Greenhouse gases are shrinking the stratosphere

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An international team of climate scientists has found evidence showing that human-created greenhouse gases have led to a shrinking stratosphere. In their paper published in the journal *Environmental Research Letters*, the group describes analyzing data from satellites to create computer models.

The stratosphere is the 20-to-60-kilometer atmospheric layer surrounding the earth above the troposphere, the layer that extends from the surface to approximately 20 kilometers. Prior research has shown that the troposphere is growing thicker due to greenhouse gases, hinting at a shrinking stratosphere due to pressure from below as the troposphere expands upward driven by the increase in heat that is captured by carbon dioxide.

In this new effort, the researchers sought to learn more about the impact of greenhouse gas emissions on the stratosphere. To that end, they obtained environmental data from satellites going back to the 1980s. They added the satellite data to a computer model that also took into account chemical interactions that occur in the atmosphere. They also factored in the impact of the ozone layer.

The models showed that as the troposphere has been expanding, it has been pushing upward on the stratosphere. They also found that as carbon dioxide made its way into the stratosphere, it has had a cooling effect, resulting in a contracting force. The researchers found the net result was a thinning stratosphere. Their calculations showed that the stratosphere has thinned by approximately 400 meters since the 1980s, which translates to approximately 1% of its thickness. Running the models forward showed that the stratosphere will continue thinning as long as greenhouse gasses are emitted into the atmosphere. They suggest it could thin by as much as a kilometer in just 60 years. They note that their model also showed that changes to the ozone layer had little impact on thinning of the stratosphere.

The researchers note that it is still not clear what impact a shrinking stratosphere may have on the planet, but note that it could affect the trajectories of satellites and how radio waves propagate, which could eventually have an impact on the Global Positioning System.

More information: Petr Pisoft et al. Stratospheric contraction caused by increasing greenhouse gases, *Environmental Research Letters* (2021). DOI: 10.1088/1748-9326/abfe2b