

Storm Events - 2008

1.0 Storm Events

Two storm events were recorded in the second St Croix deployment of Sea-Bird wave and tide recorders, 10 August to 11 November 2008 (Figure 1).

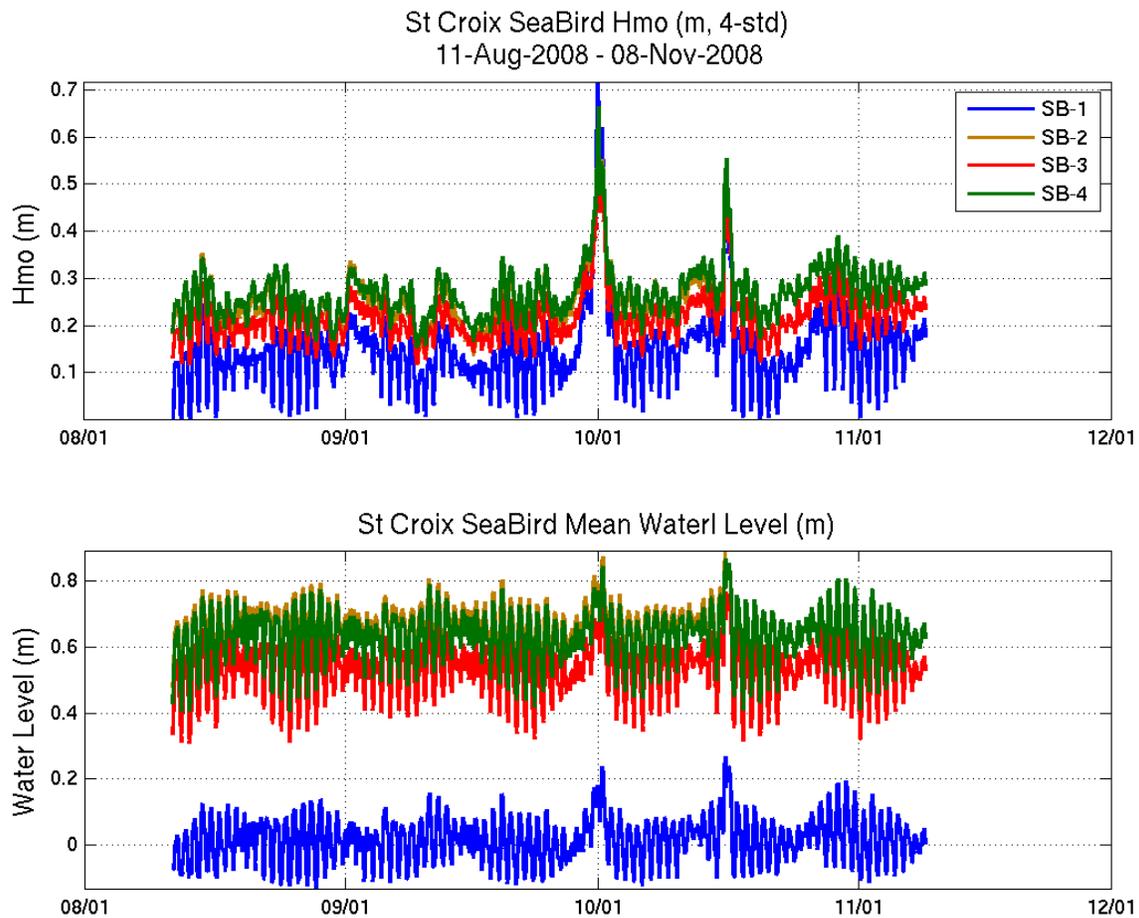


Figure 1: Sea-Bird wave height and water level during deployment #2.

1.1 Swell Event

The first event occurred 30 Sep – 1 Oct 2008, with incident large swell and low wind speeds (~7 mph E-ENE) measured at the St Croix airport. Incident wave heights peaked at 2.7m with peak periods of approximately 15 s, and directions from 47 degrees (compass direction from true north) as measured from the Waverider buoy moored in deep water just seaward of the instrumented reef. This event produced the largest waves observed over the reef in this deployment (Figure 1). Mean water level (setup/surge) was about 0.2 m above normal (Figure 2).

