

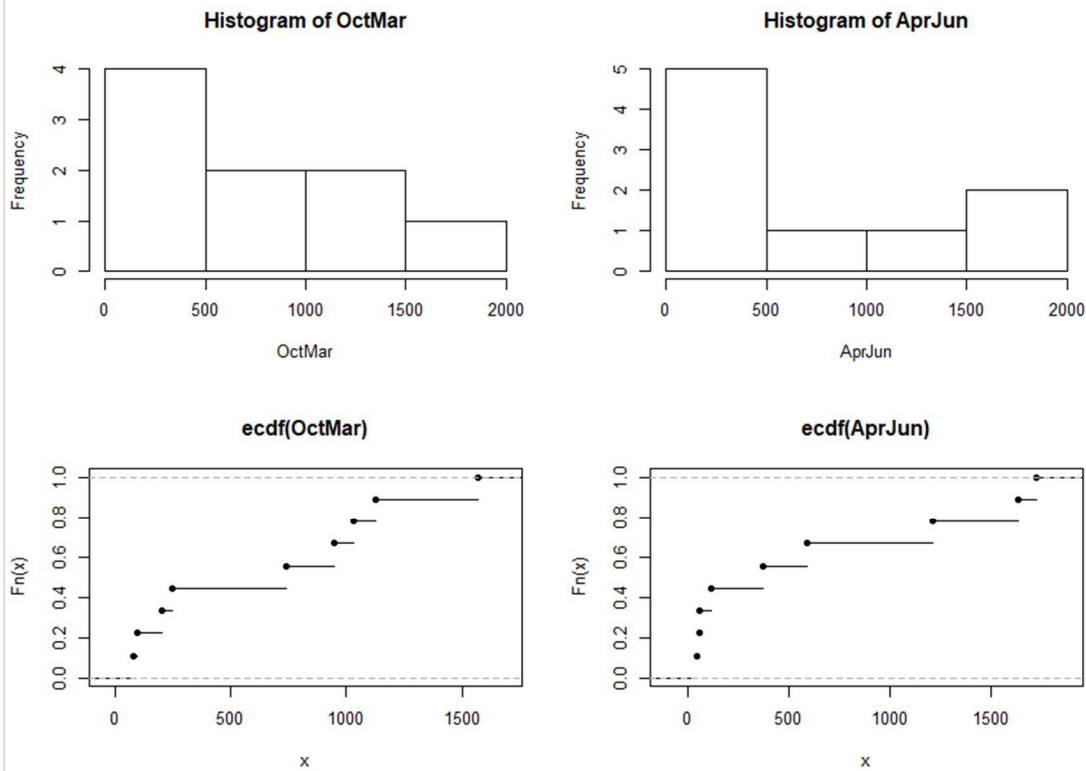
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**From:** Stephen Maurano - NOAA Federal <stephen.maurano@noaa.gov>  
**Sent:** Thursday, May 23, 2019 11:56 AM  
**To:** Barbara Byrne - NOAA Federal  
**Subject:** Re: Calculating Percentiles in R and Excel

That seems like a very reasonable way to proceed. Just to give you some more assurance, I poked around a bit with your data:

- The range of results using the different percentile functions is small for AprJun (5%,) but large for OctMar (25%), perhaps because your highest point in the OctMar timeframe (from 2010) has a lot of leverage in a small sample size (it's 30% of your total range). In other words, the high loss from OctMar 2010 (which had an exceptionally bad February) is pulling up the 90%ile substantially.
- So, you could consider what happens when removing 2010 from the calculation if there's reason to believe that year was an outlier (essentially AprJun is unchanged but the new OctMar value is equivalent to the 79%ile). Or, very similarly, you could cap loss at 2018 levels based on performance in that year. Alternatively, you could set the value at the 75%ile, will a corresponding exceedence frequency (not be exceeded more than 1 in 4 years).
- In total, looking at the range of 90%ile, I think the value you chose is defensible, highly so for AprJun, and within the limitations of the dataset for OctMar.

```
> OctMar<-c(1571, 947, 741, 1031, 202, 95, 246, 77, 1127)
> AprJun<-c(593, 1639, 372, 1215, 59, 62, 47, 116, 1725)
> par(mfrow=c(2,2))
> hist(OctMar); hist(AprJun)
> plot(ecdf(OctMar)); plot(ecdf(AprJun));
> quantile(AprJun,0.9,type=# 1 thru 9...
> quantile(OctMar,0.9,type=# 1 thru 9...
> AprJun90iles<-c(1725, 1725, 1639, 1648, 1691, 1725, 1656, 1702, 1699)
> OctMar90iles<-c(1571, 1571, 1127, 1171, 1393, 1571, 1216, 1453, 1438)
> mean(AprJun90iles); median(AprJun90iles)
[1] 1690
[1] 1699
> mean(OctMar90iles); median(OctMar90iles)
[1] 1390.111
[1] 1438
```



