Adjusting Peak 5-Second Wind to Better Fit with Past Instant Gust Measures

compiled by
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Introduction

By the end of 1996, Automated Surface Observing System (ASOS) stations had been commissioned at all of the official National Weather Service (NWS) stations in the western Pacific Northwest. With the implementation of the automated equipment, arrived a new methodology for measuring wind. Before ASOS, a gust was an instantaneous value taken from an analog anemometer with an indicator dial and/or strip-chart recorder. After ASOS, a 5-second average from a digital anemometer became the new gust. Given a high variability in wind speed over small spans of time, a 5-second average, which flattens the short-period changes in wind speed, is likely to be considerably lower than an instant reading.

For a rigorous examination of windstorm climatology, this reality is not trivial. The 5-second gust is a completely different measure than the peak instant gust that was formerly used by the NWS. This issue has been covered in a number of webpages on this site, including the case studies for the December 12, 1995 and January 16, 2000 windstorms. This essay will examine the climatological problems that result from a 5-second wind in a more systematic manner. This is important, for the 5-sec gust measure nearly invalidates comparison between storms of history with those of today. For example, it is possible that the new 5-second peak "masked" some of the storms, due to a tendency for significantly lower wind-speed numbers compared to pre-ASOS events. In other words, a major storm have struck and not produced the expected peak gust signature owing to the difference in measure.

An even newer complication with gust measurement has occurred in the 2003-2007 timeframe. The NWS switched from cup-based anemometers to sonic versions in this period, with many being commissioned in the western Pacific Northwest during 2007. With sonic anemometers, gust measure is changed again. This time to a 3-second average, which is the international standard, and used in engineering circles to help develop building codes. A 3-second gust is somewhat different from a 5-second gust. Also, sonic anemometers are purely digital systems that have no moving parts; they are a dramatically different instrument for wind measure compared to the cup-based analog systems employed before ASOS, and a substantially different instrument compared to the cup-based digital systems employed during the first decade of ASOS.

The cup-based anemometers of yesteryear, relative to sonic systems, have inertial-response issues, both in terms of the cups spinning-up during a gust, and in the movement of the indicator needle or pen or strip-chart depending on what equipment was in use. Depending on the source, it is thought that an instant gust on the old anemometer systems is akin to a 1-sec to 3-sec average.

Nevertheless, the 3-sec gust on sonic anemometers is anticipated by the NWS to be more akin to the old instant gust readings. However, early evidence (based on observations during the 2007-08 storm season) points to the 3-sec gust on sonic anemometers perhaps being slightly high relative to the old instant gust. Gust ratios on modern sonic systems appear to be higher compared to the systems of old, especially during strong storms. These new sonic anemometers are clearly a new complication to comparative analysis of storm systems over time, one that will be explored in-depth hopefully soon.

To help clarify the issues, take some wind records for Astoria, OR, for example. On October 12, 1962, Astoria reported a peak instant gust of 96 mph on an analog cup-based anemometer; on March 3, 1999, Astoria reported a peak 5-second gust of 66 mph on a digital cup-based anemometer; and, on December 3, 2007, Astoria reported a peak 3-second gust of 94 mph on a digital sonic anemometer. Given the change in equipment, and gust measure, are these numbers in any way directly comparable?

The following discussion primarily focuses on what can be termed the "Five-Second Gust Era," which, for the majority of western Pacific Northwest stations occurred from 1996-2006, with some stations like Astoria being changed to ASOS as early as 1993. Examination will primarily be on the 5-second gust. The 3-second gust is also explored, but only peripherally. Note that the data presented on the 3-second gust was collected on a cup-based system, and the results are probably not applicable to sonic anemometer systems.

Discussion

A 5-second "gust" is something entirely different from an instant gust. The former is an average, so technically it should be called a 5-second "wind" (and usually is by the NWS and NCDC). An instant gust is a direct reading, though arguably on cup-based systems inertial response can be considered to be an averaging mechanism. A specific value for a 5-second wind can contain much higher instant readings within its duration. Figures 1 through 3, below, demonstrate the high-frequency variance in speed that can be present in wind.

Figure 1: Peak gust, Oregon City, OR, during the passage of the February 7, 2002 cyclone. Maximum speed for each averaging period indicated on the chart. Peak instant gust 27 mph, peak 3-second wind 23 mph and peak 5-second wind 21 mph. Same wind gust, different measure.

