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Subject: Sound and Elevation

Posted by [Azuri](#) on Thu, 12 Dec 2013 16:59:59 GMT

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I was cooking dinner last night and part of the directions for what I was fixing stated that different oven temperatures are needed for higher elevations.

It got me to thinking. Do changes in elevation effect sound waves? ( I know, I've got a weird mind sometimes ) Where the air is thinner, do sound waves travel faster for instance?

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Subject: Re: Sound and Elevation

Posted by [Wayne Parham](#) on Thu, 12 Dec 2013 17:16:27 GMT

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Yes, the speed of sound is different at different elevations, and at different temperatures for any other reason, for that matter. But the difference is small, at least in the temperature range you are comfortable being in.

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Subject: Re: Sound and Elevation

Posted by [Chicken](#) on Thu, 12 Dec 2013 17:47:38 GMT

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Wayne's got it. It makes sense that as temperature changes, the speed of sound changes.

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Subject: Re: Sound and Elevation

Posted by [Cask05](#) on Fri, 13 Dec 2013 15:28:22 GMT

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Azuri wrote on Thu, 12 December 2013 10:59 Do changes in elevation effect sound waves?...Where the air is thinner, do sound waves travel faster for instance?

No, they don't: it's a function of temperature only:

[http://en.wikipedia.org/wiki/Speed\\_of\\_sound#Practical\\_formula\\_for\\_dry\\_air](http://en.wikipedia.org/wiki/Speed_of_sound#Practical_formula_for_dry_air)

If you've ever wondered about the speed of high performance aircraft/missiles at relatively high altitudes, it's a function of temperature at that altitude, and it's a surprise to most people that as you ascend from the earth's surface, the temperature isn't monotonically decreasing vs. altitude...

[http://en.wikipedia.org/wiki/File:Comparison\\_US\\_standard\\_atmosphere\\_1962.svg](http://en.wikipedia.org/wiki/File:Comparison_US_standard_atmosphere_1962.svg)

This also affects the performance of horn-loaded speakers that operate outside: at room

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temperature, speed of sound (celerity) is 1132 ft/s, while at 32 F (zero C) it's 1087 ft/s. In Texas on a hot summer day, the speed at 40 C (104 F) is about 1162 ft/s, which is about 7% faster than at zero C.

It makes a difference in crossover points using horns close to their cutoff points.

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Subject: Re: Sound and Elevation  
Posted by [Wayne Parham](#) on Fri, 13 Dec 2013 16:19:25 GMT  
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As an aside, have you ever been on a plane that showed altitude and temperature outside? It's pretty amazing how cold it is at 35,000 feet.

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Subject: Re: Sound and Elevation  
Posted by [Cask05](#) on Fri, 13 Dec 2013 16:47:27 GMT  
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About -72F, generally speaking...

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Subject: Re: Sound and Elevation  
Posted by [Azuri](#) on Sat, 14 Dec 2013 15:57:07 GMT  
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Temperature? I never would have guessed that. I can understand a humidity factor because the air is heavier with the moisture, but why does sound speed up as it gets hotter?

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Subject: Re: Sound and Elevation  
Posted by [Cask05](#) on Sat, 14 Dec 2013 18:31:59 GMT  
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From the same Wikipedia article  
[http://en.wikipedia.org/wiki/Speed\\_of\\_sound#Dependence\\_on\\_the\\_properties\\_of\\_the\\_medium](http://en.wikipedia.org/wiki/Speed_of_sound#Dependence_on_the_properties_of_the_medium):

"At a constant temperature, the ideal gas pressure has no effect on the speed of sound, because pressure and density (also proportional to pressure) have equal but opposite effects on the speed of sound, and the two contributions cancel out exactly."

from <http://www.ndt-ed.org/EducationResources/HighSchool/Sound/tempandspeed.htm>

"Temperature is...a condition that affects the speed of sound. Heat, like sound, is a form of kinetic energy. Molecules at higher temperatures have more energy, thus...sound waves can travel more quickly."

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