CHINA'S ACTIVITIES AND CONTRIBUTIONS IN PROTECTING THE OZONE LAYER

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Contents

Summary

Global ozone depletion, like global warming, is a common problem in the atmospheric community, the concern of people all over the world and many governments. China always takes environmental protection seriously in the process of developing its economy. It makes environmental protection a fundamental policy, and promotes international cooperation as part of a sustained effort to protect the environment. China signed the Vienna Convention in September 1989, the 1990 London Amendment, and the Montreal Protocol in June 1991. Great progress has been made since the Chinese government began to carry out the State Project of Phasing Out Substances that Deplete the Ozone Layer in 1993. No fewer than 26 laws related to the subject have been approved and the use of ozone depleting substances in aerosols ceased13 years earlier than is required by the Montreal Protocol.

China is operating six ozone-monitoring stations, i.e. Xianghe (Beijing), Kunming, Waliguan shan, Longfeng shan, Lin'an, and Zhongshan (Antarctica).

China has carried out a lot of research into global ozone variations and the Antarctic ozone hole. Through the efforts of Chinese scientists, great progress has been achieved in field observation, data analysis, laboratory simulation, theoretical analysis and numerical simulation, such as the roles of polar stratospheric clouds (PSCs) and nitrogen dioxide in the formation of the Antarctic ozone hole, and the discovery of an 'ozone depression' over the Tibetan Plateau.

For the survival of human beings and the happiness of our descendants, environmental protection is humanity's unshirkable duty. The developed countries, having produced and

used a great amount of controlled substances in the past several decades, must comply with the rules of the Protocol, fulfill international obligations, make donations to the multi-lateral fund on time, and help developing countries participate in ozone layer protecting actions. China will make even more effort and more sacrifices in phasing out substances that deplete the ozone layer.

1. Introduction

Global ozone depletion, like global warming, is a common problem in the atmospheric community—the concern of people all over the world and many governments. Ozone is a kind of trace gases distributed mainly in the stratosphere. The ozone layer is the atmospheric layer in which ozone concentrations are relatively high, with their maxima appearing usually 22 to 27km above the ground. If all the ozone in the atmosphere could all be gathered to the ground, at a standard pressure of one atmosphere and 0℃, the globally averaged depth of ozone would be merely about 3 mm, i.e. 300 DU (Dobson Unit, 1 DU=10^{-3} atm-cm). Although the amount of ozone in the atmosphere is very small, it plays important roles in the ecological and atmospheric environment of the earth because of its great capacity to absorb solar ultraviolet radiation. More ultraviolet radiation reaches the ground when ozone is depleted, increasing the incidence of skin cancer and cataract, reducing immunity, impacting agricultural crops and damaging the plankton in the photic zone of the oceans. At the same time, Ozone Depleting Substances (ODS) are also greenhouse gases, contributing to the global warming indirectly.

Scientists discovered the declining trend of atmospheric ozone in the early 1970s. Great attention was paid to global ozone depletion and its influence by the atmospheric community, and many governments realized the gravity of the situation. The discovery of the Antarctic ozone hole deepened our knowledge and emphasized the urgency of protecting the ozone layer.

Japanese scientists first pointed out that, in recent years, Antarctic ozone had decreased in the early spring each year. In 1984, Chubachi reported that the minimum amount of total ozone at Syowa station (69°00′S, 39°35′E) in September and October in 1982 was very near to 200 DU, evidently lower than the values for the same period before 1981, and that the same phenomenon had been observed at the south pole (Amundsen-Scott, 90°S). In 1985, English scientists (Farman et al.) found that the total column ozone at Halley Bay (75°31′S, 26°44′E) was depleted by 30 to 40% in the Antarctic spring compared with 10 years before, and suggested that the depletion might be caused by ClO_X/NO_X produced by human activities. Soon afterwards, using satellite data, American scientists confirmed the seasonal decreases of the Antarctic ozone in springtime, and found a region of lower ozone content, 30 to 40% lower than pre-ozone-hole global mean. This region appeared after the dramatic decline of Antarctic spring ozone, which compared with the surrounding regions, looks like a hole formed by lower content of ozone over the Antarctic continent, i.e. the Antarctic ozone hole. The hole appeared in springtime from the late 1970s only seasonally, not all the year round. Antarctic ozone usually decreases from July or August and the Antarctic ozone hole appears between September and October, with its lowest value in the first ten days of October. Antarctic ozone then increases dramatically from the end of October, filling up the hole and recovering to the normal level in November or December. The region of ozone lower than 220 DU just began to appear over Antarctica in the spring of 1979. The area of the Antarctic ozone hole increases year by year. In the spring of 1987, the maximum area of the Antarctic ozone hole was 20 000 000 km^2, spreading almost over the whole of Antarctica, and a region of ozone lower than 125 DU appeared.