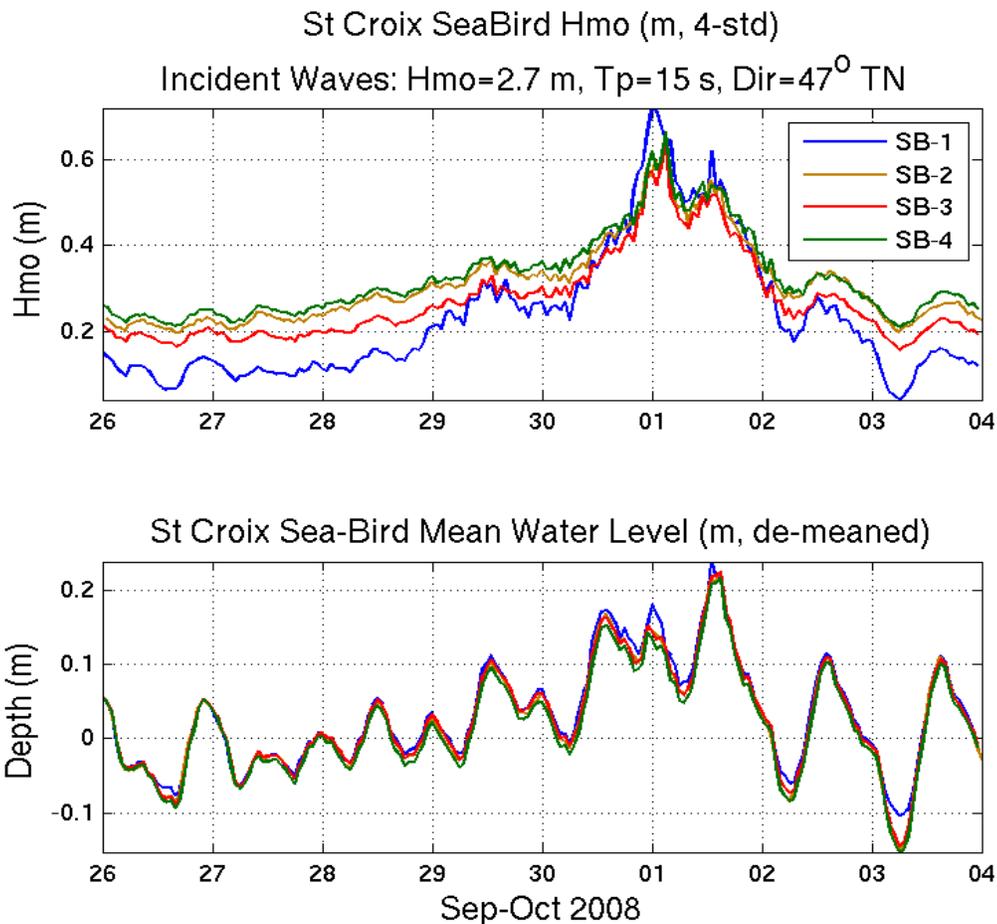


Figure 2: Swell event, 30 Sep to 1 Oct 2008.

A sample of the timeseries for the cross-shore gauges near the storm peak shows a dominance of infragravity energy (periods > 20s, frequencies < 0.05 Hz), increasing towards shore (Figure 3). Incident wave amplitudes have nearly disappeared at the shoreward most gauge. On 28 September 2008 (0000UTC), prior to swell arrival, spectra for the seaward gauge (#4) were swell frequency dominated, however the shore gauge (#1) had a comparable infragravity peak (Figures 4 and 5). It should be noted the wave heights were quite small 0.1m to 0.25m at this time. The spectra during the swell event show distinguishable spectral peak in the infragravity band when computed from 1024 s segments (lowest frequency peak in Figure 5). Total record lengths were 2048 s and spectral processing used the Welch method with 50% segment overlap. A 3-point band average was applied to smooth the spectra. The large segment length and small band averaging were selected to provide some detail in the infragravity band, but resulted in low degrees-of-freedom (dof \approx 14). Users of this spectra data may wish to perform additional smoothing in the incident band to increase the dof.

Peak period in the infragravity band were generally higher at the shoreward most gauge #1 (Figures 6 and 7).

