Earthquake Explorer
User Guide

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I. USER INTERFACE
This section describes the functionality of the Earthquake Explorer user interface. The graphical user interface offers a menu, a left panel with query options and a right panel with a tiled map. To navigate around the map, right click and drag or hold control while dragging.

Layers
The layers panel offers a dropdown menu for viewing events within four different time intervals: past hour, day, week or month. The events are displayed on the map according to their relative magnitudes, ranging from significant to all. Once earthquakes have been loaded on the map, users can then use the Get Info option from the menu bar to click on an earthquake. A popup window opens with more information about the event, including coordinates, location, magnitude, depth and time. In order to view events in one frame, Zoom to Extent shows all.
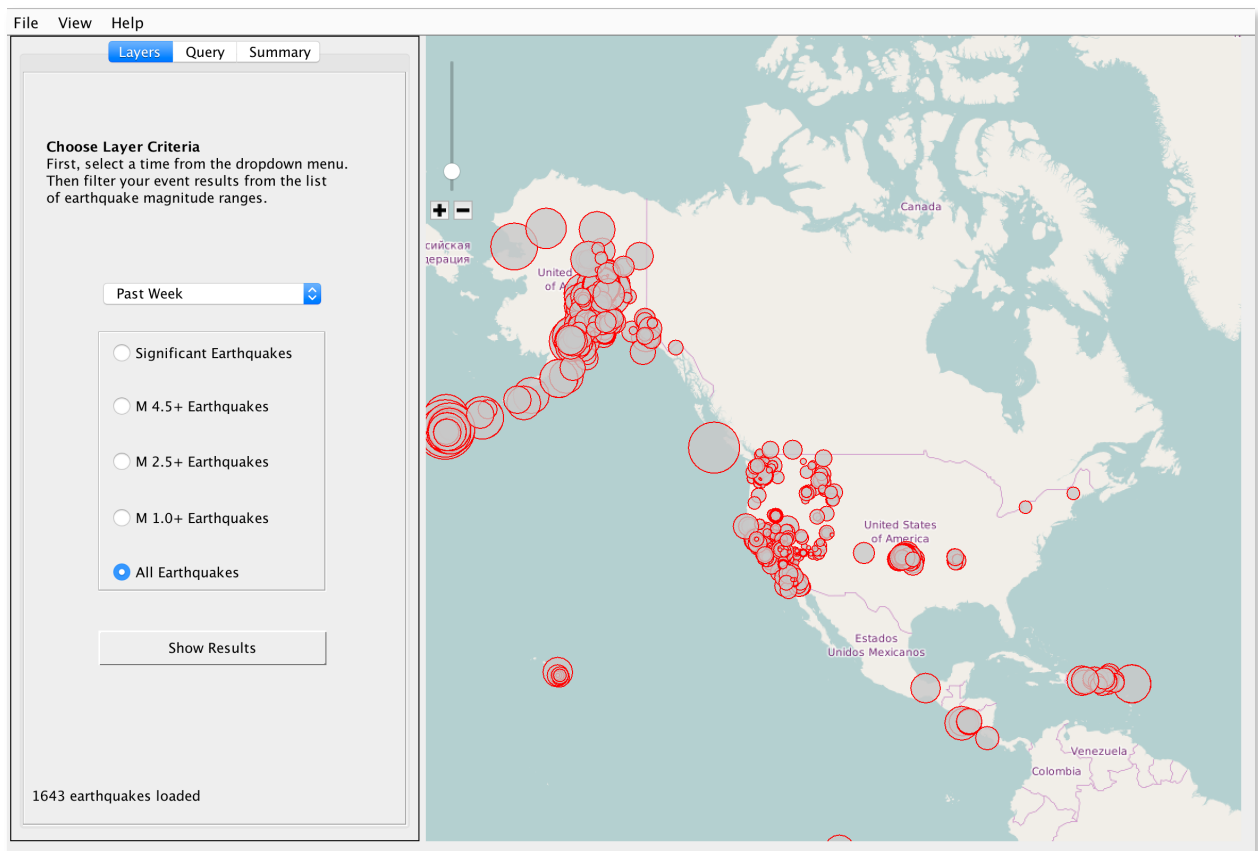
Users can also load data from the File menu through a URL. This sample URL is for USGS All Earthquakes in the Past Day and is updated every five minutes. The symbology is identical.
http://earthquake.usgs.gov/earthquakes/feed/v1.0/summary/all_day.geojson

Query

Once layers have been selected, users can query these events based on a given bounding box or a place name. To generate a bounding box, click on the button and click twice on the map: once for the upper left corner and a second time for the lower right. A popup window appears with a message count of the number of earthquakes. Once dismissed, the bounding box is hidden. To redraw the box, press the go button again. To search by place, type the name of a location into the search bar. A marker is added to the map in the approximate location. Next, specify a search radius. A buffer feature of this search distance is then applied to earthquake events. A popup window also appears with a message count of earthquakes.

