The ALBACORE project: Teaching a computer to find offshore earthquakes.

BY: Jordan Bishop
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PASADENA, Cal. – While havoc prophesied by the box office hit *San Andreas* is laughable to seismologists, the issue of earthquakes in southern California is a topic on many scientist's minds. Caltech Summer Intern Jordan Bishop is developing a series of Python computer codes that automatically identify and find the location of earthquakes occurring off the coast of southern California. Mr. Bishop, a senior Geophysics major at UNC Chapel Hill, is working with Caltech faculty members Monica Kohler, Julian Bunn, and Mani Chandy through an internship with IRIS, the Incorporated Research Institutes for Seismology.

Earthquakes are always happening around the world, several hundred a day, in fact. The good news is that most of these events are too small for humans to feel. To detect earthquakes, both small and large, geophysicists use tools called seismometers to measure vibrations from the earth. Using this data, a geophysicist can often determine when even small earthquakes have occurred.

What's more is that earthquakes are known to occur primarily along cracks in the upper layer of Earth, called the crust. These cracks, called faults, are sometimes hard to find and have the potential to be a major safety hazard. The crust is constantly being stretched and deformed by the movement of Earth's tectonic plates, building up tremendous amounts of energy. As this stored energy grows, it has the potential to create a larger and larger earthquake once it's released, which could pose a significant threat to local industries and people.

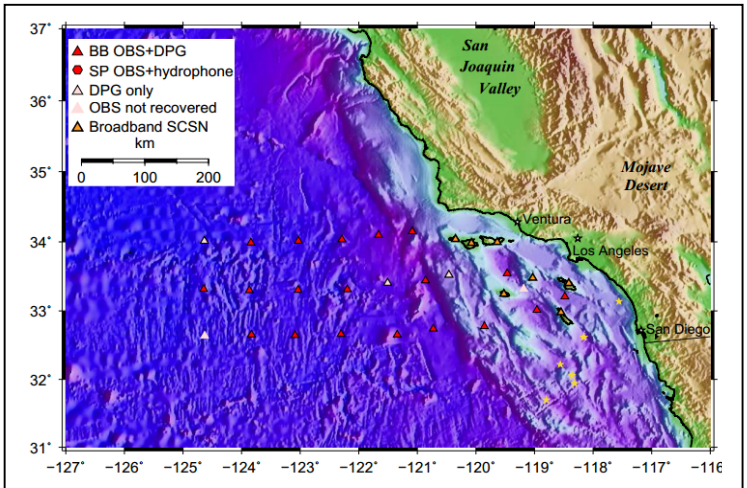

Figure 1: Located Earthquakes as yellow stars for Jan 11, 2011.

Small earthquakes, because they occur often and on faults, allow geophysicists to identify faults by looking for clusters of earthquake locations. Currently, a geophysicist has to examine the vibration data and determine the time on each seismometer that the earthquake was felt. This can be a time intensive, possibly error prone, process.

Mr. Bishop and his collaborators at Caltech want to automate this process. ALBACORE (Asthenosphere and Lithospheric Broadband Architecture from the California Offshore Region Experiment) is a series of 34 seismometers placed off of the coast of southern California, and collected data from September 2010 to August 2011. Using this data, Mr. Bishop is working on a program

that first tries to determine the time at which the earthquake was felt by all the seismometers and then uses these times to determine the location of the earthquakes.

From this data, the group plans to create a catalog of seismic events in southern California, and to examine the earthquake distribution for possible faults. Moreover, the group also plans to examine how the earthquake distribution throughout the year changes due to seasonal tidal movements. This data will be used to update fault maps in the area, which help structural engineers design stronger, safer buildings.

“We call a living planet home, and as such, we can’t possibly process all it has to offer. That’s where computers can help; we just have to teach them how,” stated Mr. Bishop summarizing the group’s mission.

References:

1. Incorporated Research Institutes for Seismology (IRIS). "How Do People Learn about Earthquakes?" *Special Publications Earthquakes: A Teacher's Package on Earthquakes for Grades 7-12 AGU/Earthquakes: A Teacher's Package on Earthquakes for Grades 7-12* (1994): 142-227. June 2011. Web. 19 July 2015