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# Brief Communication: Is there a wind connection to freaque wave occurrences?

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## Abstract

There was a recent freaque wave encounter near Scituate, Massachusetts by a local transport ferry en route from Provincetown to Boston. The encounter resulted in minimal damages, fortunately, and provided us a chance to examine a possible connection between the freaque wave occurrence and the ambient wind field, since the place of encounter was in the vicinity of a NOAA NDBC buoy where wind and wave data were recorded. Here we present a brief analysis. In particular, we found it is plausible that the freaque wave was the result of a wind speed reduction in the wind field that preceded its occurrence.

## 1 Introduction

On 13 August 2014, Boston Herald.com (2014) carried this news item with the headline "Rogue wave hits Provincetown ferry." reported by Owen Boss:

> A Provincetown ferry was temporarily disabled and suffered damage when it was struck by a 20-foot wave off Scituate, according to the US Coast Guard and Bay State Cruises, has been escorted into Boston Harbor under its own steam.

Later the local WCVB TV News (2014) reported these further details:

> "Just before 4 p.m., a ferry was midway through its fourth trip of the day, to and from Provincetown and Boston, when the vessel was hit by a large set of waves that broke two of the seven windows in the pilot house, Bay State Cruise Company officials said in a statement.
>
> The two windows that broke were in the center of the pilot house, which is where the captain navigates from.



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Officials said windows in the passengers cabin, which is under the pilot house, were not broken and it appeared as though the waves were at an angle and height that they only struck at the pilot house level, which is about 20 feet above the water.

After the large waves hit the ferry, seas returned to the normal wave pattern of about 5 feet, officials said."

Evidently the indication that the large waves hit unexpectedly, at an angle, 20 feet above the water provided the basis for the Boston Herald's "20 foot rogue wave" report. On 14 August 2014 Boston Globe correspondent Kiera Blessing (2014) further provided these details including the actual time of the occurrence:

The ferry was carrying 42 passengers around 4.10 p.m. on Wednesday when the wave struck the vessel, deflected off the ship's bulkhead and broke through the windshield into the pilot house, the company said.

This case has been well reported locally. Maybe because there was only minor damage, it did not receive worldwide attention. Nowadays, sea going passenger ships encountering freaque waves in the middle of the ocean is no longer infrequent. Earlier this year, in February 2014, it was widely reported that the Cruise Ship *Marco Polo* was smashed into by a "massive" wave where one passenger was killed with several injured during "adverse" sea conditions in the English Channel. In March 2010, another cruise ship, the *Louis Majesty,* was reportedly struck by three successive large waves near Marseille, France. Two passengers in a lounge were killed by flying glass when several of the windows shattered. Many passengers were injured, and the ship suffered extensive damage.

What makes the Boston–Provincetown ferry case different from the cases mentioned above, however, is that a few miles north from where the encounter took place near Scituate, Massachusetts (Fig. 1) there is a NOAA NDBC Buoy, Station 44013, in 200 feet of water that records wind and wave measurements for the general area. Therefore, actual wind and wave information in the vicinity where this freaque wave encounter occurred was readily available. In this paper we wish to examine the circumstances surrounding the ferry vessel's clash with the unexpected large set of waves in connection with the available measurements to see what we can learn.

## 2 The measurements

In Figs. 2 and 3 we present the available wind and wave measurements as recorded from NDBC Buoy 44013. Figures 4–10 display the hourly wave spectra for the UTC hours 17:00 through 23:00. The winds are 10 min averages, waves are sampled for 20 min hourly at 20 to 40 min after the hour. UTC 20:00 represents 4 p.m. local EDT.

A perusal of these figures does not immediately identify any indication of freaque waves. Indeed a freaque wave occurrence at one point in the ocean does not necessarily imply the same freaque-ness will also happen at other nearby points. As there are different kinds of freaque waves, the encounters by most passenger ships may likely be the kind that "appears out of the blue and then disappears without a trace." So it is very unlikely that the freaque wave that hit the ferry outside Scituate, Massachusetts was recorded on buoy 44103 a few miles north of it. While the NDBC buoy's time series data may shed some light, it will not be available until the buoy is recovered later.