Vahedi and Lafia, 2016
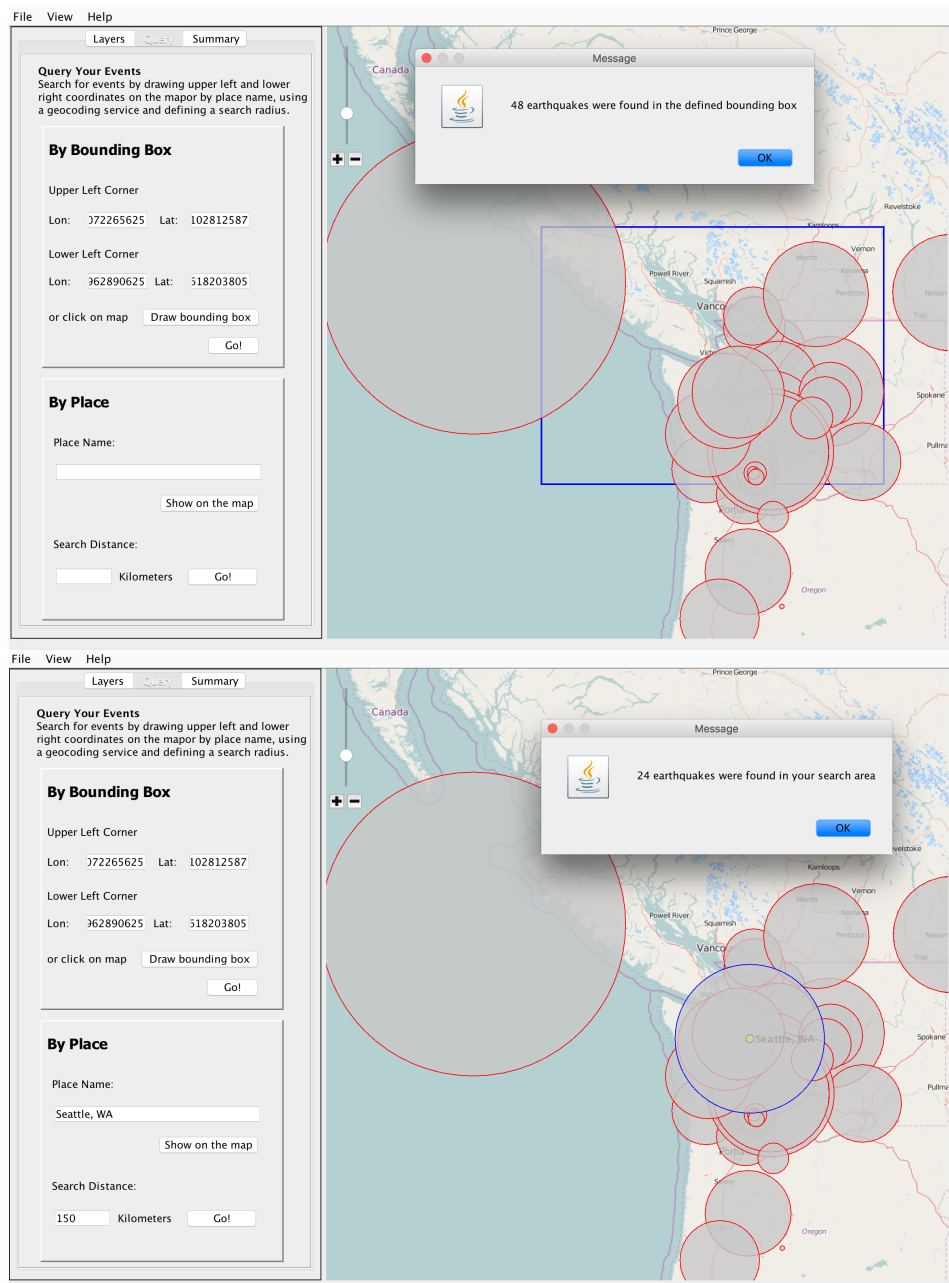
Summary

Results are returned from the search area most recently defined by the user. The results include the maximum and minimum magnitude of the selected earthquakes, the maximum and minimum depths and the time of the most and least recent events. These selected summary statistics can be regenerated as needed, while users define new search extents or select new layers by time and magnitude. These summary statistics can then be compared against the entire collection of earthquakes, which are populated in the lower table. Results can be saved to a CSV table, which is saved to the users project workspace.
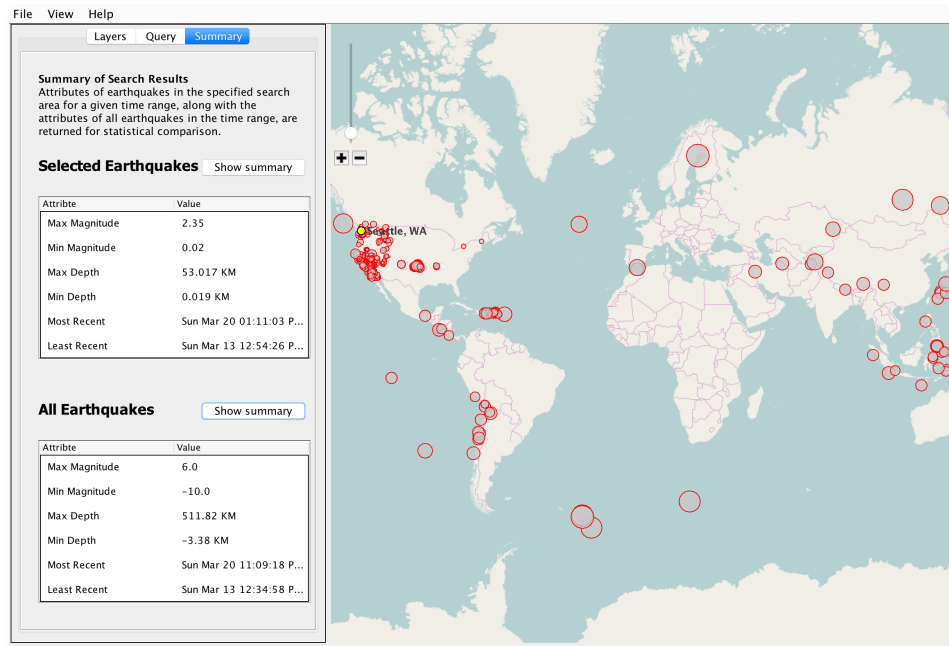
	A	B	C	D	E	F	G
1	ID	Place name	Location	Magnitude	Depth	Time	
2	nc72609880	5km WNW of Cobb	California	0.56	1.42	Sun Mar 20 11:09:18 PDT 2016	
3	ci37537800	10km S of Idyllwild	California	0.84	13.98	Sun Mar 20 11:09:08 PDT 2016	
4	ci37537792	4km W of Nuevo	California	1.05	0.41	Sun Mar 20 11:06:29 PDT 2016	
5	nm60133096	9km SW of Caruthersville	Missouri	2.5	8.86	Sun Mar 20 10:23:04 PDT 2016	
6	nn00536301	45km N of Pahrump	Nevada	0.2	2.7	Sun Mar 20 10:23:03 PDT 2016	
7	nn00536300	54km SE of Hawthorne	Nevada	0.2	3.3	Sun Mar 20 10:06:27 PDT 2016	
8	ci37537784	21km SW of La Quinta	California	0.75	7.86	Sun Mar 20 10:05:29 PDT 2016	
9	ci37537776	8km ENE of Coso Junction	California	1.93	0.59	Sun Mar 20 10:05:00 PDT 2016	
10	us20005b96	104km S of Atka	Alaska	4.1	10	Sun Mar 20 10:02:29 PDT 2016	
11	nc72609875	2km NW of The Geysers	California	1.13	2.08	Sun Mar 20 09:56:42 PDT 2016	
12	us20005b94	13km WNW of Xarlung	China	4.7	10	Sun Mar 20 09:54:13 PDT 2016	
13	ci37537768	4km NE of Anza	California	0.54	15.87	Sun Mar 20 09:54:06 PDT 2016	
14	hv61207881	13km SE of Waikoloa	Hawaii	4.58	31.836	Sun Mar 20 09:43:59 PDT 2016	
15	ci37537760	12km W of Anza	California	0.06	7.93	Sun Mar 20 09:30:43 PDT 2016	
