

CHAPTER - 1

Introduction

1.1 Chemical Identity of Ozone & Historical Background

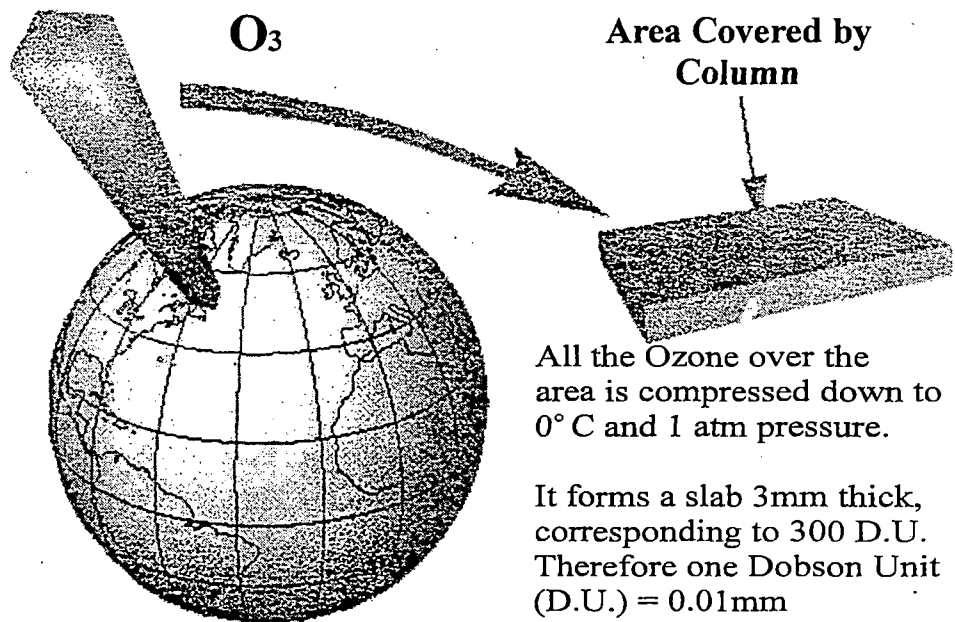
Atmospheric Ozone is a triatomic form of oxygen. Previously it was believed that Ozone is an isosceles triangle i.e., two sides equal and having three monatomic "O" atoms at its ends. But after 2nd world war it was understood that Ozone forms a triangle having a wide vertical angle of 116° . In the year 1880 it was discovered by W.N. Hartley that atmospheric Ozone absorbs solar ultra violet rays upto about 290nm wavelength, since then it has been known that the solar spectrum is cut off abruptly near 290nm., by the absorption of atmospheric Ozone. It was then believed that this atmospheric Ozone, absorbing solar UV radiation was distributed in the atmosphere which is near the earth surface. After that it was discovered, that the atmospheric Ozone which is responsible for absorption of solar U.V radiation is situated in the high altitude atmosphere. The first attempt to estimate the height of Ozone layer was made by R. J. Hon. Strutt in 1917. Later by improving the measurement technique F.W.P Gotz, A.R. Meetham and G.M.B. Dobson in 1934 showed that atmospheric Ozone is distributed at the height between 10 Km. to 50 Km. from the earth, with its centre of mass lying at about 25 Km. Soon it was confirmed by E. Renger and V.H. Renger using balloon experiments in 1934.

It is known now that the atmospheric Ozone resides in three regions. In troposphere little less than 10% of total Ozone content, in stratosphere little less than 90% of total Ozone content and in mesosphere exist very small quantity of Ozone. The Ozone in a column along these three regions of atmosphere is known as "Column Ozone" (see fig. 1.1.1,) and is measured in Dobson Units." 1 Dobson Unit (D.U.) is defined to be 0.01 mm thickness at standard temperature and pressure (S.T.P.). The thickness of Ozone layer reduced to S.T.P. is very small and varying from 1.5mm to 4.5mm, averaging 2.5mm. This thin Ozone layer acts as an atmospheric filter screen, which protects the abiotic and biotic environments of our planet, from the deleterious effects of solar U.V. radiation in the 200nm to 320nm.

(See Fig. - 1.1.2). [1nanometer(n.m) = 1×10^{-9} meter] wave length region, and maintain the ecological balance.

Column Ozone and Dobson Unit (D.U.)

Retrieved from nasa internet website
<http://jwocky.gsfc.nasa.gov/dobson.html>

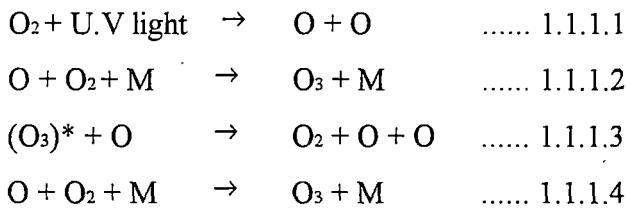


The fig shows ozone in a column covering an area 10 deg x 5 deg over labrador, Canada, along the three regions (Troposphere, Stratosphere and Mesosphere) of atmosphere, which is known as column ozone, and is measured in Dobson Unit (D.U.). One Dobson Unit (D.U.) is defined to be 0.01mm thickness at standard temperature and pressure (STP).

Fig. 1.1.1

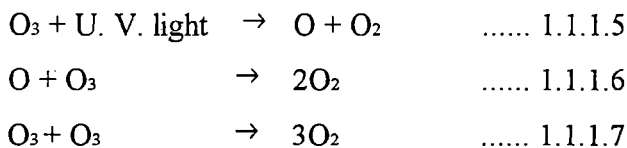
The solar ultraviolet (U.V.) wave length range $200\text{nm} < \lambda < 280\text{nm}$. known as the U.V.- C is very much lethal to the earths environment and it is totally absorbed by atmospheric Ozone. U.V. wave length between $280\text{nm} < \lambda < 320\text{nm}$, called U.V - B, which is absorbed partially by Ozone, is harmful to the terrestrial biotic and abiotic environment, the ultraviolet radiation with $\lambda > 320\text{nm}$ falls in the U.V - A region and is relatively harmless to biotic and abiotic environment and its absorption by Ozone layer is insignificant compared to other two wave length groups (See Fig. - 1.1.3).

Chapman (1930) established that the stratospheric Ozone is created by the Photodissociation of the diatomic oxygen (O_2) by the action of solar ultraviolet radiation (wave length $\lambda < 242\text{nm}$) at an altitude between 25 Km. and above. At the same time absorption of solar ultraviolet radiation upto about 320nm . converts the Ozone (O_3) to monatomic oxygen (O) and diatomic oxygen (O_2), according to the following reaction scheme

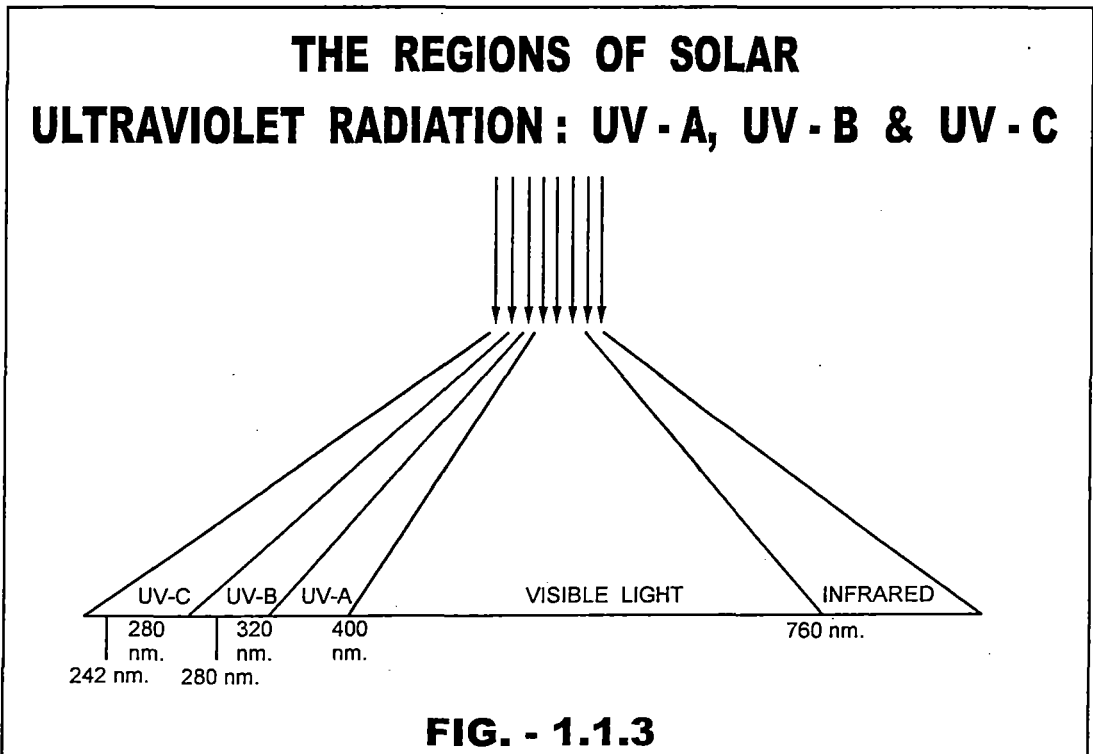
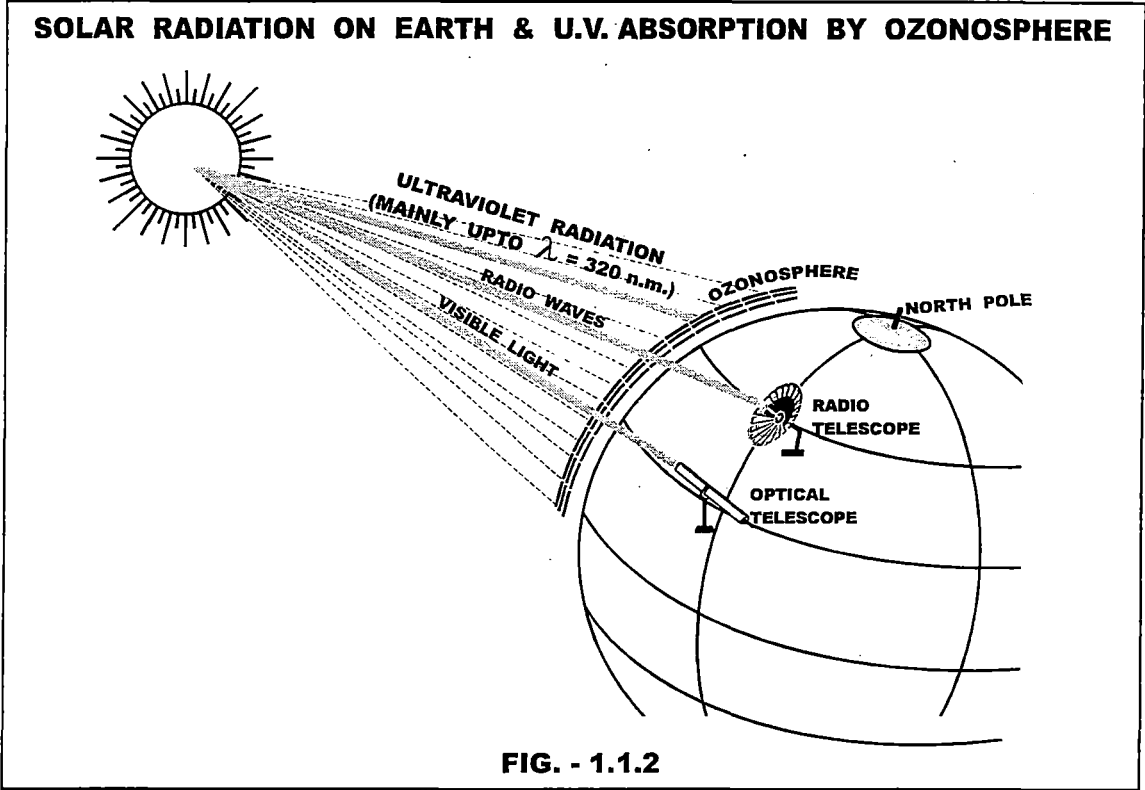


