# How much value?
# How much damage?

In the planning of response or in the aftermath of a disaster, assessing potential damage is key to recovery and rebuilding.

Dylan Bailey, Albert Wong, Justin August

# What Value? What Damage?

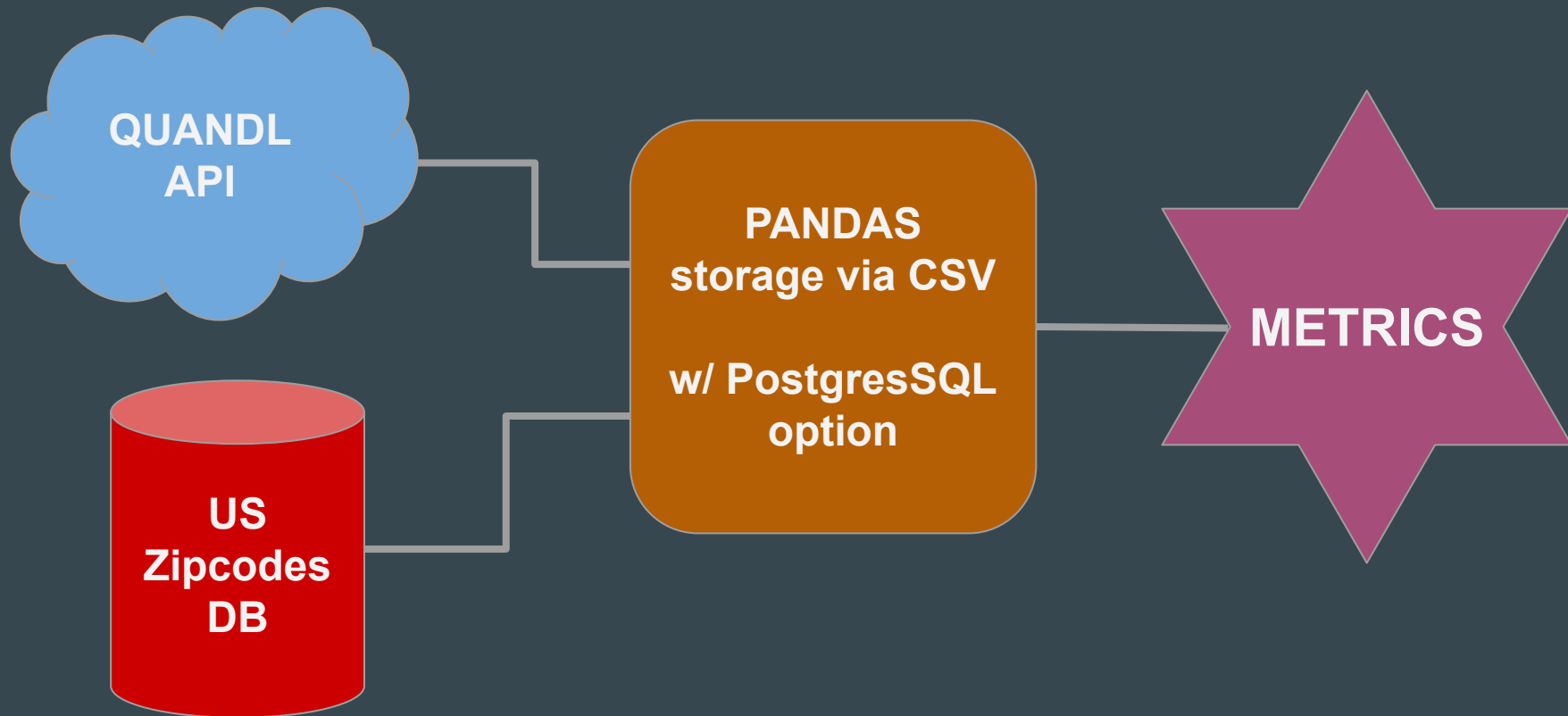Estimating pre-disaster value & post-disaster damage to property

Agenda:

- Framing & Context
- Data Pipeline
- Calculating Metrics
- Front End Engineering
- Final Prototype & Demo
- Future Possibilities

