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## **Air trends 'amplifying' warming**

**By Richard Black**

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*"Only when solar dimming disappeared could we really see what is going on in terms of the greenhouse effect"*

**Martin Wild**



**Reduced air pollution and increased water evaporation appear to be adding to man-made global warming.**

Research presented at a major European science meeting adds to other evidence that cleaner air is letting more solar energy through to the Earth's surface.

Other studies show that increased water vapour in the atmosphere is reinforcing the impact of man-made greenhouse gas emissions.

Scientists suggest both trends may push temperatures higher

than believed.

But they say there is an urgent need for further research, particularly at sea.

### **Dimming no more**

Between the 1950s and 1980s, the amount of solar energy penetrating through the atmosphere to the Earth's surface appeared to be declining, by about 2% per decade.

This trend received some publicity under the term "global dimming".

### **Clean air makes bright skies**



But in the 1980s, it appears to have reversed, according to two papers published last year in the journal Science.

The decline in Soviet industry and clean air laws in western countries apparently reduced concentrations of aerosols, tiny particles, in the atmosphere.

These aerosols may block solar radiation directly, or help clouds to form which in turn constitute a barrier; or both effects may occur.

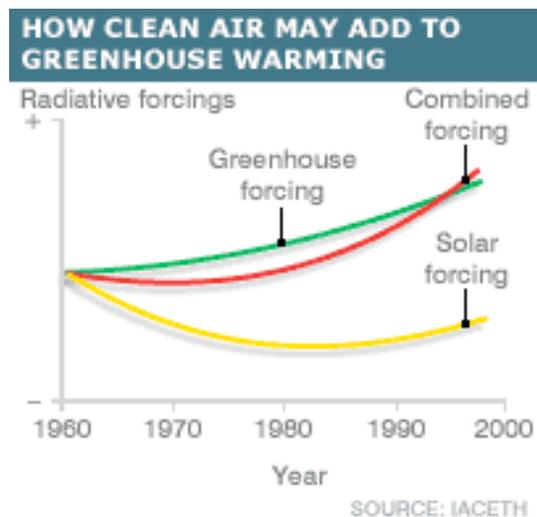
The lead researcher on one of those Science papers was Martin Wild from the Institute for Atmospheric and Climate Science (IACETH) in Zurich, and this week he has been discussing the implications of those findings at the European Geosciences Union (EGU) annual meeting in Vienna.

## Correlations and causality

The reversal of "global dimming" has been proposed in some circles as an alternative explanation for climatic change, removing the need to invoke human emissions of greenhouse gases.

Dr Wild dismissed this picture. His analysis suggests that "global dimming" and the man-made greenhouse effect may have cancelled each other out until the early 1980s, but now "global brightening" is adding to the impact of human greenhouse emissions.

"There is always this argument that maybe the whole temperature rise wasn't due to greenhouse warming but due to solar variations," he told the BBC News website.



"During the solar dimming we had really no temperature rise. And only when the solar dimming disappeared could we really see what is going on in terms of the greenhouse effect, and that is only starting in the 1980s."

Analyses of global temperature indicate that a sharp upward

trend commenced in the early 1980s.

But, said Dr Wild, there are strong regional variations in the "solar brightening" trend.

"In Eastern Europe, we see a very strong recovery [in solar radiation] - almost back to what it was before dimming began," he said.

"But India continues with the dimming - that's very much thought to be due to increasing air pollution.

"The general position is that air pollution is still increasing in the tropics, but decreasing outside the tropics; so probably that will amplify warming a little bit outside the tropics but not inside."

### **Data deficit**

There are, Dr Wild admitted, holes in the picture of change.

"The term 'global dimming' is a bit dangerous," he said. "I usually call it 'solar dimming' not 'global dimming' because we really only know about this where we have measurements; and we don't have measurements at many places, for example over the oceans, or land in the tropics."

More research facilities are needed, he said, in tropical regions, particularly sub-Saharan Africa, and especially the oceans.

As well as extending measurements of solar energy reaching the Earth's surface, he urged more research on aerosol concentrations in the atmosphere and on trends in cloud cover.

### **Water builds heat in Europe**



Rolf Philipona from the World Radiation Center in Davos, Switzerland, is attempting to improve aerosol measurements in northern Europe.

"We're trying to put a paper together which shows the aerosol depth and the amount of aerosol in the air column from about six to eight stations in Europe," he told the BBC News website.

"In Germany and Switzerland we would have stations very high up, extending all the way to the North Sea."

Last year Dr Philipona released research indicating that European warming is largely driven by increases in humidity.

The mechanism is that rising levels of what are conventionally called "greenhouse gases", such as carbon dioxide and methane, cause more evaporation of water, which in the atmosphere is itself a greenhouse gas.

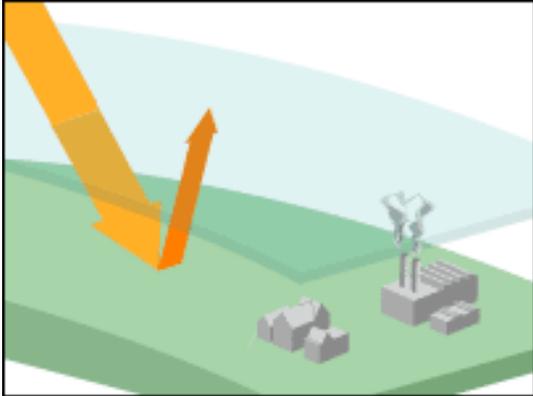
He believes this is having more impact than changes to the transmission of solar energy through the atmosphere.

"From my results I believe it's the greenhouse warming and in particular the water vapour feedback," he said.

"Studies and papers are also coming now which are looking more closely at what water vapour is doing in other regions; and there are several pieces of work showing water vapour is increasing over land areas like the United States."

## **Satellites and ships**

## Animated guide to the greenhouse effect



A further implication of "global brightening" is that the temperature difference between night and day may reduce.

The "blanket" of greenhouse gases in the atmosphere has a net heating effect during day and night, whereas changes in solar energy reaching the surface are felt only in daytime.

Disproportionately higher night-time temperatures have already been noted in many parts of the world, and research in the Philippines has linked this trend to a reduction in rice yield.

The conclusions presented here present two major challenges to the research community.

One is to find ways of extending experimental investigations into the oceans and the developing world.

The second is to integrate them into computer models of climate, something which is only just beginning to happen.

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