Where $(\text{O}_3)^*$ denotes excited state of Ozone and "M" represents a third body (O_2 or N_2 molecules) required for conservation of energy and momentum of the system.

Ozone absorbs ultraviolet radiation upto wave length $\lambda = 320 \text{ nm}$ which cause the Ozone molecule to break a part into an oxygen atom plus an oxygen molecule, according to the following reaction scheme.



Thus atmospheric Ozone is continuously being created in the stratospheres (mainly on the equatorial region) at the same time it is continuously being destroyed. The resultant

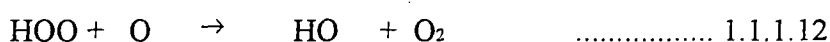
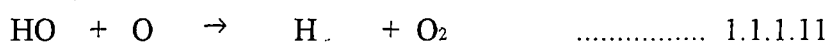
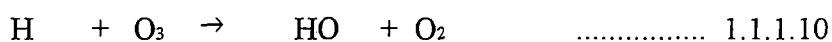
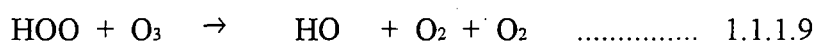
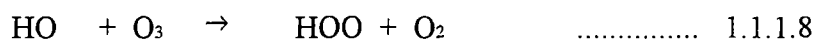


concentration of Ozone depends, at any time, on the rate of production and the rate of loss or destruction. The stratospheric Ozone thus produced in the equatorial region is carried by stratospheric wind towards north and south poles and produces a thin layer throughout the globe called Ozone layer which is also known as Ozonosphere. The distribution of Ozone in stratosphere changes daily, monthly, seasonally and yearly.

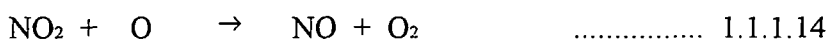
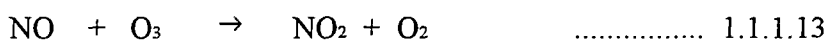
In the troposphere Ozone is a toxic constituent of photochemical smog and a highly reactive, poisonous form of oxygen having objectionable odour and can be detected easily. In the troposphere Ozone is created by the action of ultraviolet radiation with automobile and other exhaust fumes, Ozone also occurs in some industrial emissions.

In middle of 1960's new informations on atmospheric Ozone destruction process became available from the rocket - born experiments. However, David Bates and Marcel Nicolet (1950) proposed that water vapour can also destroy stratospheric Ozone, which occurs naturally in the stratosphere.

In presence of solar ultraviolet rays, water molecules split appart, gives a collections of hydrogen atoms (H), hydroxyl radicals (HO) and hydroperoxyl radicals (HOO) and collectively they are known as HO_x. These have the potential to destroy Ozone about 11% of total produced atmospheric Ozone by the following reactions.

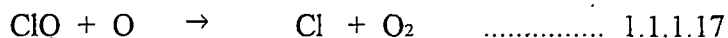
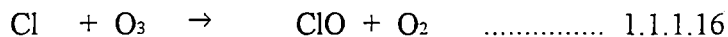


The other process of atmospheric ozone destruction are man made, in which the oxides of nitrogen plays significant role; According to crutzen (1970).

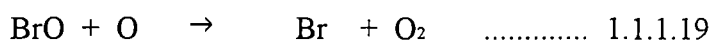
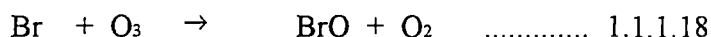


The other man made pollutant which can destroy stratospheric ozone are compounds of chlorine. The chlorofluorocarbons (CFCs) are the industrial compounds used in refrigeration, air-conditioning etc, which are one of the chief agent of atmospheric ozone destruction. CFCs remain undisturbed and inert in the lower atmosphere for decades and do rise several kilometers up to stratosphere, at altitude of 25 km. to 30 km., they release

the chlorine atoms in the presence of solar ultraviolet radiation. These chlorine atoms react with ozone and form "ClO" and "O₂". The "ClO" becomes part of a chain reaction. As a result of this chain reaction, a single chlorine atom can destroy more than 100000 molecules of ozone, according to Rowland and Molina (1974).



Methyl Bromide is the another man made pollutant which has been estimated 50 times more efficient than chlorine to destroy atmospheric ozone (WMO. 1994). The sources are soil fumigation (used for disinfection of soil), biomass, burning, also it occurs in the exhaust of automobiles using leaded gasoline. According to McElroy (1986) -



Therefore the existing evidence suggest that there are mainly two kinds of ozone destruction process in atmosphere, of which the first one is due to natural phenomena, where solar ultraviolet radiation is creator at the same time destroyer. The atmospheric ozone destruction by stratospheric water vapour also falls in the natural phenomena group. The second one is due to man made pollutants (NO_x, ClO_x, BrO_x etc.). But sofar it could not be determined that what part of the total atmospheric ozone is destroyed by natural phenomena and what part is destroyed by man made pollutants.

1.2 Discovery of ozone depletion

Discovery of further thinning of atmospheric ozone layer (known as ozone depletion) which protect earth's environment from the harmful solar ultraviolet radiation (mainly wave length between 280 nm. to 320 nm.) was first reported by Farman. et.al. (1985). They found that the spring values of ozone concentration over Antarctica (south pole) decreases with years from 1957 to 1984. The observations were made at British Antarctic survey station, Halleybay (73.5° S, 26.7° E) by ground-based spectrometer during the above mentioned period. Later this report was confirmed by different investigators and it was shown that the atmospheric ozone depletion is extended over whole of Antarctica.

1.3 Survey of Literature

From an extensive survey of Literatures it has been observed that intensive investigation on apparent cause and impact of ozone depletion have been made by different

researchers through out the world.

Anderson. et.al (1989), Abbatt. et.al (1993), Aronold. et.al. (1992), Atkinson. et.al. (1997), Avallone. et.al (1996), Angell. (1986), (1988a), (1988b), (1989), Angell. et.al. (1973), (1976), (1983), Appenzeller. et.al. (2000) Austin (1995), (1997), Bakers. et.al. (1982), Bates. D.R. et.al. (1950), Bates. J.R (1981), Barrie. et.al (1988), Benson. et.al. (1965), Benedic. (1991), Bharatia. et.al. (1981), (1984), Biglow. et.al. (1998), Bintaja. et.al. (1997), Bisset. et.al. (1989), Bojkov. (1992), (1995), (1998a), Booth. et.al. (1994), Brasseur. et.al. (1997), Breigleb. et.al. (1986), Bruhl. et.al. (2000), Callis. et.al. (1997), Chapman. (1930), Chameides. et.al. (1973), Cicerone. et.al (1974), Cox. et.al. (1988), Coy. et.al. (1997), Calkins. (1976), COMESA (1975), Crutzen. et.al. (1970), (1971), (1974), (1974), (1986), (1995), (1995), Cullen. et.al. (1994), (1997), Dessler. et.al. (1993), (1995), (1996a), (1996b), (1998), Deluisi. et.al. (1977), (1979), (1979a), (1979b), Dahlback and Moan (1990) , Diffey et.al. (1982), (1991), Douglass. et.al. (1997), Dorn et.al. (1971), Emmett. et.al (1973), EPA (1998), Elwood. et.al (1990), Evans. et.al (1988), Farman. et.al. (1985), (1987), Finsen. (1901a), (1901b), Fioletov et.al. (1998a), Forster (1997), Fishman. et.al. (1978), Fourtainer. et.al. (1989), Froidevaux. et.al. (1994), Gardiner (1988), Ghosh. et.al. (1994), Grainer. et.al. (1992), Gille. et.al (1984), Hader (1997), Hansen. et.al. (1999), Harrison. et.al. (1970), Hausen et.al. (1997a), Heath. et.al. (1977), (1985), (1986), Harris. et.al. (1986), Hilsenrath. et.al. (1992), Hofmann. et.al (1987), (1991), (1993), (1994), (1997), Held (1993), Houghton (1986), Hausmann (1994), Hood. et.al. (1991), (1992), (1997), Ilyas (1986), I.A.R.C. (1992), Johnston (1971), (1973), (1992), Jackman et.al. (1986), (1996), Komhyr et.al (1980), (1982), (1986), (1988), (1994), (1997), Kerr (1992a), (1992b), Kligman. et.al. (1986), Knudsen. et.al. (1998), Krotkov. et.al. (1998), Larko. et.al. (1982), Last (1993), Ley. et.al. (1989), Lacis e.tal. (1974), (1990), Lelieveld. et.al. (1990), Leyden (1990), Logan (1994), Lubin. et.al. (1998), Manney. et.al (1994), (1995) (1996a) (1996b), (1997), Mackay et.al (1997), Malloy. et.al. (1997), McCormick et.al (1992), Miller (1982) (1994), Molina & Rowland (1974), McElroy (1986), (1989), (1999), Mecherikunnel (1994), Meier (1991), Michelsen. et.al. (1994), Minchwaner. et.al. (1993), Muller. et.al. (1996), (1997), Murphy (1991), Midya. et.al. (1996), (1997), Myhre. et.al. (1998a) Molnar et.al. (1994), NAS (1975), Norrish & Wayne (1965), Nikula. et.al. (1992), Paltridge. et.al. (1978), Pan. et.al. (1997), Peicai. et.al. (2000), Plumb. et.al. (1998), Pommereau (1988), Pitts. et.al (1971), Ramanathan. et.al. (1979), Ramaswamy (1992), Randel. et.al. (1998), Reids (2000), Reinsel. et.al. (1994), Rex. et.al. (1998), Robertson (1972), (1975), Robert. et.al. (1997), Rockmann. et.al. (1999),