On Thu, May 23, 2019 at 10:17 AM Barbara Byrne - NOAA Federal <[barbara.byrne@noaa.gov](mailto:barbara.byrne@noaa.gov)> wrote:  
 Thanks, Stephen! I looked at this youtube video (<https://www.youtube.com/watch?v=I3Ahbn9o-5I>) and got the impression that percentile.exc made the most sense, but when I tried out both methods (see H4:J22 of the "Steel distribution" tab of the attached excel workbook), the percentile.exc function -- for both time periods -- returned the highest value in my dataset, which didn't feel very 90%-ile-y. With only 9 datapoints in a skewed distribution, I think percentiles can just get wonky. I ended up using the percentile.inc function, and just documented it in my proposal so readers can reproduce my results.

On Thu, May 23, 2019 at 9:56 AM Stephen Maurano - NOAA Federal <[stephen.maurano@noaa.gov](mailto:stephen.maurano@noaa.gov)> wrote:  
 Hi Barb,

Per the question you mentioned yesterday, there are a number of ways to calculate percentiles in R and Excel (and other statistics software). As described in [Wikipedia](#) and ultimately citing to Hyndman, R. J. and Fan, Y. (1996) Sample quantiles in statistical packages, *American Statistician* 50, 361-365. 10.2307/2684934.

- Excel PERCENTILE and PERCENTILE.INC are equivalent to R-7 (the default in R)
- Excel PERCENTILE.EXC is equivalent to R-6 (the default in other common stat software, Minitab and SPSS)

"The differences between the definitions are most evident for small data sets [ $n < 100$ ] and when there is a large "gap" between one or more adjacent data values" ([per this SAS blog](#)).

PERCENTILE.INC works for any value of k between 0 and 1 whereas PERCENTILE.EXC only works if k is between 1/n and 1-1/n, where n is the number of elements in array. Since you're looking for the 90%ile, you only need a dataset of n=9 (although the %ile return will still be sensitive to a large range b/t n and n-1 values)

Put another way, in an array of (1:9) PERCENTILE.EXC can return a 90%ile, but not a 99%ile (whereas PERCENTILE.EXC can do either)

```
9.0    =PERCENTILE.EXC ( , 0.9)
8.2    =PERCENTILE.INC ( , 0.9)
#NUM!  =PERCENTILE.EXC ( , 0.99)
8.9    =PERCENTILE.INC ( , 0.99)
```

If you're short on time, I would use the excel default (PERCENTILE). If you have even ten minutes, I would run your data in R to (1) examine the distribution (plot histogram, examine outliers) and (2) iterate [a few of the common definitions](#) quickly, and see if the results are different. I suspect the differences will be trivial. Here's sample code, accomplishing the same task as the Excel example above, although R appears to default back to the n'th value, rather than the #NUM! error, when  $k > 1 - 1/n$ . Happy to help further if there's anything I can assist with. The information seems fairly well documented online, so I'm 0.9 confident :-)) but I just googled and played around with the numbers, so you can certainly check with other folks to get a more authoritative answer. Thanks for mentioning, it's always educational to learn something new!

```
> nine<-(1:9); ninety-nine <-(1:99) #create arrays of 1 to 9 and 99
> quantile(nine,c(.9,.99),type=7) # the default in R and Excel
 90%  99%
8.20 8.92
> quantile(nine,c(.9,.99),type=6) # equivalent to PERCENTILE.EXC
 90%  99%
 9    9
```

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