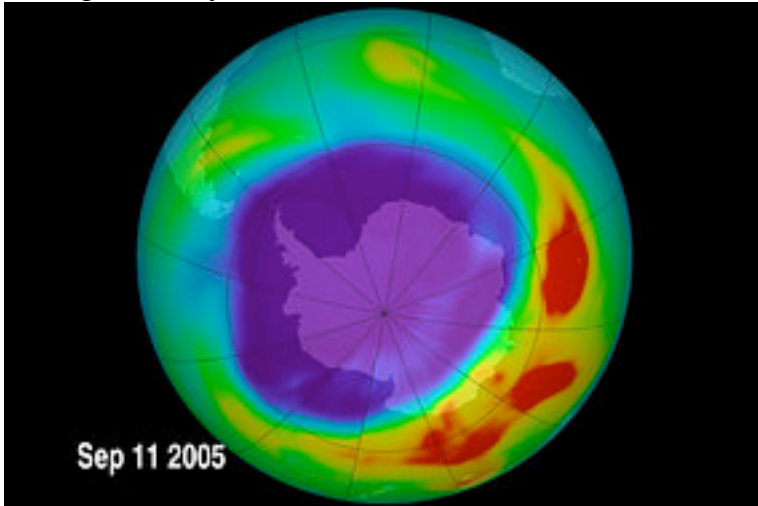


# Why is the ozone hole in the less polluted southern hemisphere?

If the atmosphere in the northern hemisphere is much more polluted than it is in the southern hemisphere, why is there an ozone hole in the south and not in the north?



The ozone hole at its largest in 2005. (Source: NASA/Goddard Space Flight Center)

I have just been reading the article '[Chemical equator' keeps southern air clean](#)' and it got me thinking... If the atmosphere in the northern hemisphere is much more polluted than it is in the southern hemisphere why is there an ozone hole in the south and not in the north?

—Damon

'The rain in Spain stays mainly on the plain' according to the classic song — but pollution doesn't. Car exhaust fumes and ozone-depleting chemicals produced in Madrid, New York and Tokyo rise into the atmosphere, where they are swept away towards the equator and the less polluted southern hemisphere.

Luckily, most of this northern hemisphere pollution is quarantined by what scientists refer to as the chemical equator — a natural meteorological boundary in the tropics.

"At the equator, there is a lot of upward moving air and precipitation, which washes out chemicals before they can get from the northern hemisphere to the southern hemisphere," says [CSIRO](#) climatologist Dr Paul Fraser.

However, the reason we have a southern ozone hole instead of a northern one is not due to the amount of atmospheric pollution — it's due to temperature.

The stratosphere in the southern hemisphere — the layer of atmosphere where the ozone layer lies, 15 to 50 kilometres above the Earth's surface — is about five degrees Celsius colder than in the northern hemisphere.

"We get more ice in the stratosphere in the southern hemisphere, making the ozone-depleting chemicals more potent," Fraser says.

"This leads to that disparity between hemispheres as far as ozone [depletion] is concerned since it's not the level of chemicals that is driving them, but the ability of those chemicals to deplete ozone." Chlorofluorocarbons (CFCs) are one type of ozone-depleting chemicals. They react with ultraviolet light to produce chlorine, which is then able to destroy ozone.

This chemical reaction that frees chlorine from CFCs takes place on the surface of tiny particles of ice in the stratosphere.

"The more ice there is in the stratosphere, the more ozone-destroying chlorine is liberated from CFCs," Fraser says.

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## **A seasonal event**

The ozone hole — which is not actually a 'hole' but a region of depleted ozone in the stratosphere over Antarctica — is a seasonal event.

Every winter, a vortex of cold air swirls around the South Pole, forming polar stratospheric clouds. The chemical reactions that deplete ozone take place on in these icy clouds and the 'ozone hole' begins to appear.

By late spring, when temperatures begin to rise, the ice evaporates and the ozone layer starts to recover.

The hole over Antarctica is much more pronounced than over the Arctic because the lower temperatures mean the stratospheric clouds form for longer periods.

*Dr Paul Fraser was interviewed by Carmelo Amalfi.*