Re: Meteoric and Cometary impacts in historical times − Hard Evidence

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From: Eric Stevens (*eric.stevens_at_sum.co.nz*)
Date: 10/22/04

Date: Sat, 23 Oct 2004 12:50:11 +1300

On Fri, 22 Oct 2004 19:20:44 GMT, Joe Jefferson
<jjstrshp@mindspring.com> wrote:

>Eric Stevens wrote:
>>
>> On Fri, 22 Oct 2004 01:50:31 GMT, Joe Jefferson
>> <jjstrshp@mindspring.com> wrote:
>>
>> >Eric Stevens wrote:
>> >>
>> >> It
>> >> certainly appears as though there should have been a Tunguska size
>> >> impact about once every century with even more of smaller bolides.
>> >
>> >Okay, we'll take your figure of once a century. That's within the same
>> >degree of magnitude as the figure I've seen. Going back to the NASA web
>> >site, I see that the explosion flattened trees within about a 40km
>> >radius, so call it 5,026 square kilometers. According to my home atlas,
>> >the total surface of the Earth is 512,175,090 square kilometers. So the
>> >critical missing factors are, first the average percentage of the
>> >Earth's total surface that was inhabited during the time period you're
>> >interested in, and second the percentage of those inhabited regions
>> >about which we know enough to be able to tell whether or not they were
>> >affected by an impact event. My gut feeling is that neither of these is
>> >very large for most of human history, but it's not my gut that matters
>> >here. What percentages were you using when you concluded that
>> >statistically there should have been more significant impacts than
>> >archaeologists and/or historians have believed?
>>
>> I think you are trying to oversimplify the problem. Lets use the
>> figure 1−1 I referred to above. If we assume the smallest noticeable
>> impact is a mere (?) 10 kilotons (I mean most people would notice a 10
>> kiloton explosion in their neighborhood) you read from the graph that
>> there should be about 8 to 10 per year.
>
>People might notice a bolide of that size, but it wouldn't be likely to

>have much of an effect on their lives.

Don't forget we are talking about >10 kilotons. Most people would tend to be affected by an explosion of that magnitude in thei vicinity.

>They'd see a bright flash high up
>in the air, or if they happened to be looking in just the right
>direction they might see a fireball cross the sky and disappear in a
>bright flash. Maybe, MAYBE, something nearby might be hit be a small
>piece of debris. In the modern era there might be a story about it in
>the local newspaper. As you said, these events occur fairly commonly.
>They do not do anything that could be considered historically significant.
>
>> That is say 27,000 in the last
>> three millennium. If you go to the say 100 kilotons you get about one
>> every 3 years. Say 1000 in the last 3000 years. At the 1 megaton level
>> we get an impact about once a decade. Say 300 in the last 3000 years.
>> Tunguska is about once per century − say 30 in the last 3000 years.
>
>Your numbers are too high by a factor of three, probably because the
>chart you're looking at is poorly designed. Try the NASA diagram at
>http://liftoff.msfc.nasa.gov/academy/space/solarsystem/meteors/ImpactHazard.html
>and the trend is much clearer. For every tenfold increase in explosive
>power, there is a tenfold decrease in frequency, starting with a 10 kt
>blast about once a year.

Thats a good page but its 4 years old. The estimate of the number of potential impactors has increased exponentially since then. Right now they are arguing about whether there is even a larger number of virtually indetectable dark bodies out there which will increase the numbers even again. This question won't really be answered until after NASA launches its orbiting infrared telescope called the Wide−field Infrared Survey Explorer (WISE) in 2008.

>
>> What I have done is so crude that it doesn't even amount to Simpson's
>> rule but if you integrate the probability curve between the 10 kiloton
>> and Tunguska range you end up with (have a guess) 60,000 impacts in
>> the last 3000 years.
>
>Integration is the wrong procedure. You can't treat these numbers as a
>continuum; that's just an artifact in the charts to make the trend more
>obvious.

That's why I didn't. But it was late at night and I didn't feel up to the effort of delving into the underlying probability distribution to enable a proper analysis. Another reason is that current theory predicts that these things come in bursts and that impact events were much more common in the past than they are now.

>(The observed frequency of events similar in size to Tunguska
>over the past century should make this very obvious.) You'll get a much

>better approximation by turning the chart into a histogram with the bars
>each covering a factor of ten, then simply adding together the ones big
>enough to be interesting.

