Simulated Ground Motion Database User Guide

1. PEER-LBNL simulated ground motion database can be accessed at https://sgmd.peer.berkeley.edu/.
2. For a new user, the first step is to sign up by selecting a username and password, providing basic personal details, and supplying a valid email address.
3. After signing up, users can access the database by logging in.
4. Once logged in, the next step is to enter the database by clicking "Enter Database Beta" in Figure 1. Please note that the database access is currently limited to beta users and the development team.

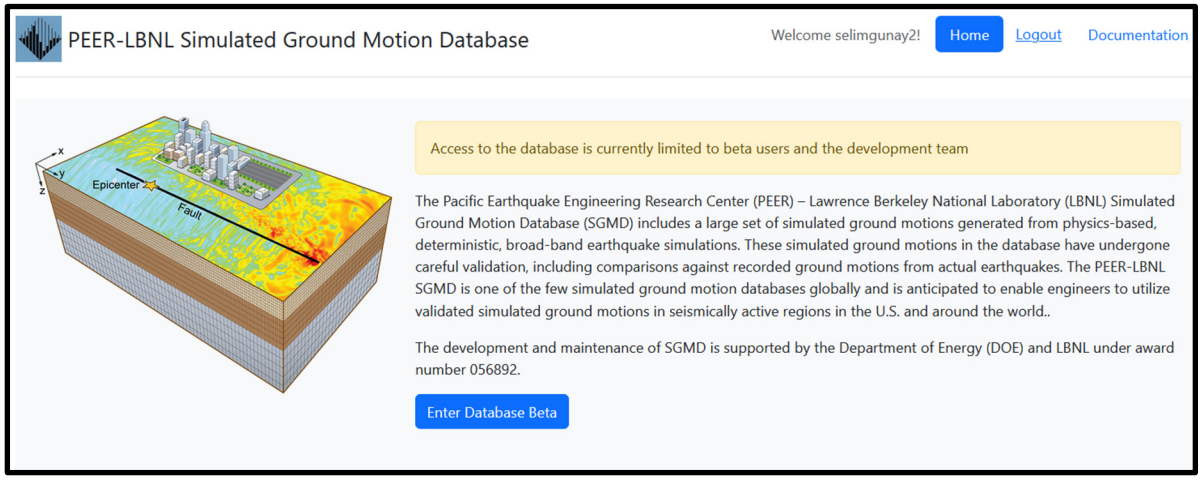

Figure 1. Entering the database.

5. Once in the database, the first step is to select the region to download ground motions (Figure 2). Currently, the San Francisco Bay Area (SFBA) is available as a region, and Greater Los Angeles Area and New Madrid Seismic Zone are two regions that will be included in the near future.

