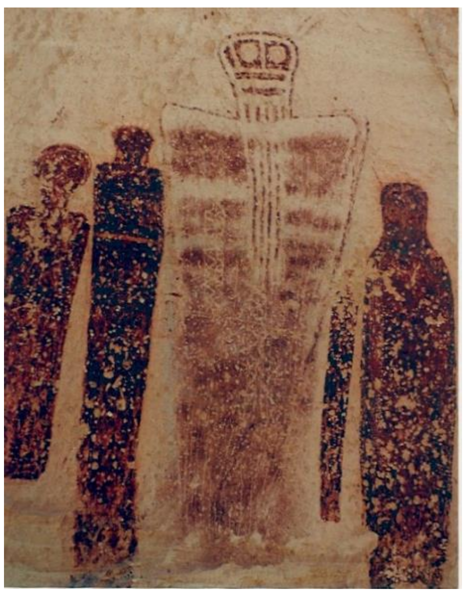
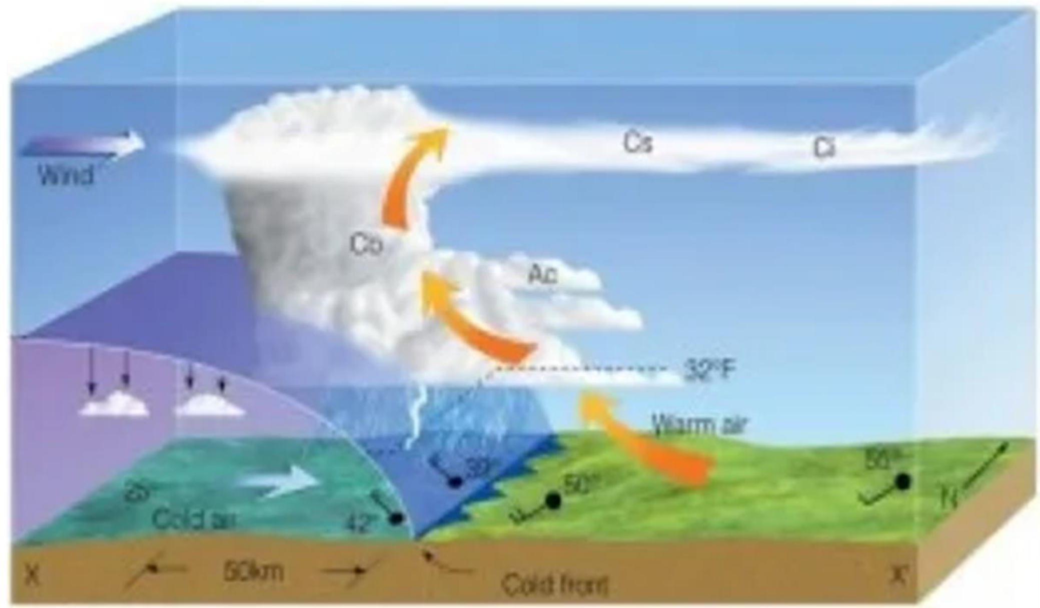
Rock Art and Effects of Weather Conditions on Sound Propagation

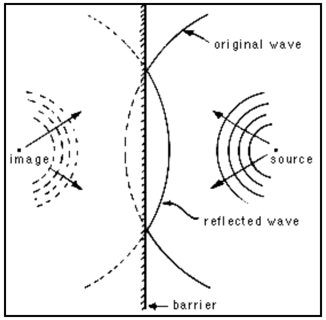




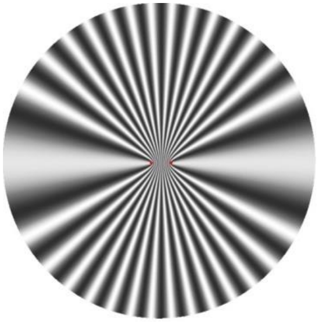
Steven J. Waller, Ph.D.

Sound Effects and Auditory Illusions

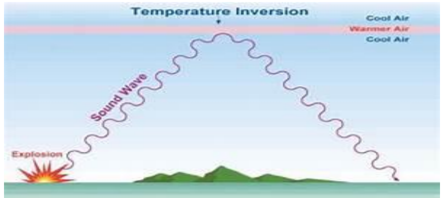
- **Reflection:**
  - Echoes
  - Reverberation