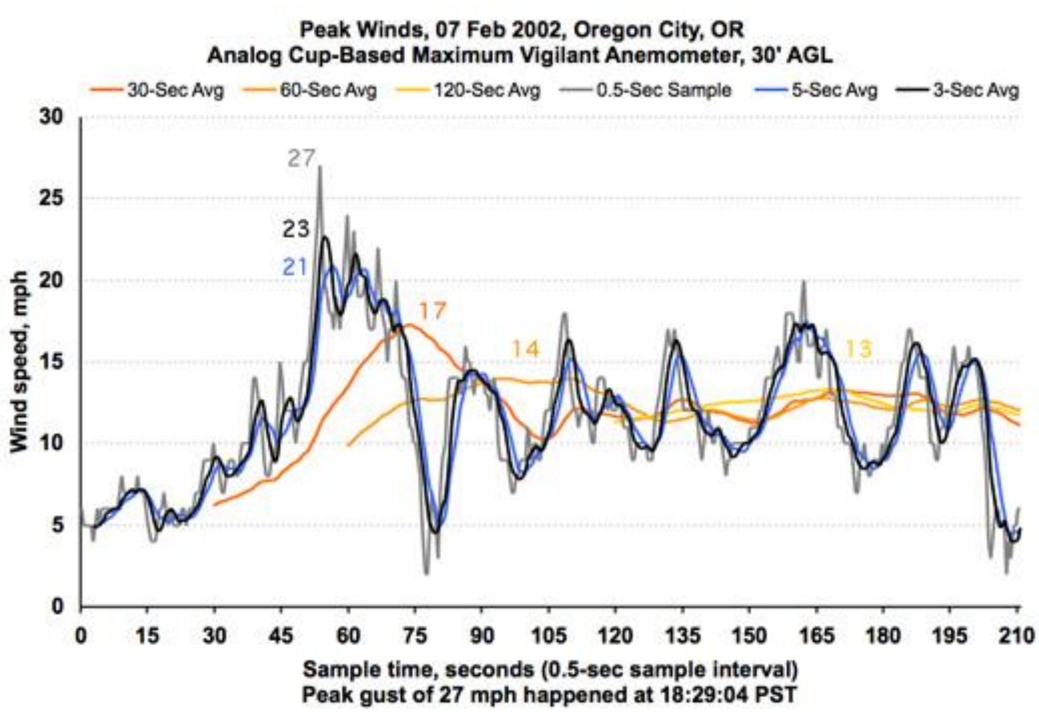


Figure 2: Peak gust, Albany, OR, for the December 5, 2003 passage of a strong open wave. Maximum speed for each averaging period indicated on the chart. Peak instant gust 38 mph, peak 3-second wind 33 mph and peak 5-second wind 30 mph.