## 3 The ambient wind condition

While nearby ocean areas might not be affected by the same freaque wave at the same time, different parts of the same general area clearly share the same general wind field. Thus, while wave measurements at Buoy 44013 may not be directly representative of the wave conditions near Scituate, Massachusetts, the wind data recorded at 44013 should be indicative of the approximate wind conditions where the freaque wave encounter occurred.

On examining the 44013 wind data, Fig. 3, we inevitably noticed something rather intriguing: at the approximate time the ferry was encountering the freaque wave, there





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was a conspicuous sharp drop in wind speed. Might this wind speed plunge be related to the occurrence of freaque waves in the proximate area?

## 4 Did the drop in the wind field cause the freaque waves?

Because wind and wave measurements have not been available in the proximity over previous freaque wave encounters, wind connection has not been discussed in most of the previous freaque wave studies aside from limited hindcasting attempts with inferred wind information from elsewhere.

Because of the measurements in this Boston ferry case, for the first time, a possible connection between freaque wave occurrence and the simultaneous wind speed reductions in the ambient wind field deserves closer attention. In this regard, the recent publication of Babanin and Rogers (2014) may have a direct bearing here. Along with general discussions in Babanin (2011), we may readily postulate the possible relevancy between a wind speed drop and a happening of freaque waves through wave breaking considerations as follows:

> Higher frequency wave energy and wave breakings generally coexist under the typical situation of large winds and wave conditions, possibly also intertwine with potentially freaque wave generation mechanism, then a sudden wind speed dropping in the nearby wind field may leads to a rapid reduction in high frequency energy, with corresponding diminishing in whitecaps, but still buttressing steeper non-breaking waves (as the wind was blowing hard very recently), these mixed actions can conceivably be *conducive for likely appearance* of freak waves.

This is a plausible explanation on the possible connection between a freaque wave happening and the prevailing wind field. As it has not been previously discussed or noticed, we may choose to call this inference the "*Babanin–Rogers Conjecture*". If it can be aptly established, this connection can be a useful tool for alertness or preliminary freaque wave warnings in the ocean. Of course, we need further corroboration, which will not be easy to come by due to lack of physical data. Nevertheless, this may provide an additional discretion for coastal officials to post early warnings to the general public whenever a wind speed reduction appears in the forecasts!

## 5 Discussion and concluding remarks

From all indications, the ferry returning from Provincetown to Boston that encountered a freaque wave near Scituate was a relatively minor mishap without severe damage or fatality. But it was a freaque wave that they encountered, as evidenced by the statement "the vessel was hit by a large set of waves that broke two of the seven windows in the pilot house." The stated "large set of waves", which were clearly unexpected, befits the notion of freaque wave occurrences in general. It is a fortuitous advantage that the encounter took place near the NDBC instrumented buoy station 44013 and makes this encounter stand out from other encounters in the world oceans. This paper represents part of a preliminary effort to look into this freaque wave occurrence, and the discovery of the possible connection between the freaque waves and the ambient wind field. This is certainly of interest and useful to academic studies and coastal officials alike for warnings of possible freaque wave occurrences in the future – an approach not previously recognized, but that hopefully will lead to detailed understanding in the time to come!

*Acknowledgement.* GLERL Contribution No. 1738.

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**Figure 1.** Map of Boston–Provincetown Ferry surrounding area.