et.al. (1956), Rigel. et.al. (1987), Setlow (1974), Schoeberl. et.al. (1986),(1990), (1996), Schwarzkopf. et.al. (1993), Siskind. et.al. (1995), Sirosis. et.al. (1999), Slinger. et.al. (1988), Smith (1989), Smith. et.al. (1980), Sliney (1987), Staehelin. et.al. (1998a), (1998b), SPARC (1998), Summers. et.al. (1990), Shen. et.al. (1995), Shine. et.al. (1998), Stolarski. et.al. (1974), (1986), (1991), Schothorst. et.al. (1987), Scotto. et.al. (1981), Solomon. et.al. (1986), (1990), (1998), Taylor. et.al. (1988) (1989), Tevini & Teramura (1989), Tie. et.al. (1997), Tucker. et.al. (1985), Toon. et.al. (1995), Uchino. et.al. (1998), UNEP (1991), (1997), (1998), Urbach. et.al. (1969), USEPA (1997), Vanderleun. et.al. (1993), (1995), Wardle. et.al. (1997), WMO (1981), (1985), (1988), (1992), (1994), (1998), (1999), Worrest (1986), (1997), Wang. et.al. (1980), (1983), Watts. et.al. (1990), Williamson (1995), Winner. et.al. (1999), Young (1990), Zander.etal. (1992), Zurek. et.al. (1996).

The data available from Nimbus 7 satellite of NASA was analysed by stolarski et.al. (1986) and found that the spring value of minimum ozone is not localised at a particular place but it changes its position and shape from day to day.

A balloon-brone experiment was performed by Hofmann et.al. (1986) and found a loss of 35% of total ozone.

Komhyr et.al. (1988) observed a loss of 40% of atmospheric ozone from his experiment by spectrometer. Gardiner (1988) found that the period of maximum ozone loss in Antarctica is during late winter to spring.

It is interesting to note that Schoeberl and Krueger (1986) found there was no clear link between ozone depletion and man-made pollutant and also spring ozone concentration in Antarctica is declining year after year.

Solmon et.al. (1986) found ozone concentration is low during August to October, i.e. Antarctic Late winter to spring.

The ozone observations in the Arctic region (Northern polar region) were first made by prof. Dobson of oxford university during 1926 to 1929 at Abisko (68°N), Lerwick (60°N), Spitzbergen (78°N), but the systematic ozone observation were started in July, 1935 by Dr. Kaare Langlo who later become Deputy Secretary of World Meteorological Organisation (W.M.O.), Geneva. (W.M.O. Bull No. 41. 1992).

In 1988, it was reported by NASA / Ozone trend scientists, a loss of 5% atmospheric ozone level in Northern hemisphere during 1957 to 1986. Similar ozone destruction was also confirmed (particularly in winter-spring season) by satellite measurements. (W.M.O. Bull. No. 41. 1992).

Later ozone loss in Arctic region (North Pole) has been reported by various researchers (Schoeberl, et.al. 1990, Froidevux et.al. 1994, Zurek et.al. 1996, Manney et.al. 1996, Dessler. et.al. 1998 and others).

Many researchers have investigated for both the polar region about the polar vortex (Anderson. et.al. 1989, Barrie. et.al. 1988, Crutzen. et.al. 1986, Dessler. et.al. 1998, Hansen. et.al. 1999, Manney. et.al. 1996a, Muller. et.al. 1996), the stratospheric wind pattern (Deluisi et.al. 1977, 1979b, Manney. et.al. 1994, Schoeberl et.al 1990), the temperature (Benson. et.al. 1965, Toon et.al. 1995, WMO. Bull. 41. 1992, Ghosh and Midya, 1994 Dessler et.al. 1998 and also about the ozone destroying pollutants (Arnold et.al. 1992, Avallone et.al. 1996, Austine. et.al. 1995, Crutzen 1970, 1974, Cicerone et.al. 1974, Cox. et.al. 1988, Vondergathen. et.al. 1995, Mc elroy et.al. 1999, Rockmann. et.al. 1999). They observed some similarity of phenomena in both Arctic and Antarctic regions. But there were also some differences between the two regions so far the causes of ozone depletion mechanisms. However a greater ozone loss has been expected due to increase of man-made pollutants (CLO_x, NO_x, BrO_x etc.) in the stratosphere of subpolar latitudes (WMO Bull 41, 1992).

In Antarctica a large ozone loss, about 60 to 70% in total column ozone has been recorded (Hofmann et.al. 1994) and designated as "ozone hole". On the other hand in Arctica the ozone loss is about 10 to 15% in total column ozone (Froidevaux et.al 1994), which is much less compared to Antarctica. Therefore ozone hole (when the loss is greater than 50% of total column ozone) has not yet been formed in Arctica. Dessler et.al. (1998) suggested two reasons for this disagreement between two polar regions. (i) The temperature of the polar stratospheric coloud" is not sufficiently cold in Arctica to create ideal conditions to precipitate the pollutant particles in the stratosphere which have the potential to deplete large amount of ozone molecules, which occurs in case of Antarctica. (ii) The duration of "Polar vortex" in Arctica is shorter compared to Antarctica. This "Polar vortex" have the potential to keep the region isolated from the lower latitude ozone rich air.

Though the "Ozone hole" has not yet been formed in Arctica, still evidence shows that the ozone hole chemistry is destroying a significant amount of atmospheric ozone in Northern hemisphere (WMO. 1994).

Schoeberl. et.al. (1990) made an important observation that "A deficit of atmospheric ozone could occur even in the absence of chemical loss, due to ozone poor air transportation from the middle latitude to the poles in Arctic region".

But Manney et.al. (1995a) found the pollutants are responsible for ozone loss in Antarctica, also author found that the effect of transport of ozone poor air from the lower latitude to pole is negligible due to the strong polar vortex.

There are some discrepancies also in the ultraviolet flux measurement; The U.V. measurement made by Scotto et.al. (1988) from the mid-latitude Robertson-Berger (R.B.) meter found a down ward trend in the ultraviolet radiation from 1974 to 1985. But Watson et.al. (1988) shown an increasing trend in the U.V. irradiance. The results of both the findings contradict each other.

Meier et.al. (1997) explained this discrepancies that other than ozone depletion some more environmental factors may be affecting this U.V. penetration and suggested that (1) increased absorption of U.V. radiation in the troposphere may be due to enhanced abundance of absorbing gases. (2) Due to industrial revolution in the developed countries of northern hemisphere may lead to increase of anthropogenic pollution, resulting in the decrease of the U.V. penetration by 5 to 18% (Liu et.al. 1991). (3) The decrease in stratospheric ozone and increase in tropospheric ozone may lead to a decrease (rather than increase) in U.V. penetration (Bruhl and Crutzen 1989).

On the other hand Tasy and Stamnes (1992) shows that a decrease in U.V. penetration is expected due to high solar elevations, while for low solar elevation, an increase in U.V. penetration may occur.

Now obviously the question arise that why the environmental scientists are so much worried about atmospheric ozone depletion and increased U.V. penetration. The answer in single sentence is - as a consequence of atmospheric ozone depletion the increased dosage of solar U.V. radiation are severe and deadly on the earth's environment.

The global ozone assessment has shown that ozone is declining everywhere throughout the world (WMO report No 25, 1991 and WMO bull. No 41, 1992). Decrease in atmospheric ozone concentration allows enhanced solar U.V. radiation (mainly UV-B, wave length range, between 280 n.m. to 320 n.m.) which is very much harmful to the earth's environment as well as ecosystem. As a result of ozone depletion, the enhanced dosage of U.V radiation can affect severely : Plants and Crops (Tevini and Teramura, 1989 and other.), aquatic life (smith. et.al. 1980, Bakers and Smith 1982, Worrest 1986, Smith 1989 and others), human and animals (Dorn. et.al. 1971, Emmet et.al. 1973, Vanderleun et.al. 1993, Ley et.al. (1989, Nikula et.al. 1992 and others). It can also affect the climatic condition of the

earth (Bates, J.R. 1981, Stolarski et.al. 1991, Mc Cormic et.al. 1992, Logan 1994 and Mackay et.al. 1997 and other). Which may cause global warming and may influence ocean current. This may alter the distribution of rainfall, weather disturbances. The other effect of global warming is the rise in sea level caused by melting of ice and thermal expansion of sea water mass, which may submerge many coastal areas and disturb their ecosystems. As a result of global warming, the temperature of the cities will rise, which may increase the heat related illness (Last. 1993).

Many investigators worked on the relation between solar activity and Global ozone change. Observational evidence shows an upward trend in solar U.V radiation with increase in sunspot number (Heath and Thekaekara 1977, Gille, et.al. 1984, Heath and Schlesinger. 1985 and others). A number of investigators had used the sunspot number as the proxy of solar ultraviolet in absence of long period U.V. data and performed many mathematical models and found Global total ozone expected to be approximately in phase with sunspot number (Callis and Nealy 1978, Penner and Chang. 1978, Penner and Chang 1980, Brasseur and Simon 1981, Natarajan et.al. 1981, Brasseur and Solomon 1984, Garcia et.al. 1984).