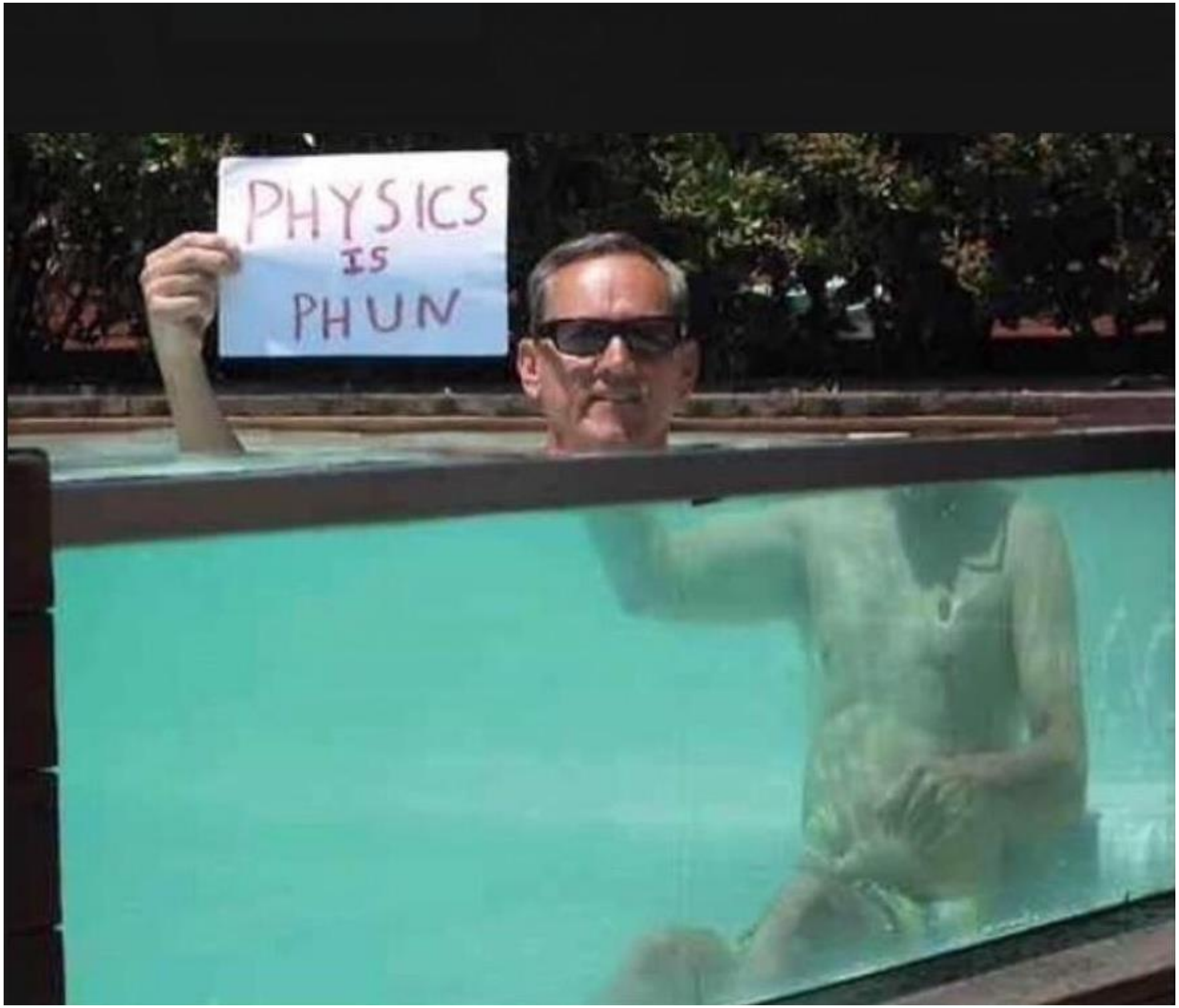
- **Interference**



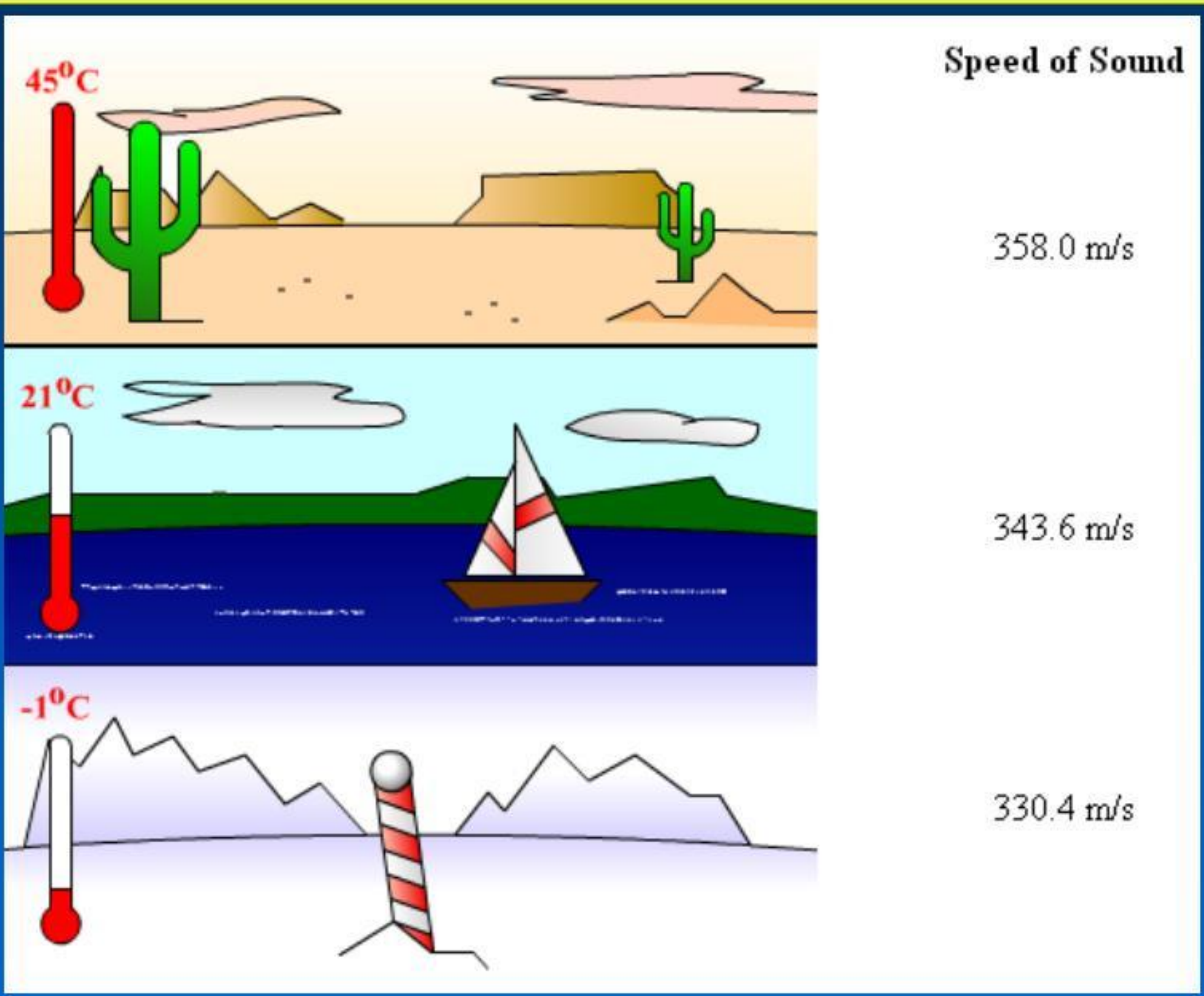
- **Refraction**



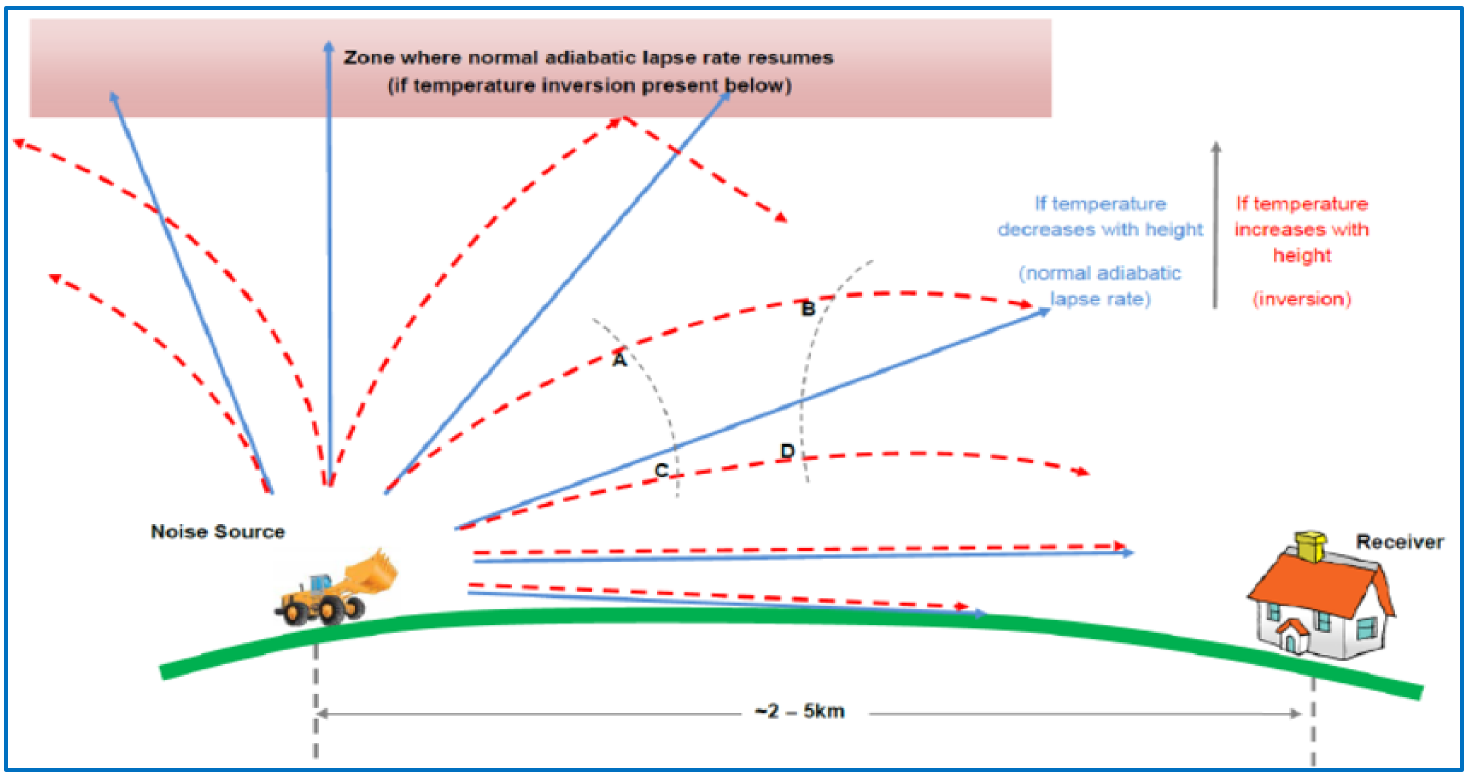