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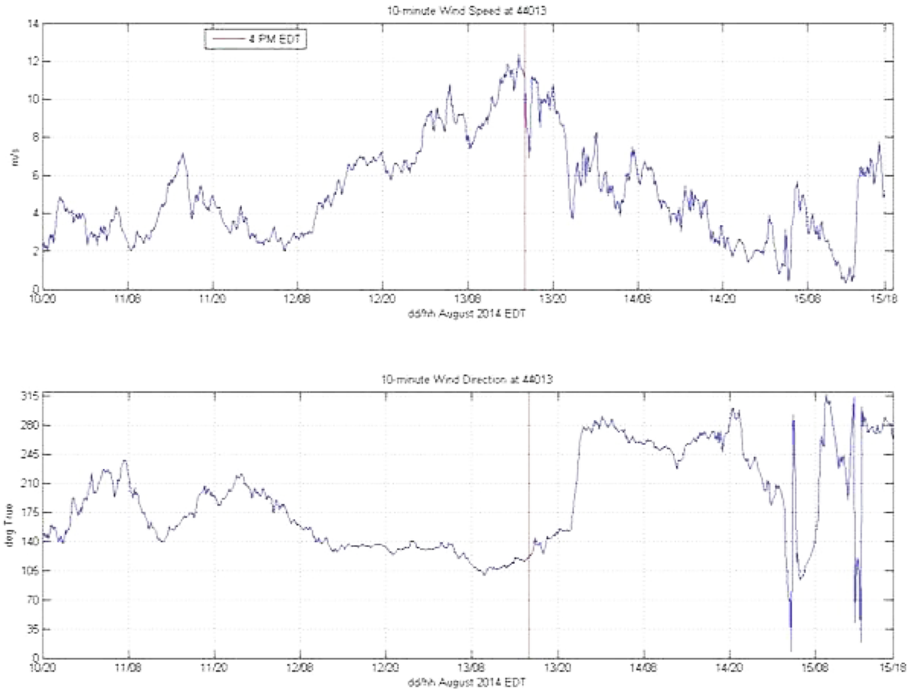


**Figure 2.** Hourly data of wind speed and wind direction recorded at NDBC Buoy 44013. The red line indicates the approximate time when the ferry boat possibly encountered a freaque wave outside Scituate, Massachusetts.





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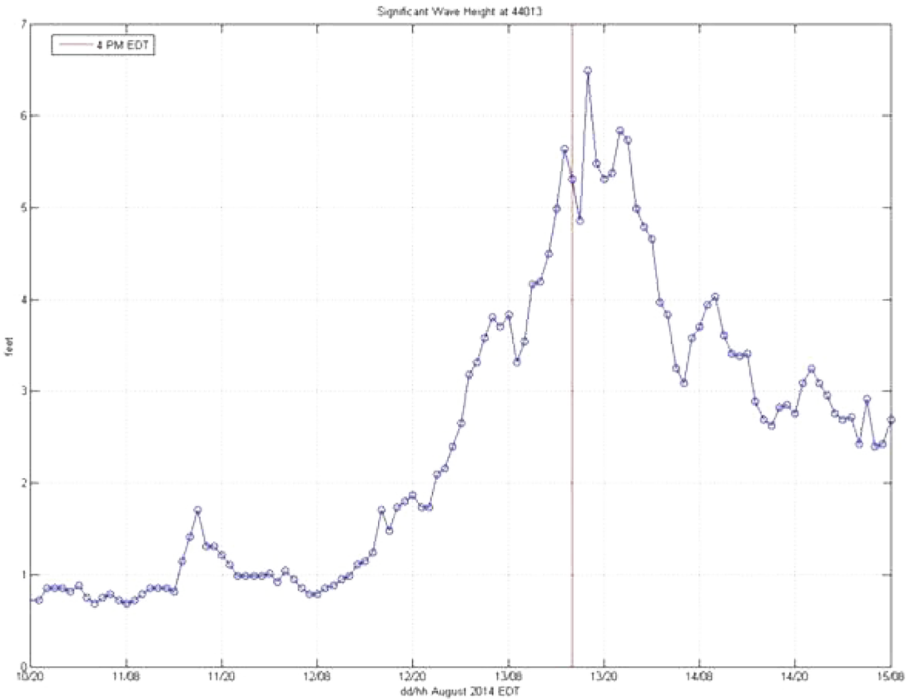


**Figure 3.** Hourly data of significant wave heights recorded at NDBC Buoy 44013. The red line indicates the approximate time when the ferry boat possibly encountered a freaque wave near Scituate, Massachusetts.



