Measuring the effect of water vapor on climate warming

March 18 2014

Water vapor is a potent greenhouse gas. In the atmosphere, the concentration of water vapor increases with the temperature, setting up a powerful positive feedback loop. This water vapor feedback is the strongest known positive feedback, with the potential to roughly double the effect of warming caused by other sources. Determining the exact strength of the water vapor feedback, then, is incredibly important to limiting uncertainty in future climate change projections.

From 2002 to 2009, an infrared sounder aboard NASA's Aqua satellite measured the atmospheric concentration of water vapor. Combined with a radiative transfer model, Gordon et al. used these observations to determine the strength of the water vapor feedback. According to their calculations, atmospheric water vapor amplifies warming by 2.2 plus or minus 0.4 watts per square meter per degree Celsius. This value, however, is only the "short-term" feedback—the strength of the feedback as measured during the observational period. This value is subject to short-term climate variability. The true value of the feedback, the "long-term" value, is what the short-term observed values should trend towards when given enough time.

Using a series of climate models, the authors estimate the strength of the long-term water vapor feedback. Extrapolating from their short-term observations they calculate a long-term feedback strength of 1.9 to 2.8 watts per square meter per degree Celsius. They find that most models get to within 15 percent of their long-term value within 25 years. The accuracy of calculations, then, could be improved with a longer set of

observations.

More information: An observationally based constraint on the water-vapor feedback, *Journal of Geophysical Research-Atmospheres*, DOI: 10.1002/2013JD020184, 2013 onlinelibrary.wiley.com/doi/10 … 013JD020184/abstract

Provided by American Geophysical Union