Re: Elevation Calculator for Distant Object?

Source: http://sci.tech−archive.net/Archive/sci.astro.amateur/2004−12/3624.html

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From: W. Watson (*wolf_tracks_at_invalid.inv*)
Date: 12/20/04

Date: Mon, 20 Dec 2004 02:15:52 GMT

Stuart Levy wrote:

> In article <Uunwd.1352$9j5.288@newsread3.news.pas.earthlink.net>,
> W. Watson wrote:
>
>>I would like to think that someone has already produced the program to
>>do the simple calculations to determine the elevation angle of an
>>object from an observer. This given the object's altitude and the
>>ground distance from the observer to a point directly below the object.
>>That is, as an example, suppose that I know I'm 400 miles from Los
>>Angeles, and a meteor burst into view that was 60 miles over LA, what
>>is the elevation angle of the burst I see at 400 miles distant? I'd
>>like to know what is the elevation angle of an object whose altitude is
>>60 miles at a distance of 50, 100, 150, 200, ... miles for the
>>observer? I just did the trig on this for one case, but would like to
>>see a more general calculation. It would be easy to do in a program,
>>but I have no access to any programming language. I would think someone
>>might have done it already. Does anyone know where such a program might
>>be found? Perhaps a web site with a java calculator for it?
>
>
> Hey, maybe you could write in Javascript! Most any web browser
> can run Javascript programs. It's vaguely Java−like. Includes
> the usual bunch of math functions, Math.sqrt, Math.sin, acos, atan2, log, etc.
>
> You could also use "awk", which is also vaguely C− or BASIC−like,
> and available for free on pretty much any operating system.
>
> Of course there are lots of other programming language implementations
> available for free on 'most any platform, but I mention these two
> since they're (a) interpreted and (b) pretty simple to learn.
>
> Actually, for distances that are a small fraction of the size of the
> earth, you could simplify this calculation enough that you might not
> bother with a computer:
>
> Suppose the earth were flat, and you saw something that stood
> at height h above a ground−level point P that was distance

> *d away from you. You'd see it at altitude atan(h/d) above the horizon.*
> *But, the earth is curved, so the point P isn't on your horizon,*
> *it's some angle below your horizon. It's easy to calculate,*
> *thinking of the isosceles triangle from you to P to the center*
> *of the earth: it's half the angle that distance d subtends*
> *as seen from the center of the earth.*
> *So if the earth's radius is R, the chord from you to P*
> *is directed 1/2 (d/R) radians below your horizon.*
> *If we make the approximation that your "up" direction is*
> *parallel to the "up" direction over point P −− which will be true*
> *to second order in d/R −− then the angle above your horizon will be*
> *atan(h/d) − 1/2 (d/R)*
> *If h is much less than d −− for things not too high in the sky −−*
> *you can simplify further that atan(h/d) is close to h/d radians,*
> *or about 60*h/d degrees.*
> *For your example above: on a flat earth, you'd see a 60−mile−high*
> *400−mile−away event as about 60*(60/400) or about 9 degrees above*
> *the horizon.*
> *Remembering that 70 miles is about one degree of arc (d/R) on the*
> *earth's surface, 400 miles is about 6 degrees of arc.*
> *So Los Angeles stands about 1/2 * 6 = 3 degrees below your horizon,*
> *and you'd see that meteor at 9 − 3 = 6 degrees above your horizon.*
> *Stuart Levy*

Hi, thanks for your interest. I've gone off the deep end now. :−) I bought Matlab. Should get it next week. Used it many, many years ago. I happen to be taking a fun class at a local college and qualified for a student discount. Discovered a couple of astronomy matlab libraries on the web.

Yes, Java is a good suggestion. Haven't used it in six years. I can probably relearn matlab much faster than Java. Had my fun with AWK years ago, and really don't want to revisit it. Yes, flat earth works. Good simplification, but with Matlab, I'll go for the so called 'precise' solution. BTW, I did a hand calc with a web calculator for a meteor 500 miles away and 60 miles over head there. Got 1/2 degree for the elevation. Maybe I should do the calc over. The distance to LA from here is really more like 380 miles, and I was driven to this calc when an observer down there wanted to know if my camera caught it. It didn't but I started thinking that's going to be very low on the horizon anyway. Just looked it up. I'm 391 miles away.

Nevertheless, I still surprised this sort of thing isn't all over the web. None of the meteor groups seem to care. Odd. I could be missing something.

I'll have to look for a web scripting page. Maybe I'll putz with it sometime. Might come in handy for an astro calc on my web site.

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(121.015 Deg. W, 39.262 Deg. N) GMT-8 hr std. time)
Obz Site: 39° 15' 7" N, 121° 2' 32" W, 2700 feet
"I'm sure we all agree that we ought to love one another and
I know there are people in the world that do not love their
fellow human beings and I hate people like that." -- Tom Lehrer
Web Page: <home.earthlink.net/~mtnviews>