Refraction



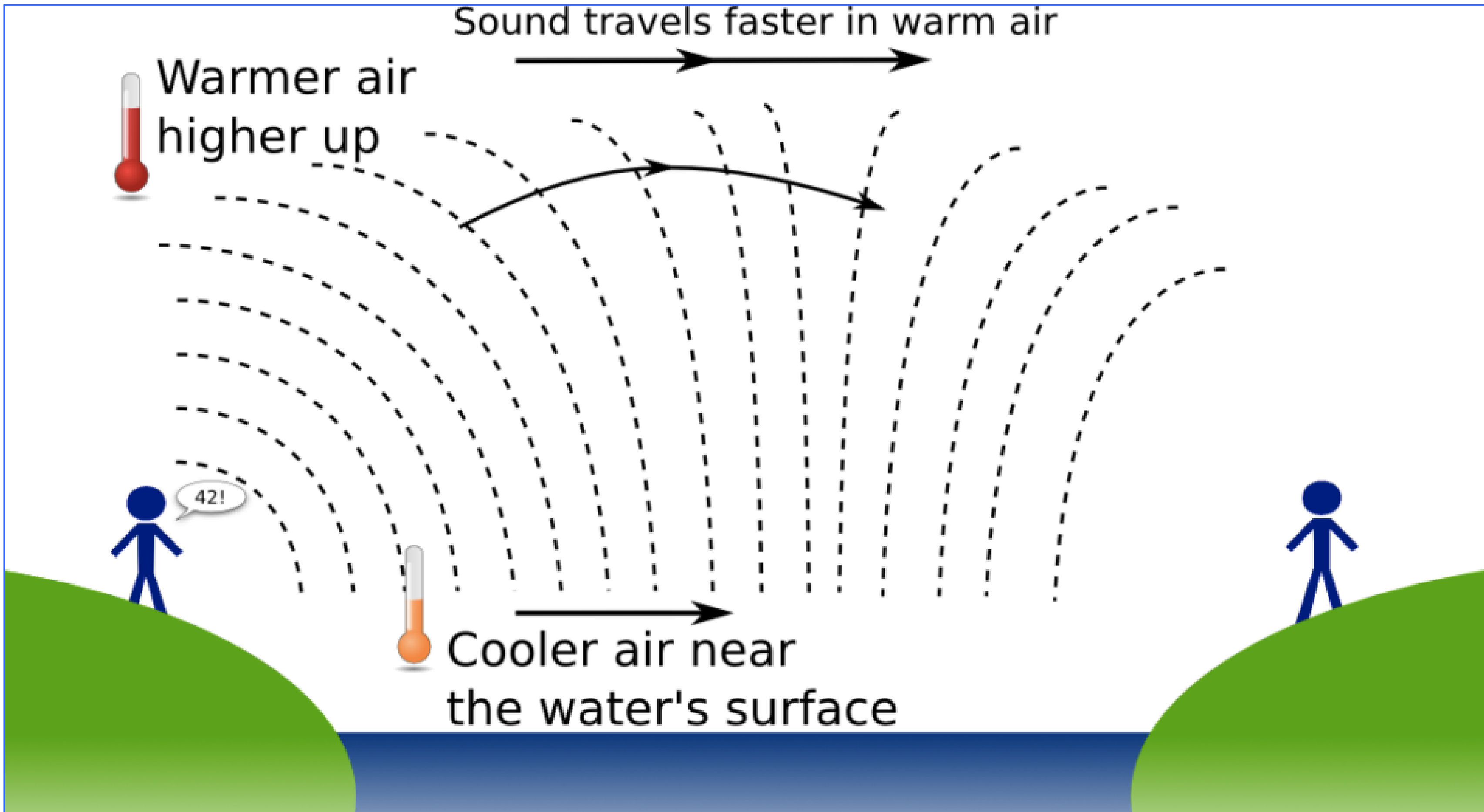
Speed of Sound at different temperatures



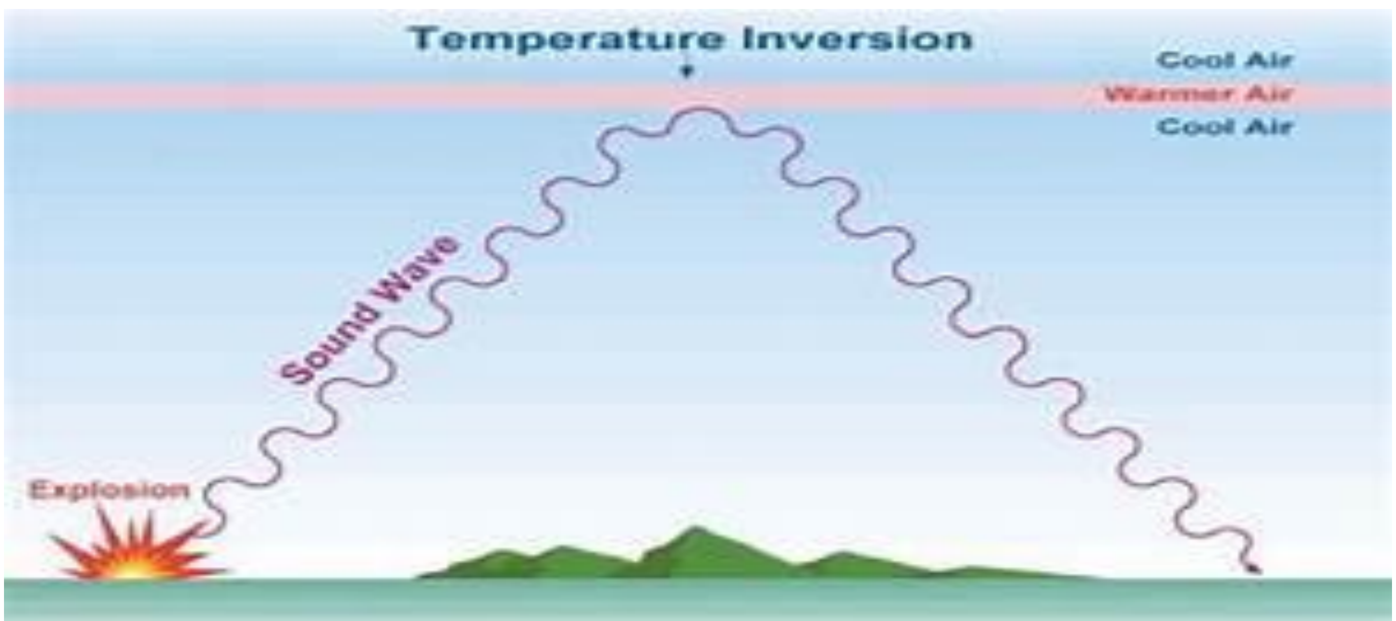
Sound waves are bent downward via refraction due to the difference in the speed of sound between the different temperature layers