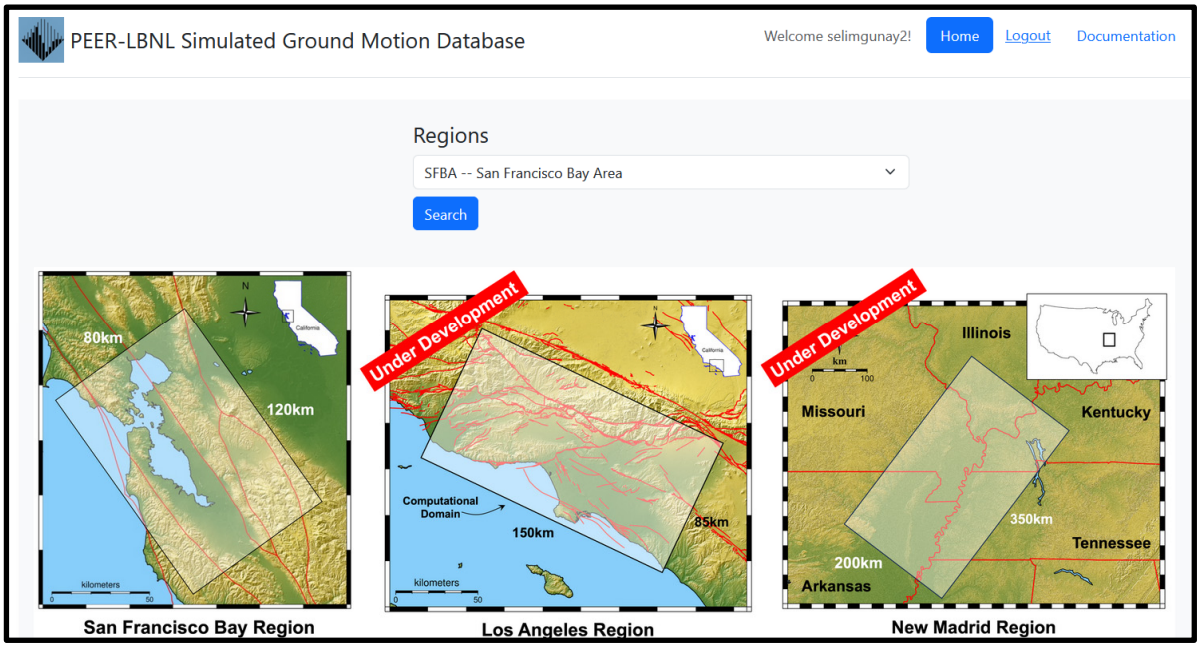

Figure 2. Region selection.

6. After selecting the region, the next window allows the user to search for ground motions across multiple realizations and multiple parameters (Figures 3-6). Several points to consider when using the Search are listed below:
    a) Users can select any number of realizations of interest; at least one realization must be selected. Each realization represents a unique earthquake, and it is recommended that users make themselves familiar with all the 50 realizations, details of which are provided in the *Simulations_Flatfile.xlsx* of the Documentation.
    b) All search parameters are initially deactivated. Users can activate the parameters of interest using the Switch buttons (Figures 3-6). At least one parameter must be activated for the search, and users can utilize as many parameters as needed. For example:
        - Figure 3 shows a search for all ground motions in Realizations 1 and 2, and Realizations with patches 4 and 5 within a region defined by latitude boundaries of 37.68˚ and 37.72˚ and longitude boundaries of -122.30˚ and -121.90˚.
        - Figure 4 shows a search for all ground motions in the same region, but only those with V_{s30} between 300 m/s and 500 m/s.
        - Figure 5 shows a search for all ground motions in the same region but only those with V_{s30} between 300 m/s and 500 m/s, and R_{jb} between 10 km and 20 km.
        - Figure 6 shows a search for all ground motions with PGV between 0.8 m/s and 1.0 m/s in Realizations 1-10, and Realizations with Patches 1-10.
    c) If a user wants to search for a specific location, such as the site of a building or a bridge, they should set the maximum latitude equal to the minimum latitude and the maximum longitude equal to the minimum longitude. This search finds ground motions at the locations closest to the specified coordinates. The distances between the specified location and the locations of the identified motions are provided in a summary file titled "Distance Results."
    d) Brief definitions of search parameters are as follows:
        - Latitude and longitude: Geographical coordinates.
        - V_{s30}: The time averaged shear wave velocity to 30 m depth.
        - R_{jb}: Joyner-Boore distance, shortest horizontal distance from the site to the vertical projection of the rupture, R_{rup}: Closest distance from the site to the fault rupture, R_x: Horizontal distance from the surface projection of the top edge of the fault rupture to the site.
        - PGA, PGV, PGD: RotD50 Peak ground acceleration, velocity and displacement. The RotD50 metric represents the median from the two horizontal components rotated across 180 orientations, ranging from 0˚ to 179˚.
7. Clicking "Search" in Figures 3-6 starts the search process. Once all ground motions that meet the search criteria are found, they are available for download by the user (Figure 7). Figure 8 displays the search results based on the search parameters specified in Figure 5. For each grid point that meets the search criteria, results include nine files: acceleration, velocity and displacement time histories in the Fault Normal, Fault Parallel and Vertical directions. The naming convention for these files is explained in Figure 9.
8. The documentation includes this User Guide, several flatfiles, and publications that provide technical background on the physics-based simulations that were performed to generate the ground motions. Two types of metadata are available for the user, both provided in flat files. The first type is metadata for the

rupture realizations and the second type is metadata for the ground motion histories. The metadata for the realizations, provided in *Simulations_Flatfile.xlsx*, includes three sets of information:

- A general description of the simulated earthquake including the region name, corresponding region code, and the realization number.
- Fault rupture parameters, including fault geometry characterized by the fault name; rupture geometry defined by fault length and width, depth to top of rupture, dip, strike, and rake; earthquake magnitude and hypocenter location; the rupture model utilized in the regional simulations (e.g., the Graves-Pitarka kinematic rupture model) and slip characteristics. A visual graphic that displays the slip, slip-rate and rise time across the fault rupture is also provided to assist in interpretation.
- Simulation model parameters, which include maximum frequency resolved, minimum shear wave velocity included in the model (Vsmin), surface grid spacing that defines the distance between computational nodes in the simulation model, output spacing that provides distance between the down-sampled grid points where ground motion data is available, and the geologic velocity model utilized in the simulation (e.g., the USGS velocity model for SFBA).