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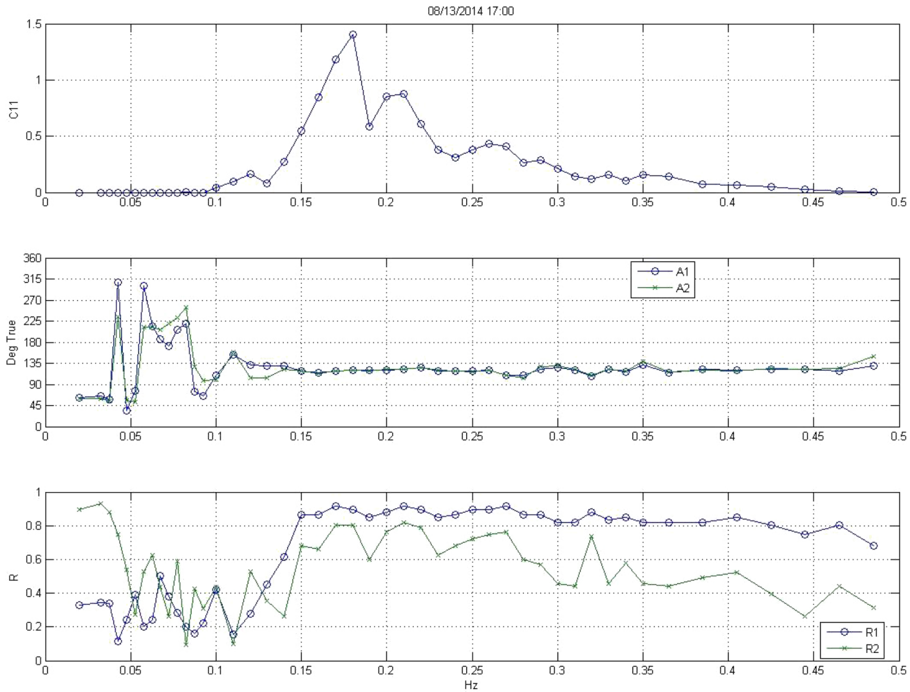


**Figure 4.** Wave spectrum recorded on NDBC Buoy 44013 at hour 17:00, 13 August 2014.





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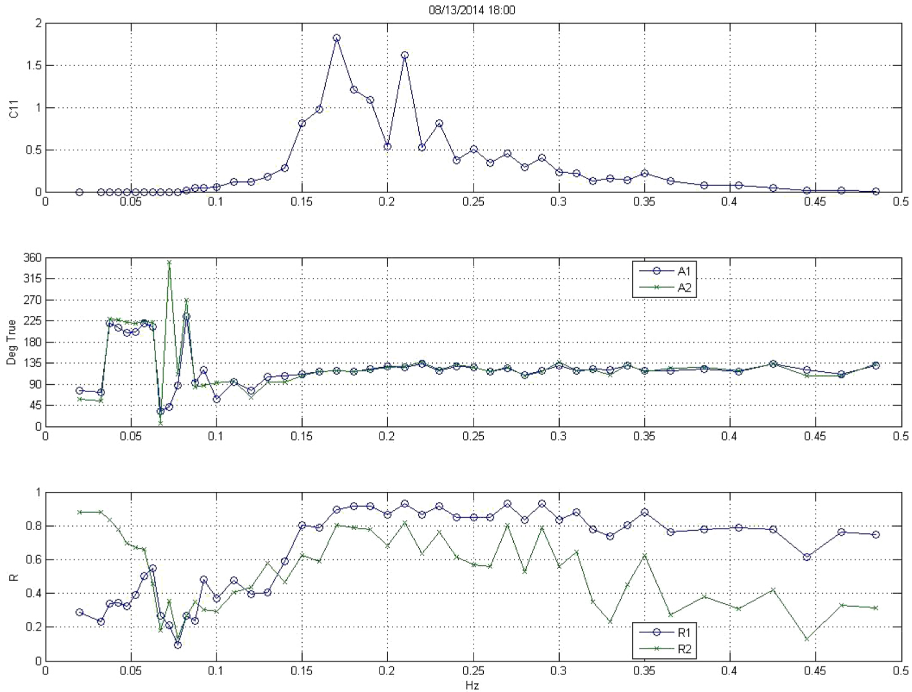


