Blog Post 3: Scenario Deep Dive – Modeling Earthquakes, Fire, Heat, and Cyber Threats

Operationalizing the Data The repository supports four distinct scenarios, each requiring unique data structures and processing capabilities. Here is a technical look at how data drives these operations.

1. Earthquake Planning (Attica)

- Input: Seismic hazard parameters (PGA: 200-300 cm/s²) and building soil classifications (Rock/Stiff/Soft).
- Processing: The simulation identifies structural failures, generating `BlockedRoads.geojson` files—vectors representing impassable streets.
- Output: Algorithms calculate optimal evacuation routes to Assembly Points, factoring in the debris field and population density.

2. Heatwave Planning (Vienna)

- Input: A fusion of Google Solar API radiation data and demographic maps of vulnerable facilities (139 nursing homes, 85 schools, 29 hospitals).
- Processing: The system models the "Urban Heat Island" effect.
- Output: It optimizes the allocation of at-risk populations to "Cooling Spots" (parks with high tree coverage and air-conditioned public spaces), generating CSV reports on capacity and walking distances.

3. Wildfire Training (Attica)

- Input: ArcFuel vegetation maps (fuel loads) + ERA5 wind/humidity history + Copernicus DEM (terrain slope).
- Processing: Fire propagation models run in 15-minute intervals.
- Output: Dynamic GeoJSON perimeters of the fire front. This data is validated in real-time against video streams from UAV swarms to correct simulation drift.

4. Cyberattack & Explosion (Vienna)

- Input: Critical Infrastructure graphs (Power, Telecom, Transport).
- Processing: Modeling a cyber-induced blackout followed by a physical explosion (0.5–4km radius).
- Output: Gaussian Plume models simulate smoke/chemical dispersion. The system maps cascading failures—if the power grid fails, which cell towers and hospitals go dark?