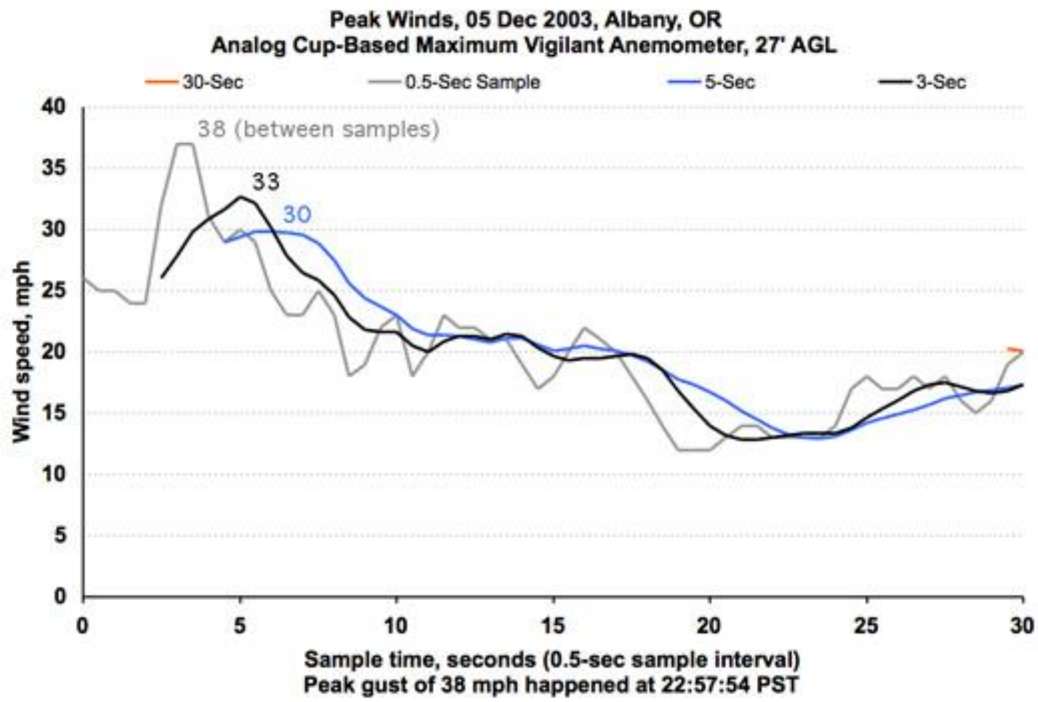
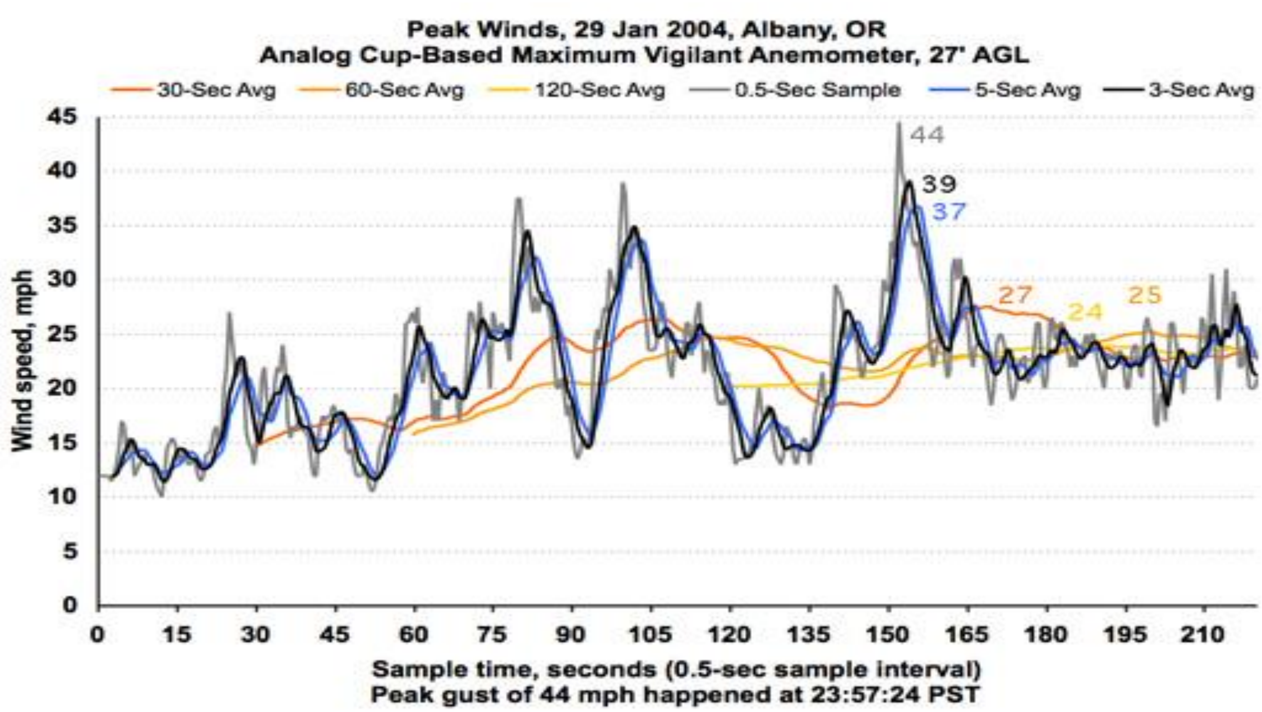


Figure 3: Peak gust, Albany, OR, for the January 29, 2004 passage of a strong cyclone. Maximum speed for each averaging period indicated on the chart. Peak instant gust 44 mph, peak 3-second wind 39 mph and peak 5-second wind 37 mph.



The above figures focus on short time periods around the peak gusts of various storms, and show 0.5-second samples from a Maximum Vigilant anemometer and various average velocities calculated from the samples. The February 7, 2002 South Valley windstorm, which only gave the anemometer site a glancing blow, produced a gust of 27 mph, with a peak 5-second wind of just 21 mph. The December 5, 2003 open wave brought an instant gust of 38 mph, yet the peak 5-second average only managed 30 mph. The January 29, 2004 cyclone landed a gust to 44 mph, which resulted in a peak 5-second wind of 37 mph. These differences are significant, amounting to a factor of about 1.20 to 1.30. It is clear that the 5-second average smoothed out the spikes--peak instant gust is lost in the longer-term measure.

The values and actual ratios are listed below in Table 1. Official readings taken during the December 12, 1995 windstorm are included. It is fortunate that the old direct-reading anemometer was still in operation then, and that the peak gust was noted by NWS personnel.

Table 1: Summary of known peak gust to 5-second wind measures. The NWS readings were from two different systems, the old direct-reading equipment and the ASOS sensor, a fact that confounds the estimation.