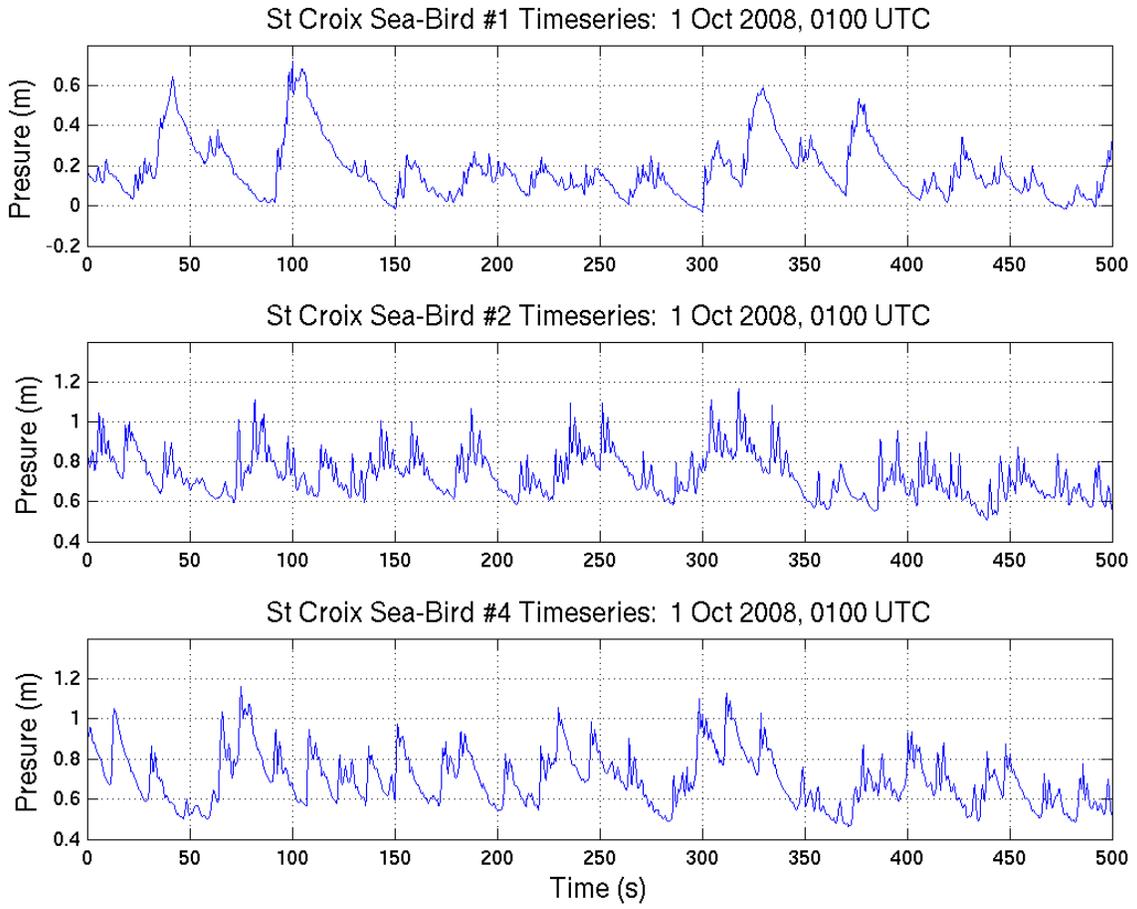


Figure 3: Timeseries near peak of swell event.