For each region, the metadata for the ground motions of all realizations are provided in a separate flatfile. The metadata includes two sets of information; the first set includes the name, latitude and longitude coordinates of the grid point, the vertical elevation of the grid point from sea level, the 2D cartesian coordinates of the grid point in the computational model domain (with X and Y axes in the fault normal and parallel directions respectively), the Vs30, and the depth at which the shear-wave velocity reaches 1.0 km/s and 2.5 km/s (Z1.0 and Z2.5) at the location of the grid point. The second set consists of the distance parameters (Rjb, Rrup and Rx) and peak ground motion values (RotD50, PGA, PGV, and PGD). The flatfile for the SFBA region is titled *Hayward_M7_GMs_Flatfile.xlsx*.

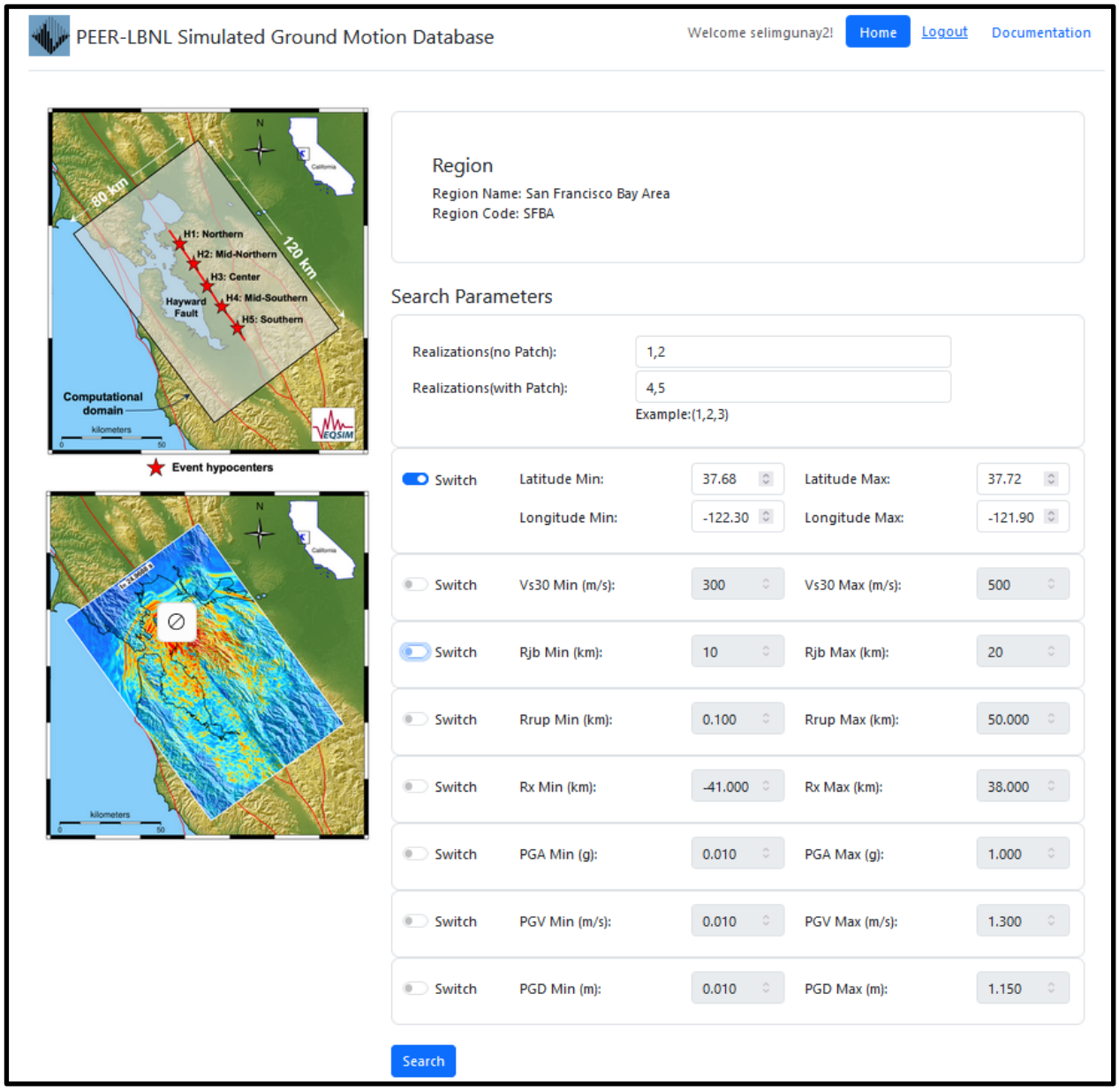

Figure 3. Search for all ground motions in Realizations 1 and 2, and Realizations with patches 4 and 5 inside a region defined by latitude boundaries of 37.68˚and 37.72˚, and longitude coordinates of -122.30˚ and -121.90˚. Please note that the realization numbers should be entered without spaces, and with only commas as shown above.

