ENVIRONMENTAL DEFENSE
finding the ways that work

Carbon Dioxide, Water Vapor and Global Warming

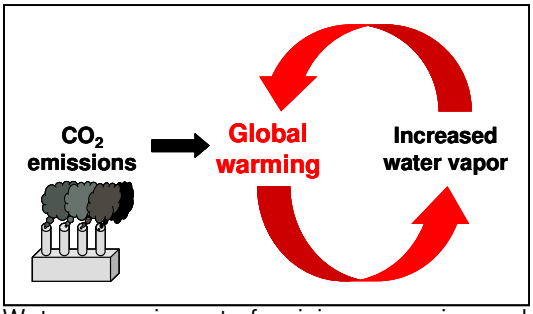
Some people have argued that because water vapor is a more important greenhouse gas than carbon dioxide (CO_2), it's pointless to regulate CO_2 emissions. Water vapor does trap more heat than CO_2, but because of the relationships among CO_2, water vapor and climate, to fight global warming nations must focus on controlling CO_2.

If water vapor is so important, why don't we control its concentration instead of CO_2?

Atmospheric levels of CO_2 are determined by emissions (for example, from burning fossil fuels), as well as by plant growth and ocean uptake. Atmospheric levels of water vapor, on the other hand, are determined by temperatures because warmer air holds more water vapor. Humans can only "control" water vapor levels by changing air temperature—and the best way to control temperature is to reduce CO_2 emissions.

Water vapor accelerates warming

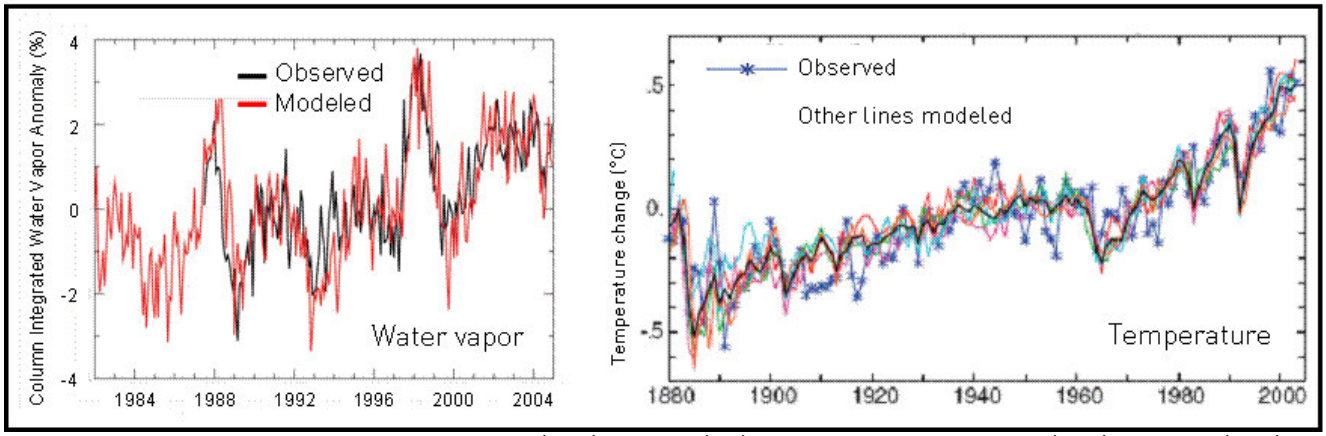
Water vapor is part of a vicious cycle. As humans emit greenhouse gases like CO_2, the air warms and holds more water vapor, which then traps more heat and accelerates warming. In fact, scientists calculate that changes in water vapor double the climate's temperature response to increasing CO_2.



Water vapor is part of a vicious warming cycle

Model results match observations

Scientists are confident that the warming cycle involving water vapor is real because climate model simulations are very close to actual water vapor and temperature measurements (see graph below). This also increases scientific confidence in model predictions of future warming.



Sources: Figures adapted from Soden et al, *Science* 310 (2005): 841 – 844 (left) and Hansen et al., *Science* 308 (2005): 1431-1435 (right).
Left: Modeled (red) and observed (black) water vapor levels over the ocean. **Right:** Modeled (lines) and observed (stars) temperature changes; the black line is the average of several different simulations. The climate models do a good job simulating actual measurements of water vapor concentrations and temperatures.

Environmental Defense, 257 Park Avenue South, New York, NY 10010
1-800-684-3322 • members@environmentaldefense.org • www.environmentaldefense.org