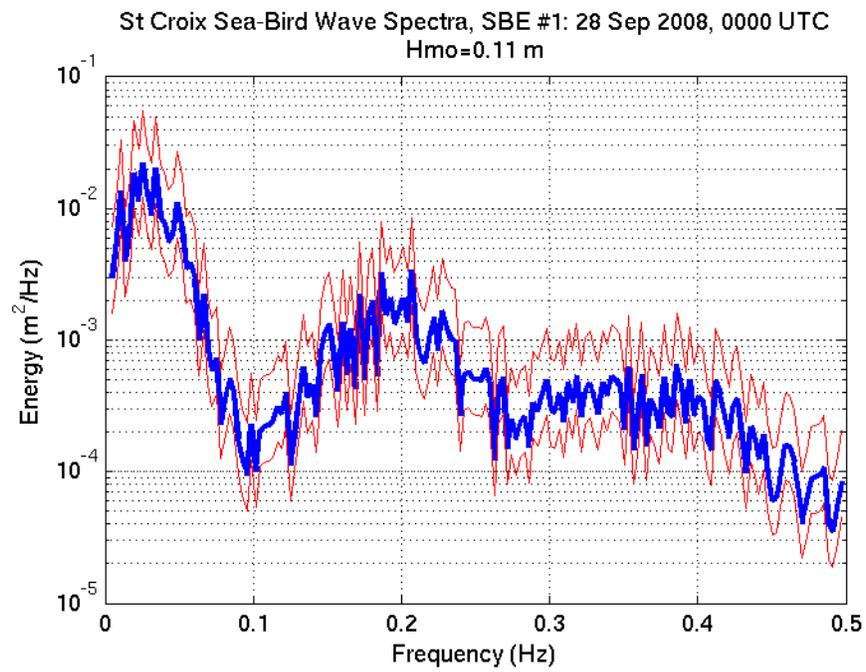


Figure 4: Shoreward Sea-Bird spectra prior to swell event

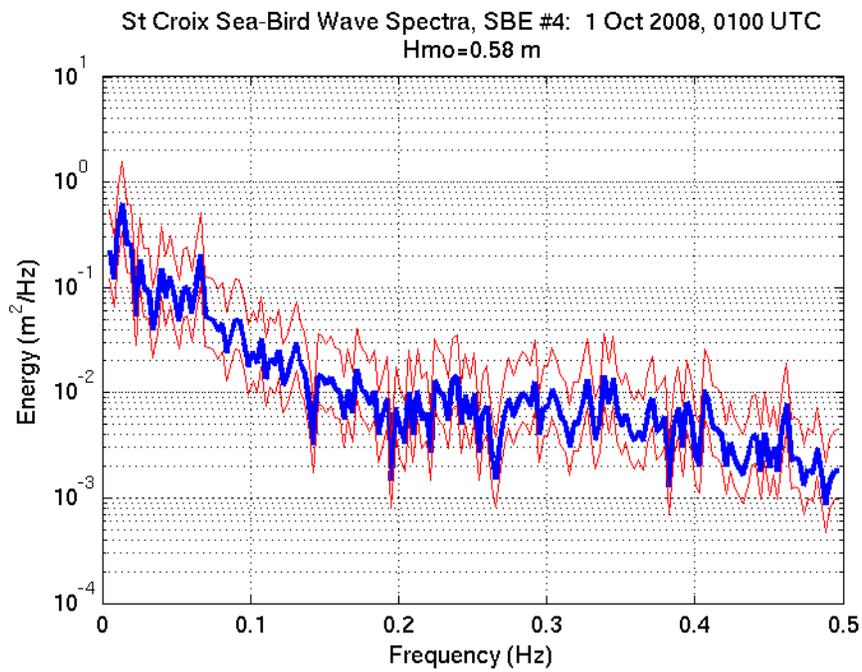


Figure 5: Infragravity dominated spectra during swell event.

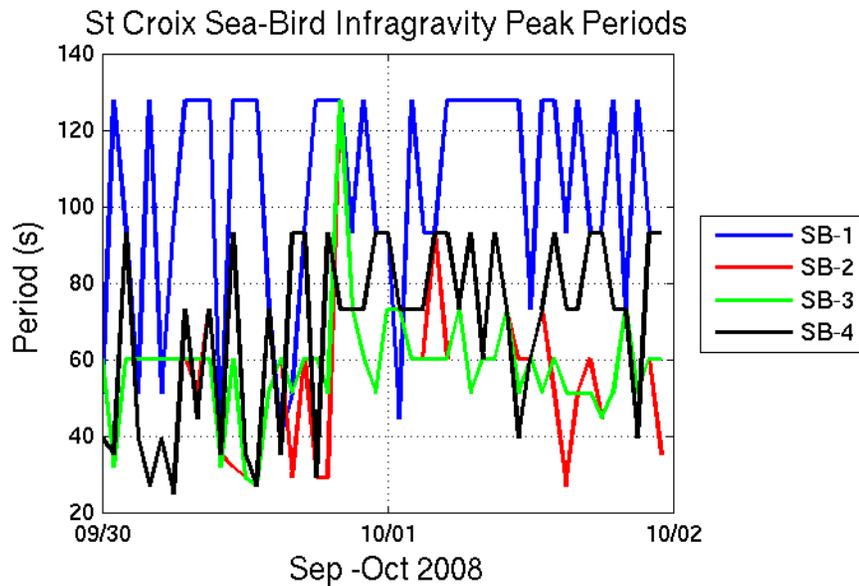


Figure 6: Peak periods in infragravity band in swell event

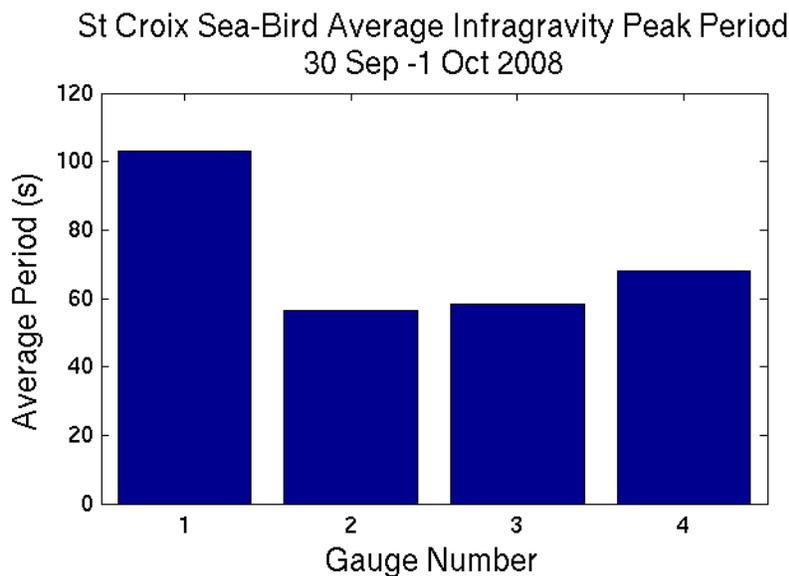


Figure 7: Average infragravity peak period during swell event.