**Figure 5.** Wave spectrum recorded at NDBC Buoy 44013 at hour 18:00, 13 August 2014.

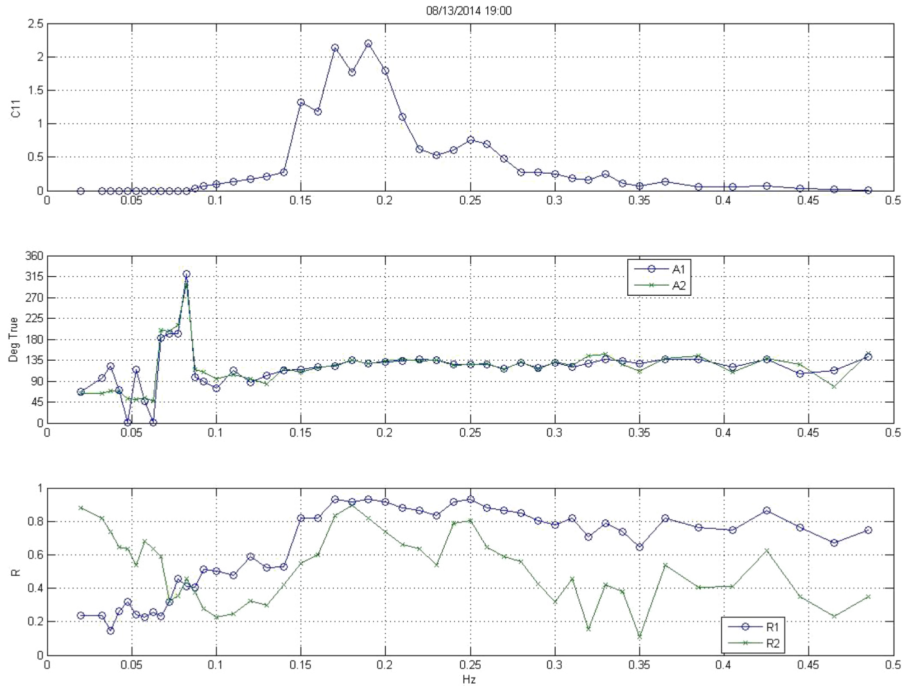


**Figure 6.** Wave spectrum recorded at NDBC Buoy 44013 at hour 19:00, 13 August 2014.

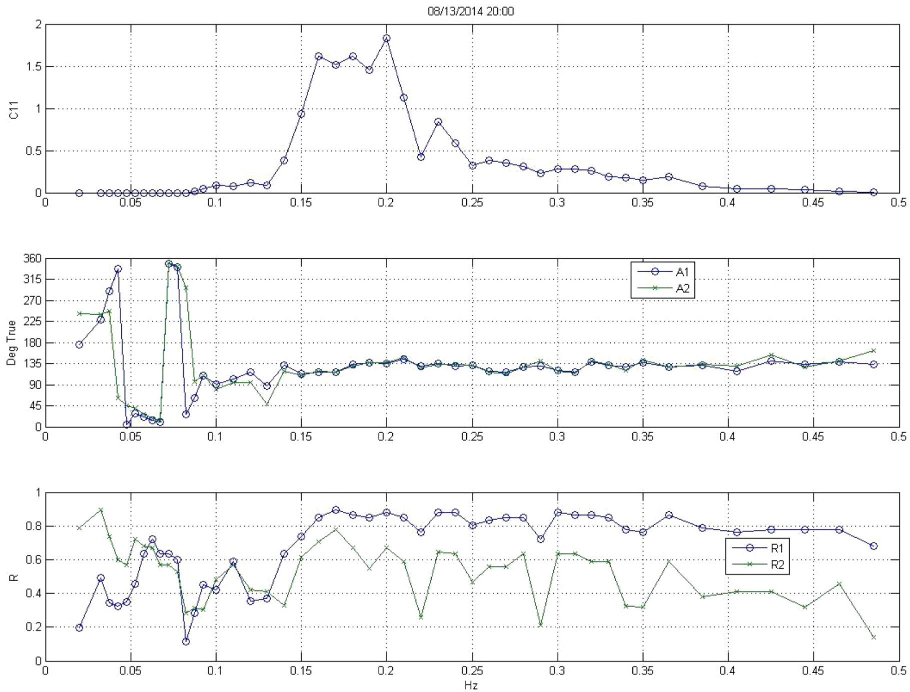