Since early 60's many works had been reported on relation between atmospheric ozone concentration and sunspot number (willet 1962, London and haurwitz 1963, willet and prohaska 1965, Berson and Kulkarni 1968, Dutsch 1969, Paetzold et.al. 1972, Angell and Korshover 1973, Christie 1973, London and Oltmans 1973, Paetzold 1973, Angell and Korshover 1976, Pittock 1978, Dutsch 1979, London and Reber 1979, Keating 1981.)

The paper presented by Angell and Korshover (1976) suggested that the ozone loss between 1970 and 1974 is due to the solar minimum particularly due to lower sunspot number and not due to the anthropogenic effects. Also they claimed that the upward ozone trend in 1976-1977 is due to the increased sunspot number. Angell (1988a) shows that the Global ozone variation during 1975 and 1987 is due to variation in sunspot number. Also another statistical model suggested a high positive correlation between global ozone and sunspot number (Angell 1989).

However Global ozone assessment by world Meteorological organisation (WMO) has shown that atmospheric ozone is declining every where throughout the world mainly due to anthropogenic effect and transportation (WMO. 1991, WMO 1992). It was confirmed by many investigators (Schoeberl et.al. 1990, Stolarski et.al. 1991, Manney et.al. 1994, Manney et.al. 1995a Zurek et.al. 1996, Midya et.al. 1996, Lipson et.al. 1997, Dessler et.al. 1998. WMO 1999.)

Midya et.al. (1996) shows in their analysis on Antarctic ozone depletion, that correlation coefficients between ozone concentration and solar ultraviolet radiation are highly positive and mainly controlled by their October values. They concluded that the solar ultraviolet radiation is not responsible for Antarctic ozone depletion.

Various investigators presented different findings about this dreaded global aspect of atmospheric ozone depletion, but no specific conclusions about the causes are obtained although most of them are aware and agree about the consequences.

1.4 Aims and Object of Work

“Environmental Engineering” is a subject under Civil Engineering Branch, which deals with the various Environmental Problems and hazards, viz. soil pollution and control, and treatment, water pollution, air pollution and control. Identification and treatment of wastes and sewage, Identification and safe disposal of Hazardous substances and risk analysis, Global atmospheric and climatic change and control, Atmospheric Ozone depletion, its impact on environment and control etc. “Public health Engineering” is a part of Environmental Engineering which deals with the causes and effects of environmental pollution and its impact on public health and its control.

The whole world is developing rapidly, with this progress the new environmental challenges are coming in front of the Environmental Engineers. The new pollutants are less visible in nature and are more global in spread, having longer response time, viz. radon, CO₂, CFCs, oxides of nitrogen, compounds of bromine etc. are not visible but silently they are creating many problems to the public health and as a whole on the environment. Many environmental problems have been encountered by the environmental Scientists and Engineers with some success for the last few decades. But after the discovery of atmospheric ozone depletion and its impact on earth’s environment, it has become one of the most vital challenge to the Scientists and Engineers. Now they have to think more critically on every existing and coming environmental problems with a new look. For example - In the past days the Scientists and Engineers were worried about the automobile and industrial emissions on the air quality of the places where man live. Now in addition they must consider the impact of those exhausts on the climate and on the atmospheric ozone layer, of the entire planet.

If the present trend of ozone depletion continues, then with in the middle of current century the situation may become most dreaded and deadly. This question of survival has

compelled the environmental Scientists and Engineers to work more on this dreaded global problem. The Scientists and Engineers of - United States Environmental Protection Agency (USEPA), United Nations Environmental Programme (UNEP), WMO, NASA, NOAA and others are already in work on this issue. The Scientists and Engineers of third world countries, particularly the countries near equator and tropics need be urged to get themselves involved in this global issue.

From the survey of literatures it has been observed that many investigation on ozone depletion and its apparent causes have been made by different researchers with some success but till now, the problem is only partially understood and requires further analysis of the available observed data. For better understanding of the problem and the effect of ozone depletion on earth's environment, a longterm study and observation is needed. So more continuous study on this heterogeneous problem is needed.

From the existing theory it is known that solar ultraviolet radiation is responsible for atmospheric ozone formation as well as ozone destruction, some evidence suggests that it is also destroyed by man made pollutants. To investigate the cause of atmospheric ozone depletion, attempt has been made to study whether the creator is the killer, i.e whether the solar radiation itself is responsible for this ozone depletion.

In the present dissertation, works are intended to investigate on available information on ozone concentration variation of different stations in different latitudes in Antarctica (South pole), Arctica (North pole), The stations in Middle Latitude of both the hemispheres, Tropical region particularly at DumDum (West Bengal, India) with solar parameters which may be responsible for atmospheric ozone depletion.

The ozonelayer thickness is significantly small near tropics, obviously the solar U.V. penetration thus maximum throughout the year. Infact this high dosage of deleterious solar U.V. radiation may have the potential to influence human and animal health (Such as cataract, viral infections, damage of natural immune system, skin cancer, sunburn, photo ageing of skin etc.). Also it can influence climatic condition (such as rainfall distribution pattern may change, warm climate may lead to heat related illness etc.). Moreover the mass population is poor, do not have proper education and awarness of the harmful solar U.V. related damages, even do not have sufficient food and adequate clothing, most of them are outdoor workers. The air temperature and humidity are high throughout the year, in addition the high dosage of deleterious solar U.V. radiation may lead to severe biological damage.

Though there is a lack of observational data still an attempt has been made to work on this region.

An analysis on impact of ozone variation on environment at Jalpaiguri has been performed with the meteorological parameters. Further in absence of long period ozone data an attempt has been made to derive mathematically the long period O₃ data at Jalpaiguri to study its variation since 1979, and perhaps this is first attempt to work on atmospheric ozone concentration variation and its impact on environment in subhimalayan region at "Jalpaiguri".

A study has been made about the man-made pollutants (chemicals), natural phenomena and transporatation of ozone by stratospheric wind to investigate their role in atmospheric ozone depletion. And also at the sametime its effects on abiotic and biotic environments are scrutinised from the available published standard experimental data.

The ozone and soalr data for analysis are obtained from globally carried out satellite experiments, balloon-borne experiments, ground based observations and published in Geophysical Data Book. NOAA. Dept. of Commerce USA, and as recorded in different International Journals, Internet Websites, which are mentioned in the respective chapters. The meteorological data are obtained from meteorology office, Jalpaiguri, Govt. of India.

The analysis of the problems are based on statistical calculation supported by logic and graphical representation. The computed results have been discussed and compared with available published results from which conclusions have been drawn.

1.5 Data source and instrumentation of ozone concentration, solar and meteorological parameters.

OZONE DATA

The Total Ozone Mapping Spectrometer (TOMS) Program started by NASA / Goddar space flight center, USA on 24th October 1978 with the launch of TOMS flight on the NIMBUS-7 space craft. Till now the TOMS instrument have been flown on four space craft :- NIMBUS - 7 : Presented data from November'78 to May'94, METEOR 3 : Presented data from August'91 to Decembewr'94. ADEOS : Presented data from September'96 to June'97 and EARTH PROBE : Presents data from July'97 to till date. These satellite ozone data presents a set of data for more than 20 years. With a gap of one and half years 95/96

found in the data set as the instrument could not provide data from December 1994 to June 1996.

All the data have been processed by McPeters and Labow (1996) and compared with available ground based measurement data and found that the TOMS ozone values are within 1% to 2%.

From the "TOMS" overpass files it is also possible to get ozone data for any other location, at the 1 degree latitude by 1.25 degree longitude resolution of the gridded ozone data.

The other ozone data source is the "World ozone and ultraviolet radiation data center" (WOUDC) which are ground stations data. Previously known as "Ozone data for the world", often known as the "Red Books", Published bimonthly in Downsview, Canada by the Atmospheric Environment service, Department of the Environment, in co-operation with the world Meteorological organisation (WMO). Geneva Switzerland. This ground based stations measure ozone data by the instrument known as "DOBSON SPECTROMETER" which is named after G.M.B. Dobson, one of the first and famous Scientists to investigate atmospheric ozone (1920-1960). Dobson spectrometer is the invention of him, it is the standard instrument used to measure atmospheric ozone from the ground.

The satellite based ozone data as well as the ground based ozone data may also be obtained from the NASA website <http://jwocky.gsfc.nasa.gov> and the WOUDC website www.tor.ec.gc.ca/woudc respectively.

The ozone data are measured in Dobson Unit (D.U.). The ozone in a column along the three regions (Mesosphere, Stratosphere, Troposphere) of atmosphere is known as column ozone. If all the ozone in this column were to be compressed to standard temperature and pressure i.e S.T.P. (0°C and 1 atmosphere pressure) and spread out evenly over the area, it would form a thin slab and is measured in Dobson units. Thus one Dobson Unit is defined to be 0.01 mm. thickness at S.T.P.

SOLAR DATA

The solar ultraviolet flux, which is the core to wing ratio of Mg ii h & k lines was measured from the "Solar Back Scatter Ultraviolet spectral scan of Nimbus-7 satellite" in arbitrary unit. The data are available from November '78 to October '84 and can be obtained from "Solar Geophysical Data comp. reports. October 1989. No 542-Part - II" Published by Department of Commerce. USA.

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The solar 10.7 cm. radio flux data are the measured data of the “Radio observatory” ottawa and Alogoquin in “Solar flux unit” (sfu).

$$\text{One sfu} = 10^{-22} \text{ W M}^{-2} \text{ Hz}^{-1} \text{ (} 10^{-22} \text{ watt per squm per harz).}$$

The radio flux data can be available from “Solar Geophysical Data Book” published by dept of commerce. USA. Also available at National Oceanic Atmospheric Administration (NOAA) web site : ftp://ftp.ngdc.noaa.gov/STP/SOLAR_DATA.

The daily sunspot number are obtained from the US National oceanic and Atmospheric Adminstration’s (NOAA) space Environment Laboratory in Boulder, colorado and are published in the NOAA bulletin of solar activity, Solar-Geophysical Data and other publications, also available in NOAA internet website ftp://ftp.ngdc.noaa.gov/STP/SOLAR_DATA/SUNSPOT_NUMBERS

The sunspots are the region of solar photosphere, where temperature are relatively low than their surroundings, when viewed in white light they appear dark. The sizes of individual sunspot vary from 300 km to 100000 km which are much greater than earth’s diameter (12740 km). The numbers of sunspot varies with the sunspot cycle. The average length between sunspot maxima is 11.1 years, but varies in individual cases between 8 to 15 years. As per “World Data center for Solar Terrestrial Physics NOAA” the recent maxima occured in the years 1957, 1968, 1979 and 1989, they are designated as cycles 19,20,21 and 22 respectively (See Fig. - 1.5.1).