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# Launch map

# Data Pipeline

QUANDL API

US Zipcodes DB

PANDAS storage via CSV

w/ PostgresSQL option

METRICS

# Calculating Damage: Hurricane

$$\text{Hurricane Damage} = -976532 + 2.22 * (Wind)^3 + 9.81e^{-10} * (Population)^3$$

- The function was taken from the Department of Urban and Regional Planning at Florida State University
  - 3rd degree polynomial function
  - Variables are wind (km/hr) and population.
  - Linear Regression model using historical hurricane damage costs of Florida counties
  - Used 20 independent variables with the focus being population, house value, geography, and wind
- Assumptions
  - The zip code is hit equally by the category level of the hurricane

### Saffir-Simpson Hurricane Wind Scale

| Category | Wind speeds |
|----------|-------------|
| Five | ≥157 mph,≥252 km/h |
| Four | 130–156 mph, 209–251 km/h |
| Three | 111–129 mph, 178–208 km/h |
| Two | 96–110 mph, 154–177 km/h |
| One | 74–95 mph, 119–153 km/h |

| | |
|----------|-------------|
| Tropical storm | 39–73 mph, 63–118 km/h |
| Tropical depression | ≤38 mph,≤62 km/h |

# Calculating Damage: Flood

$$Flood\ Damage = (Cost[InchesOfWater]) * (NumberOfHouses)$$

- Function Variables
  - Inches of water = water depth in house
  - Cost = converted from inches of water
  - Number of Houses = number of houses in zip-code
  - Groups 3 types of houses into small, average and large homes based on sq ft
  - Covers damage to house (no personal property)
- Estimates taken from FEMA for flood loss potential as of 2017
- Assumptions:
  - Each houses in the zip code is the same type of house
  - Each house is flooded with same amount of water

**Average Home: 2,500 sqft**

| Interior Water Depth (Inches) | Cost to Home |
|---|---|
| 1" | $23,635 |
| 2" | $23,720 |
| 3" | $24,370 |
| 4" | $31,345 |
| 5" | $31,425 |
| 6" | $37,260 |
| 7" | $37,691 |
| 8" | $38,122 |
| 9" | $38,553 |
| 10" | $38,983 |
| 11" | $39,414 |
| 12" | $39,845 |
| 24" | $44,325 |
| 36" | $47,905 |
| 48" | $53,355 |