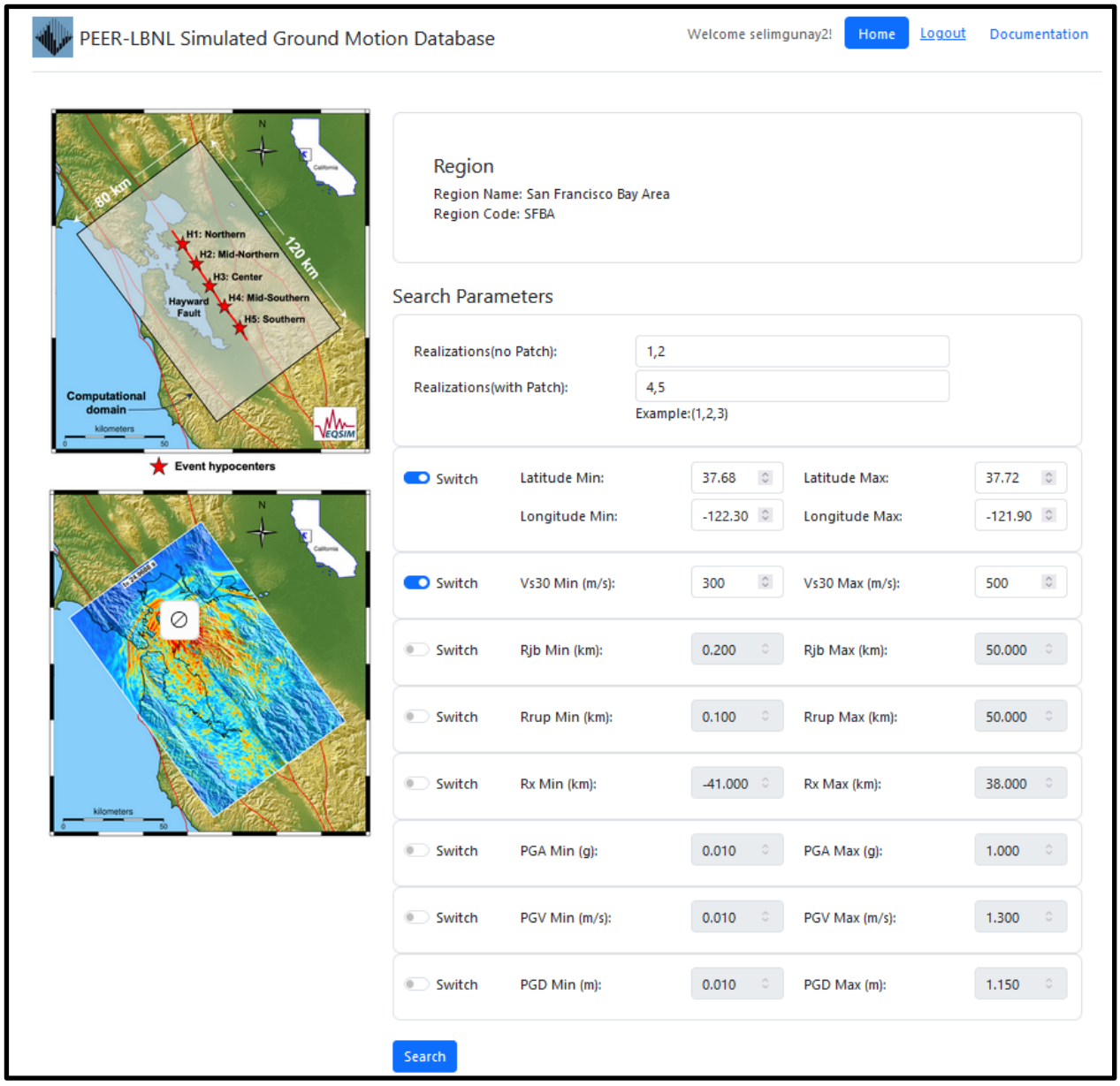

Figure 4. Search for all ground motions in Realizations 1 and 2, and Realizations with patches 4 and 5 with V_{s30} between 300 m/s and 500 m/s inside a region defined by latitude boundaries of 37.68˚ and 37.72˚, and longitude boundaries of -122.30˚ and -121.90˚.