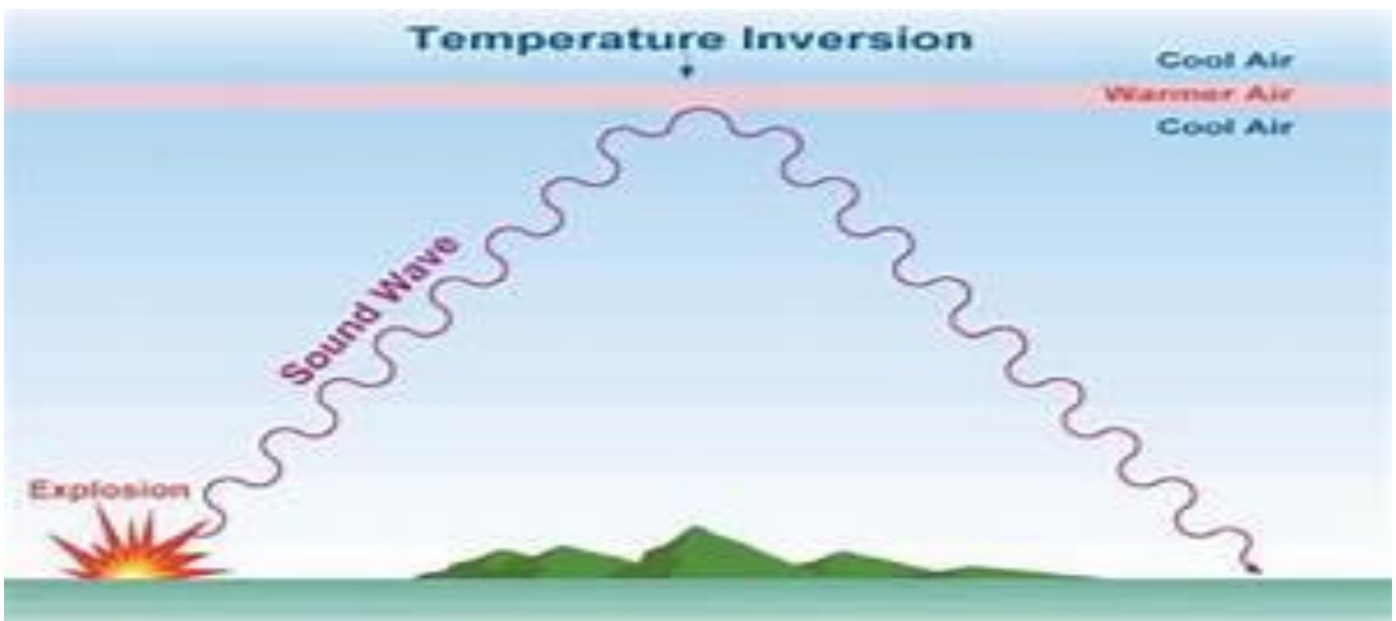
Weather conditions affect long-range sound transmission, e.g. inversion



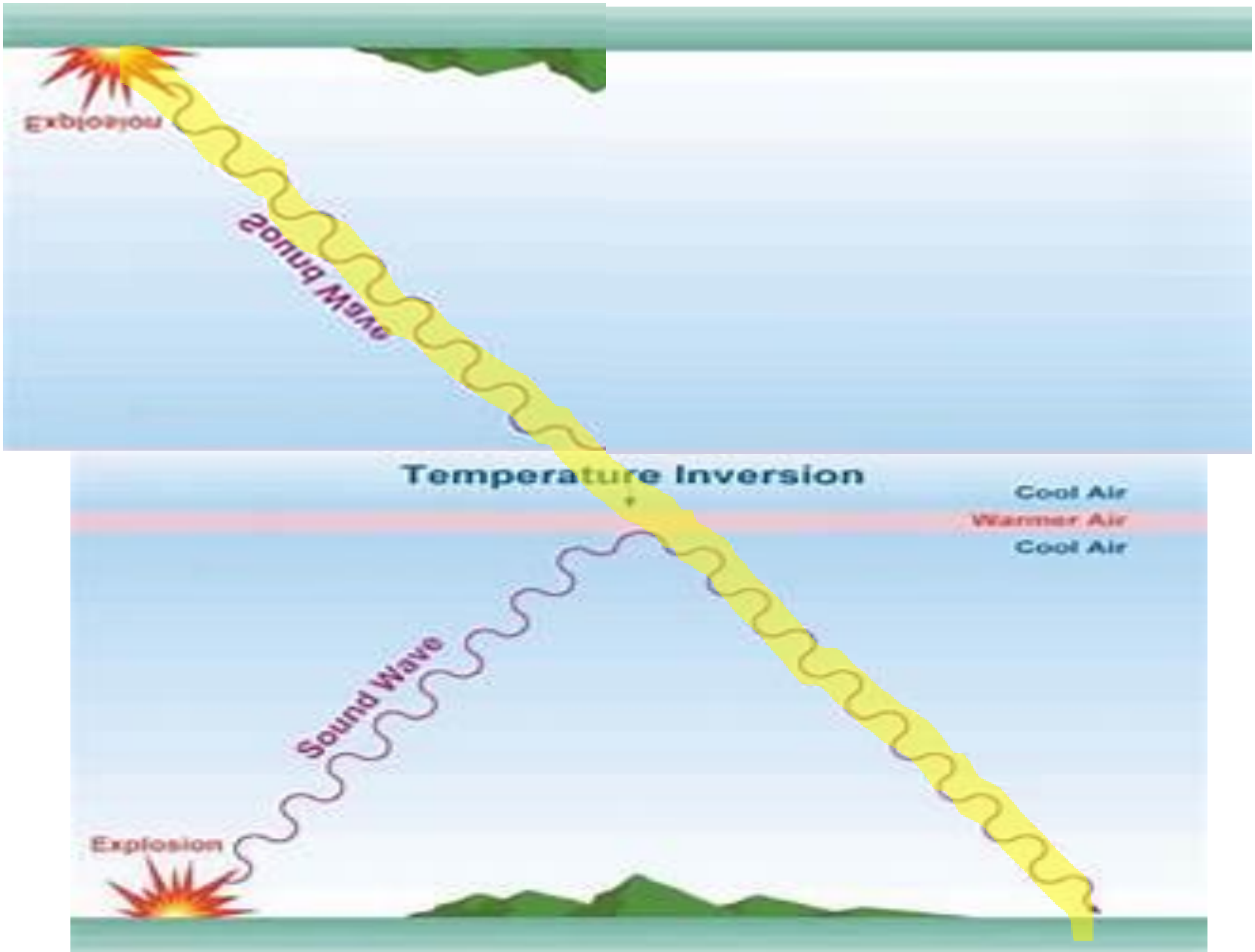
The boundary between layers can act as a “lid” to <u>**increase the distance sound travels (lounder)**</u>.