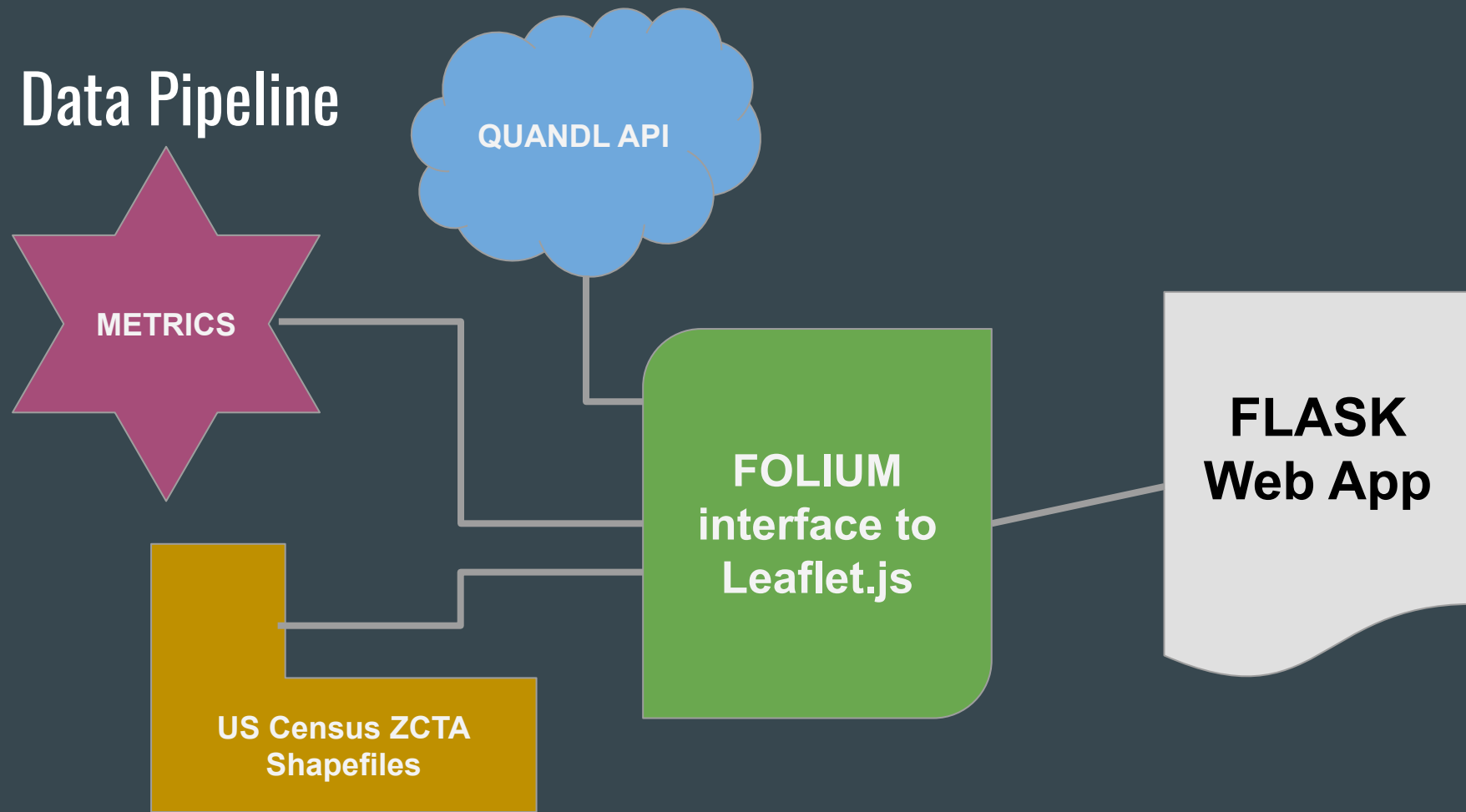# Calculating Damage: Tornado

$$Tornado\ Damage = (PercentDamage * (Zestimate)) * (NumberOfHouses) * (PercentageOfZipcode)$$