Meteorological DATA

The daily maximum and minimum temperature are measured in deg. centigrade by the instrument known as “Stevenson’s screen” which consists of four thermometer.

Maximum thermometer works with a mercury column and the days maximum temperature measurement done at 5.30 pm.

Minimum thermometer works with an alcohol column and the days minimum temperature measurement done at 8.30 am. Drybulb thermometer works with mercury column and it deals with the temperature in sorrounding air.

Wet bulb thermometer works with mercury column and it deals with the relative humidity.

**MONTHLY SUNSPOT NUMBERS FROM JANUARY 1900 TO DECEMBER 1998.
(OBTAINED FROM WORLD DATA CENTER FOR SOLAR TERRESTRIAL PHYSICS, NOAA)**

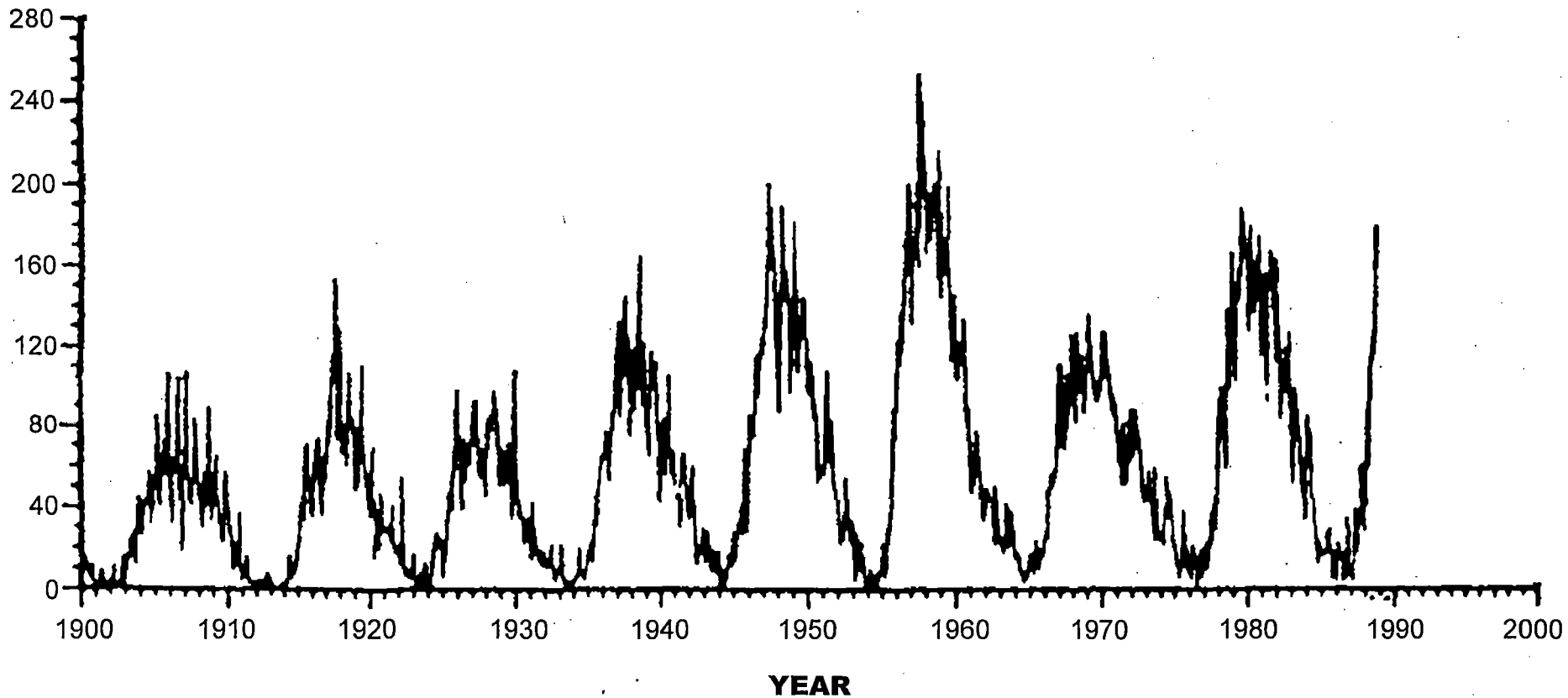


FIG. - 1.5.1

The Stevenson's screen consists of a white wooden box, whose four sides are louvered to allow free entry of air. It is placed on a stand about 1.25 meter above the ground level. The screen is designed in such a way that the shade temperature of the air can be measured. For this the roof is made of double boarding, with an intervening air space to prevent the sun's heat from reaching the inside of the screen. The floor of the screen is also louvered. One side of the box is hinged and it acts as a door. Which can be opened and closed freely for giving access to the instruments inside the box. The box is painted outside white in order to improve the insulation further.

Measurement of rainfall is done by means of an instrument known as ordinary rain gauge. It consists of a metal cylinder, on the top of which a funnel, with antispash lips. This funnel is 159.6 mm in diameter and leads into a smaller metal jar kept inside the metal cylinder. When rain falls in the funnel, it trickles into the jar below. At the end of 24 hours, the rain water is emptied into a special type of graduated cylinder for measurement. The unit of rainfall measurement is "milimeter".

The amount of precipitation collected in a raingauge depends to a considerable extent on its exposure and great care must be exercised in selecting the suitable site. The rain gauge should be set on a level ground away from trees, buildings and other obstructions and not upon a slope or terrace.

In any case the distance between the rain gauge and the nearest object should not be less than twice the height of the object above the rim of gauge.

The raingauge should be fixed on a masonry or concrete foundation 60cm x 60cm x 60cm sunk in to the ground. The base of the gauge should be embedded in the foundation, so that the rim of gauge is exactly 30cm. above the surrounding ground level. This height is necessary to prevent more than a negligible amount of rain splashing into the gauge from the surrounding ground.

These informations about instruments, and the meteorological data of Jalpaiguri (West Bengal, India) has been obtained from the Director. Meteorology office, Jalpaiguri.

1.6 DATA :

The tables on the next several pages present the DATA, used for the work. Which were obtained from the sources as mentioned above also mentioned in the respective chapters where they have been used for further analysis.

DAILY OZONE DATA (NIMBUS - 7 TOMS) Stn : HALLEYBAY
YEAR - 1979

DAY	JAN	FEB	MAR	APR	AUG	SEP	OCT	NOV	DEC
1	322.7	296.5	288.7	304.8		247.4	266.9	325.6	349.1
2	345.8	300.8	294.5	310.3		231.1	259.0	296.9	363.4
3	352.9	308.1	310.9	323.9		257.3	261.8	287.8	377.8
4		291.1	315.6	316.0		251.3	268.3	293.9	376.3
5	346.5	316.7		320.8		245.5		288.6	369.4
6	330.1	324.9	285.5	303.7		256.4		303.0	360.1
7	337.3	313.0	285.5	313.9		284.5	288.3	313.9	359.7
8		319.6	294.7	277.5		272.5	282.7	320.8	360.6
9	309.1			254.9		268.6	293.4	327.6	362.9
10	300.5	308.9	317.0	267.4		281.4	301.5	317.1	368.7
11	298.0	304.0	306.8	300.4		255.5	331.7	299.2	361.6
12	325.2	289.7	306.5	313.0		293.3	318.2	295.8	347.0
13	315.8		304.0	311.2		304.0	294.9	290.2	363.3
14	310.3	277.4	315.6			295.8	294.7	292.7	374.5
15	301.3	272.6	302.7	288.8		274.5	291.5	293.1	374.4
16		280.8	315.9	288.8		245.1	296.6	302.1	388.1
17	304.8	276.7		313.8		260.4	293.4	304.3	368.0
18	322.7	274.0	284.5	283.2		234.2	291.8	333.3	368.5
19	310.3	275.2	304.9	270.2	323.1	264.5	298.5	321.2	361.5
20		287.3	289.5	302.1	314.0	274.5	294.3	355.2	358.1
21	259.3			277.7	298.0	270.1	308.6	390.9	355.1
22	284.9	273.3	317.5		293.0	260.7	311.4	387.7	
23	294.9	288.4	282.8	265.2	287.2	274.8	303.2	402.8	341.9
24	291.5	294.5	273.7	278.7	312.6	286.5	298.0	383.7	348.2
25	298.0	276.4	254.4	267.9	290.8	263.9	299.0	404.3	340.1
26	300.4	281.5	253.3		264.9	265.2	281.9	369.5	345.6
27	288.6	287.1	287.6		268.4	259.8	286.8	373.4	350.3
28	295.4	296.6	275.2		275.3	265.6	329.9	376.2	338.9
29	305.9				289.2	259.1	323.2	375.4	343.9
30	298.8		316.6		280.4	263.8	330.3	360.7	337.9
31	307.9		296.4		250.5		319.9		336.8

Note : Daily O₃ data at Halleybay are not recorded at source from 26.4.79 to 18.8.79