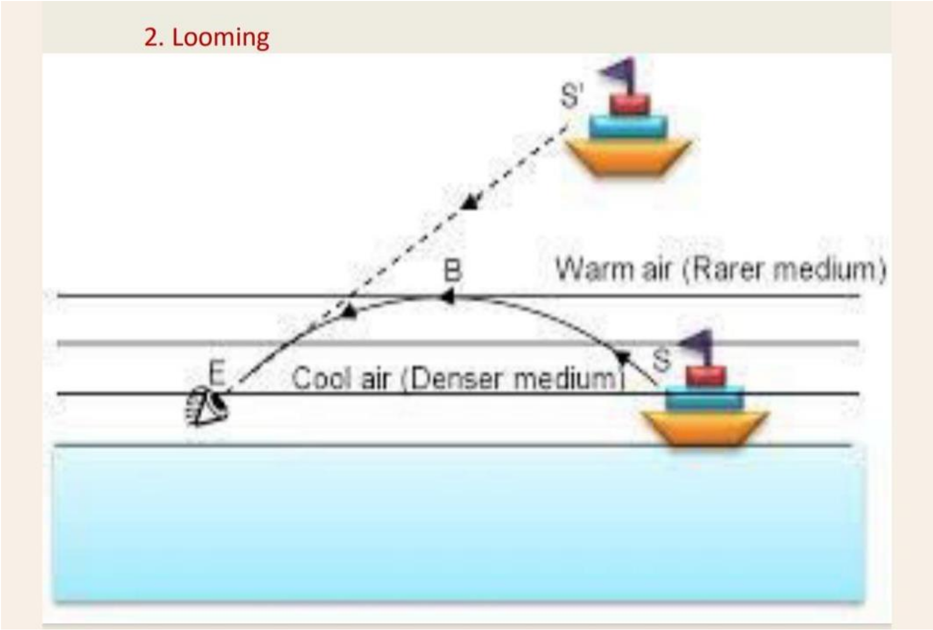
The boundary between layers can act as a "lid" to **<u>CHANGE THE APPARENT SOURCE OF THE SOUND</u>**



Illusion: Sounds from the SKY!