Maximum Vigilant Values (Unofficial)			
	Peak Velocities, mph		
Date of Event	Instant	5-second	Ratio
07-Feb-2002	27	21	1.29
05-Dec-2003	38	30	1.27
29-Jan-2004	44	37	1.21
NWS Measures (Official, from Portland, OR)			
Date of Event	Instant	5-second	Ratio
12-Dec-1995	74	62	1.19
		Average	1.24

Table 2, below, compares the 3-second average to the instant readings. As expected, the ratios are less than with the 5-second average. Interestingly and coincidentally, the average turns out to match the 1.15 conversion for knots to mph. Note that this is a 3-second wind as measured on a cup-based anemometer system, not a sonic anemometer, and therefore these ratios are likely not useful for converting NWS gust readings post-2006.

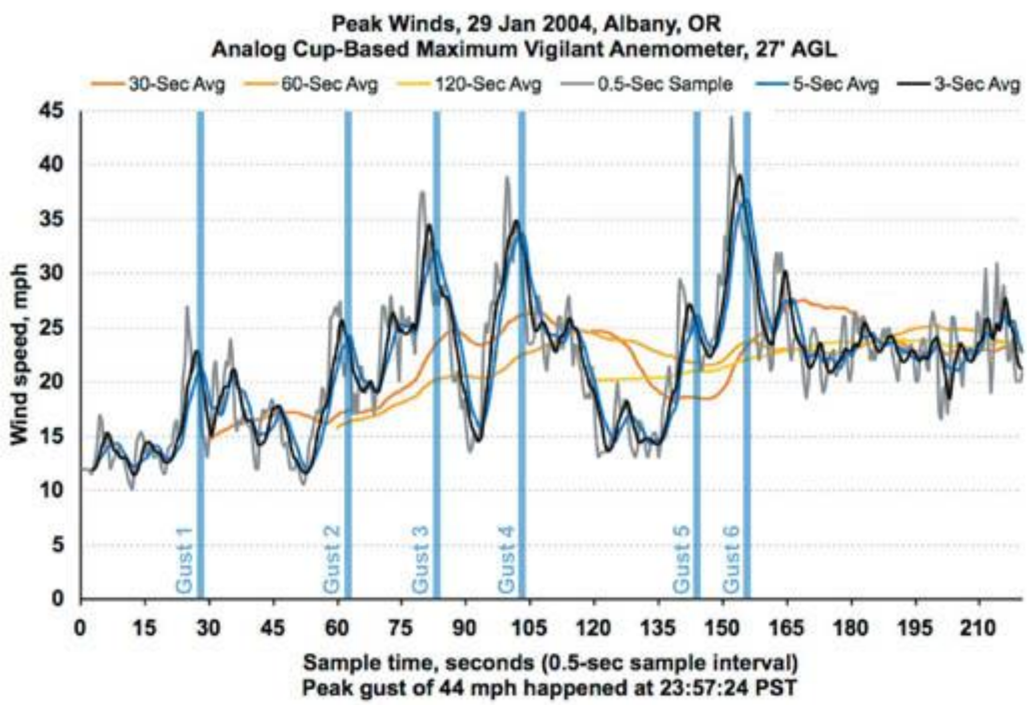
The information in Table 1 can be used to make an instant-peak-gust estimation for windstorms that occurred during the five-second gust era. There is some evidence of a trend in the above data where the ratio decreases as the peak gust increases, suggesting that the higher the gust, the longer its duration. If this is true, using the straight average of the ratios would result in overestimation of peak gusts at the high end. For the following calculations, the 1.19 ratio from the official data will be used for the peak gust adjustments. At some point a sliding scale might be employed for finer-tuned estimations--this probably won't happen until more data is added to the above list, especially for faster than 27, 38 and 44 mph peak gust readings.

Outside the peak gust, a number of significant gusts are indicated in some of the charts in Figures 1 through 3. The January 29, 2004 cyclone produced a number of surges that were on par, or faster than the other storms. These data provide an opportunity to further scrutinize the 5-sec-gust / instant-gust ratio.

Looking specifically at the chart for the January 29, 2004 storm event, there are many waves in the data, some larger than others. Since the focus of the research presented on this website is peak gust, and there may be something unique about a peak gust relative to the other, slower gusts in a windstorm, logically an analysis of a continuous wind trace should concentrate on surges in wind speed that resemble the peak gust. Using the available data, a standard, or rule, should be developed for isolating legitimate gusts that also adequately describes the peak gust. Looking at the 5-second wind during the peak gust, the ratio of peak, 37 mph, to the preceding trough, 23 mph is about 1.61. Interestingly, this happens to be very close to the Golden Ratio of 1.618. Using a rounded version of the ratio as a guide, any change in wind speed with a peak-speed / preceding-trough-speed ratio of about 1.6 or greater counts as a legitimate gust.

