Environmental

APPLIED GEOGRAPHIC SOLUTIONS
Powering Smarter Market Decisions™

Vintage

Release 2022A

Content

The environmental suite of data consists of several separate database components including:

- Weather Risks
- Seismological Risks
- Wildfire Risk
- Climate
- Air Quality
- Elevation and terrain

A wide range of applications benefit from these databases, including insurance underwriting, retail merchandising, real estate, and a wide range of applications benefit from these databases, including insurance underwriting, retail merchandising, and real estate. In some cases, many of these variables are simply useful for reference purposes or general interest.

The weather risk data covers five separate risks:

- Hurricane
- Tornado
- Hail
- Damaging Winds
- Coastal Storm Surge Inundation

The seismology risk includes both earthquake risk and tsunami risk, and can provide surprising insights in areas outside the well-known seismic zones of the far western states.

Wildfires are an annual major risk in most areas of the western United States, and while large fires often burn in the rugged and generally unpopulated mountainous areas, the combination of dry conditions, heat, and winds can often lead to major disasters along what is known as the wildland-urban interface.

For automated merchandising systems, the climate data (average January, July, and annual temperatures, rainfall, and snowfall) can help to avoid costly stocking errors. The heating and cooling degree days can assist in determining demand for heating and cooling equipment, for example.

These measures also are of general interest, especially in residential real estate applications.

In addition, the coastal sea level rise risk index is useful for long term planning, assuming that sea levels may rise over the coming decades due to climate change.

The air quality measures can be important to individuals contemplating relocation, health care research, and commercial site selection and economic development.

The nature of the local terrain can be of great interest to real estate developers and others; local terrain variables include elevation (minimum, maximum, average), slope (average, maximum), and ruggedness. The TRI (Terrain Ruggedness Index) is a new index which encapsulates the overall nature of the local terrain.

Methodology

Indexing

Most of the risk indexes (weather, seismological, sea level rise) are presented on a "100" basis, meaning that the average value for the nation is 100.

Within the Snapshot engine, any of these indexes can be recomputed onto any fixed scale (e.g. a 1 to 7 scale). Many of the core indexes are now available on a 0 to 10 scale. This assists users in interpreting the values between indexes.

Weather Risks

The core risk database consists of four separate types of weather-related hazards: hurricanes, tornadoes, hail, and damaging winds. The data are the results of a series of spatial analysis carried out on records compiled from publicly available USGS sources aimed at producing risk index estimates at the block group level and above.

Cartographic databases, while certainly interesting, do not provide any "actionable" information to the user, as it is extremely difficult to interpret the likely risk for any given point using historical location data. The spatial analysis undertaken is based on several underlying facts:

- At a "macro" scale, there is a clear pattern of incidents of any type (e.g. "tornado alley")
- At a "micro" scale, the particular path which a single tornado or hurricane takes, or the precise location of high wind incidents or hail is essentially a random occurrence. It is only through the accumulation of a large number of historical records that the randomness at the local scale begins to show a pattern at a regional scale.

As such, a simple count of how many tornadoes have passed through any particular block group is of no value, as this certainly falls within the "micro" scale. Given a long enough historical record (e.g. several thousand years), this might be an appropriate technique for evaluating the potential risk. However, given the relative shortness of these data series, a simple arithmetic exercise is not sufficient. Instead, for any particular point occurrence (e.g. hail observation) a conical filter was applied using a simple distance decay measure. For path events (e.g. a tornado path), a distance-decayed linear filter was applied. For any particular point in space, the accumulated probabilities could then be calculated by summing the areas underneath these conical and linear filters.

All of the resulting indexes are "100" based, which means that a value of 100 for a particular level of geography is the average national value. A value of 200 indicates that the area has two times the average risk level, while a value of 50 indicates that the area is at half the average risk level. For example, a value of 200 for the "HailIndex" indicates that the particular area is two times as likely to suffer hail damage in any given time period than an area with a 100 score.

Hurricane track data was obtained from publicly available USGS records. Atlantic hurricane coverage is from 1851 to 2016, covering a total of 1,360 storms. Pacific hurricane coverage is from 1949 to 2016, covering a total of 384 storms. Storm locations are tracked every six hours while the storm maintains the minimum wind speed required to be classified as a tropical storm. Along with location, the database includes information on wind speed and barometric pressure.

