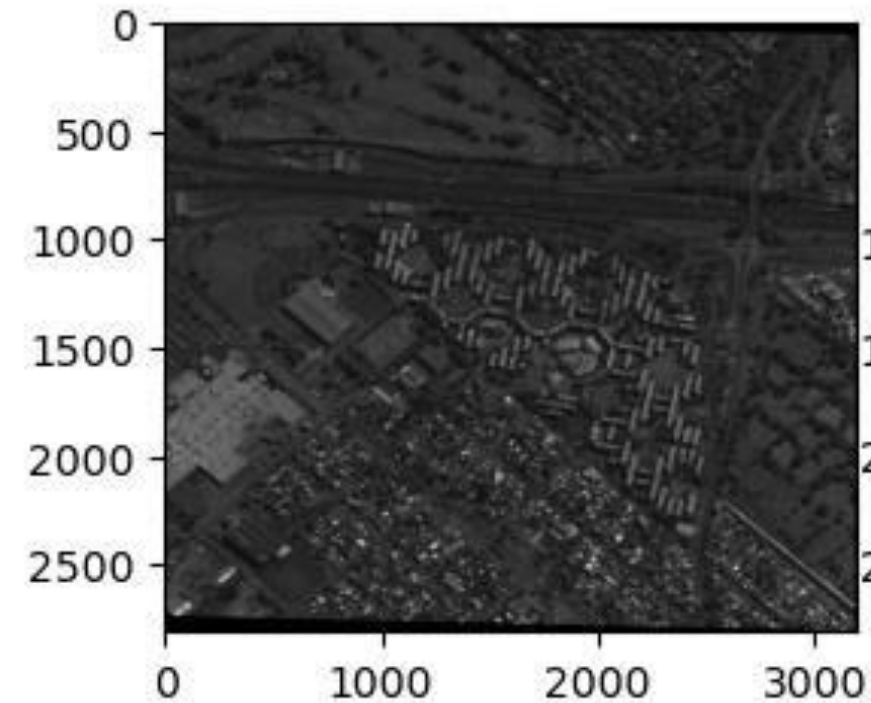
After:



Workflow

Disparity Map

Image 01



Disparity Map

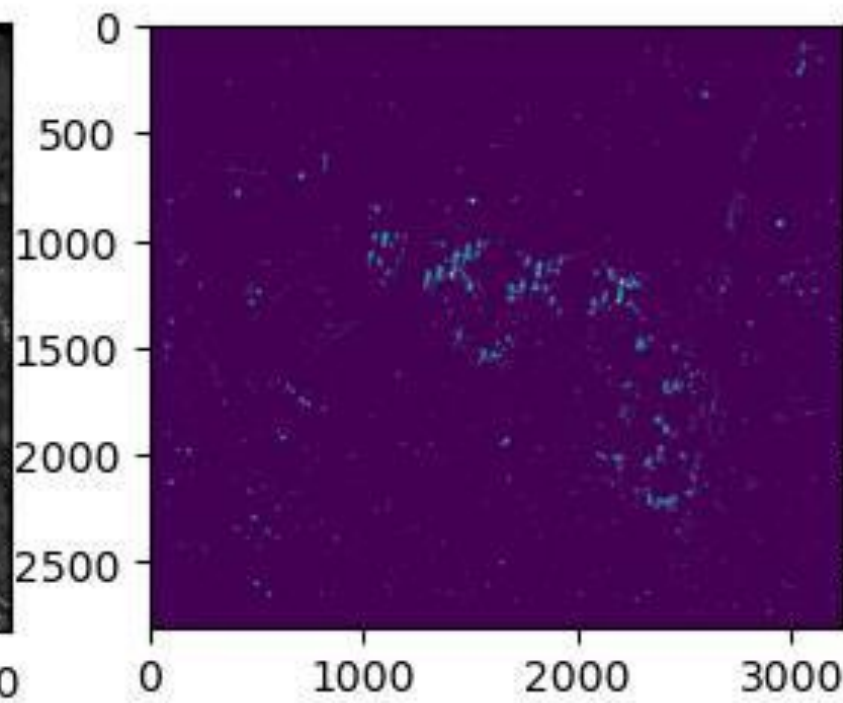
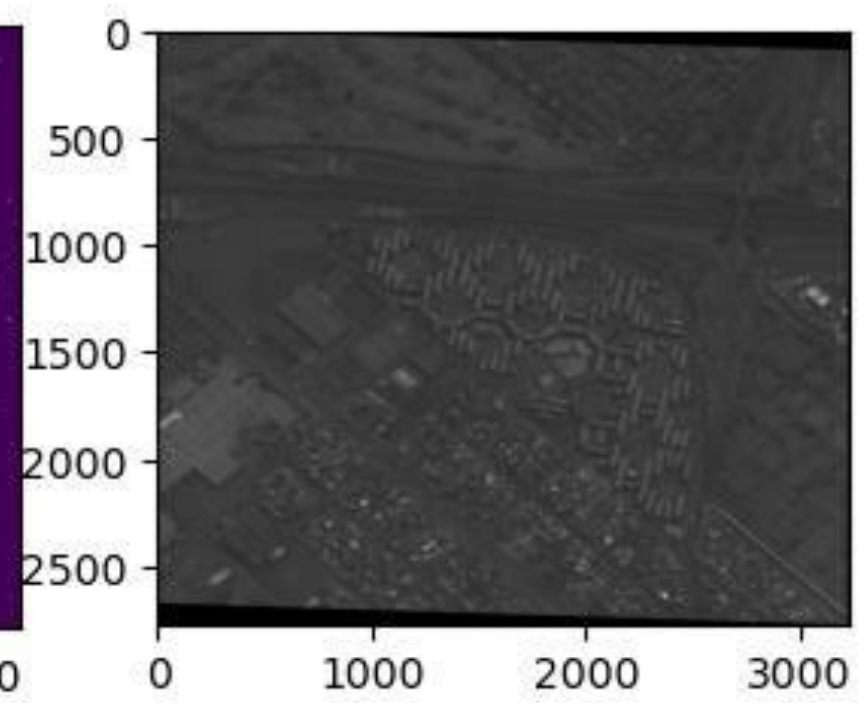