When this methodology is employed, six gusts are identified in the January 29, 2004 record. These are shown in Figure 4, below. The ratios for all these gusts are above 1.6 save in the case of gust-3. For gust-3, the brief, and very shallow trough at about 80 seconds results in a ratio of about 1.3. However, given that there is a more significant trough at about 65 seconds, ahead of the brief stall in wind speed acceleration, gust-3 is considered valid as it results in a ratio of 1.7. Gust-5, which has a very shallow trough afterward on the way up to the peak gust, is perhaps more questionable than gust-3. Figure 4 is provided, in part, to let the reader decide on the veracity of these identified gusts.

Figure 4: In the high-resolution record of the January 29, 2004 peak wind period at Albany, OR, six gusts are identified. The basic gust criteria is to have a trough-to-peak ratio of approximately 1.6 (peak/trough), the value for the peak gust during this storm. The vertical blue lines indicating the various gusts are centered on the peak 5-second wind speed.



The data for the six gusts are provided in Table 3, below. The average ratio of instant-gust to 5-second gust is around 1.19, with a range of 1.15 to 1.29. In other words, instant gust--as determined by taking 0.5-second samples from the indicator dial of an analog cup-based anemometer during the highest wind phase of a single storm event--tends to be approximately 20% higher than 5-second gust. The average ratio of instant-gust to 3-second gust is around 1.12, with a range of 1.08 to 1.17. Instant gust tends to be approximately 10% higher than 3-second gust. These numbers probably delimit good rules-of-thumb: The conversion for 5-sec to instant is 1.2, and 3-sec to instant is 1.1.

Table 3: Gust Data Collected from the January 29, 2004 Gale

Gust	Trough 5-sec mph	Peak 5-sec Gust mph	Ratio Peak / Trough	Instant Gust mph	Peak 3-sec Gust mph	Ratio Instant / 5-sec	Ratio Instant / 3-sec
Gust 1	13	21	1.62	27	23	1.29	1.17
Gust 2	12	24	2.00	28	26	1.17	1.08
Gust 3	24	32	1.33	38	35	1.19	1.09
Gust 4	16	34	2.13	39	35	1.15	1.11
Gust 5	15	26	1.73	30	27	1.15	1.11
Gust 6	23	37	1.61	44	39	1.19	1.13
Averages			1.74			1.19	1.12

Table 4: Peak Gust Adjustments for "Modern" Storms, 1995-2006, mph.											
High wind warning criteria gusts (58 mph or more) are shown in red.											
Storm	ACV	OTH	AST	UIL	MFR	EUG	SLE	PDX	OLM	SEA	BLI	Avg
*12Dec1995**												
Official	58	86	62	61	45	49	59	62	57	60	76	61.4
Adjusted	58	86	72	61	54	58	70	74	57	60	76	66.1
01Jan1997												
Official	46	64	56	47	25	45	41	51	46	39	55	46.8
Adjusted	55	76	67	56	30	54	49	61	55	46	65	55.7
05Feb1999												
Official	*15*	52	49	43	*13*	35	39	43	38	40	55	38.4
Adjusted	*18*	62	58	51	*15*	42	46	51	45	48	65	45.7
06Feb1999												
Official	33	54	55	31	40	46	43	40	37	45	40	42.2
Adjusted	39	64	65	37	48	55	51	48	44	54	48	50.2
03Mar1999												
Official	40	49	66	55	38	52	46	51	47	60	63	51.5
Adjusted	48	58	79	65	45	62	55	61	56	71	75	61.3
16Jan2000												
Official	47	51	66	45	39	39	60	59	54	52	66	52.5
Adjusted	56	61	79	54	46	46	71	70	64	62	79	62.5
13Dec2001												
Official	43	58	49	50	26	36	45	38	40	40	41	42.4
Adjusted	51	69	58	60	31	43	54	45	48	48	49	50.4
07Feb2002												
Official	39	53	33	*10*	36	70	31	31	16	21	21	32.8
Adjusted	46	63	39	12	43	83	37	37	19	25	25	39.1
27Dec2002												
Official	32	61	59	32	30	39	37	39	40	52	22	40.3
Adjusted	38	73	70	38	36	46	44	46	48	62	26	47.9
05Dec2003												
Official	24	45	49	36	*15*	30	33	31	37	32	43	34.1
Adjusted	29	54	58	43	*18*	36	39	37	44	38	51	40.6
29Jan2004												
Official	36	48	47	47	47	39	44	41	37	40	43	42.6
Adjusted	43	57	56	56	56	46	52	49	44	48	51	50.7
25Dec2005												
Official	35	55	54	36	30	37	35	46	41	38	48	41.3
Adjusted	42	65	64	43	36	44	42	55	49	45	57	49.1
01Jan2006												
Official	45	43	46	51	35	41	45	44	45	49	53	45.2
Adjusted	54	51	55	61	42	49	54	52	54	58	63	53.8
04Feb2006												
Official	39	51	59	53	32	46	39	44	43	47	62	46.8
Adjusted	46	61	70	63	38	55	46	52	51	56	74	55.7
*14Dec2006***												
Official	36	48	69	59	47	54	53	53	53	69	55	54.2
Adjusted	43	57	82	70	56	64	63	63	63	82	65	64.5
	ACV	OTH	AST	UIL	MFR	EUG	SLE	PDX	OLM	SEA	BLI	Avg