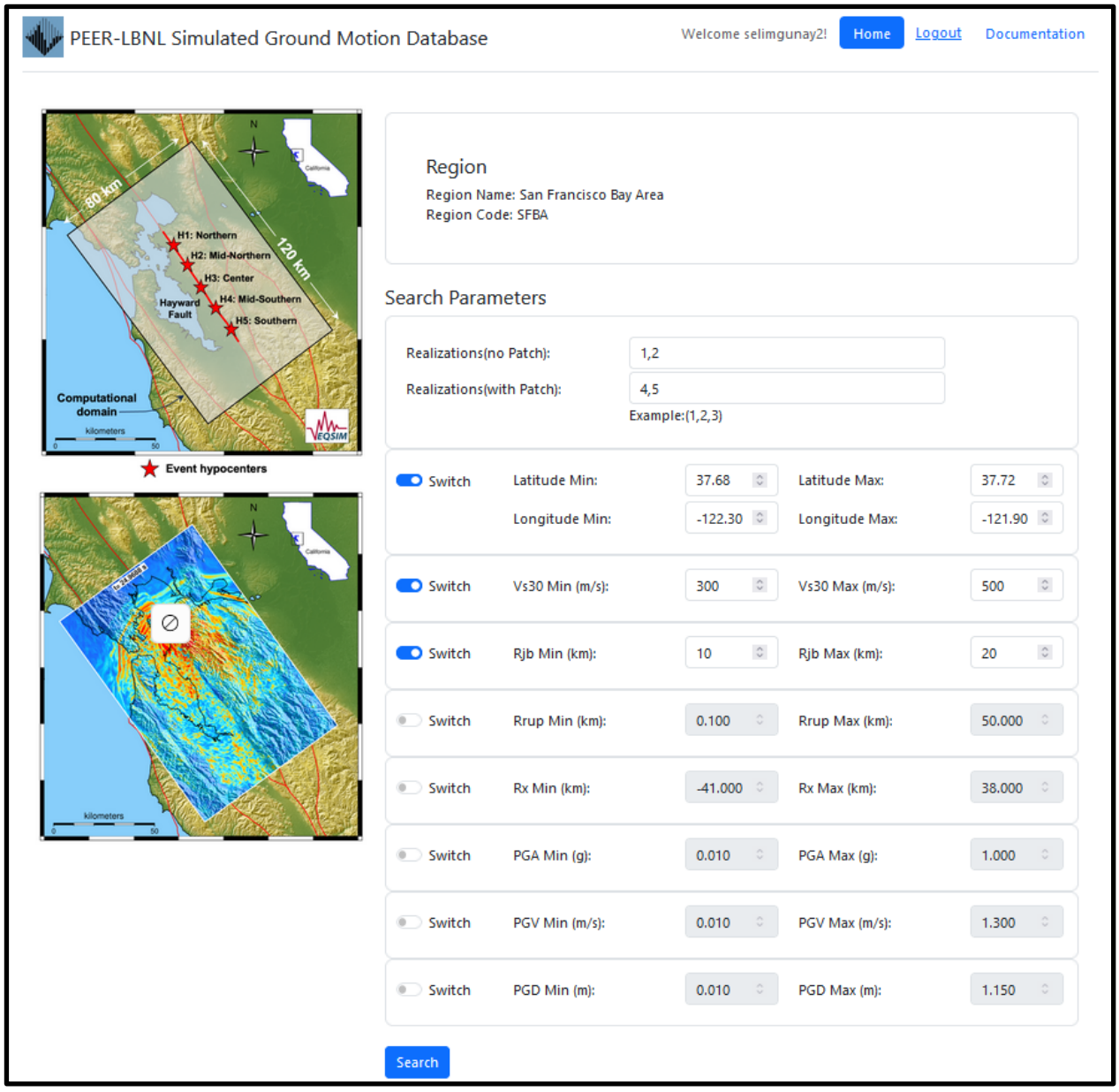

Figure 5. Search for all ground motions in Realizations 1 and 2, and Realizations with patches 4 and 5 with V_{s30} between 300 m/s and 500 m/s and R_{jb} between 10 km and 20 km inside a region defined by latitude boundaries of 37.68˚ and 37.72˚, and longitude boundaries of -122.30˚ and -121.90˚.

