Researchers suggest ozone hole responsible for warming in southern Africa

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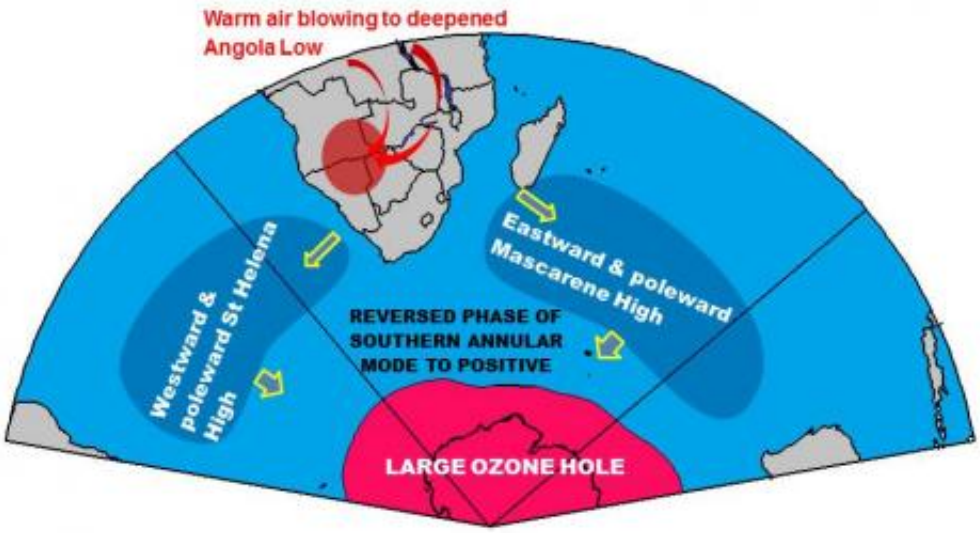
Linking the development of Large Ozone Hole to warming over southern Africa. Panel representd the state before the development of the large ozone hole. Credit: Desmond Manatsa

(Phys.org) —An international team of researchers has concluded that a two decade early summer surface-air warming in southern Africa is likely due to the ozone hole over Antarctica. In their paper published in

the journal *Nature Geoscience*, the team describes how ozone hole size variations cause changes to wind patterns in the southern hemisphere and why they believe it leads to heating up southern African.

Every year in early summer, southern Africa is impacted by what is known as the Angola Low, a low pressure system that pulls in warm air from the lower latitudes, causing a rise in temperatures. Over the past twenty years, however, the annual rise in temperatures has been nearly two degrees Fahrenheit hotter than "normal." To find out why, the researchers looked to the hole in the ozone over the Antarctic, which most scientists believe came about due to the use of fluorocarbons by humans. They studied temperature data for southern Africa and compared it with the appearance of the ozone hole in the 1980's and found it occurred in lockstep—as the hole increased in size, temperatures in southern Africa rose as well.

To find out why the ozone hole might cause temperatures in southern Africa to rise, the researchers looked at data obtained over several decades that described a belt of westerly winds that surround Antarctica. They found that as the ozone hole appeared and grew in size (it's generally largest in the spring) the westerly winds began to shift slightly, resulting in more clouds being pushed towards the South Pole—that would change how much heat could escape into the atmosphere. The researchers believe the additional heat impacted the Angola Low, making it more intense, which would in turn cause more warm air to be pulled in from around the equator causing temperatures in southern Africa to be higher than they would have been otherwise in the early summer.



Linking the development of Large Ozone Hole to warming over southern Africa. Panel represents the state after the development of the large ozone hole respectively. Credit: Desmond Manatsa

The ozone hole is believed to have come about due to the use of fluorocarbons in aerosols and refrigerants. Since its discovery countries around the world have banned use of such fluorocarbons and as a result, the size of the ozone hole has been decreasing. Scientists expect it to disappear completely by 2065, at which point, the researchers on this latest effort suggest, surface temperatures in southern Africa will likely return to normal.

More information: Link between Antarctic ozone depletion and summer warming over southern Africa, *Nature Geoscience* (2013) DOI: 10.1038/ngeo1968

The notable rise in surface air temperatures over southern Africa over the past two decades is thought to largely result from the human-induced increase in atmospheric greenhouse gas concentrations. In addition, the loss of stratospheric ozone over Antarctica is thought to have had a significant impact on tropospheric circulation, and hence climate, in the Southern Hemisphere summer, by favouring the positive phase of the Southern Annular Mode. Here, we use reanalysis data to compare the climate of southern Africa before and after the development of the large ozone hole, and investigate possible links between the development of the Antarctic ozone hole and summer warming in the region, defining 1970–1993 as the pre-ozone hole era, and 1993–2011 as the large ozone hole era. We find that the ozone-induced shift in the polarity of the Southern Annular Mode after 1993 coincided with an intensification of the Angola Low, a continental low pressure system that normally develops in austral summer and is mostly located over Angola. We show that the deepening of this low pressure system, in turn, was associated with an increase in the flux of warm surface air from the lower latitudes to southern Africa. We suggest that the recent summer warming over southern Africa is linked to these shifts in atmospheric circulation that are probably induced by Antarctic ozone loss.