OZONE DATA (NIMBUS - 7 TOMS) Stn : HALLEYBAY
YEAR - 1980

DAY	JAN	FEB	MAR	APR	AUG	SEP	OCT	NOV	DEC
1	340.1	316.3	301.7	318.0		286.4	248.1	256.9	370.1
2	325.2	324.2	305.7	309.2		241.6	237.3	256.3	376.8
3	324.1	314.0	300.9	273.2		278.1	247.9	255.3	378.1
4	320.9	309.0	298.9	294.8		307.8	258.0	281.5	383.9
5	321.0	301.8	291.7	286.8		286.9	227.2	280.9	397.2
6	324.0	311.1	275.9	298.3		271.0	226.4	270.8	399.5
7	325.8	300.0	287.6	315.8		267.4	230.0	300.1	384.4
8	321.8	308.9	294.9	294.9		277.3	244.4	286.1	386.0
9	338.6	308.3	330.5	304.8		249.6	268.0	275.2	358.3
10	327.5	312.8	327.0	290.1		244.6	261.4	262.8	355.5
11	334.6	313.5	328.9	276.7		254.1	277.0	293.1	370.7
12	334.6	299.5	325.3	291.9		265.6	274.2	292.0	364.9
13	349.6	284.1	323.3	273.5		262.6	252.8	280.3	339.7
14	335.0	297.8	317.6	283.8		266.0	255.1	278.2	345.3
15	342.0	292.5	310.9	297.7		258.2	259.9	285.0	349.8
16	359.1	302.9	308.0	299.2		250.2	269.4	317.3	347.8
17	357.3	313.7	314.5	302.6		248.7	246.0	309.8	331.2
18	350.1	302.8	314.7	288.1	306.9	257.7	245.2	309.4	332.8
19	360.5	289.3	312.1	305.1	284.9	258.0	246.8	322.0	343.8
20	361.4	281.6		315.2	275.7	249.3	245.6	306.9	348.3
21	361.1	295.6	313.1	303.9	286.2	255.9	239.1	298.8	358.5
22	362.7	299.7	320.4	317.7	288.4	259.6	241.8	306.3	356.0
23	333.7	300.0	302.9	305.3	302.9	235.2	223.4	342.4	360.8
24	334.9	295.6	283.6		298.8	268.6	248.5	373.7	362.1
25	338.0	287.9	278.8		283.6	289.9	244.5	406.4	364.7
26	337.2	289.9	286.7		285.0	281.1	239.3	420.3	356.5
27	337.0	289.3	275.4		300.2	250.9	234.3	403.1	354.0
28	320.3	291.6	281.6		279.7	243.2	241.6	416.3	339.1
29	349.6	298.6	303.6		285.3	239.8	268.4	411.0	330.0
30	336.3		318.6		279.0	231.6	277.5	384.7	341.6
31	327.0		313.0		270.2		274.6		328.3

Note : Daily O₃ data at Halleybay are not recorded at source from 24.4.80 to 17.8.80

DAILY OZONE DATA (NIMBUS - 7 TOMS) Stn : HALLEYBAY
YEAR - 1981

DAY	JAN	FEB	MAR	APR	AUG	SEP	OCT	NOV	DEC
1	306.1	298.4	278.9	295.7		324.0	273.2	263.2	356.0
2	301.5	302.4	269.3	270.8		307.6	254.4	263.1	357.7
3	313.3	301.3	280.4	265.3		272.4	268.8	252.8	356.2
4	320.5	297.3	269.9	272.8		275.5	262.7	246.1	377.9
5	319.6	296.8	269.5	272.0		265.5	243.6	252.6	390.2
6	336.3	290.1	288.3	254.6		268.4	252.5	251.9	396.5
7	331.1	292.3	297.6	245.9		253.0	266.9	259.7	402.3
8	328.7	293.0	301.5	256.0		265.2	273.7	253.9	395.5
9	320.6	296.4	280.8	279.1		266.7	273.0	266.4	399.5
10	325.5	296.0	303.3	275.0		281.6	281.0	279.6	403.0
11	318.0	307.2	293.5	293.6		301.3	288.3	281.1	369.7
12	318.3	303.6	334.2	312.0		281.9	279.0	343.4	381.7
13	317.4	304.5	334.7	292.5		264.0	267.9	376.2	381.2
14	308.9	308.5	251.9	290.4		260.5	274.8	398.1	358.6
15	307.8	318.5	267.3	284.0		256.5	263.2	398.2	351.4
16	340.8	309.8	278.8	315.2		255.0	266.0	371.4	341.6
17	330.2	329.8	285.1	258.8		261.4	271.6	342.0	367.3
18	314.5	325.3	244.0	245.4	311.4	262.6	279.2	331.3	324.1
19	313.1	346.3	225.8	241.3	303.6	290.7	279.2	302.7	319.6
20	314.3	353.5	254.9	274.2	302.4	274.1	269.6	311.9	332.5
21	309.2	344.7	255.8	282.2	313.0	268.9	251.2	314.4	332.6
22	320.7	342.3	252.9	258.6	303.9	273.9	253.6	313.3	337.6
23	305.2	297.0	267.6	289.5	318.1	281.5	245.6	346.1	348.0
24	303.6	293.9	279.1		294.7	244.1	276.8	359.5	339.0
25	298.1	294.7	292.4	285.6	287.2	246.9	285.6	338.1	329.8
26	284.8	279.3	298.0		279.4	263.5	284.7	352.4	342.8
27	281.5	278.0	320.4		278.3	263.8	301.4	365.1	347.7
28	301.6	277	312.0		281.4	275.6	258.4	358.4	343.9
29	316.1		258.6		280.7	271.6	239.0	353.3	342.5
30	294.6		316.8		311.0	277.3	238.9	358.1	348.8
31	287.6		312.6		244.6		260.3		351.6

Note : Daily O₃ data at Halleybay are not recorded at source from 26.4.81 to 17.8.81

DAILY OZONE DATA (NIMBUS - 7 TOMS) Stn : HALLEYBAY
YEAR - 1982

DAY	JAN	FEB	MAR	APR	AUG	SEP	OCT	NOV	DEC
1	346.7	280.6	265.9	313.2		299.4	209.7	246.3	321.3
2	354.4	277.6	290.8	300.5		258.9	210.6	256.9	316.5
3	336.6	290.1	295.7	325.6		256.0	202.4	248.6	315.5
4	325.6	289.4	262.3	312.6		280.8	222.4	239.2	300.2
5	316.0	296.1	266.1	331.0		264.9	220.0	243.1	306.7
6	324.9	301.4	266.7	318.9		258.3	215.7	249.8	321.6
7	308.0	311.3	244.9	324.4		281.7	245.5	292.3	330.2
8	313.3	288.6	260.6	299.1		278.5	213.9	308.6	343.3
9	310.3	287.7	283.0	289.4		260.5	223.0	342.9	348.3
10	310.9	286.4	276.1	306.4		269.4	222.4	321.7	355.4
11	311.6	290.7	286.9	282.9		253.4	233.2	327.5	363.8
12	321.7	289.4	277.7	262.6		263.9	238.7	301.0	369.1
13	322.9	297.7	298.3	281.6		251.8	241.1	300.0	370.6
14	309.3	304.7	327.4	272.1		254.4	250.6	269.6	368.8
15	292.1	300.9	280.7	276.7		237.6	242.4	270.0	376.0
16	309.9	318.3	278.9	260.7		236.6	237.1	254.3	366.3
17	304.7	322.2	272.8	262.3		241.7	245.0	260.9	351.4
18	282.0	329.5	271.0	302.7		248.4	238.3	294.5	345.1
19	299.0	307.4	273.5	264.5	290.4	240.2	225.4	285.2	342.6
20	287.3	291.2	288.8	244.1	305.8	226.2	249.9	265.0	323.6
21	292.5	300.2	271.5	280.3	289.6	244.1	250.5	271.1	329.8
22	306.4	284.9	259.9	270.9	295.7	245.5	244.1	279.9	325.5
23	296.8	285.0	287.1	285.1	276.9	246.6	246.0	330.1	314.9
24	293.6	275.3	343.7	313.0	272.5	245.0	251.3	320.7	322.7
25	306.5	269.4	295.4	293.3	260.9	223.3	260.0	319.6	330.2
26	314.4	284.8	291.4		269.5	228.5	244.1	330.0	331.9
27	314.2	298.4	274.3		278.3	226.6	244.5	346.7	350.5
28	311.9	272.2	275.0		266.1	235.7	244.8	331.0	347.7
29	295.9		306.6		292.0	225.9	252.2	323.3	342.7
30	254.7		278.3		288.5	212.6	240.4	322.0	361.7
31	287.0		306.7		274.3		242.4		346.3

Note : Daily O₃ data at Halleybay are not recorded at source from 26.4.82 to 18.8.82

DAILY OZONE DATA (NIMBUS - 7 TOMS) Stn : HALLEYBAY
YEAR - 1983

DAY	JAN	FEB	MAR	APR	AUG	SEP	OCT	NOV	DEC
1	346.3	313.9	288.8	262.3		252.6	217.0	247.4	367.4
2	336.5	320.4	276.7	289.2		257.6	213.7	237.2	375.4
3	322.9	322.9	259.2	299.9		257.4	209.0	246.3	378.6
4	321.8	321.9	254.8	300.5		290.9	198.9	268.6	347.1
5	320.9	313.4	274.1	304.3		271.6	194.2	297.2	345.6
6	314.3	326.0	255.0	285.9		256.3	188.7	314.1	363.2
7	309.9	325.8	260.3	285.5		257.6	212.0	370.0	350.8
8	316.2	317.1	282.7	263.3		257.1	222.4	353.3	355.3
9	313.9	317.8	290.4	266.4		291.4	203.4	318.1	358.9
10	324.1	312.7	308.8	270.1		288.2	219.0	301.1	347.4
11	318.2	332.8	321.7	296.7		275.9	205.0	272.1	338.2
12	327.4	338.1	323.4	296.2		250.7	203.7	317.2	341.9
13	326.8	338.4	343.8	301.7		268.5	210.6	313.9	341.8
14	320.6	324.6	293.6	292.6		238.3	206.0	289.0	320.5
15	328.1	330.0	311.9	281.0		246.0	202.8	287.8	321.8
16	333.1	334.6	306.3	285.8		267.4	190.5	309.5	318.4
17	347.2	320.4	293.4	269.5		237.4	200.6	320.1	323.6
18	343.7	319.8	276.4	253.7	257.8	227.7	214.5	296.3	313.3
19	339.4	325.9	290.0	250.8	287.4	237.3	223.6	298.5	302.8
20	343.2	310.3	316.1	279.0	296.4	226.3	228.1	295.1	314.0
21	344.7	317.3	304.6	290.7	282.7	229.3	227.1	301.8	324.5
22	343.9	311.1	295.3	299.4	272.4	240.7	235.3	287.6	345.7
23	338.2	297.1	297.0	286.4	241.6	254.5	256.5	286.8	342.1
24	335.9	294.0	291.1	297.7	292.7	255.5	231.0	311.5	346.7
25	322.5	254.5	310.3	336.3	254.7	257.4	243.1	287.4	338.7
26	308.5	266.9	311.7		258.7	240.6	242.7	339.0	338.8
27	311.9	269.4	283.4		254.0	223.4	227.7	387.0	335.4
28	303.8	281.1	337.8		268.0	213.4	215.6	363.8	342.1
29	308.9		310.1		286.6	216.0	248.5	366.9	349.5
30	323.0		314.1		254.9	235.6	258.6	347.7	334.1
31	321		288.4		251.1		241.4		321.5