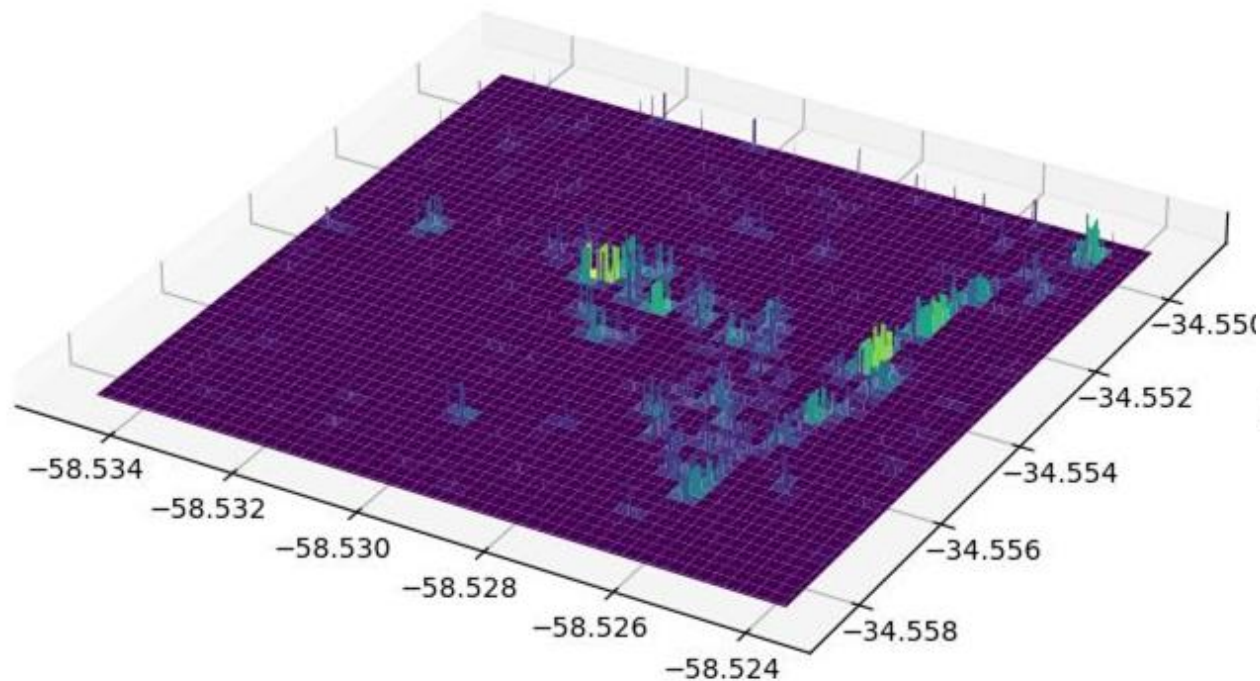
Image 02



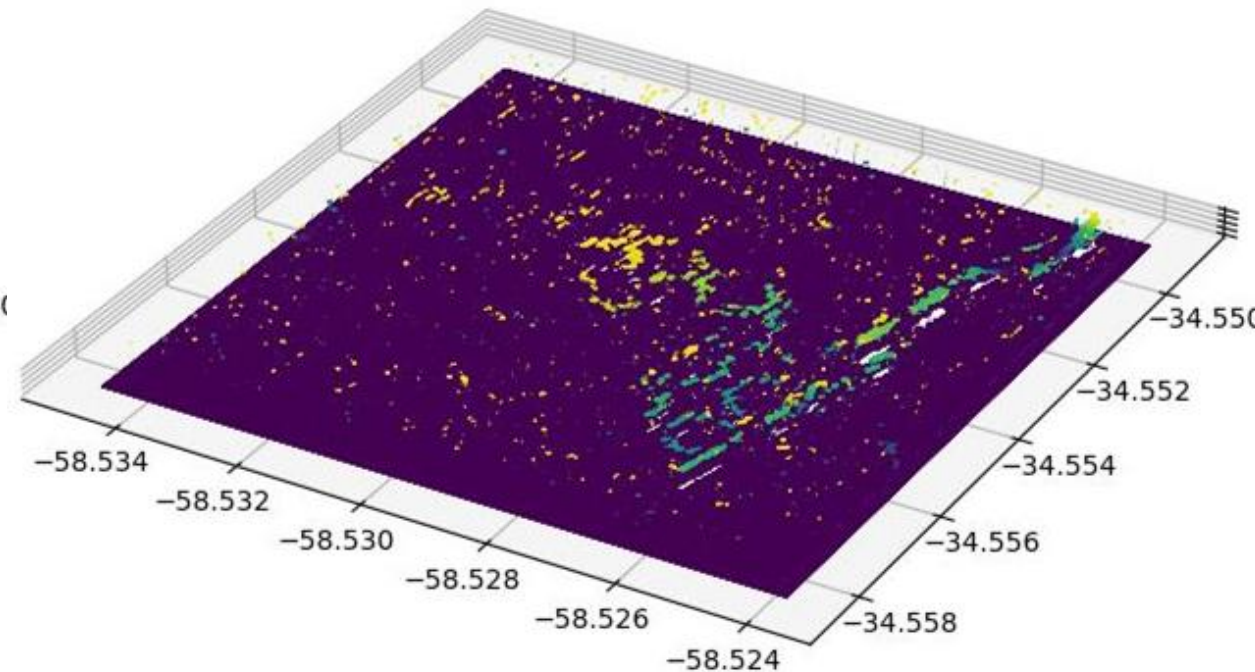
Workflow

Surface Plot - Point Cloud

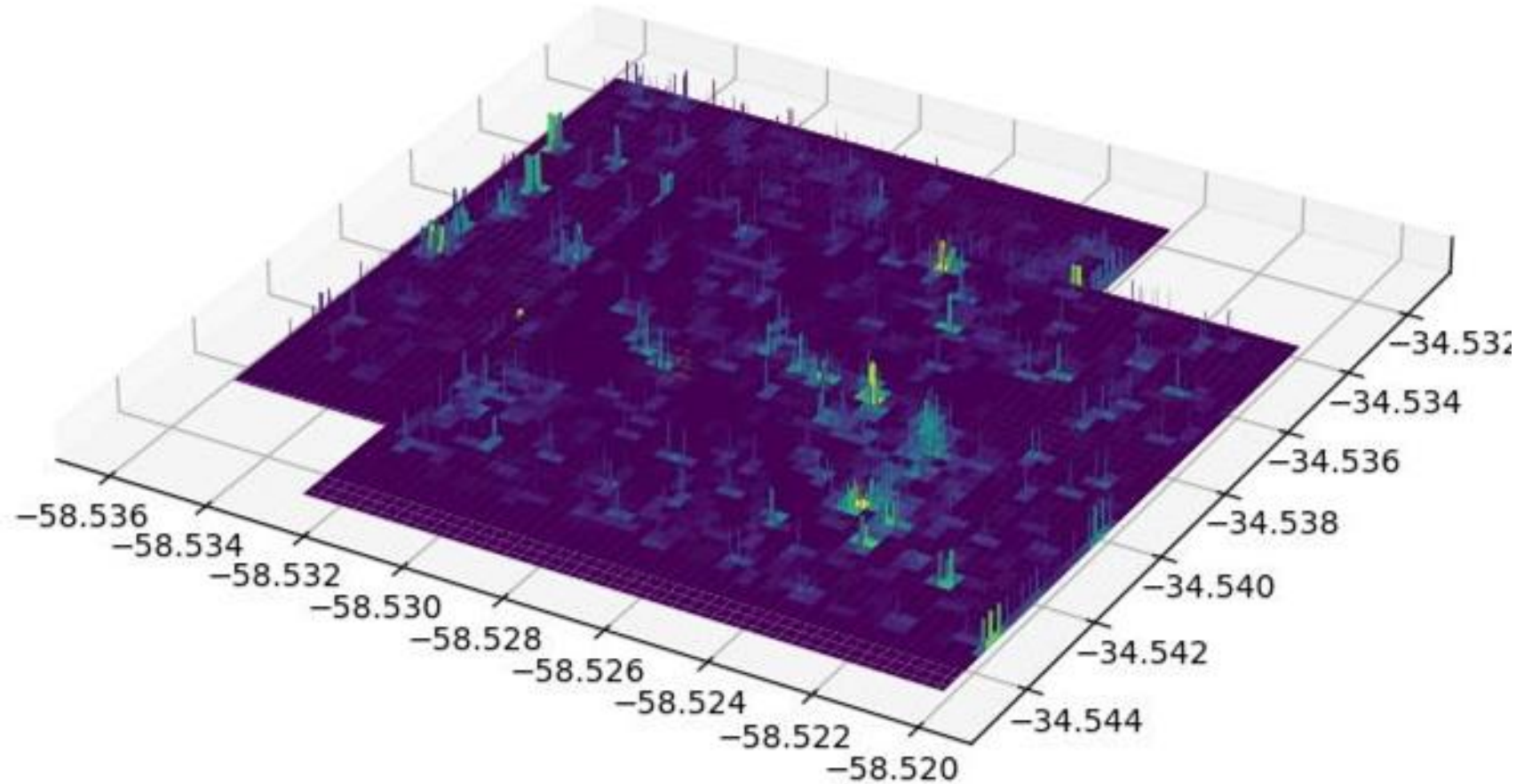
Surface Plot



Point Cloud



Results



Challenges

- ▶ Understanding data
- ▶ Issues with dependencies with s2p
- ▶ High computational effort impeded further progress

The background of the slide is a photograph of a satellite in orbit, viewed from a distance. The satellite has a central body with various instruments and a large, rectangular solar panel array extending from it. The Earth's surface is visible in the background, showing cloud patterns. In the top right corner, there is a solid red rectangular block.

Remaining
questions?