1.2 Hurricane Omar

The second wave event occurred with the passing of Hurricane Omar on 16 October 2008. Incident waves (wind seas) peaked at 4.4m with peak period near 8 seconds and directions from about 36 degrees true north as measure at the deep-water Waverider buoy just offshore. It is interesting to compare these storm waves to the previous swell event. Although the incident waves were substantially higher, 4.4m vs 2.7m, the peak wave heights over the reef were lower, 0.55m vs 0.72m (Figure 1). Surge and setup were similar and only about about 0.2 m (Figure 8). Note SB-2 stopped

functioning at the peak of the storm, with only three lines are plotted in Figure 8 after the storm peak.

A sample of timeseries near the peak of the storm are shown in Figure 9. Infragravity waves were not as obvious in the timeseries as during the swell event since the incident wind-wave periods were not as fully dissipated. Time series from the shoreward most gauge (#1) does have a long-period component about 100s.

Spectral analysis used the same method as in the swell event. At the peak of the storm (16 Oct, ~ 0500 UTC) the shore gauge spectra was infragravity dominated and had a wind-wave peak near 0.15 Hz (~ 7s) (Figure 10). At that time the offshore gauge spectra was nearly “white” with little structure in the sea-swell band (Figure 11).

Infragravity wave peak periods were generally less in the H. Omar storm than during the swell event (compare Figures 12 and 13 with 7 and 8).

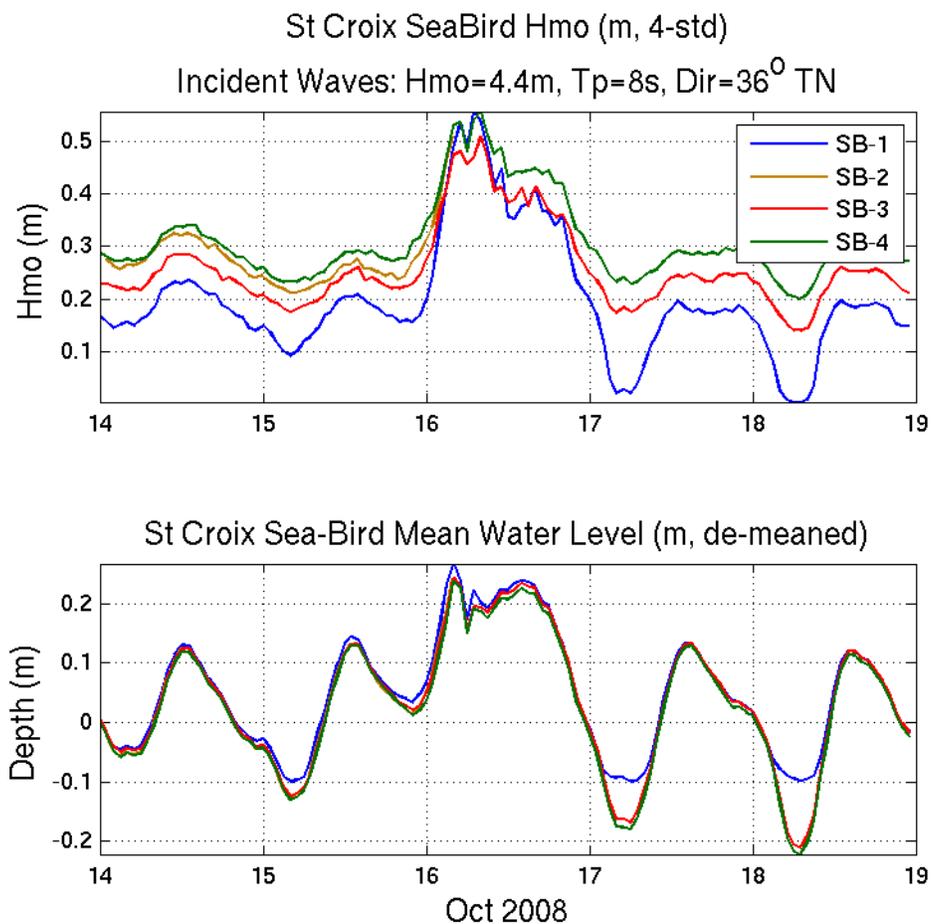


Figure 8: Sea event from Hurricane Omar, 16 October 2008.