Note : Daily O₃ data at Halleybay are not recorded at source from 26.4.83 to 17.8.83

DAILY OZONE DATA (NIMBUS - 7 TOMS) Stn : HALLEYBAY
YEAR - 1984

DAY	JAN	FEB	MAR	APR	AUG	SEP	OCT	NOV	DEC
1	318.7	302.4	294.4	267.4		256.6	200.5	220.3	301.4
2	320.3	292.0	288.1	276.2		263.2	207.0	220.6	290.0
3	323.6	306.5	286.9	294.3		271.9	199.2	229.7	327.4
4	322.6	301.8	291.6	294.3		253.8	200.8	234.9	329.2
5	319.2	297.8	306.3	266.3		222.6	218.6	241.6	345.1
6	324.8	302.4	311.1	250.6		237.3	201.5	270.6	342.5
7	324.4	314.6	323.4	250.0		243.5	195.3	255.4	334.1
8	323.9	318.9	312.2	262.6		244.3	179.8	274.8	330.3
9	332.8	323.9	309.2	280.6		219.7	204.1	248.9	340.5
10	328.4	314.7	305.5	288.2		226.0	205.4	246.9	343.9
11	329.6	311.2	299.8	296.1		240.1	203.4	234.7	337.8
12	350.6	313.0	322.1	280.5		233.2	191.8	245.2	352.7
13	336.3	315.2	296.4	266.5		252.4	197.8	279.1	344.6
14	306.3	304.8	294.0	274.7		223.6	194.9	298.0	346.2
15	308.5	294.0	291.9	275.9		230.1	213.3	267.2	327.2
16	318.3	286.1	327.8	265.3		242.0	217.4	275.3	315.8
17	325.3	281.6	268.1	275.5		238.6	213.6	255.2	316.4
18	318.3	279.9	278.9	273.1	300.5	248.1	199.3	251.4	339.4
19	319.1	276.2	261.8	266.7	256.1	225.8	219.8	236.4	319.6
20	292.8	267.7	268.1	266.2	281.4	216.6	221.6	236.7	329.8
21	292.6	263.5	261.1	268.0	279.3	223.6	216.7	263.1	321.4
22	294.2	255.3	277.4	286.3	264.3	218.6	203.9	263.1	311.1
23	307.0	255.2	286.1	274.0	240.1	204.6	194.0	238.1	313.4
24	318.5	257.6	280.3	271.6	236.3	206.9	207.9	253.4	314.4
25	327.7	262.5	284.5		282.7	214.0	214.7	251.2	310.8
26	329.7	270.5	286.7		259.5	226.1	196.3	263.7	307.1
27	322.3	277.8	284.1		251.6	219.0	204.0	249.9	309.8
28	303.5	269.2	290.7		290.0	220.4	199.7	263.9	323.7
29	303.7	282.7	280.4		284.9	209.8	191.0	257.3	330.5
30	304.7		293.5		221.6	202.4	191.1	275.9	338.0
31	296.6		276.0		232.0		209.3		333.8

Note : Daily O₃ data at Halleybay are not recorded at source from 25.4.84 to 17.8.84

Monthly Mean Total Ozone Data* for South Pole, Antarctica, Derived from Dobson Spectrophotometer Observations

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
1964	30(309)11	22(279)25	02(287)07	03(285)16	07(270)23	05(249)11	04(274)07	05(260)19				
1965	32(311)19	24(276)14	03(252)05	07(324)21	05(322)46	05(309)17	08(292)26	03(287)21		11(364)32	30(410)33	30(355)18
1966	28(306)12	12(290)14								12(256)19	12(296)10	24(348)10
1967	31(300)17	22(285)14								14(269)13	26(353)40	31(344)18
1968	31(312)12	19(284)20								13(364)24	26(378)34	30(351)23
1969	31(322)10	25(301)14								09(324)24	24(394)30	30(355)21
1970	29(298)13	22(284)15			06(316)16	08(288)21	09(277)55	04(285)32		14(261)21	27(301)18	31(339)15
1971	31(316)22	25(282)09								09(300)34	31(322)19	31(366)26
1972	[322]	[292]								14(303)19	15(323)15	[366]
1973	15(327)15	10(302)13			05(278)12	06(288)22	07(287)38	07(272)27	01(282)—	[289]	[339]	23(365)20
1974	22(314)10	13(292)13				03(277)12	07(230)23	05(243)27	05(229)36	13(274)12	16(354)75	20(366)20
1975	9(329)13	[293]				05(249)17	07(257)08	07(276)17	06(282)11	03(280)04	13(269)18	26(373)47
1976	28(311)15	22(293)08				07(272)19	04(259)16	07(277)16	07(268)12	08(283)11	11(253)19	28(328)53
1977	24(303)11	22(280)11	02(261)07				06(258)13	07(251)19	08(273)17	04(275)16	09(296)16	24(355)44
1978	31(327)12	25(295)15			02(257)04	06(253)19	06(267)07	04(268)16	08(269)08		20(258)23	29(381)34
1979	26(309)15	25(285)15				06(272)10	01(280)—	03(258)15	04(297)16	01(265)—	17(294)29	29(386)40
1980	27(322)15	24(296)18				05(263)15	06(294)27	05(257)23	04(261)15		16(290)20	27(349)52
1981	30(319)16	17(291)15				04(262)21		03(279)13	02(257)08		14(220)09	28(310)62
1982	31(306)13	24(285)16				02(277)32	03(253)24	06(319)28	06(262)16	02(238)14	15(230)08	29(305)54
1983	31(307)13	18(307)13									13(238)15	24(262)36
1984	23(300)17	24(308)59									[225]	08(308)46
1985	31(288)12	23(278)09									[225]	[318]
					07(236)27	07(229)14	07(227)10	07(259)22	06(250)34		12(211)14	30(267)21
					01(245)—	03(213)31	04(236)38	07(234)14	03(207)26		18(161)09	26(238)36
												30(314)17

* Values in round brackets are total ozone in D.U. Values preceding and following each bracketed value are the number of daily total ozone observations per month and the standard deviation of the monthly mean value, respectively. Total ozone amounts in square brackets are interpolated values.

MONTHLY MEAN OZONE DATA (WOUDC) Stn : SYOWA

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1978	339	325	310						292	311	353	335
1979	298	307	282						298	365	352	325
1980	322	318	317						269	276	331	337
1981	294	293	285						325	318	309	342
1982	297	314	289	284	266	308	314	294	262	227	349	330
1983	315	315	291	279	283	276	284	286	282	251	296	328
1984	316	308	299	273	305	292	286	266	238	245	281	314

Note : Monthly mean O₃ data at Syowa are not recorded at source for April to August during the period 1978 to 1981

MONTHLY MEAN OZONE DATA (TOMS) Stn : HALLEYBAY

YEAR	JAN	FEB	MAR	APR	AUG	SEP	OCT	NOV	DEC
1979	309.59	292.6	295.4	293.66	288.26	265.58	297.25	332.9	358.39
1980	338.42	301.11	304.93	297.68	287.63	261.23	250.12	316.10	358.57
1981	312.56	306.35	283.09	275.44	293.55	271.83	267.23	316.81	358.93
1982	308.42	293.98	282.52	290.96	281.58	249.88	235.73	291.73	340.01
1983	326.35	312.79	295.81	285.81	268.5	250.75	219.09	307.75	340.45
1984	317.56	289.62	291.56	273.8	263.10	231.16	203.67	253.42	326.71
1985	307.88	277.33	271.87	280.52	252.19	227.20	205.98	229.65	320.93
1986	298.0	281.55	259.01	245.32	270.51	226.55	254.62	284.16	317.27
1987	307.71	280.82	284.84	281.28	255.68	193.62	173.33	210.52	303.10
1988	306.09	280.37	280.19	280.59	264.05	224.81	234.18	331.61	338.33
1989	299.95	295.46	277.82	277.84	246.32	207.00	173.40	275.65	304.15

Note : Monthly mean O₃ data at Halleybay are not recorded at source for May to July

MONTHLY MEAN OZONE DATA (NIMBUS - 7 / EARTH PROBE TOMS) Stn : BARROW.

YEAR	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV
1979	437.12	456.71	445.43	407.45	366.89	324.52	295.14	312.13	337.65	342.2
1980	436.1	483.07	467.8	411.79	357.00	328.51	321.16	301.13	347.72	340.67
1981	408.47	430.93	434.63	383.15	369.45	347.1	317.25	324.12	329.1	387.13
1982	403.34	454.14	496.78	432.36	363.14	323.4	297.00	301.58	321.74	311.63
1983	427.83	443.67	430.21	399.72	356.12	321.09	302.45	299.60	325.08	319.50
1984	472.07	469.22	465.48	427.34	363.14	328.08	307.97	289.18	297.45	286.9
1985	448.00	482.44	471.57	412.74	357.82	316.06	299.39	307.53	323.49	387.03
1986	408.20	477.79	443.82	397.57	343.82	307.21	304.93	308.13	293.73	308.0
1987	481.21	421.93	427.54	389.22	363.53	326.77	297.28	324.10	328.93	379.65
1988	423.18	466.70	447.37	393.33	358.63	330.22	303.51	308.23	318.99	339.53
1989	400.16	429.25	422.36	394.54	354.70	313.07	294.40	292.08	344.66	320.10
1990	479.06	406.70	384.02	380.55	354.36	308.23	282.35	312.31	288.30	305.87
1991	425.89	467.12	428.77	392.86	348.60	338.84	303.95	312.12	311.81	298.20
1992	393.0	434.38	429.69	396.98	334.88	297.34	310.68	312.05	325.05	305.50
1993	362.26	378.62	388.97							
1996						317.79	299.00	301.08	324.13	347.8
1997	397.45	397.21	403.22	394.1	352.31	326.22	291.88	285.21	312.48	287.15
1998	458.98	461.68	462.42	417.76	371.57	333.69	325.26	332.84	338.77	367.60
1999	466.85	468.24	437.08	386.62	344.34	321.68	294.80			

Note : Monthly mean O₃ data at Barrow are not recorded at source for the month December & January and from May'93 to June'96.