- Function Variables:
  - Percent Damage = estimates created from fujita scale
  - Zestimate = price value of home
  - Number of Houses = Number of Houses in zip-code
  - Percentage of Zip Code = (1.081 sq miles/sq miles of zip-code)
- Assumptions:
  - Each house in zip code is same type of house
  - Each tornado travels the same average distance
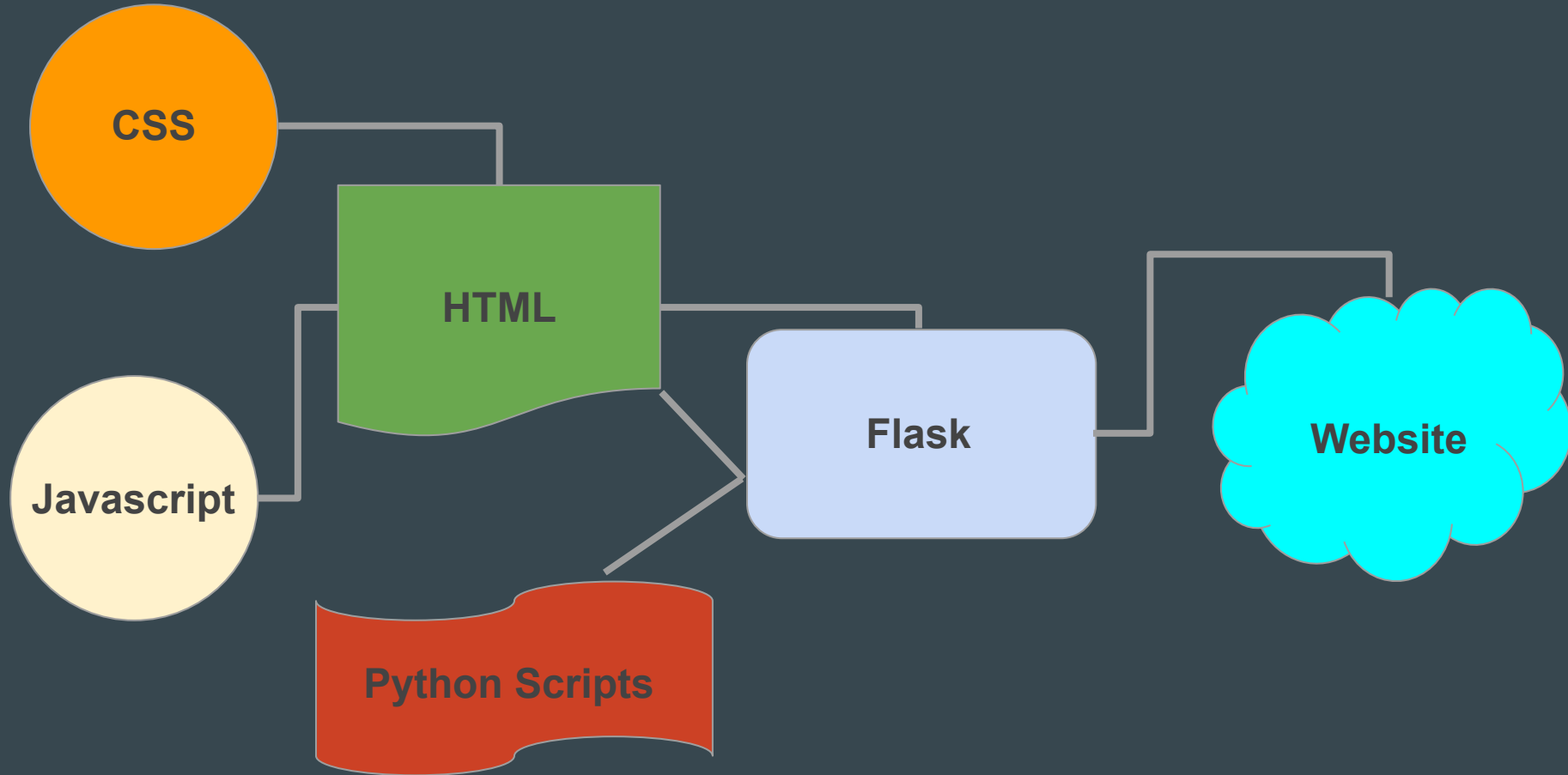  - Houses directly next to each other

## Enhanced Fujita Scale
### (Implemented February 2007)

| Rating | Winds | Expected Damage |
|--------|-------|-----------------|
| EF0 | 65-85 mph | **Minor damage.** Shingles or parts of roof peeled off; damage to gutters/siding; branches broken off; shallow-rooted trees toppled. |
| EF1 | 86-110 mph | **Moderate damage.** More significant roof damage; windows broken; exterior doors damaged or lost; mobile homes badly damaged or overturned. |
| EF2 | 111-135 mph | **Considerable damage.** Roofs torn off well-constructed homes; homes shifted off their foundation; mobile homes completely destroyed; large trees snapped or uprooted; cars may be tossed. |
| EF3 | 136-165 mph | **Severe damage.** Entire stories of well-constructed homes destroyed; significant damage to large buildings; homes with weak foundations may be blown away; trees begin to lose bark. |
| EF4 | 166-200 mph | **Extreme damage.** Well-constructed homes leveled; cars thrown significant distances; top story exterior walls of masonry buildings likely collapse. |
| EF5 | > 200 mph | **Incredible damage.** Well-constructed homes swept away; steel-reinforced concrete structures critically damaged; high-rise buildings sustain severe structural damage; trees usually completely debarked, stripped of branches, and snapped. |

# FLASK

**CSS**

**Javascript**

**HTML**

**Python Scripts**

**Flask**

**Website**

| 94133 | 94110 | 94128 | Population Stats | Home Value | Hurricane Damage Estimates | Flood Damage Estimates | Tornado Damage Estimates |

| 94124 | 94105 | 94134 |
| 94109 | 94130 | 94115 |
| 94102 | 94121 | 94104 |
| 94107 | 94123 | 94129 |
| 94116 | 94103 | 94127 |
| 94118 | 94111 | 94112 |
| 94122 | 94117 | 94114 |
| 94132 | 94131 | 94108 |