In 1988, the Antarctic ozone hole was moderate. After 1990, especially from 1992 through 1994, the Antarctic ozone hole became severe again, its maximum extent being up to 24 000 000 km^2. The area, intensity and duration were all larger than in 1987, and an extremely low value of 81 DU was observed. The Antarctic ozone hole in 1995 and 1996 was similar to that in the previous years in the timing of its appearance, maximum area, lowest value and duration; no new records were made in general. Summing up the situation with regard to the Antarctic ozone hole in the 1990s, it is noticeable that the Antarctic spring ozone hole which originally appeared over the non-inhabited land south of 60°S, had spread in a few years to the southern end of South America. An extremely low ozone level of 151 DU was observed at Ushuaia (54°48′S, 68°19′W). Ultraviolet radiation reaching the ground is enhanced dramatically by ozone depletion, and this may have ecological consequences still unknown today. In addition, from 1996 to the present, the Antarctic spring ozone in the polar vortex at a height of 14 to 21 km was severely (80 to 90%) depleted for 4 to 8 weeks from September to the end of October during 1980 to 1985. This situation lasted eight weeks in 1995 and seven weeks in 1996. Of course, ozone depletion does not happen all over the southern hemisphere. In the mid-latitudes of the southern hemisphere, especially in eastern Australia and New Zealand, ozone has maintained a high value of 350 to 450 DU.

The globally averaged column ozone has declined at the rate of about 3% per decade since the early 1970s. Evidence shows that the ozone layer over the northern hemisphere was also depleted in addition to the south polar region. For example, in the winter/spring seasons of 1991/1992 and 1992/1993, the monthly mean ozone was depleted by 10 to 25% in the north polar region, with 35% to 40% less than normal values at some special stations, not far above the level of the Antarctic ozone hole, just over 240 DU. So far, however, ozone content of less than 220 DU, i.e. an ozone hole, has not been found in the north polar area.

The international community has paid a lot of attention to protecting the ozone layer and the possible impact on human living conditions. In 1978, World Meteorological Organization suggested an impact of human activities on the ozone layer and the possible geophysical consequences. They pointed out that stratospheric ozone would be significantly depleted if releases of chlorofluorocarbons (CFCs) to the atmosphere were not reduced. In 1985, more than twenty countries sponsored a conference at which the depleting effect of pollutants like CFCs on the ozone layer was confirmed, and leading to the signing of the Vienna Convention. Subsequently, in 1987, Foreign Ministers from 30 countries signed the Montreal Protocol on Substances that Deplete the Ozone Layer. The Parties to the Protocol convened in Helsinki in 1989 and in London in 1990, and passed Amended Protocols, in which more CFCs and other halocarbons were covered in the phase-out schedule. Most of them were scheduled to be reduced by 50% by 1995, 85% by 1997 and 100% by 2000. The number of parties to the Protocol has increased to more than 60. A multi-lateral fund for the Montreal Protocol was established to assist developing countries to observe the transitional measures. Afterwards, the Copenhagen Amendment was approved in 1992. In 1995, the Parties to the Protocol convened again in Vienna to discuss further strengthening of the control on substances that deplete ozone.

Ozone layer protection was listed as an important content in the Climate Change Framework of UN in 1992. Since 1991, in order to disseminate information regarding the Antarctic ozone hole, and improve knowledge concerning protection of the ozone layer, WMO has issued the Antarctic Ozone Bulletin three or four times each month from August to December every year, through the Global Telecommunication System. Since 1995 various issues of the Antarctic Ozone Bulletin can be obtained through the Internet (http://www.wmo.ch/web/arep/ozbul*.html). The 1995 Nobel Prize for Chemistry was awarded to three atmospheric chemists who performed outstanding works on ozone layer protection.

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Biographical Sketches

Lu Longhua was born in December 1942, in Shanghai city, P. R. China. He is a Chinese national. He is presently Professor of Chinese Academy of Meteorological Sciences (CAMS), Director of Polar Meteorology Research Laboratory (PMRL), CAMS, and a member of the academic committee in CAMS. From 1960 to 1965 he attended at the Department of Meteorology, Nanjing Institute of Meteorology (NIM). From 1965 to 1979 he was Researcher at Academy of Meteorological Science ,State Meteorological Administration .

1979 to 1985:Lecturer in the Qinghai-Xizang Plateau Meteorology at Academy of Meteorological Science.

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