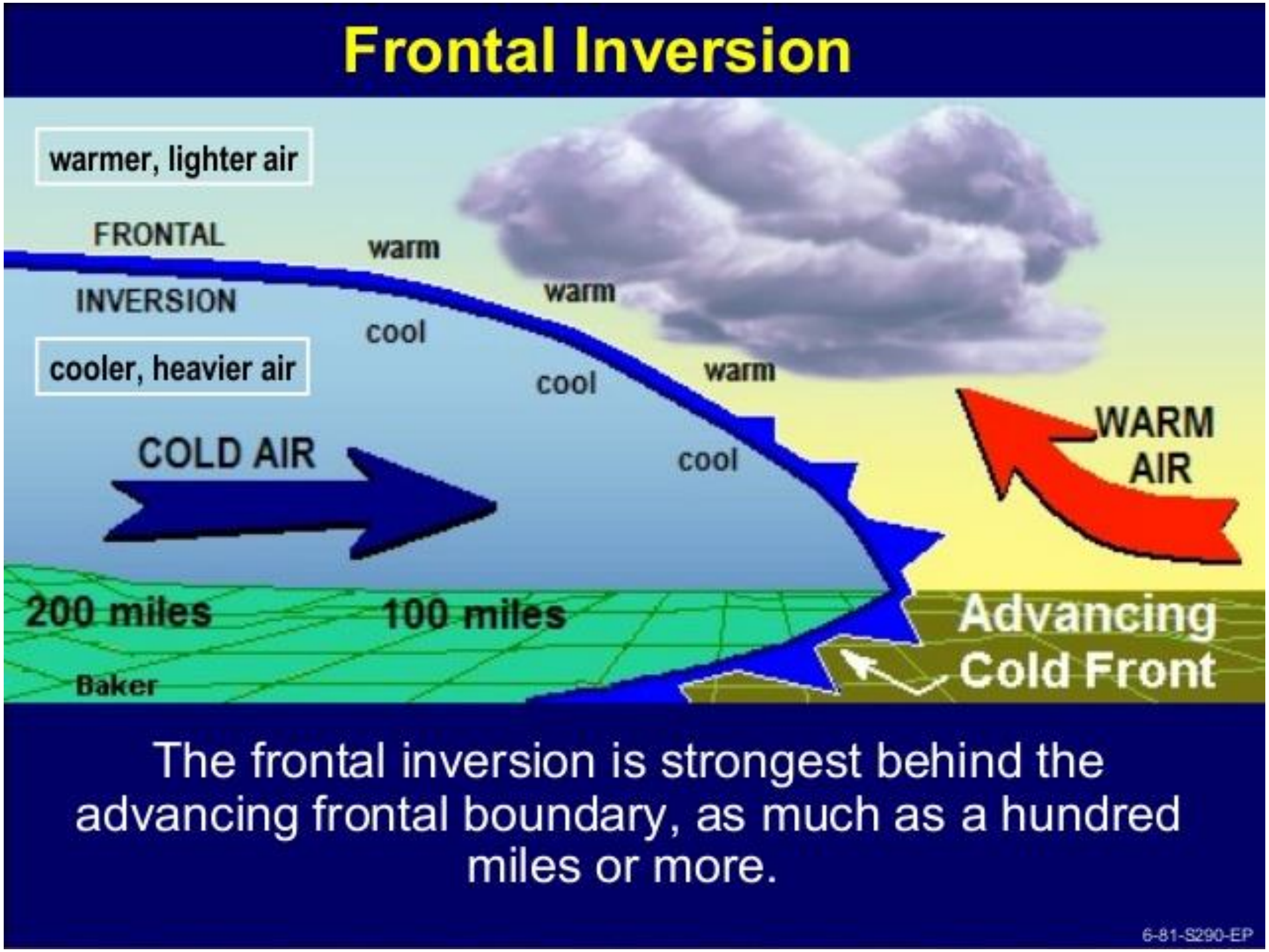


Illusion: Sounds from the SKY!
"Looming" = superior mirage

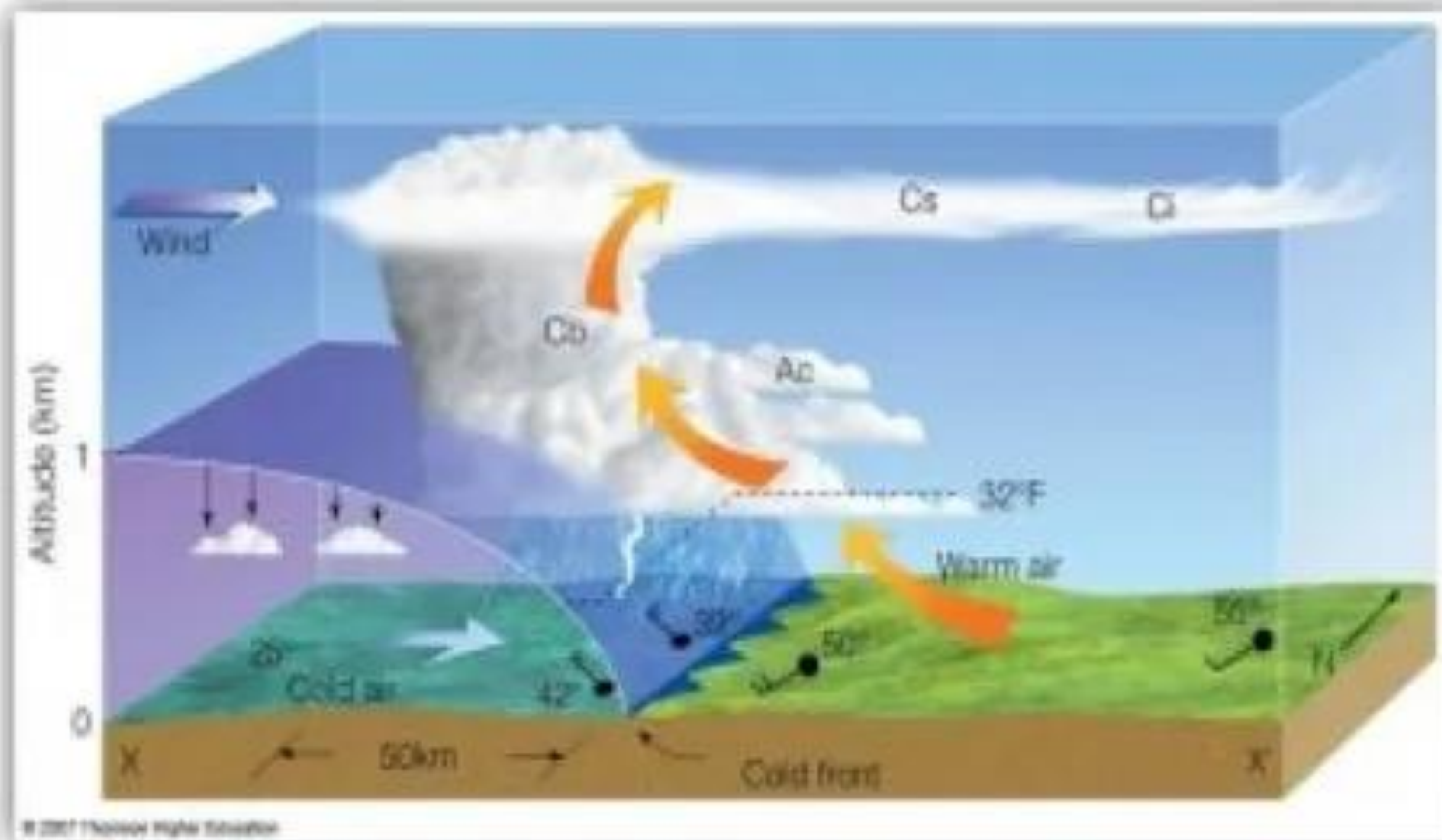


Thus, sound propagation could be used to predict weather phenomena such as thunderstorms

Atmospheric temperature inversions occur when a layer of cold air forms under a layer of warm air.



Cold front inversions are linked to severe thunderstorms.