**Figure 7.** Wave spectrum recorded at NDBC Buoy 44013 at hour 20:00, 13 August 2014.

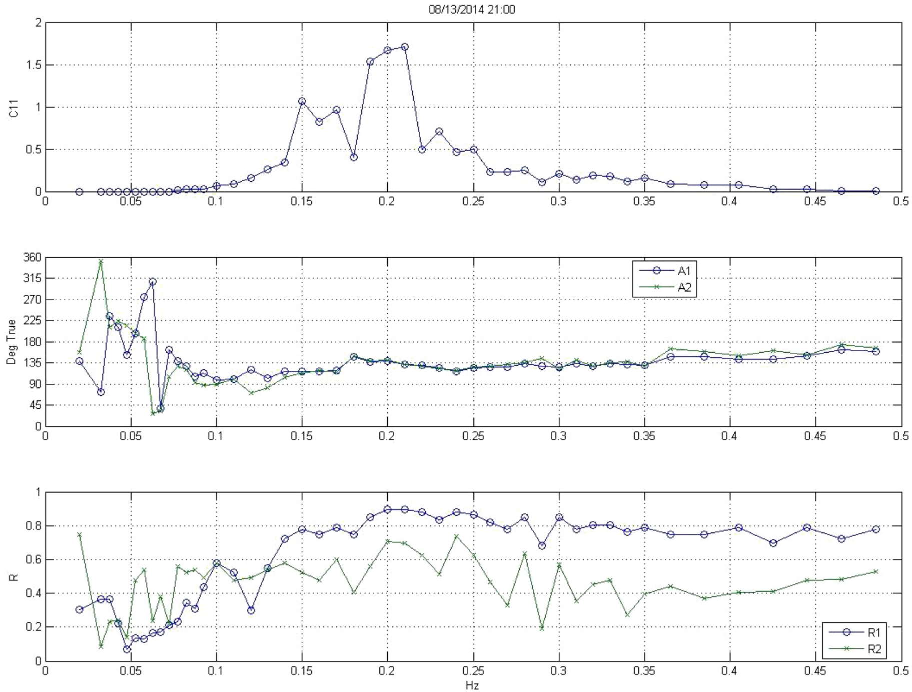


**Figure 8.** Wave spectrum recorded at NDBC Buoy 44013 at hour 21:00, 13 August 2014.





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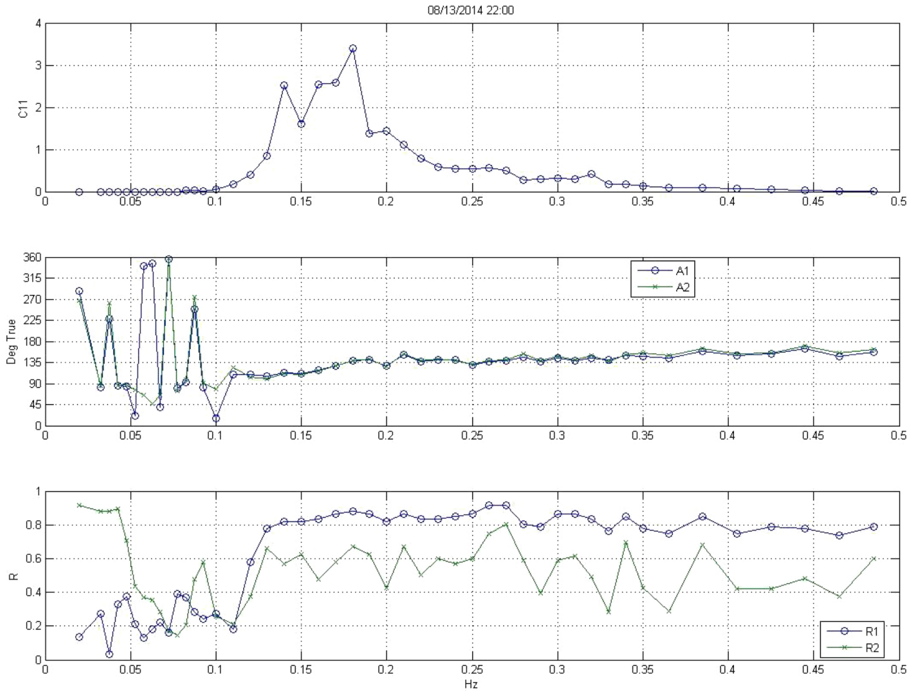


