



This is the print version of the [Skeptical Science](http://sks.to/vapor) article '[Water vapor is the most powerful greenhouse gas](http://sks.to/vapor)', which can be found at <http://sks.to/vapor>.

Explaining how the water vapor greenhouse effect works

What The Science Says:

Increased CO₂ makes more water vapor, a greenhouse gas which amplifies warming

Climate Myth: Water vapor is the most powerful greenhouse gas

"Water vapour is the most important greenhouse gas. This is part of the difficulty with the public and the media in understanding that 95% of greenhouse gases are water vapour. The public understand it, in that if you get a fall evening or spring evening and the sky is clear the heat will escape and the temperature will drop and you get frost. If there is a cloud cover, the heat is trapped by water vapour as a greenhouse gas and the temperature stays quite warm. If you go to In Salah in southern Algeria, they recorded at one point a daytime or noon high of 52 degrees Celsius – by midnight that night it was -3.6 degree Celsius. [...] That was caused because there is no, or very little, water vapour in the atmosphere and it is a demonstration of water vapour as the most important greenhouse gas." ([Tim Ball](#))

When skeptics use this argument, they are trying to imply that an increase in CO₂ isn't a major problem. If CO₂ isn't as powerful as water vapor, which there's already a lot of, adding a little more CO₂ couldn't be that bad, right? What this argument misses is the fact that water vapor creates what scientists call a 'positive feedback loop' in the atmosphere — making any temperature changes larger than they would be otherwise.

How does this work? The amount of water vapor in the atmosphere exists in direct relation to the temperature. If you increase the temperature, more water evaporates and becomes vapor, and vice versa. So when something else causes a temperature increase (such as extra CO₂ from fossil fuels), more water evaporates. Then, since water vapor is a greenhouse gas, this additional water vapor causes the temperature to go up even further—a positive feedback.

How much does water vapor amplify CO₂ warming? Studies show that water vapor feedback roughly doubles the amount of warming caused by CO₂. So if there is a 1°C change caused by CO₂, the water vapor will cause the temperature to go up another 1°C. When other feedback loops are included, the [total warming from a potential 1°C change caused by CO₂ is, in reality, as much as 3°C](#).

The other factor to consider is that water is evaporated from the land and sea and falls as rain or snow all the time. Thus the amount held in the atmosphere as water vapour varies greatly in just hours and days as result of the prevailing weather in any location. So even though water vapour is the greatest greenhouse gas, it is relatively short-lived. On the other hand, CO₂ is removed from the air by natural geological-scale processes and these take a long time to work. Consequently [CO₂ stays in our atmosphere for years and even centuries](#). A small additional amount has a much more long-term effect.

So skeptics are right in saying that water vapor *is* the dominant greenhouse gas. What they don't mention is that the water vapor feedback loop actually makes temperature changes caused by CO₂ even bigger.

Basic rebuttal written by James Frank

Update July 2015:

Here is a related lecture-video from [Denial101x - Making Sense of Climate Science Denial](#)

[see video at [this link](#).]



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