

Buoy Wind Performance in Hurricane Ivan and how findings relate to buoy verification in the Anchorage Area of Responsibility.

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As has been noted by marine forecasters in the Anchorage office for years, moored buoys tend to under report the sustained winds when wind speeds and sea heights get large. The question as to whether the sustained wind or wind gusts that are reported by buoys are more representative as to the actual conditions experienced by mariners has become a larger question as products to verify marine forecasts against the buoys have become routinely issued. It is the belief of the forecasters and management of the Anchorage forecast office that winds should be verified against a buoy's wind gust speed instead of the sustained wind speed.

As winds increase and seas build, errors in the sustained wind speed become prominent. This appears to be caused by two major factors - both of them influenced by eight minutes that wind speeds are averaged over to produce the sustained wind. The first is the amount of time the buoy spends in the wave trough as seas get large. When the buoy is spending a significant part of its eight minutes in the trough of the wave, the wind is partially blocked by the wave and the speed consequently diminishes. Another factor is buoy tipping as the waves propagate through it. Especially when the wave period is short and waves are steep, the buoy bends over in relationship to the horizon. Since the anemometer is no longer perpendicular to the surface wind, its reported speed is reduced. Both of these problems become significant as wind speeds and sea heights increase.

A case in point comes not from Alaskan waters, but from the Gulf of Mexico as Hurricane Ivan moved through a dense network of buoys and made landfall along the Alabama coast. This system gave a look at the performance of the moored buoys as compared with coastal observing stations (C-MANs) for a storm of known intensity.

The part of the storm track that I will focus on is the final 30 hours before landfall when it moves from 25.1N, 87.2W to near 30.2N, 87.8W. During this time the storm passed near five moored buoys and four C-MAN stations. The hurricane force winds were said to have covered three of the buoy locations and two of the C-MAN locations. The other two buoys and two C-MANs were said to experience tropical storm force winds. This can be seen on the figure 1 graphic where the buoy and C-MAN locations are overlaid on top of the wind swath image

produced by the National Hurricane Center.

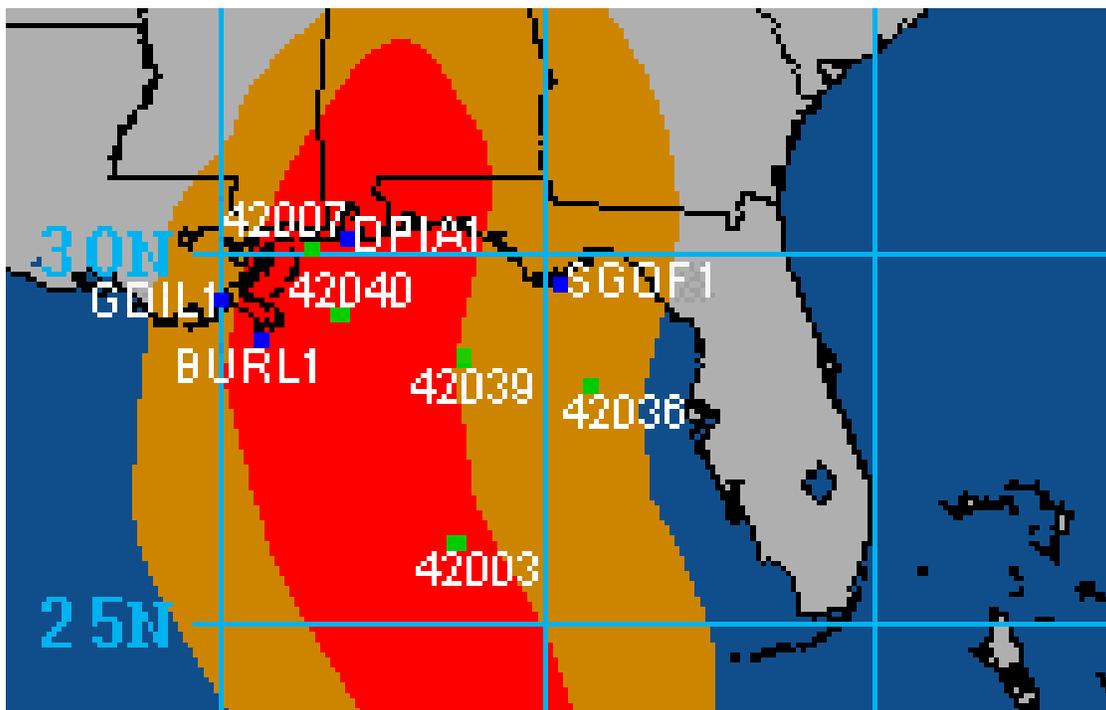


Figure 1

Of the three buoys that were in the hurricane force wind area, buoy 42003 was the first to be encountered by the storm. It experienced maximum sustained winds of 56 knots with gusts to 74 knots during 36 foot seas. The maximum sustained wind in the storm at that time was reported to be near 120 knots.

Buoy 42040 had the highest seas at 52 feet. When the sea heights were between 42 and 52 feet is when it recorded its maximum sustained wind speed at 55 knots. The wind gusts at this time were 74 knots.

Shortly after that buoy 42007 reported sustained winds of 48 knots with a gust to 68 knots. Seas at this time were between 12 and 20 feet.

What is interesting to note here is that none of the three buoys reached hurricane criteria with their sustained wind speeds, but each one of them did when wind gusts were used. Also, the average difference between sustained maximum wind speed and the associated wind gusts was 19 knots. When the two buoys in the tropical force wind swath are included, the average difference between sustained winds and associated wind gusts for all five buoys was 16 kts.

When the two land stations that were in the hurricane swath are looked at, BURL1 did reach hurricane force sustained winds at 69 knots, and DPIA2 had 63 knots which is only 1 knot under hurricane criteria. Associated gusts were 77 knots and 79 knots, respectively. The average difference in sustained winds and associated gusts was 12 knots. When the two C_MANs that were in the tropical storm force winds are factored in, the average difference between sustained wind and associated gusts was 9 knots for the four stations.

This is a brief look at the situation, but we can see that the buoys had an average difference between sustained wind and gust at the time of maximum wind 7 knots higher than the C-MAN stations. Once again no buoy hit hurricane criteria unless gusts were used as the verifying factor. The C-MAN stations either hit hurricane force with their sustained wind or were within 1 knot.