**Figure 9.** Wave spectrum recorded at NDBC Buoy 44013 at hour 22:00, 13 August 2014.





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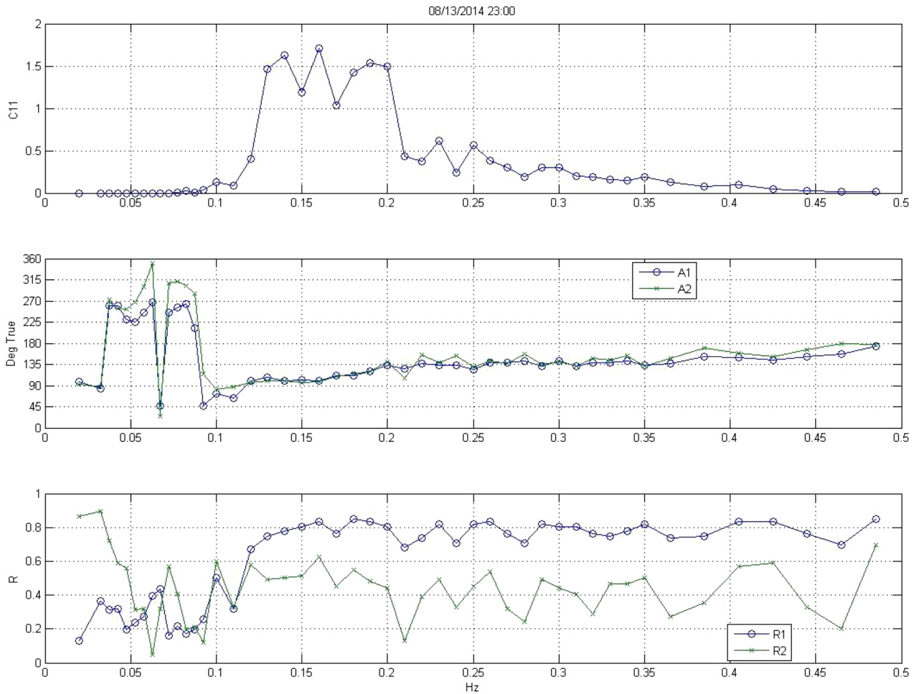


**Figure 10.** Wave spectrum recorded at NDBC Buoy 44013 at hour 23:00, 13 August 2014.





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