In effect, that's what I did.
>
>> Not all of them are going to do damage and it depends upon whether
>> they are predominantly icy, rocky, or iron. This will determine
>> whether they will end up as an air blast (Tunguska), a shower of
>> stones (China 500 years ago) or a hole in the ground. But leaving that
>> out, if the impacts are evenly distributed (which they will not be) it
>> gives rise to one impact per 8536 sq km. In terms of circular area,
>> that is one impact per 100 km diameter circle. Now, if the blast area
>> covers only a 20 km radius (one quarter of the area of Tunguska), that
>> means that 4% of the earth's surface has been within the blast zone of
>> an impact within the last 3000 years.
>
>You're enormously overestimating the average blast radius. For anything
>less that a 1 megaton event, the blast radius at the Earth's surface is
>likely to be zero; the explosion occurs so high in the atmosphere that
>the blast doesn't reach the surface at all. Remember that we do have
>pretty good data on damage caused by meteor impacts for at least the
>past 100 years, and any estimate of past effects needs to take that into account.

http://nai.arc.nasa.gov/impact/news_detail.cfm?ID=137 suggests the
lower limit is 2 Mtons. Maybe, I should have not picked the 10 Ktons
that I used originally. I plead lack of sleep. :−)
>
>> In fact the affected area is much larger than that in which trees are
>> laid flat. It is likely that on average every one of those 100 km
>> diameter circles will have contained an impact sufficiently close to
>> the people (if any) living there to make them realise that something
>> rather drastic has happened.
>
>Okay, now I see where you're coming from. But both the frequency of
>events and the average blast radius you're assuming are very much higher
>than can be justified by the observed rate of damaging meteor impacts in
>modern times.

Not quite. I'm suggesting that the affected radius extends beyond the
distance at which trees are knocked flat.
>
>> My suspicion is that most people would have so little understanding of
>> what had happened that they could not describe it in terms which are
>> comprehensible today. In fact, because the ideas of such disasters are
>> beyond the knowledge of most of us, I strongly suspect that some of
>> their stories have come down to us even today in a form which we
>> presently cannot readily recognise. The question is whether or not
>> some of the physical evidence is unrecognisable to us for much the
>> same reason.
>

>What do you base that suspicion on? Ancient peoples were able to
>describe volcanoes as big fiery explosions coming from the ground. Why
>do they think they couldn't just as easily describe a big fiery
>explosion in the sky?

I think they did, but they had nothing in their cosmology to explain such events. Instead they come down to us as, for example, 'Jupiter's bolts' (changed in later translations to Jupiter's lightning bolts). How do you think they would describe a repeated bombardment of up to Tunguska size events? What about:

... and the infinite great sea
moaned terribly
and the earth crashed aloud,
and the wide sky resounded
as it was shaken, and tall Olympos rocked
on its bases
in the fan of the wind of the immortals,
and a strong shudder drove deep
into gloomy Tartaros under the suddenness
of the footrush
and the quenchless crashing of their feet
and their powerful missiles.
So either against either they threw
their re−echoing weapons
and the noise of either side outcrying
went up to the starry
heaven as with great war crying
they drove at each other.
Now Zeus no longer held in his strength,
but here his heart filled
deep with fury, and now he showed
his violence entire
and indiscriminately. Out of the sky
and off Olympos
he moved flashing his fires incessantly,
and the thunderbolts*,
the crashing of them and the blaze
together came flying, one after
and spinning whirls of inhuman
flame, and with it the earth,
the giver of life, cried out
aloud as she burned, and the vast forests
in the fire screamed....

The wonderful conflagration crushed Chaos, (line 700)
and to the eyes' seeing
and ears' hearing the clamor of it,
it absolutely
would have seemed as if Earth
and the wide Heaven above her

had collided, for such would have been
as Earth wrecked and the sky came piling down
on top of her,
so vast was the crash heard
as the gods collided in battle.
The winds brought on with their roaring
a quake of the earth and dust storm,
with thunder and with lightning,
and the blazing thunderbolt*,
the weapons thrown by great Zeus,
and they carried the clamor
and outcry between the hosts opposed,
and a horrible tumult
of grisly battle uprose,
and both sides showed power in the fighting.

* A more accurate translation may just be 'bolt'.

Have you ever heard 'the vast forests in the fire screamed....'?
They do just that as all the trees flash into flame at the same
instant. Its a terrifying sound if you are anywhere near when that
occurs.

What do you think the author was talking about?

Hesiod's Theogony by the way. 8th century BC.

>
>> By the way, talking of disasters, would you care to have a crack at
>> the etymology of 'disaster'? :−)
>
>It comes from Greek astrology by way of Latin; loosely meaning "opposed
>by the stars". It can be compared with Shakespeare's "star−crossed lovers".

Try 'dis' = evil, and 'aster' = star.

Eric Stevens