* Dec 1995: Not all stations had switched to ASOS; these values are left unadjusted.
** Dec 2006: Gusts for OTH and OLM may be low due to data interruptions. Gusts are highest reported.
Numbers in italics are values extrapolated from peak 2-minute wind by applying a standard 1.3 gust factor.

The values given in Table 3 support the ratios from the other wind events that are listed in Tables 1 and 2. These data lend some weight to the idea of a ~1.2 conversion factor for 5-second gust to instant gust.

To be slightly more conservative than 1.2, the 1.19 adjustment factor supported by NWS equipment during the December 12, 1995 windstorm is used on some wind events from 1995-2006. The results appear in Table 4, below.

Before entering the discussion, it should be noted what the adjusted values in Table 4 *are not*. Likely, the adjusted values are not the actual peak instant-gust from the sample storms. The actual maximum instant-gust could have been lower, or even higher. The number simply represents a realistic approximation for the peak instant gust. The official gust value provides the lower boundary. Most likely, the real value lies between the two numbers.

That said, we can do some comparisons. The December 12, 1995 storm still stands on top of everything that has occurred during the ASOS era. However, two storms, when adjusted, become close in average gust strength to the 1995 event: March 3, 1999 and January 16, 2000. And more importantly, the December 14, 2006 windstorm very closely approached the overall gust strength of the December 12, 1995 cyclone. Indeed, during the 2006 storm, wind gusts may have been higher than indicated in Table 4 for two stations that experienced data interruption. Perhaps the storm of 2006 at least equaled the 1995 event. Given the eleven year separation, perhaps these two windstorms can be considered good approximations for "storm-of-the-decade" events, with November 14, 1981 (shown in Table 6, below) holding the title for the 1980s.

By my own breakdown, storms that produce a peak gust average of 55.0 or greater at the 11 stations are considered "major" events. The adjustments elevated the three abovementioned storms well into this category, from positions that were still a strong showing, but not of "epic" proportions. Storm that rank in the 60s are very rare; the adjustments reveal that possibly two happened in less than a year in 1999-2000--a noteworthy happenstance. But this is not known for certain--that is the problem with the change in wind measure brought by ASOS.

A few details could help with assessing just how powerful the March 3, 1999, January 16, 2000 and December 14, 2006 events were.

The March 3, 1999 storm caused some incredible wind gusts unofficially, and much damage. It is considered by forecasters as being one of the most intense storms in recent memory. The March 1999 *Storm Data* publication from the NCDC shows unofficial gusts of 120 mph at Depoe Bay, 105 at Cannon Beach, 92 at Tillamook along the Oregon coast, and 77 mph at Sandy and 75 mph at Sheridan in the Willamette Valley. Instrument exposure and calibration notwithstanding, these values suggest that the 1.19 factor may underestimate the power of the March 3, 1999 event. This storm looks every bit as bad as the December 12, 1995 windstorm. For another example, in Washington, the Evergreen Point Floating Bridge was closed during the March 3, 1999 gale--an eventuality that hadn't happened since the 1995 storm.

The January 16, 2000 sou'wester also appears quite intense. The January 2000 *Storm Data* shows unofficial gusts of 115 mph at Cannon Beach, 87 at Newport (officially 60 mph) and 80 mph at the Newport Jetty. No unofficial observations for the Willamette Valley are available, but the data suggest a storm of similar magnitude to March 3, 1999. Instant gusts into the low 70s are not out of line for the Salem to Portland region. The *Storm Data* publication also notes the closure of the Evergreen Point Floating Bridge during the January 16, 2000 event, suggesting a similarity to the big 1999 and 1995 storms.

During the December 14, 2006 windstorm, unofficial gusts reached 65-80 in the Willamette Valley, well above the adjusted official readings in the region. On the coast, unofficial readings included 79 mph at Cannon Beach, 82 mph at the Newport Courthouse and 97 mph at Rockaway Beach. In Washington, both the Hood Canal and Evergreen Point Floating Bridges were closed due to the wind strength in this storm.

So, was December 12, 1995 the last truly major storm? The evidence suggests, "No." The March 3, 1999, January 16, 2000 and December 14, 2006 events appear to belong in this "esteemed" category.