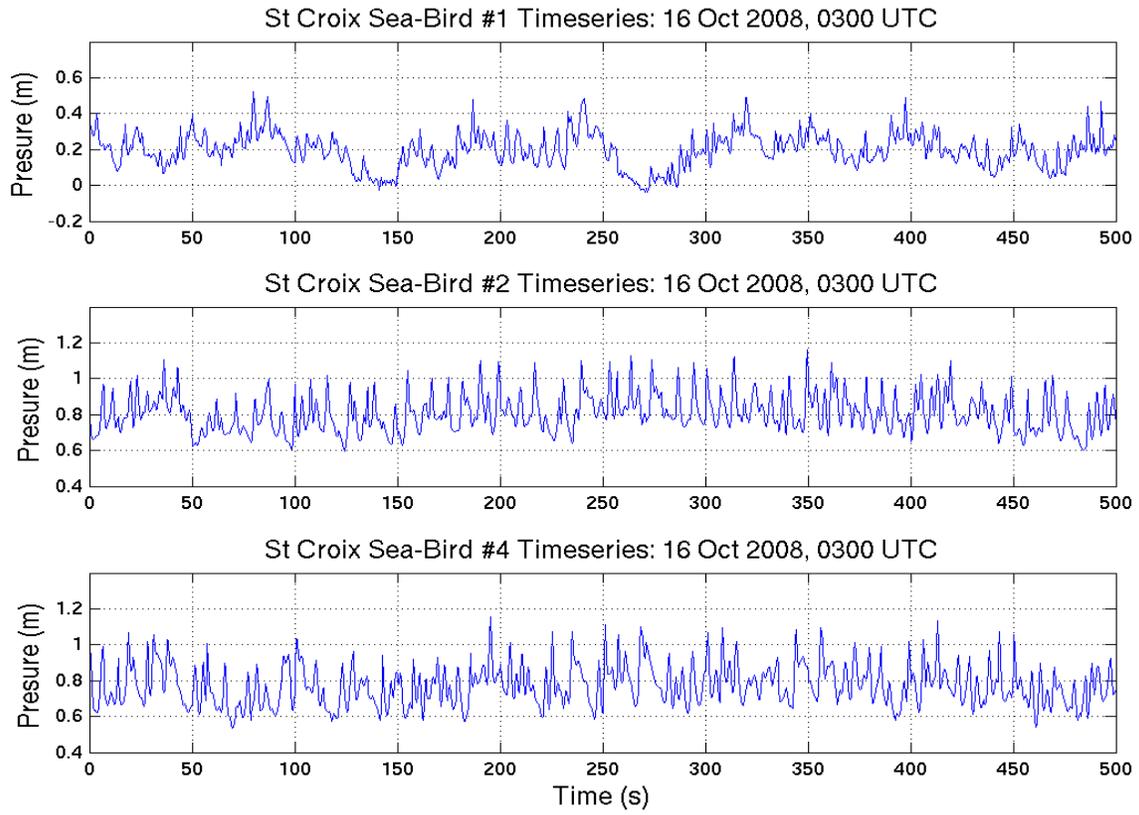


Figure 9: Sample timeseries from wind-sea incident waves.

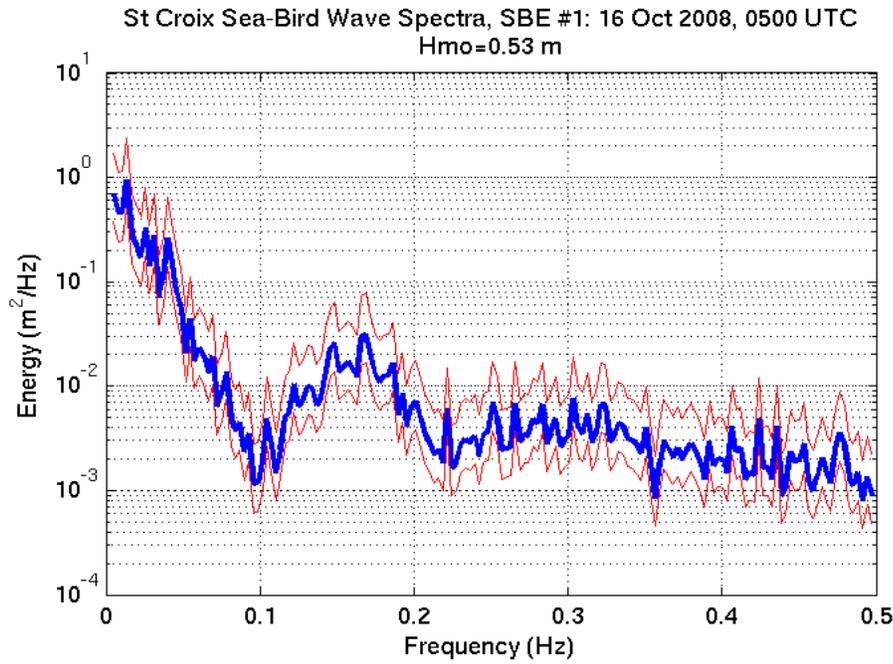


Figure 10: Shoreward most Sea-Bird spectra at H. Omar peak wave heights.