Median Home Value — $1,465,700

Median Home Value - High Tier — $1,189,600

Median Home Value - Mid Tier — $1,465,700

Median Home Value - Low Tier — $1,841,300

**JavaScript + CSS**

**Python Function Generated HTML code push to HTML Templates using Flask**
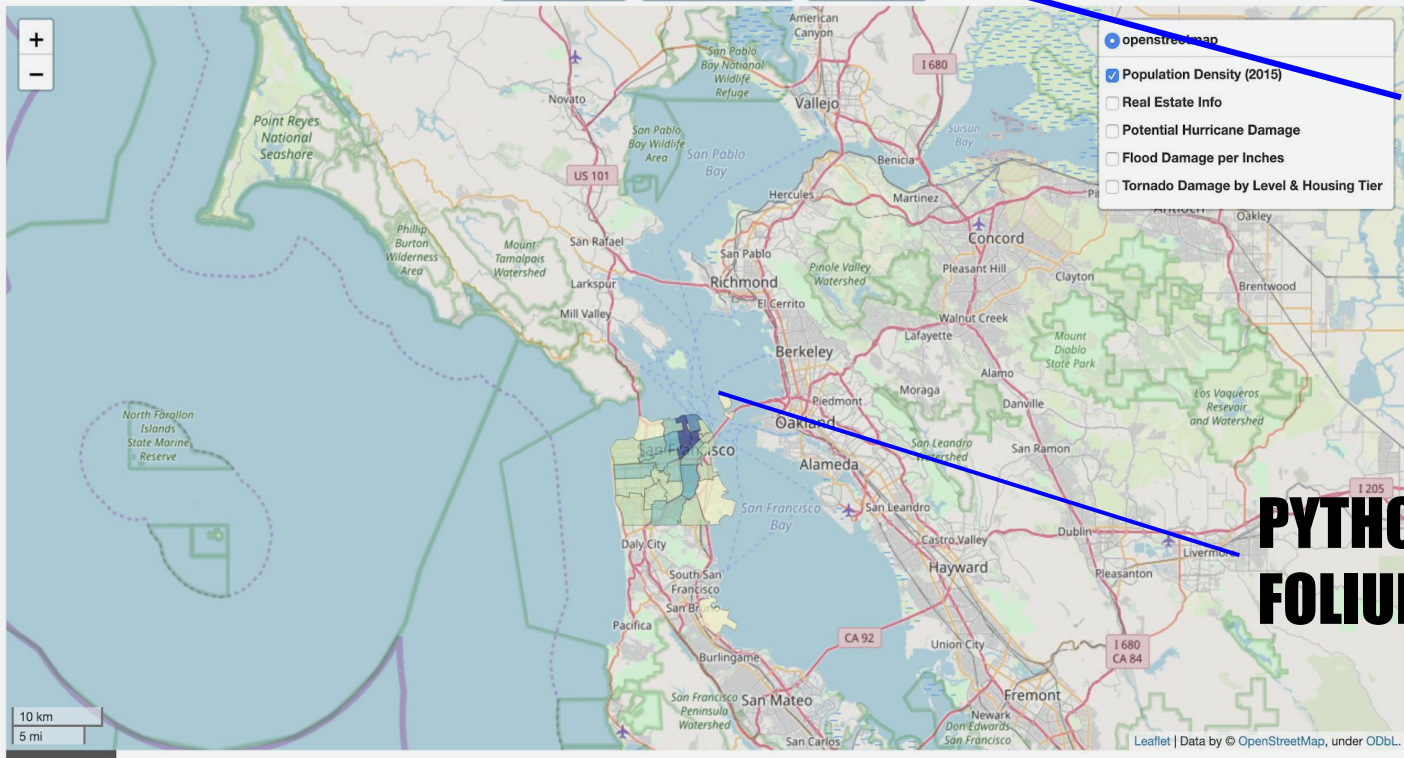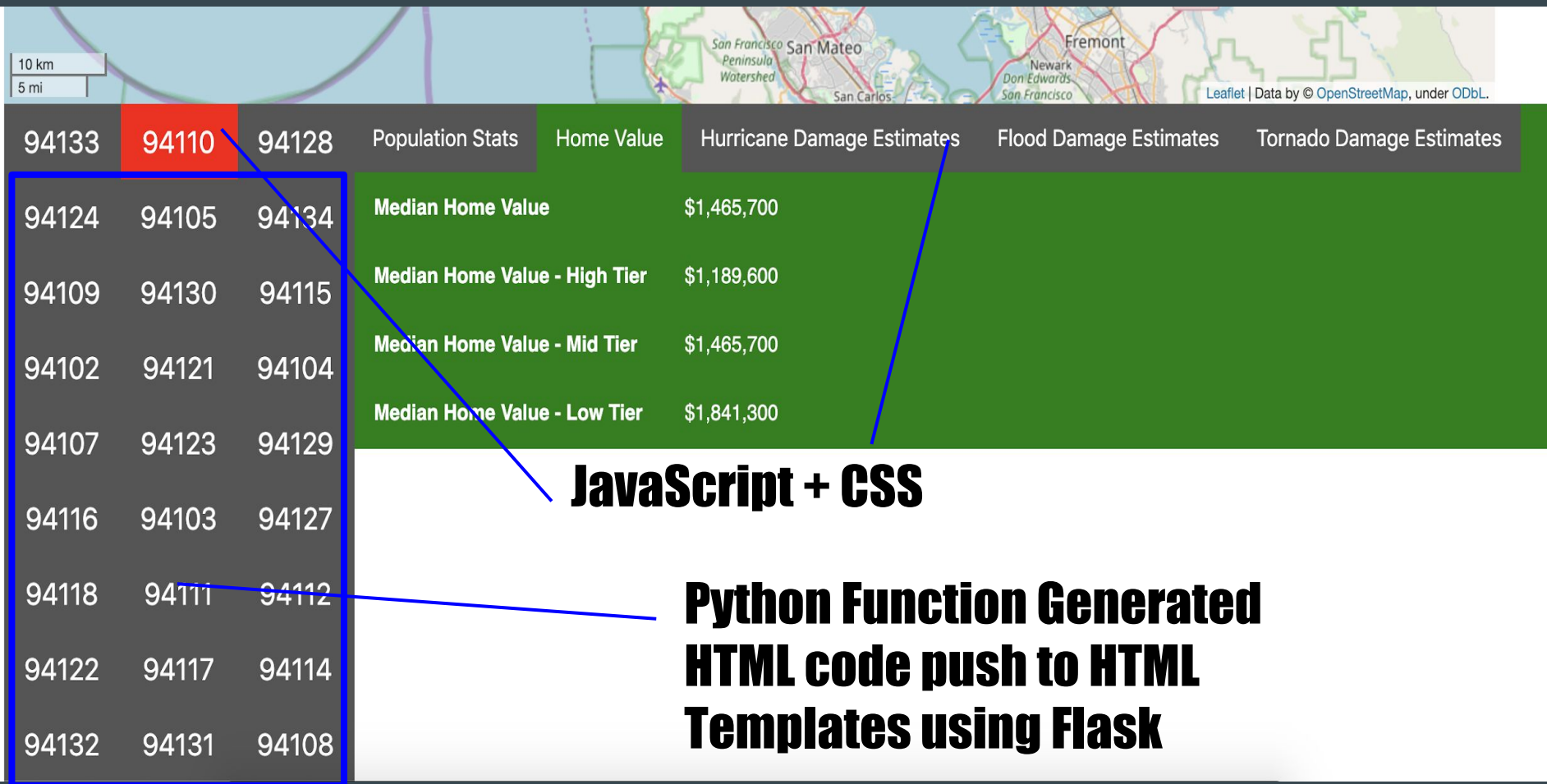
# Launch map

# Future Features
# &
# Known Issues

## Known Issues
- ZIP Codes without Zillow data are not displayed
- Folium limits access to Leaflet.js options
- Some metrics are naive

## Future Features

- Earthquake damage simulator
- Fire damage simulator
- "Drop a pin" functionality
- Improve existing metric functions
- More robust home data using multiple inputs
- Full Leaflet.js implementation
- Aggregate damage estimates for all zip codes

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