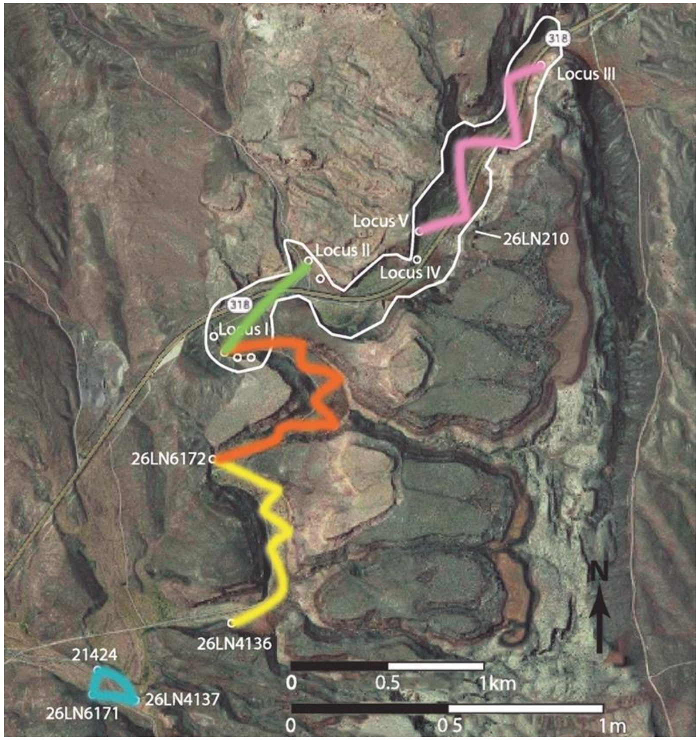
Rock art imagery in many instances has been interpreted as being related to thunderstorms and rain.

1E) Thunderbird, Susquehanna River, Pennsylvania;

Sound of Thunder:

Thunder Beings on the San Juan River
Katsina Panel

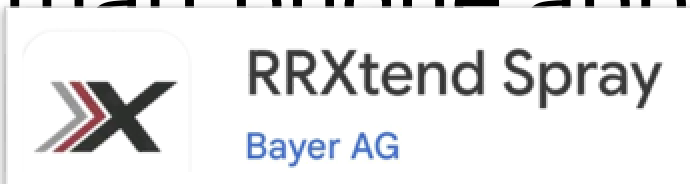
Rock art sites have been demonstrated to collect and magnify sound, and typically are excellent places to listen for long-range sound propagation, such as echoing through canyons.



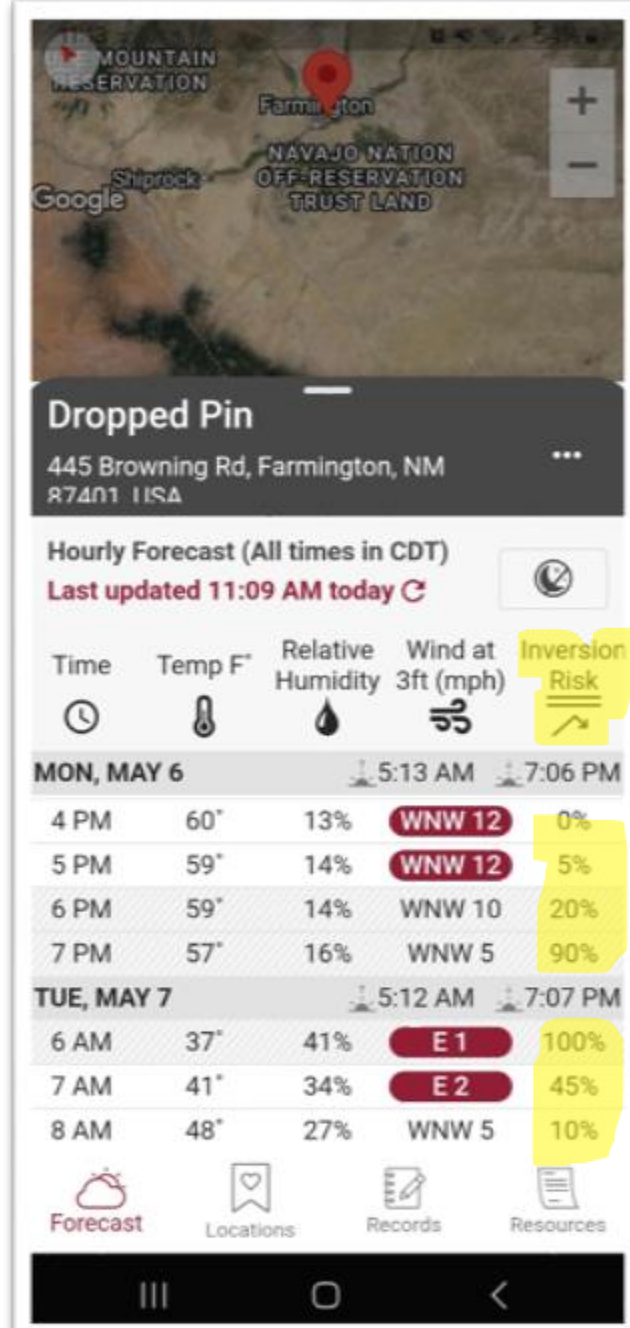
Sound propagation between rock art sites in White River Narrows

Various cultures have used sound in rain-making ceremonies.

Use meteorological smart phone apps



that forecast the presence or absence of atmospheric inversions



Conclusions for rock art research:

- Listen
- Record sounds and Responses
- Document weather conditions
    - Temperature
    - Relative Humidity
    - Wind velocity & Direction
    - Inversion

Questions? Email:

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