The risk indexes were derived using a distance decay spatial filter along the line of the storm track with a width of 100. Statistics at the block group level were then compiled by computing summary statistics of hurricane impact at the block group centroid.

Tornado records published by the USGS from 1950 were analyzed for the purpose of identifying relative risk at the block group level. Unlike hurricanes, which are always presented as a hurricane path, tornadoes are presented either as a path or as a single touchdown point. A total of 65,306 separate tornado events were analyzed. Similar spatial filters to those described under hurricanes were applied to both the point and path data.

Reports of damaging hail (over 0.75 inch in diameter) were compiled from USGS data sources, consisting of 320,182 records dating back to 1955. Point filters were applied to this database to derive relative frequency and intensity measures at the block group level.

The WindRisk data elements are based on reported events with wind speeds exceeding 50 mph, and consist of 222,640 separate events dating from 1955.

The composite risk index presents a unified risk index based on the relative damage expected from each of the four types of events. The relative weights of each of the source indexes were derived by weighting estimates of total annual damage caused by storms of each type.

Seismological Risks
QuakeRisk presents the relative risk of damaging earthquakes on a 100 based scale, with 100 being the national average risk. The data was constructed from USGS models using 0.01-degree grids, except in Hawaii where a 0.02-degree grid was utilized, and Alaska which used a 0.05-degree grid.

The tsunami risk index is based on an analysis of the very detailed USGS digital elevation model data. For each census block, the percentage of the block's area at each elevation group (in five-foot increments) was computed. A review of historical tsunami data was used to compute a probability table representing the expected maximum elevation of the tsunami surge, which was then applied to the distribution of area by elevation.

Wildfire Risk
Wildfire Risk is based on models produced by the United States Forest Service (G.K. Dillon, Wildfire Hazard Potential (WHP) for the Coterminous United States, 2018), the core index shows the relative risk of wildfires at

the block level of geography. Hawaii and Alaska have been modeled using similar techniques.

Climate and Air Quality

The climate database was created from two separate sources. The temperature, precipitation, and degree days variables were derived from an analysis of weather observations from federal government sources. In order to derive values for individual block groups, the data for each observation point (over ten thousand in all) were contoured in order to estimate the likely values at block and block group centroids.

The sea level rise index is based on a census block level analysis of the USGS digital elevation models by computing the percentage of each block at one foot intervals above sea level (to ten feet). These were then weighted inversely by a probability score.

The air quality indexes were derived from data obtained from the EPA and modeled using similar methods.

Elevation and Terrain

The USGS publishes digital elevation model files nationwide at very high resolution (1 arc-second). Portions of Alaska are at slightly lower resolution (3 arc-seconds). These files were processed into the AGS standard detail grid (500 square foot cells) by tracking maximum and minimum elevation, average elevation, and by computing the slope between each point on the USGS grid and its adjacent neighbors. The computations yield an excellent set of slope variables for very small areas including average slope, terrain ruggedness, and a complete distribution of slopes within each cell.

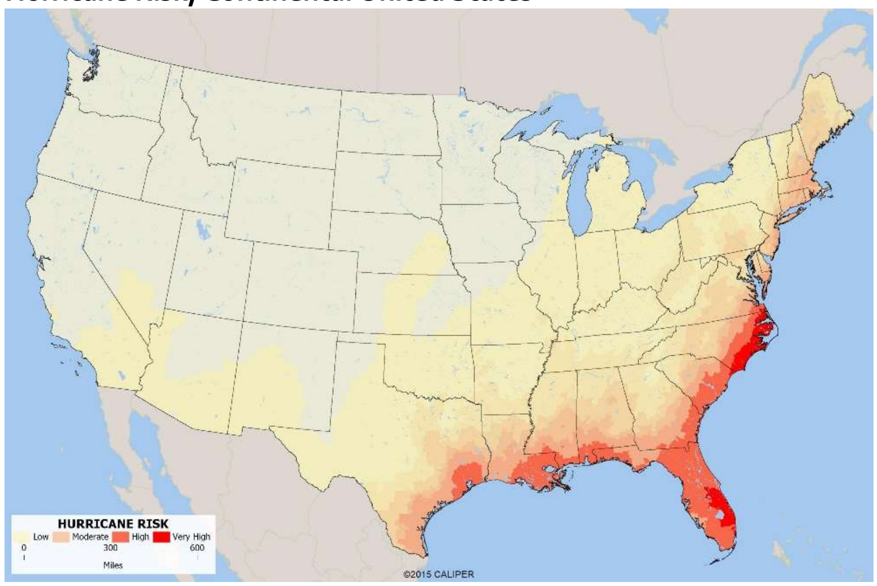
The data were then aggregated to census blocks and block groups.