16	ak13018888	109km WNW of Talkeetna	Alaska	2.1	0	Sun Mar 20 09:24:30 PDT 2016	
17	ak13018887	57km W of Talkeetna	Alaska	1.4	15	Sun Mar 20 09:21:03 PDT 2016	
18	ak13018886	75km ENE of Sutton-Alpine	Alaska	1.7	32.5	Sun Mar 20 09:05:55 PDT 2016	
19	nn00536281	51km NE of Mammoth Lakes	California	1.1	12	Sun Mar 20 08:47:45 PDT 2016	
20	ak13018241	102km W of Cantwell	Alaska	1.7	5	Sun Mar 20 08:47:33 PDT 2016	
21	ci37537752	11km N of Adelanto	California	1.16	0.01	Sun Mar 20 08:41:17 PDT 2016	
22	ci37537744	24km NNW of Tehachapi	California	1.33	8.12	Sun Mar 20 08:35:28 PDT 2016	
23	nc72609830	6km NW of The Geysers	California	1.61	2.7	Sun Mar 20 08:32:47 PDT 2016	
24	nc72609825	8km WNW of The Geysers	California	1.87	1.63	Sun Mar 20 08:31:33 PDT 2016	
25	nc72609835	9km WNW of The Geysers	California	2.17	1.75	Sun Mar 20 08:31:27 PDT 2016	
26	nc72609815	2km E of The Geysers	California	1.04	1.29	Sun Mar 20 08:21:46 PDT 2016	
27	us20005b8r	94km N of Yelizovo	Russia	4.4	167.68	Sun Mar 20 08:18:46 PDT 2016	
28	nc72609810	9km WNW of Cobb	California	0.43	1.45	Sun Mar 20 08:17:53 PDT 2016	
29	ci37537736	4km NW of Glen Avon	California	1.01	2.51	Sun Mar 20 08:05:48 PDT 2016	
30	nn00536277	47km NE of Mammoth Lakes	California	1.5	9.7	Sun Mar 20 07:45:57 PDT 2016	
31	nc72609795	5km WNW of Cobb	California	0.51	2.08	Sun Mar 20 07:34:45 PDT 2016	
32	nn00536296	17km NW of Truckee	California	0.6	10.1	Sun Mar 20 07:27:08 PDT 2016	
33	hv61207846	13km NE of Pahala	Hawaii	1.76	2.56	Sun Mar 20 07:26:23 PDT 2016	
34	ak13017591	23km E of Healy	Alaska	2.4	104.1	Sun Mar 20 07:16:47 PDT 2016	
35	pr16080006	2km NE of Pole Ojea	Puerto Rico	1.8	14	Sun Mar 20 07:01:44 PDT 2016	
36	ak13016950	33km NE of Eielson Air Force Base	Alaska	1.1	13.4	Sun Mar 20 06:42:58 PDT 2016	
37	pr16080005	4km SSE of Boqueron	Puerto Rico	1.3	10	Sun Mar 20 06:27:46 PDT 2016	
38	nc72609780	6km W of Cobb	California	0.88	1.76	Sun Mar 20 06:09:35 PDT 2016	