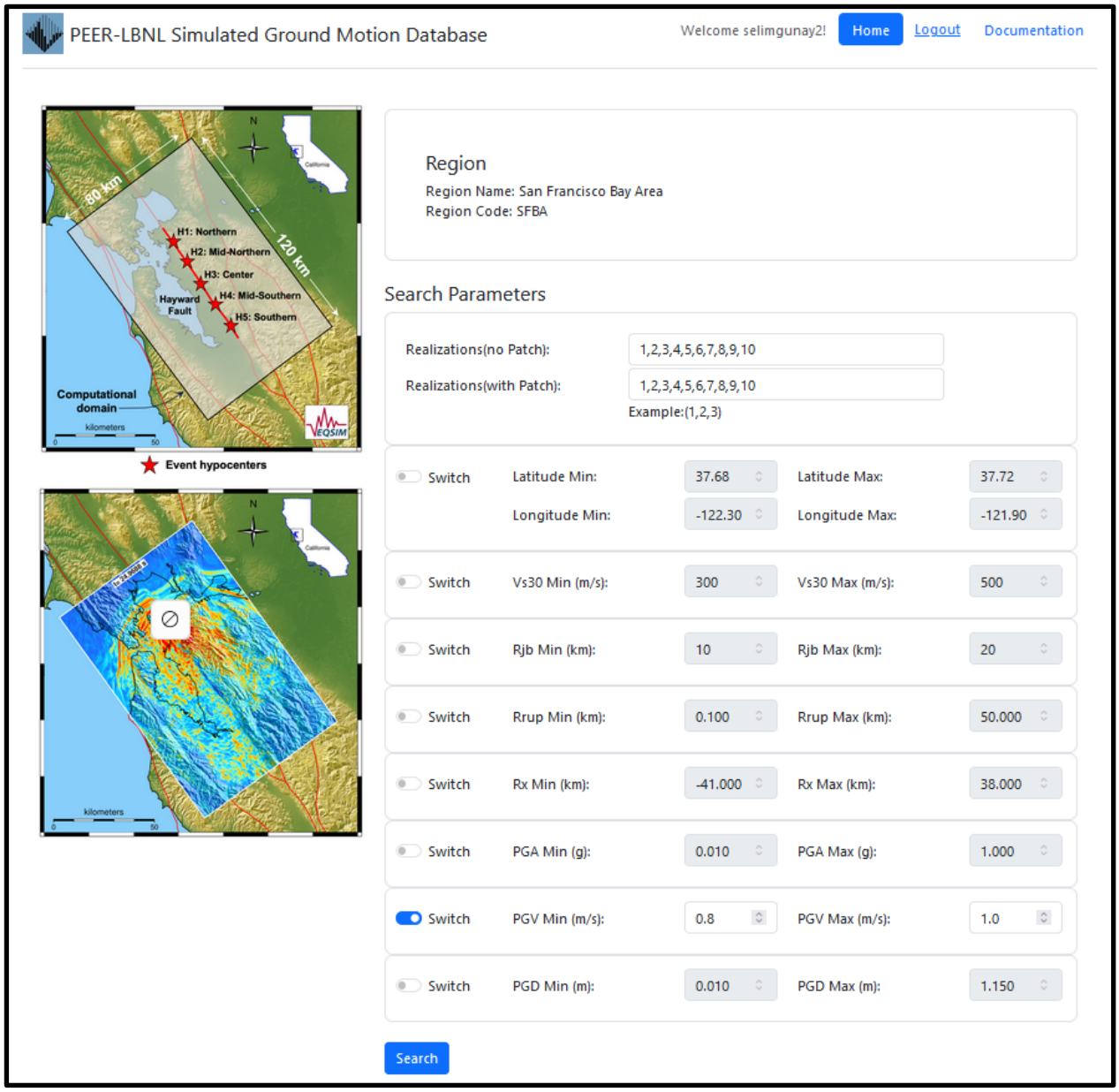

Figure 6. Search for all ground motions with PGV between 0.8 m/s and 1.0 m/s in all Realizations.