The terrain ruggedness index is essentially the coefficient of variation of the slopes – the higher the value, the more rugged the local terrain.

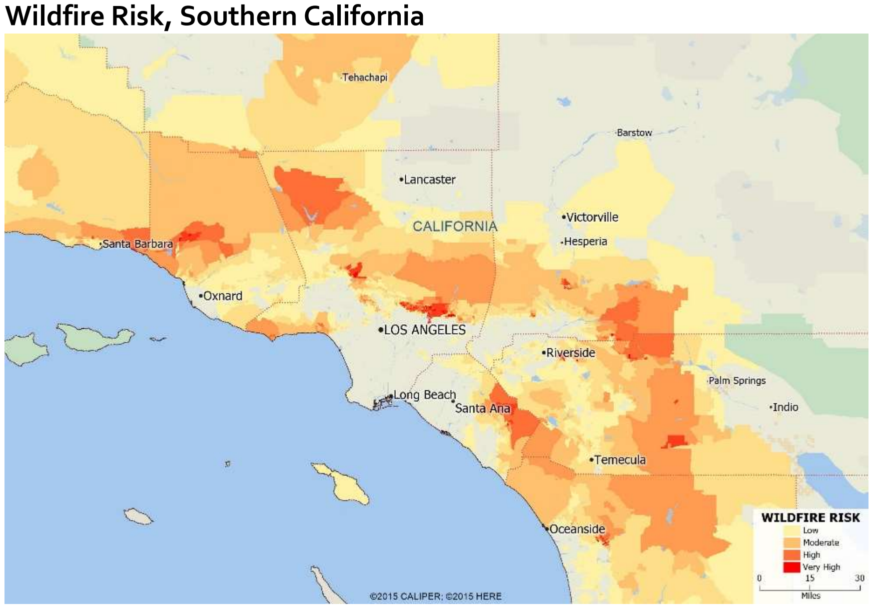
Environmental

Selected Maps

Hurricane Risk, Continental United States



Wildfire Risk, Southern California



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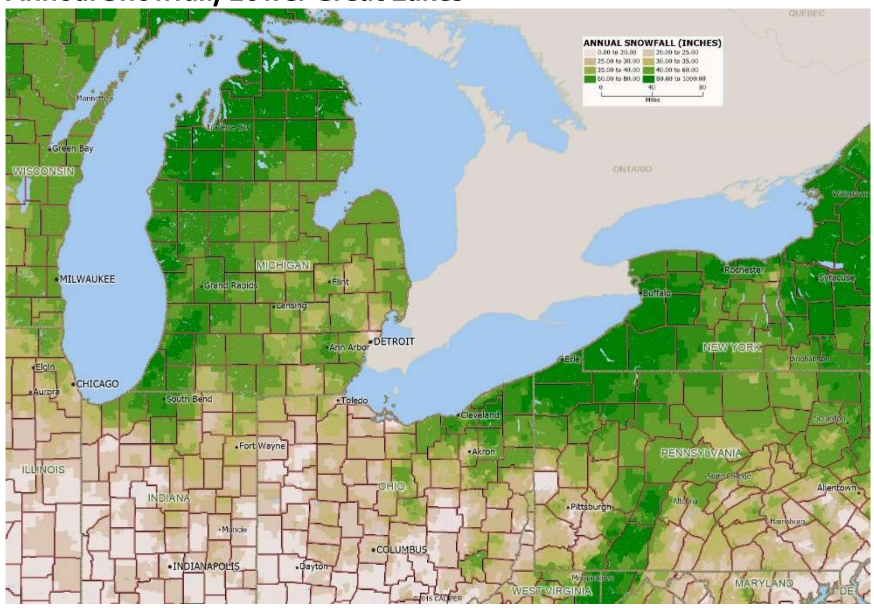
Annual Snowfall, Lower Great Lakes



Further Information

Contact customer service at 877-944-4AGS or email support@appliedgeographic.com.