

Re: a simple(?) probability question...

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- *From:* "Joe" <jconcordia@xxxxxxxxxxxx>
  - *Date:* 28 Jan 2007 15:19:35 -0800
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On Jan 28, 5:08 pm, matt271829-n...@xxxxxxxxxxxx wrote:

On Jan 28, 3:54 pm, "Joe" <jconcor...@xxxxxxxxxxxx> wrote:

On Jan 25, 1:35 pm, "Randy Poe" <poespam-t...@xxxxxxxx> wrote:

On Jan 24, 9:57 pm, "Joe" <jconcor...@xxxxxxxxxxxx> wrote:

On Jan 21, 4:16 pm, James Waldby  
<j-wal...@xxxxxxxx> wrote:

Joe wrote:

[...] By  
definition, a  
100 Years  
Storm is a  
storm that  
will occur at  
least once in  
100 years.  
That means  
certainty  
within 100  
years, i.e.

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probability  
equals 1 in  
the elapsed  
time of 100  
years....

That doesn't agree with  
common terminology as  
stated, for example,

in <http://bcn.boulder.co.us/basin/watershed/flood.html> and <http://en.wikip...>

From the former:

The terms "10 year", "50  
year", "100 year" and "500  
year" floods  
are used to describe the  
estimated probability of a  
flood event  
happening in any given  
year. [...] A 10 year flood  
has  
a 10 percent probability of  
occurring in any given year,  
a 50  
year event a 2%  
probability, a 100 year  
event a 1% probability,  
and a 500 year event a .2%  
probability. While unlikely,  
it is  
possible to have two 100 or  
even 500 year floods within  
years or  
months of each other.

Given the likelihood of 1%  
for a 100-year event to  
occur in a  
given year, one could figure  
 $1 - (1 - 0.01)^{50}$  or  $\sim .395$   
likelihood  
for it to occur at least once  
in any given 50-year period,  
or  
 $1 - (1 - 0.01)^{100}$  or  $\sim .634$   
likelihood for any 100-year  
period.

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A Poisson process  
([http://en.wikipedia.org/wiki/Poisson\\_process](http://en.wikipedia.org/wiki/Poisson_process))  
with  $\lambda = 0.01$  per year  
has probability  $\sim .632$  of 1  
or more  
events occurring in any  
100-year period, which is  
about the same  
as for the Bernoulli process  
mentioned in the preceding  
paragraph,  
just as one would expect for  
a small probability and  
many years.

–jiw While that calculation  
provides a numerical result  
of 0.634, I think

the notion that a  
100 year storm has only a 63% chance of  
happening in 100 years would  
seem silly  
to engineers. A coin has a 50% chance of  
coming up heads. Nevertheless,

the probability is not 100% that you will see heads in 2 flips.  
It is only 75%.

A 6-sided die has probability  $1/6$  of coming up with a 3.  
That  
does mean that in six throws a 3 is guaranteed. The  
probability  
of seeing a 3 at least once in six throws is 66.5%.

Your intuition is leading you astray.

It would also be rather inconsistent with  
decisions by  
rational people  
to spend tremendous amounts of money on

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facilities to deal with planned  
100 year  
storm situations. Why? What is the  
inconsistency?

Actually, I think it would be silly to spend that money in  
your  
model. Suppose the last 100-year storm was in 1965. Why  
bother spending money until 2065, since you are guaranteed  
there will be no 100-year storm till then?

I think the real weather data would show the  
calculation as giving a  
conclusion that  
is faulty. The threshold rainfall levels for the  
100 year storm are set  
by examining available  
data, based on real events. The value of the  
rainfall intensity is  
selected because  
such storms have actually occurred, not that  
they "might" occur.

Some interesting data is available from the  
National Climatic Data  
Center to support the  
concept that when a given rainfall intensity  
is stated for the 100 year  
storm it certainly  
will occur. After looking at the actual data  
for a 50 year interval I  
am quite convinced of this. You're quite  
convinced from 50 years of data about exact

100 year cycles? How so?

Could you point to some of this data and what conclusions  
you draw from it?

– Randy–

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This discussion has gotten rather out of hand. My principle point in my first response to the question posed was that the Poisson distribution is not an appropriate one for the 100 Year Storm. Really nothing more than that. I suggested the process is more like one of flipping a coin, where a storm is equally likely to either occur or not occur in any given year. A case could be made that a binomial model (flipping a biased coin) is

more appropriate than the Poisson, but it is not in my opinion appropriate for the granularity to be as coarse as one year: a hundred-year storm \*could\* occur twice in one year. And it is also certainly not the case that a hundred-year storm is "equally likely to either occur or not occur in any given year". Wherever did you get that idea?

From that, others through application of certain probability formulas interpret this as meaning a 100 years storm will certainly occur every 100 years, etc. etc. Um, hold on... that's what \*you\* said. You wrote: "By definition, a

100 Years Storm is a storm that will occur at least once in 100 years. That means certainty within 100 years" (<http://groups.google.com/group/sci.math/msg/b6b4950c0a03ee51>).

The numerical solution of a probability function of 1.0 does not guarantee that the event will actually occur in nature. It only means the arithmetic was executed accurately. I am not surprised or dismayed by the various comments that extrapolate these calculations to ridiculous solutions. It was you who proposed the "extrapolation to ridiculous solutions"

with statements such as "A ten year storm that has a probability of 10% in one year adds to a 100% in 10 years, i.e. probability of 1.0 (certainty)." (<http://groups.google.com/group/sci.math/msg/44ffbaa13a24f85b>).

Other people have merely been giving further examples to try to help you understand why your ideas about how these probabilities should be combined are incorrect.

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The value of statistical analysis is in applying a proper model to the natural process being analysed. The Poisson distribution does not properly model the 100 year storm for the various reasons I have discussed in previous posts. Your previous posts make very little sense, unfortunately. Not to me

anyway. Either I am extremely muddled about this, or you are.

Since there is limited data to verify this, it cannot be shown with a high degree of reliability, however looking at real data for a 50 year cycle gives interesting insight. I would be happy to email the data to anyone that requests it. — Hide quoted text — Show quoted text — Hide quoted text — Show quoted text —

My point is this. Do not assign probability of 1.0 or 0.0 to anything, since nothing in nature is absolutely certain nor absolutely uncertain. These numbers are artifacts in arithmetic formulae. When I said the storm will occur in 100 years, it should not be interpreted that I meant it was impossible to not occur in that time, or that it must occur only once. Perhaps my language is too imprecise for the discipline of statistical analysis. I agree your statement that the 100 year storm is "likely" to occur is a more appropriate way to state it. However if the probability for an event is very high could you accept the notion that it is "virtually certain" and speak of it as if it actually will occur, and likewise if the probability is very low you can speak of it as "virtually impossible".

The line of discussion for many of these posts following my first comments have been a distraction.

My comments in this dialogue have been directed at whether the Poisson distribution is or is not appropriate to estimate the likelihood of a 100 year storm in an element of time. My contention is that it is not. That is really the whole point of my posts, not a discourse on calculating probabilities using various probability functions. I note that you may feel that a binomial distribution may be a better fit. It would be interesting to hear more commentary on the applicability of the Poisson distribution to the original 100 year storm question.

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The 100 year storm is a rare and unique event. That is what I mean when I say it is a discrete event. The process is not a continuous one, it is "discontinuous". The process of 100 year storms has no characteristics like those usually analysed by using the Poisson function. There is no flowing stream of events to be enumerated, there is one occurrence in the time domain of concern.

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