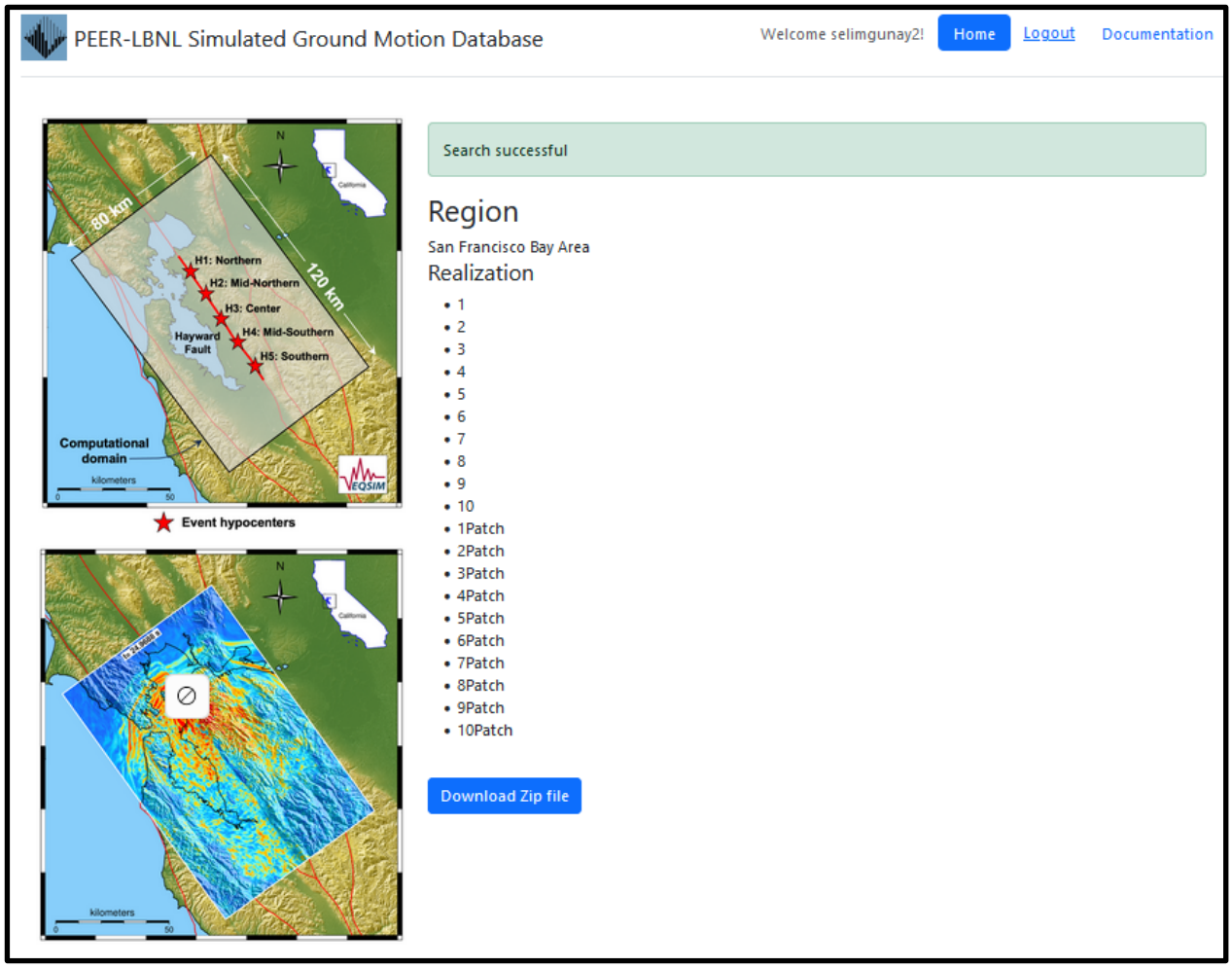

Figure 7. Ground motions meeting the search criteria, ready for user download.