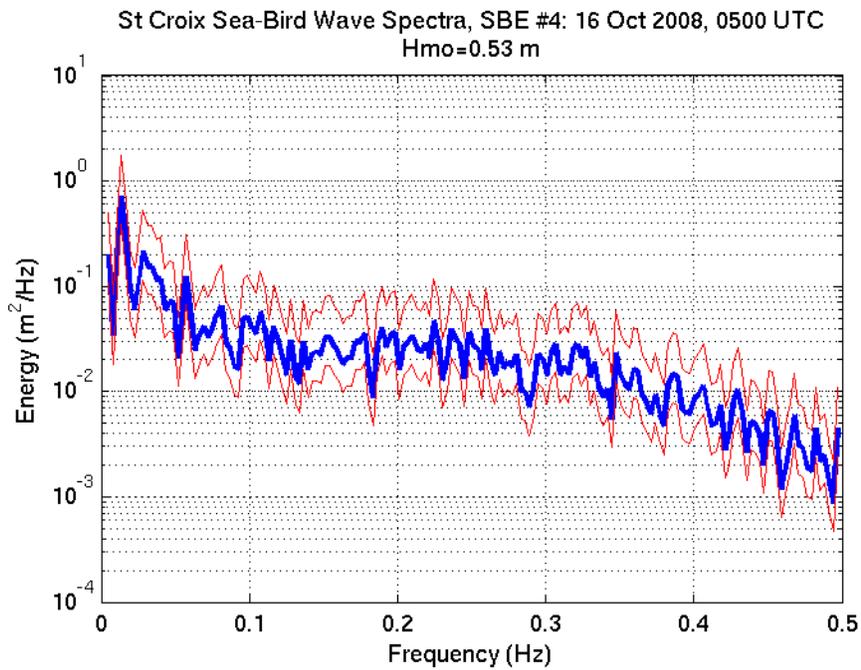


Figure 11: Seaward most Sea-Bird spectra at H, Omar peak wave heights.

