Recovery of the ozone layer continues

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Researchers at the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR) have been instrumental in the preparation of a report by the World Meteorological Organization (WMO) regarding the development of the ozone layer in the stratosphere. Based on estimates, by about the mid 21st century, the ozone layer will have the same thickness as it had in the early eighties. The latest evaluations of space-based measurements acquired by the DLR Remote Sensing Technology Institute, combined with model computations from the DLR Institute of Atmospheric Physics support the statement that 'the regeneration of the ozone layer continues'.

"Measurements show that the ozone hole above Antarctica in 2012 is one of the smallest in recent years," reports Martin Dameris from the Institute of Atmospheric Physics. Both the area of expansion and the reduction in ozone concentrations are small this year in comparison to the values observed in past years. "This is a clear indication that the ozone layer is staging a good recovery," states Dameris.

Based on climate chemistry models

So far, climate chemistry model computations performed by the Institute of Atmospheric Physics have been in line with observations. The models demonstrate that, if this trend continues, the ozone hole will close up and that the ozone layer will regenerate itself. These forecasts are based upon computational models that simulate the physical, dynamic and chemical processes in the atmosphere. The Institute of Atmospheric Physics collaborated on the production of these climate chemistry models. To investigate the ozone layer, long-term simulations, starting, for example, in 1960 and extending beyond the simulation date, were conducted at the DLR Institute.

Computational results for the past are compared against observational data, in part to assess the quality of the results from the model. It is only on the basis of well-evaluated models that it is possible to produce reliable estimates of future developments, such as that of the ozone layer. To understand atmospheric processes, atmospheric researchers use data from the DLR Remote Sensing Data Center. The scientists at this Institute are primarily involved in the provision of data products derived from satellite measurements. These satellite data products are compared against other independent data to achieve the highest possible level of precision.

The reduction in chlorofluorocarbon consumption is having a considerable and positive effect

Since the early eighties, the ozone hole has been observed at the start of the Antarctic spring – from mid-September to mid-October. It is the consequence of high chlorine levels in the stratosphere, and is caused by the emission of chlorofluorocarbons (CFCs). The drastic reduction of CFC levels in the atmosphere has had a positive impact on the ozone layer. The production and use of CFCs was regulated by the Montreal Protocol in 1987 and in subsequent agreements; since the mid-nineties, the use of CFCs has been almost totally banned. As a result, a decline in the chlorine content of the stratosphere has been observed since the beginning of this century.

Due to meteorological factors, such as the temperature-dependent nature of the ozone-depleting chemical reactions, the ozone layer does not regenerate steadily. This means that the ozone hole shows year-to-year variations, fluctuating between large and small ozone losses, but nonetheless exhibiting a positive trend towards higher ozone levels, and therefore to the restoration of normal levels. The observations carried out this year support this overall positive trend.

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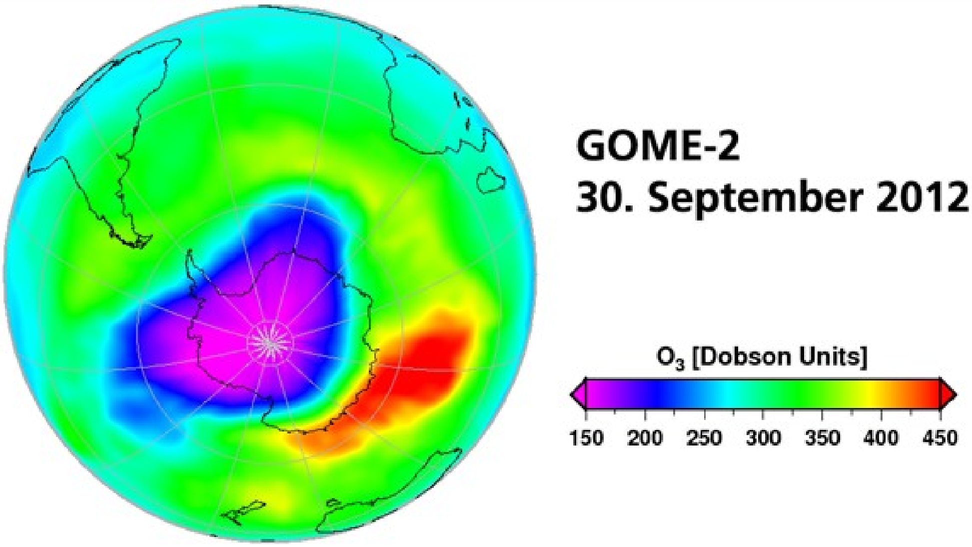
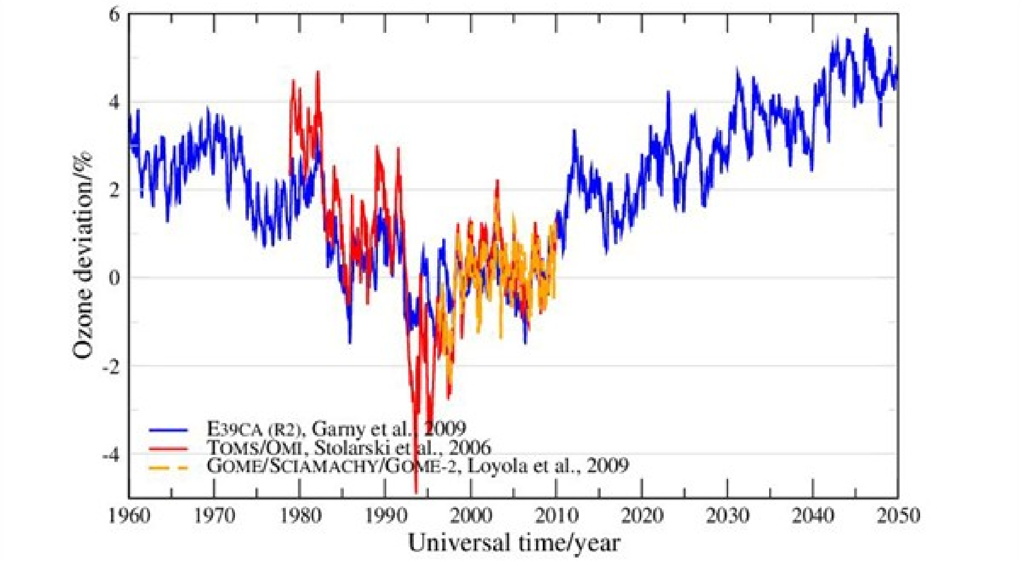
Horizontal and vertical distribution of trace gases



The Global Ozone Monitoring Experiment–2 (GOME-2) is a further development of GOME, a sensor that was used successfully on the ESA satellite ERS-2 that was in service from 1995 to 2011. In contrast to its predecessor, the GOME-2 provides almost global coverage on a daily basis and achieves four times the spatial resolution in the process. The instrument measures the horizontal and vertical distribution of trace gases. By virtue of the high time and spatial resolution, the spectrometer can track the origin of airborne pollutants over population centres and their subsequent movements.

Satellite observations combined with climate chemistry models



Anomalies in the global levels of ozone – orange and red lines represent satellite observations; the blue line shows the results of a digital simulation with a DLR climate chemistry model. The ozone layer reached its lowest levels in the nineties and has been recovering ever since.
