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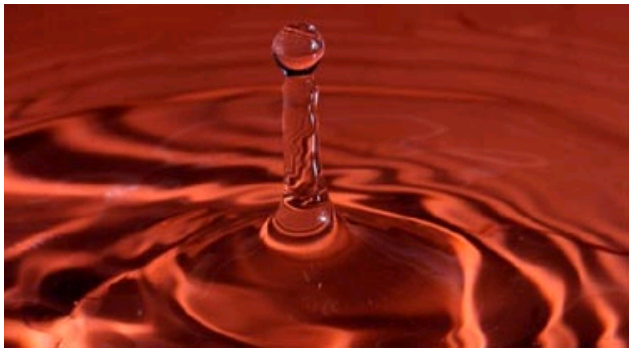
Heavy water could add weight to climate models

Sep 15, 2009 2 comments



Making a splash Can heavy water shed light on the climate?

An international collaboration of researchers has produced the most detailed map to date of water content in the lower atmosphere. This is the first such map to be made with satellite data and could lead to improvements in weather forecasting and climate modelling.

Water is a powerful greenhouse gas that is expected to contribute significantly to global warming. As global temperatures rise, the quantity of water in the atmosphere will increase exponentially – due to increased global evaporation – which will lead to even higher temperatures.

To gain a clearer picture of how the changing water distribution across the Earth is impacting on the climate, researchers need to develop a more sophisticated understanding of the hydrological cycle. That is, the budgeting of water between the Earth's surface and atmosphere via evaporation and condensation.

Heavy water

One way of achieving this is to look at the abundance of deuterated, or "heavy", water (HDO), in relation to standard water (H2) in the atmosphere. These data can yield valuable information about prevailing atmospheric conditions because the amount of heavy water in water vapour is related to prevailing temperatures.

Over the past few years, researchers have started to trace the distribution of heavy water in the upper atmosphere using a number of space-borne interferometers. These projects, however, have struggled to generate an accurate picture of how heavy water is distributed closer to the Earth's surface, because the infrared detection technique does not reach the lower troposphere in which most atmospheric water resides.

Now, Christian Frankenberg at SRON-Netherlands Institute for Research and his colleagues have carried out a new series of measurements using a different technique, to incorporate this important zone in the lower atmosphere. Their technique involves a form of spectroscopy that is capable of resolving thermal emissions in the short-wave infrared, called SCIAMACHY or scanning imaging absorption spectrometer for atmospheric cartography.

Using an instrument on board the European Space Agency (ESA)'s Environmental Satellite (ENVISAT) the researchers monitored the changing global distribution of heavy water between 2003 and 2005.

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Clearer picture

The researchers say that their findings can now be fed into climate models to give a more accurate representation of the hydrological cycle. "The potential to retrieve water isotopes from SCIAMACHY has been either overlooked or underestimated," Frankenberg told *physicsworld.com*.

Fred Taylor, the Haley Professor of Physics at the University of Oxford is impressed by the latest work. "It has a lot of potential for clarifying the contributions of different processes within a complicated climate system and it is likely to lead to better regional climate models," he said. However, Taylor believes that the data will not be as beneficial to weather forecasters. "I doubt it will make any difference to global mean forecasts, which probably reached the limit of their potential several years ago."

The next challenge for the researchers is to further explore the relationship between temperature and water isotope ratios. "It is generally accepted that not only temperature but also dynamics impacts the variability of isotopes in ice-cores," said Frankenberg. "Atmospheric circulation models are needed in order to understand this variability and to disentangle temperature from dynamics effects."

Adam Scaife, a climate scientist at the UK Met Office believes that there may be other climate issues that need to be addressed before this research can be valuable. "It is clear that the fraction of deuterated water is dependent on several climate processes," he said. "While this research may help to provide a tighter constraint on climate models, it will be difficult to untangle the causes of the differences between models and observations."

About the author

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2 comments

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1

joeblasted
Sep 18, 2009 1:03 PM
plantsville, United States

"it will be difficult to untangle the causes of the differences between models and observations."

you dont say! not as many "climate researchers" are quite so honest.

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2

Latecommer
Sep 18, 2009 3:02 PM
United States

water and the climate

Water vapor has a cooling effect on the atmoshpere, both in the moist adabotic process of assending vapor, and in the precipitation it causes.
It has always been a mystery to me how watervapor, powerful as it is as a green house gas is never described as a negative feedback to warming as well.
In past ages of much higher levels of greenhouse gases, it is difficult to explain why there was no runaway warming without using the cooling (negative feedback) of water in the atmoshpere.
The Earth reflects a finite amount of IR radiation, lower than the amount of greenhouse gases avialble to absorb and refelect same. At the point of saturation the additional water can only act as a natural cooling agent as it transports moisture to the atmoshpere.
The Earth has a natural thermostat which has keep temperatures within a rather small range, even when CO2 and water vapor were at a much higher level than today. Why would that have changed in the last 100 years or so?
Remember the atmoshpere does not care where the greenhouse gas occured or how it was produced...the effects are the same for the tiny amount of gases produced by humans as it is for that produced the natural process.

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