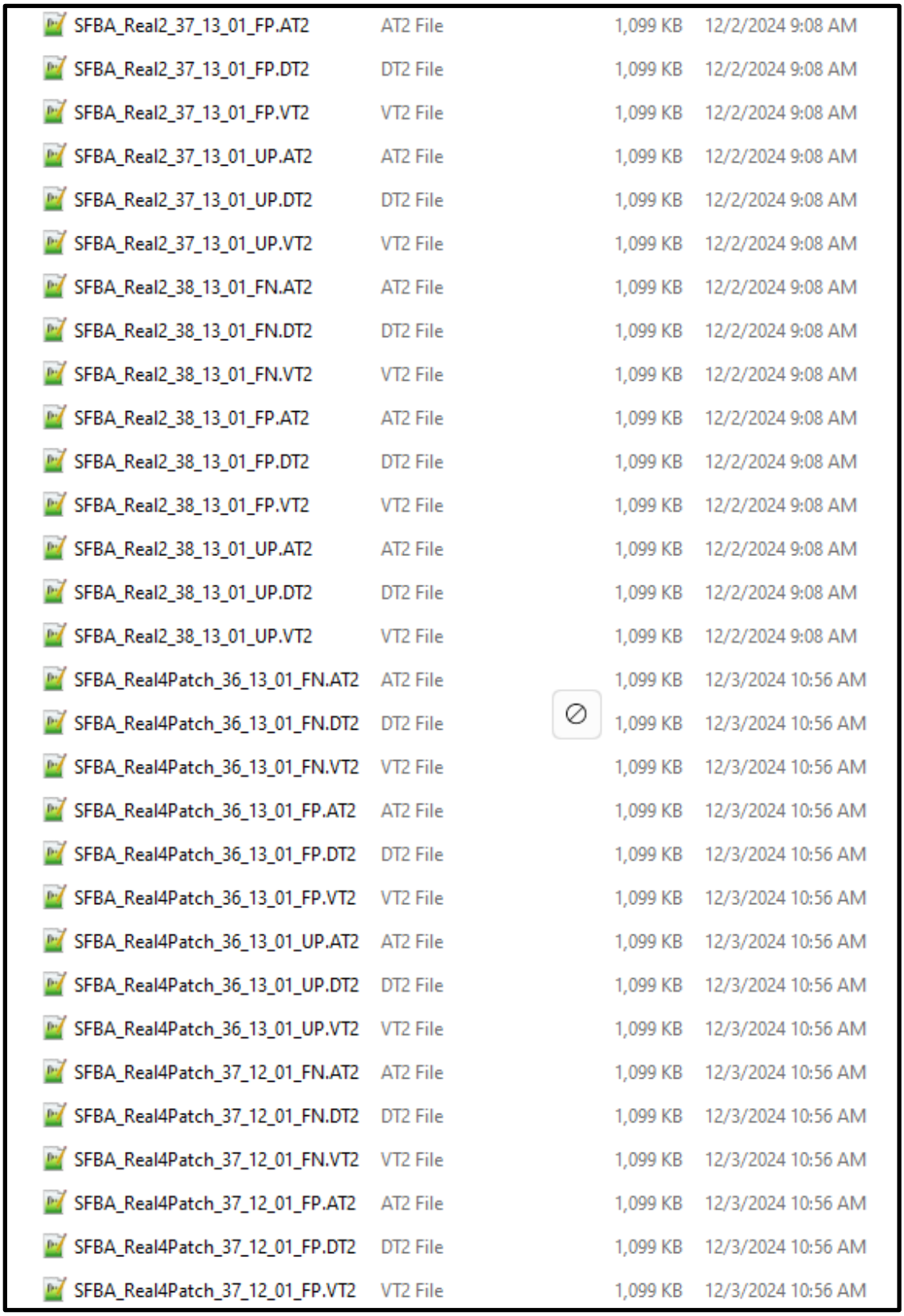

Figure 8. Search results based on the search parameters specified in Figure 5.

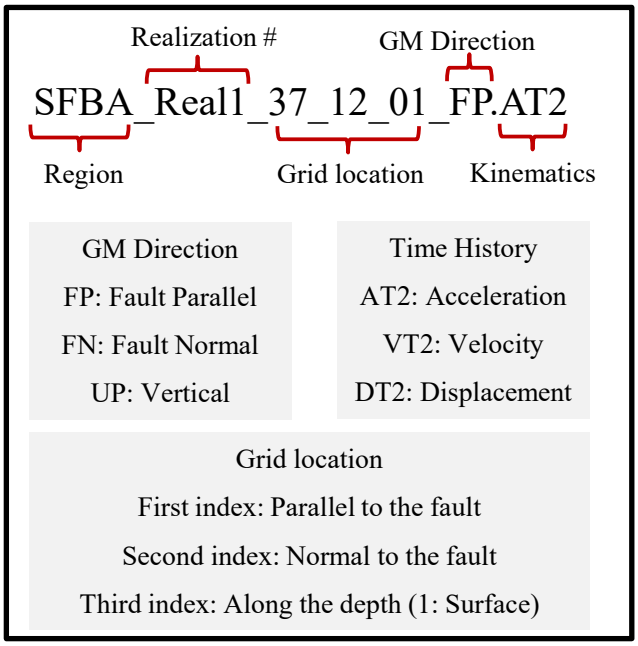

Figure 9. File naming convention.