Rough Windstorm Return Intervals and Expanded Categories

Using the 55 mph cutoff, six major events (January 1, 1997 and February 4, 2006 make the cut) happened in the eleven years 1995-2006: On average, that is one big windstorm about every other year. Elevating the cutoff to an average peak gust of 60 mph, four events occurred in the eleven-year timeframe, or about one big windstorm every three years. Lifting the cutoff to an average peak gust of 65 mph, definitely one, and perhaps two (December 14-15, 2006), event(s) occurred within the span of eleven years. This suggests the threshold for storm-of-the-decade may be around an average peak gust of 65 mph. A new category is suggested: Extreme windstorm.

Since categories are being added, it makes sense to provide an even higher category, one that accommodates the Columbus Day Storm, which had an average peak gust of 80.5 mph: Phenomenal. This brings the number of windstorm categories to five, sort of like the Saffir-Simpson scale for hurricanes, but via a significantly different method for rating storm strength, as the windstorm categories use gust (not wind) at specific stations.

For clarity, cutoffs for the windstorm categories are included in Table 5, below.

Table 5: The Expanded Windstorm Categories

Average Peak Instant Gust (mph)	Windstorm Category	Approximate Return Interval
39 to 44	Minor	Several per year
45 to 54	Moderate	Annual (the endemic storm)
55 to 64	Major	Once every 2-3 years
65 to 74	Extreme	Once every 5-10 years
75+	Phenomenal	Once every 25-50 years
Average-peak-instant-gust is based on the average of peak gusts for these stations: ACV, OTH, AST, UIL, MFR, EUG, SLE, PDX, OLM, SEA and BLI.		

Peak 5-Second Gust of 70 mph or More: A Very Rare Event

It is noteworthy that not a single ASOS station managed to show a peak gust of 70 mph or more in Table 4, save for Eugene during the February 7, 2002 windstorm. Not even the better-located coastal stations have recorded gusts as high [Footnote 1]. This serves to emphasize the significance of that 70 mph wind gust at Eugene, and the true power of the February 7, 2002 windstorm. Considering the damage wrought by this mesoscale event, which included swathing of trees, physical damage to structures by raw wind force, and lines of power-poles being toppled--relatively new poles that were rated at 112 mph!--the 83 mph instant gust estimate at Eugene seems an appropriate estimate, if a bit low! It appears that Eugene, and the South Willamette Valley, were visited by wind speeds comparable to the great Columbus Day Storm of 1962. Eugene's peak instant gust during the "mother of all windstorms" was 86 mph, highest ever recorded at the station. Just for the sake of examination, the average of the gust adjustment ratios in Table 1 yields an estimated peak gust of 88 mph at Eugene; higher than the peak for the 1962 Big Blow.

Had storm watchers received their long awaited Columbus-Day winds, or did the February 7, 2002 windstorm fall short? We will never truly know if 83, 86 or 88 mph was the case for February 7, 2002, or if the highest gust was simply the 70 mph shown by the ASOS. Unfortunately, unofficial instant-gust readings for this storm's main strike zone are absent from the record (such as *Storm Data*). All we have are the estimates in Table 4, and the visible storm damage to suggest that, indeed, winds approaching Columbus Day strength visited the south Willamette Valley in 2002.

Converting Instant Gust *to* 5-Second Gust

There is another way to look at what the 5-second gust means for windstorm comparisons. The calculations can be done in reverse for historic storms to estimate what the maximum 5-second wind might have been. The resutls for two big storms in history, the Columbus Day Storm of 1962 and November 14, 1981, are presented in Table 6, below.

Table 6: Peak Gust Adjusted to 5-Second Wind for Two Major Storms of History

High wind warning criteria gusts (58 mph or more) are shown in red.

Storm	ACV	OTH	AST	UIL	MFR	EUG	SLE	PDX	OLM	SEA	BLI	Avg
*12Oct1962**												
Official	58	81	96	78	58	86	90	104	78	58	98	80.5
Adjusted	49	68	81	66	49	72	76	87	66	49	82	67.6
14Nov1981												
Official	60	92	68	48	62	58	71	71	64	67	64	65.9
Adjusted	50	77	57	40	52	49	60	60	54	56	54	55.4

* For the 1962 storm, TTI is substituded for UIL.