II. ARCHITECTURE
This section describes the packages, classes, methods and referenced libraries used to develop Earthquake Explorer.

Model

> **Geometry** public interface with dimension, geometry type
>> **Surface** public interface, extends geometry with area, centroid
>>> **Polygon** implements Geometry interface
>>>> **Bounding Box** constructed from a Polygon or OurPoint
>>> **OurPoint** implements Geometry interface
>>>> **Buffer** constructed from OurPoint
>>>> **Earthquake** extends OurPoint and declares member variables of place, magnitude, depth and id with getters and setters for each

View

> **GUI** extends JFrame implements JMapViewerEventListener, MouseListener, EventListener
>> **JFrame** is the container of the GUI and has main menu bar and two panels
>>> **mainMenuBar** has File, View and Help dropdown options
>>> **panel** contains mapv, the JMapViewer slippy map
>>> **tabbedPane** contains a **layers** panel for loading earthquake data from USGS by time and magnitude, a **query** panel for filtering data by place or bounding box, and a summary panel for returning maximum and minimum attributes for selected earthquakes and all earthquakes

Controller

> **Geocoder** The Google Maps API provides geocoding services to find the latitude and longitude of addresses. The service returns results in JSON. This class was adapted from an existing code base. This class contains methods that do the following:
>> Build a URL to access the geocoding service.
>> Read from the URL.
>> Build a JSON object for the content.
>> Store the first result from an array of results.
>
> **GeoJSONParser** The USGS Earthquakes Hazards program makes a GeoJSON feed of earthquake events available for use within programatic interfaces for applications. The GeoJSON objects are encoded as geometry, in this case as a collection of features. This class contains methods that do the following:
>> Build a URL to access the geojson service.
>> Read from the URL.
>> Build a JSON object for each attribute of interest from the content.
>> Store the results to an ArrayList of type Earthquake from OurPoint class.

Utility The utility class contains a method for calculating geographic distance between two points, which is used in the search distance query. It also contains conversion methods between radians and degrees, used in the distance calculation.

      Convert between radians and degrees.

      Calculate geographic distance between two points of OurPoint.

Referenced Libraries

JSON (json.org) This library implements JSON encoders and decoders.

OpenCSV (au.com.bytecode.opencsv) This library parses CSV.

JMapviewer (org.openstreetmap.gui.jmapviewer) This library integrates an OSM map view into your Java application.