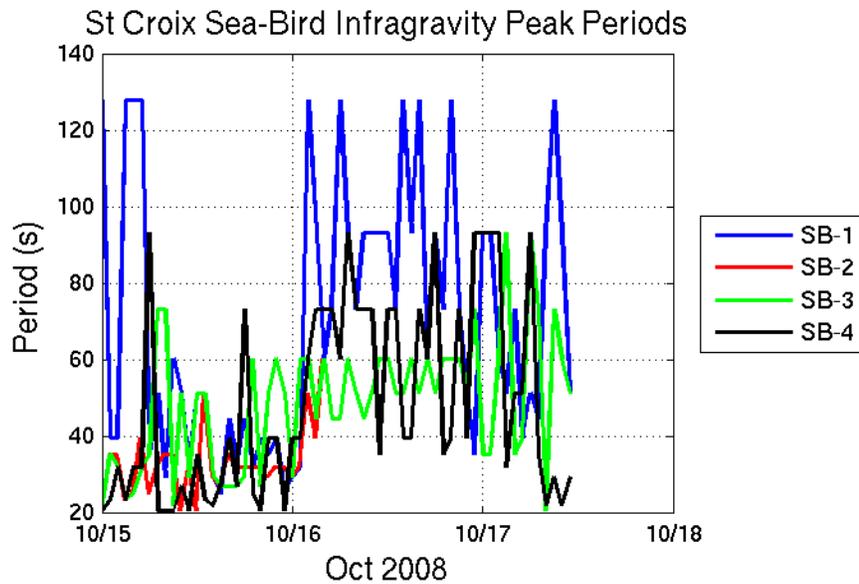


Figure 12: Peak periods in infragravity band during H. Omar

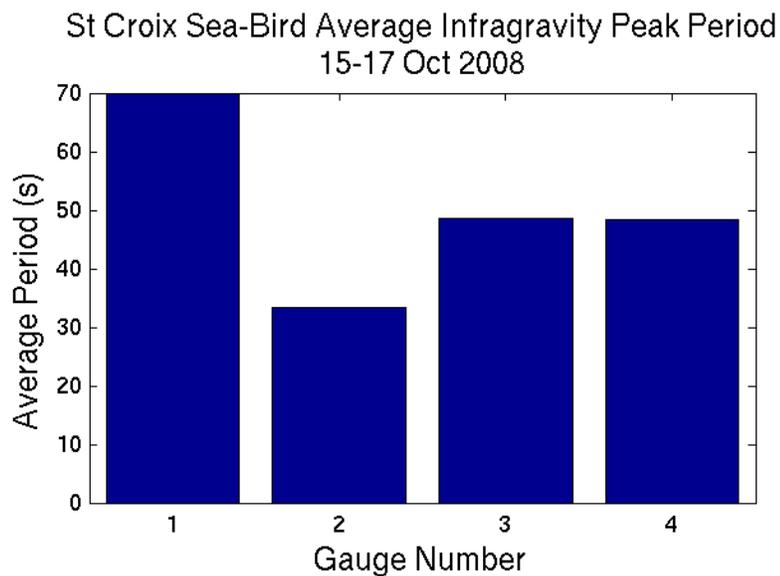


Figure 13: Average infragravity peak period during H. Omar

Figure 14 and 15 show a comparison of incident wave spectra (Waverider) with the shoreward most Sea-Bird gauge during the two wave events. It is interesting to see the Sea-Bird spectra show little energy of the peak incident wave frequencies. There may be possible harmonic peaks of the incident peak frequency.

Sea-Bird #1 and Waverider Spectra: 1 Oct 2008, 0100 UTC
Waverider Hmo=2.25 m

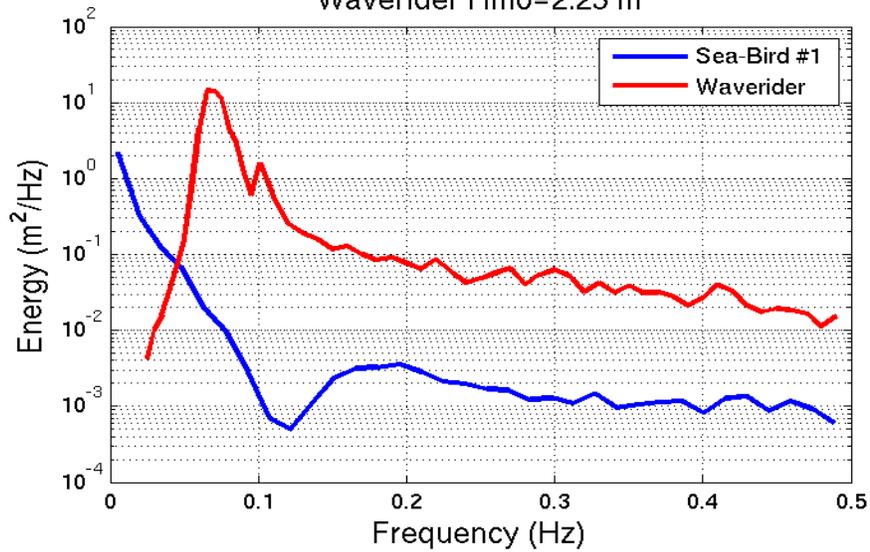


Figure 14: Waverider and SB-1 spectra in swell event.

Sea-Bird #1 and Waverider Spectra: 16 Oct 2008, 0500 UTC
Waverider Hmo=4.41 m

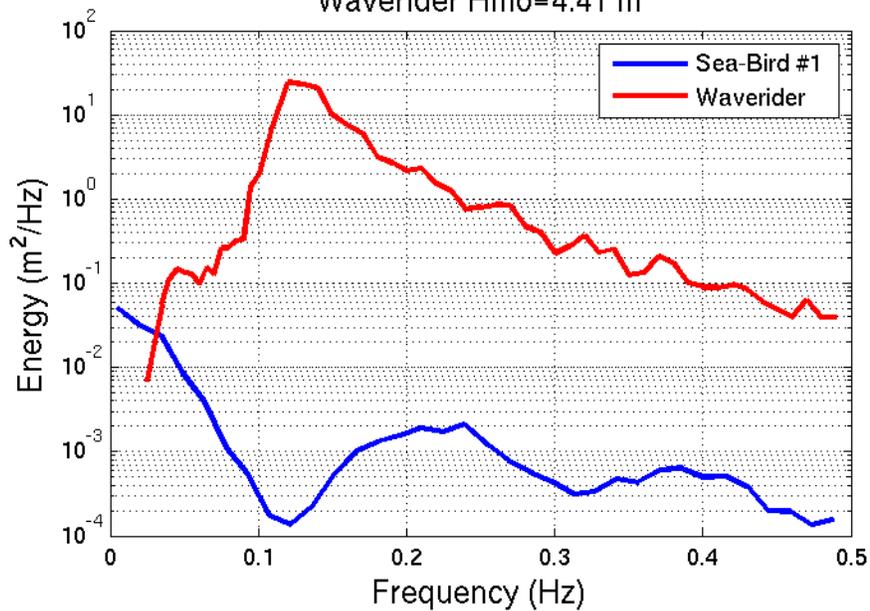


Figure 15: Waverider and SB-1 spectra during H. Omar.