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# The Green Canyon Event as Recorded by the Atlantis OBS Node Survey

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## Abstract

Because of its location, the magnitude 5.2 Green Canyon earthquake of 10 February, 2006 has been of considerable interest to the oil industry. Unfortunately, because the nearby stations were all located to the North (onshore), its location and depth were only poorly constrained by the traditional worldwide seismic network. Fortunately, the Atlantis 3D survey happened to be ongoing at the time of the earthquake and recorded it on over 500 4C ocean-bottom nodes. The Atlantis array was closer to the event than any station on shore, and recorded the event from the South. These data thus provide an opportunity to dramatically refine our knowledge of the earthquake's location.

We preserved 2.5 hours of data spanning the time of the earthquake and analyzed it for signals, both man-made and natural. Although there are a large number of overlapping signals in the data, they can be clearly separated by their distinct arrival times, temporal frequencies, and phase velocities across the 10km x 6km array. At frequencies of 5Hz and above repetitive air-gun signals from 4 ongoing seismic surveys dominate the data. These account for all the surveys shooting in the Northern Gulf of Mexico at the time. At frequencies of 1Hz and below there is a nearly continuous background noise coming primarily from the South and East that rumbles along for the entire 2.5 hours, with a phase velocity across the array of about 2000 m/s. This is most likely ocean wave-generated noise.

At frequencies below 2Hz the earthquake signal dominates the data from 04:14:34 UT to about 04:20. It begins with several discrete arrivals from the NNW over a span of about 20 seconds, which are then followed by a drawn-out coda from the NW lasting over 8 minutes. At

04:22:13 a second event arrives from the SE, which is in turn followed by its own coda from the SSE, which lasts about 3 minutes. (It's not yet clear what this second event might be.) At about 04:27 a 3rd arrival, a weak, diffuse event from the ESE, fades in and lasts about 3 minutes.

These data have been provided to earthquake experts and we expect to have a revised location for the event by the time of the OTC meeting in May. Preliminary indications are that the earthquake was well to the North of the originally published position.

## Making use of the Atlantis OBS-node array

The geometry of the active nodes at the time of the earthquake is shown in Figure 1. We have a large, dense array (at least at low frequencies!) in this dataset, which allowed us to recycle a program called "Radar" for analyzing the signals in the data. "Radar" was originally written for examining surface-wave noise in land seismic data. It performs plane-wave stacks across the array and produces a graphical result showing the time, phase velocity, and azimuth of arriving energy. Figure 2 shows that "Radar" was able to correctly determine the azimuths of all the active air-gun surveys in the Northern Gulf of Mexico shooting at the time of the dataset.

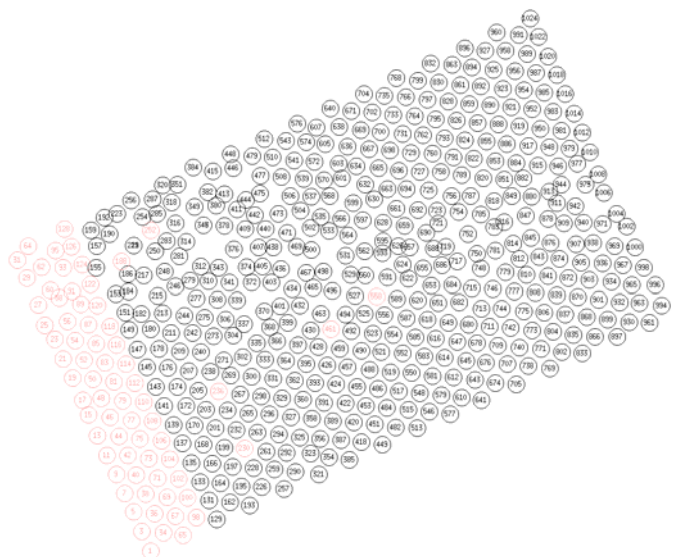


Figure 1: The active Atlantis array at the time of the earthquake. The dimensions are approximately 10km by 6km. The nodes are 400m apart. The disturbance running across the middle of the array is the Sigsbee escarpment.