Storm watchers, pay close attention to the modified readings for the Columbus Day Storm. That's the 5-sec gust signature of a "storm-of-the-century" event. The extreme instant gust values are reduced considerably, with the storm's average falling close to the unmodified value for the November 14, 1981 windstorm. With peak gusts depicted in estimated 5-second averages, the Columbus Day Storm stands out somewhat less. Gusts in the 60s and 70s don't seem as spectacular as 80s, 90s, and 100s. Nevertheless, even with the reduction, some stations still have a strong showing, including Portland, OR, with an 87 mph 5-second wind. Of course, the 104 mph was an estimate--a necessity as the storm knocked out power early and shut down the direct-reading wind equipment. Using the measured value of 106 mph at Troutdale, we get 89 mph, which does stand out, and is a close match to an 88 mph "fastest mile" (88 mph 41-second wind) at Portland that was recorded near the beginning of the storm. In any event, a Columbus-Day type of event would show up numerically less strongly in a 5-second wind regime, but, owing to some stations being subjected to particularly strong winds (and the physical reality of the kind of damage such a storm would cause), will still stand out as something unusual.

For an extreme, but not Columbus-Day-Storm-extreme, event like November 14, 1981, the story is different. Save for at North Bend, the peak wind values do not stand out much. Many storms in history have produced 50 to 60 mph instant gusts. The average of 55.4 is still in major category, but is right at the borderline. This clearly demonstrates how peak 5-second gusts can "mask" a rare windstorm. This table suggests that the 5-second gust signature for a major event is 50 to 60 mph gusts, not 60 to 75.

There's another twist to the story being examined here: What happens to the frequency of high wind warnings between the pre and post 5-second-gust eras? Did more than one standard for a high wind event, by NWS definition, change?

High Wind Warnings in the Five-Second Gust Era

National Weather Service criteria for a high wind warning (HWW) event is for gusts of 50 knots, or 58 mph, to occur within the warning area. Gusts meeting this criterion are shown in red in Tables 2 and 3. This definition has been around some time; minimum HWW criteria during the pre-ASOS era certainly wasn't higher. I recall a few high wind warnings for 55 mph gusts in the Seattle area during the 1980s.

If the NWS bases its wind forecasts on how the official stations respond, then, quite possibly the frequency of HWW might have decreased since the inception of ASOS. Note that three storms in Table 4 did not produce HWW criteria "gusts" under the official peak 5-second wind record of ASOS: February 5, 1999, February 6, 1999 and December 3, 2003. Yet, based on the 1.19 adjustment factor, it appears that these three events could have achieved gusts of 58 mph or higher at coastal stations. For the last storm, this point is kind of moot, for a HWW was issued for the coast (one that was verified by stations not included in the table).

High wind warnings for the interior sections, like the Willamette Valley, are rare. The difference between peak 5-second wind and peak instant gust is probably more significant than on the coast, where gusts to 60 and 70 mph are regular occurrences during the winter season. The January 1, 1997, March 3, 1999 and December 27, 2002 windstorms, which generally didn't have a strong showing in the interior for 5-second wind measures (save SEA and BLI in 1999), meet HWW criteria with the peak instant gust adjustment, either at one point, or over a wider portion of the inland region.

Another way of looking at this is with Table 6, especially the November 14, 1981 windstorm. The number of stations meeting HWW criteria drops from 10 to 3 when the peak instant gusts are adjusted to 5-second wind! The storm appears to barely meet the high wind warning standard, yet it was one of the biggest in history.

It seems that the standard for high wind was automatically changed by employing a new peak 5-second "gust" at official stations. Instant gusts of 69 mph are a reasonable expectation when

5-second winds are approaching 58. So, the new ASOS era appears to have changed the HWW criteria to approximately a minimum of 70 mph for instant gust. The other way to look at this is that peak 5-second winds of 48 to 50 mph (implying potential instant gusts of 57 to 60 mph) at ASOS stations would have likely met the minimum HWW criteria pre-ASOS. It seems that 5-second "gusts" of 43 knots, approximately 50 mph, might have been a reasonable new criteria for high wind warnings, certainly for interior sections of the Pacific Northwest (there's good reason to distinguish between coastal and interior regions when providing wind advisories and warnings, a topic in its own right).

Since it's doubtful that 58 mph instant gusts have changed in force during the implementation of the 5-second gust, it's interesting that the NWS has kept the 58 mph minimum for HWW when using a 5-second wind to "verify" warnings. Skywarn spotter reports probably reduce this issue to some extent. A number of personal anemometers still report instant gust in analog format (Maximum equipment being one example), though digital stations that show short-duration averages, like 2.5-seconds on Davis systems, are also common, watering down the effect.

The bottom line: The 5-second gust era of 1996-2006 was different from the periods both before and after. A 5-second average on a cup-based anemometer system is a unique kind of wind measure. This should be kept in mind when trying assess the strength of a particular wind event relative to other storms in history.

Footnotes

[Footnote 1] Certain stations, like Cape Arago and Cape Blanco, of course, have recorded significantly faster 5-second winds, but these are among the most wind-favored locations in the Northwest and aren't included in Table 2.