



## **On possible quantifications of the water vapour feedback**

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The sensitivity of climate to external perturbations such as anthropogenic greenhouse gases has long been known to be about doubled by water vapour feedback - at least in GCMs, but the basic physics (the distribution of RH changing little with warming, so that SH increases nearly exponentially with temperature) is simple and believed to be correct.

However, seeking detailed quantification of the effect in GCMs is not simple. Using the overall clear-sky OLR to compare the net effect of water vapour between GCMs is easy, and suitable for many purposes, but includes all temperature effects too, is distorted by omitting cloud shielding, and provides no basis for a breakdown into specific components. The latter have been obtained instead by running radiation codes changing surface temperature, lapse rate and SH one at a time. However, the substantial cancellation between the "lapse rate feedback" and "water vapour feedback" indicates they do not provide any sort of physical separation.

A new physically-inspired model of water vapour feedback does provide a natural breakdown into components without these problems, and the largest component (though probably not the one with the largest uncertainty) is effectively verifiable against observations. It is slightly more complex than the conventional analysis, though. Another alternative is to modify the conventional breakdown by using RH rather than SH, which avoids all these problems, but at the cost of not having a natural "water vapour feedback" term.