MONTHLY MEAN OZONE DATA (NIMBUS - 7 / EARTH PROBE TOMS) Stn : DUM DUM, INDIA.

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1979	258.4	270.37	277.4	287.52	291.26	290.92	285.20	284.64	280.76	272.20	254.85	255.01
1980	244.9	255.67	257.93	268.47	283.78	286.68	285.00	279.65	278.17	269.59	262.32	257.34
1981	258.19	267.54	282.26	291.03	296.03	287.95	285.30	280.48	273.07	268.54	261.13	258.23
1982	257.37	265.47	283.30	292.45	295.58	296.69	287.97	285.76	276.29	266.91	258.59	236.55
1983	246.98	257.70	262.77	271.58	287.91	281.77	277.62	279.45	268.15	262.96	252.68	257.29
1984	262.72	256.15	275.21	279.15	290.77	287.49	280.62	280.80	273.40	257.68	242.72	229.59
1985	238.78	239.76	245.15	255.89	280.01	273.66	279.38	276.60	270.71	263.89	251.97	255.32
1986	247.99	270.13	271.95	285.37	285.47	283.41	279.64	271.14	269.11	264.76	249.13	255.07
1987	252.64	262.16	271.34	286.92	287.60	285.81	284.74	276.77	270.14	261.76	237.75	233.05
1988	246.47	254.44	255.14	270.53	277.01	283.47	278.35	269.73	267.76	260.05	258.36	252.85
1989	254.35	258.40	281.96	286.39	292.16	293.73	288.83	288.06	279.18	271.37	258.32	255.55
1990	246.45	259.58	266.25	274.14	283.19	283.15	285.85	282.06	277.15	268.18	257.77	248.93
1991	252.85	254.47	276.71	280.24	292.99	288.09	288.94	282.67	275.23	267.70	258.04	246.32
1992	247.75	275.14	266.02	274.34	293.30	290.44	281.87	280.69	269.11	258.24	248.89	248.56
1993	247.05	248.99	254.63	277.31	282.48	283.50	267.73	268.59	265.85	255.60	248.56	240.55
1994	256.27	255.49	271.44	273.46	288.10	281.87	281.57	276.13	266.09	260.48	243.42	
1996							278.16	273.35	268.37	262.93	253.85	234.32
1997	241.73	242.22	260.60	280.72	282.32	283.46	277.90	275.25	271.78	275.71	255.99	249.96
1998	265.01	265.74	272.38	287.03	286.81	282.77	280.80	278.47	275.73	266.45	248.31	243.28
1999	236.68	245.32	249.91	271.37	283.47	281.01	284.29	282.55	277.66	270.32	263.84	261.45

Note : Monthly mean O₃ data at Dum Dum are not recorded at source during the period Jan'95 to June'96

MONTHLY MEAN OZONE DATA (WOUDC) Stn : LAUDER, NEWZEALAND

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1987	291	281	270	280	300	320	308	324	359	355	331	300
1988	285	283	271	267	273	298	317	356	349	380	316	297
1989	285	280	272	268	293	315	327	351	332	363	336	301
1990	283	261	271	274	292	296	321	328	347	335	319	296
1991	271	267	258	274	303	308	320	355	370	365	348	302
1992	287	280	277	266	311	*	*	368	366	348	316	286
1993	284	265	263	282	288	327	307	345	325	349	327	288
1994	277	267	262	265	289	315	337	361	370	360	341	302
1995	277	267	282	273	280	302	335	336	361	348	328	287
1996	259	265	262	273	289	306	329	368	356	360	344	306
1997	279	284	265	271	276	297	306	324	324	326	317	299

Note : * Signifies that the monthly mean O₃ data at Lauder are not recorded at source.

MONTHLY MEAN OZONE DATA (WOUDC) Stn : BUCHAREST, ROMANIA

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1987	334	337	411	391	376	347	328	331	309	298	300	320
1988	329	330	385	359	*	*	309	299	288	277	282	311
1989	316	345	360	332	264	341	331	326	304	292	284	310
1990	314	316	331	358	352	346	*	314	321	280	291	321
1991	348	383	348	404	381	*	320	328	308	287	299	313
1992	307	348	344	329	346	332	322	298	292	291	284	301
1993	294	323	331	340	*	330	316	302	295	277	*	*
1994	338	379	348	354	367	334	321	317	289	286	291	314
1995	315	309	354	348	334	321	*	*	295	294	318	317
1996	338	381	394	386	346	335	315	308	319	295	281	310
1997	345	*	*	*	*	*	*	*	*	*	*	*

Note : * Signifies that the monthly mean O₃ data at Bucharest are not recorded at source.

DAILY OZONE DATA (TOMS) Stn : JALPAIGURI, INDIA
During June'98 to May'99

DAY	JUNE'98	JULY'98	AUG'98	SEP'98	OCT'98	NOV'98	DEC'98	JAN'99	FEB'99	MAR'99	APRIL'99	MAY'99
1	300	280	284	282	276	269	256	*	250	239	270	270
2	*	276	*	270	279	269	247	*	255	235	267	269
3	291	283	291	276	278	261	240	241	248	*	268	273
4	297	285	282	282	279	253	248	239	247	242	280	282
5	300	286	280	283	284	263	251	237	254	241	286	278
6	290	282	283	286	273	265	243	237	253	244	280	282
7	298	281	279	283	271	258	247	228	259	229	285	279
8	297	278	281	287	266	258	251	259	*	228	278	276
9	296	283	278	280	270	250	273	253	262	237	285	279
10	296	290	275	275	271	265	252	290	282	246	280	297
11	281	297	*	276	271	262	279	262	268	253	278	298
12	300	291	284	280	275	256	*	257	255	*	287	308
13	283	289	277	282	271	246	*	250	258	247	*	302
14	284	295	279	282	268	243	*	256	260	251	275	298
15	285	*	279	280	266	233	*	260	*	257	269	300
16	291	289	283	269	267	228	*	238	258	257	277	298
17	285	288	278	263	265	*	*	258	246	256	268	294
18	280	285	282	266	263	*	*	250	248	253	273	302
19	271	278	279	274	264	234	*	244	246	255	264	292
20	268	281	*	264	279	228	*	237	252	251	266	291
21	271	288	286	267	289	232	*	234	247	244	273	285
22	284	281	*	279	279	226	*	231	241	257	279	279
23	289	291	283	273	276	234	*	*	227	256	271	274
24	281	*	283	269	263	244	*	299	*	254	266	*
25	275	291	281	265	268	243	*	227	240	259	266	290
26	289	278	268	280	264	248	*	232	239	263	266	291
27	290	279	279	274	258	239	*	233	235	270	269	297
28	287	286	272	276	258	244	*	235	239	*	277	294
29	277	285	*	269	256	241	*	246		263	266	286
30	274	283	281	271	257	254	*	*		258	265	300
31		281	275		255		*	264		276		290

Note : * Signifies that the daily O₃ data at Jalpaiguri are not recorded at source.

MgII Center to Wing Ratio
Nimbus 7 Six Year Data Set (11/78 to 10/84)

Date	Value	Date	Value	Date	Value	Date	Value
78 11 7	.2772	79 1 1	.2810	79 2 24	.2787	79 4 17	.2799
78 11 8	.2770	79 1 2	.2814	79 2 26	.2779	79 4 18	.2784
78 11 9	.2769	79 1 3	.2824	79 2 27	.2789	79 4 19	.2772
78 11 10	.2765	79 1 5	.2819	79 2 28	.2796	79 4 20	.2754
78 11 12	.2759	79 1 6	.2804	79 3 1	.2802	79 4 21	.2749
78 11 13	.2747	79 1 7	.2815	79 3 2	.2822	79 4 23	.2746
78 11 14	.2736	79 1 9	.2812	79 3 3	.2828	79 4 27	.2812
78 11 19	.2728	79 1 10	.2801	79 3 4	.2831	79 4 28	.2820
78 11 20	.2722	79 1 12	.2801	79 3 6	.2827	79 4 29	.2815
78 11 22	.2718	79 1 13	.2804	79 3 7	.2823	79 5 1	.2809
78 11 23	.2718	79 1 14	.2795	79 3 8	.2815	79 5 2	.2798
78 11 24	.2725	79 1 15	.2788	79 3 10	.2803	79 5 3	.2781
78 11 25	.2732	79 1 18	.2767	79 3 12	.2816	79 5 6	.2769
78 11 26	.2742	79 1 19	.2765	79 3 13	.2817	79 5 7	.2772
78 11 27	.2754	79 1 21	.2787	79 3 14	.2821	79 5 9	.2796
78 11 28	.2755	79 1 23	.2813	79 3 15	.2826	79 5 10	.2813
78 12 1	.2783	79 1 24	.2823	79 3 18	.2834	79 5 11	.2816
78 12 2	.2790	79 1 25	.2825	79 3 19	.2828	79 5 13	.2826
78 12 4	.2782	79 1 27	.2811	79 3 20	.2816	79 5 14	.2823
78 12 5	.2789	79 1 28	.2803	79 3 22	.2804	79 5 15	.2819
78 12 6	.2781	79 1 29	.2797	79 3 24	.2803	79 5 16	.2804
78 12 7	.2784	79 1 30	.2803	79 3 25	.2801	79 5 17	.2788
78 12 8	.2776	79 1 31	.2798	79 3 26	.2803	79 5 18	.2773
78 12 9	.2774	79 2 2	.2815	79 3 27	.2810	79 5 19	.2766
78 12 12	.2776	79 2 3	.2827	79 3 28	.2812	79 5 22	.2759
78 12 13	.2775	79 2 4	.2827	79 3 29	.2827	79 5 25	.2804
78 12 14	.2769	79 2 5	.2833	79 3 30	.2835	79 5 26	.2802
78 12 16	.2761	79 2 7	.2838	79 3 31	.2849	79 5 27	.2796
78 12 17	.2720	79 2 8	.2843	79 4 1	.2850	79 5 30	.2783
78 12 18	.2742	79 2 10	.2820	79 4 2	.2846	79 5 31	.2776
78 12 19	.2732	79 2 11	.2805	79 4 3	.2839	79 6 2	.2787
78 12 20	.2730	79 2 12	.2804	79 4 4	.2815	79 6 3	.2800
78 12 21	.2694	79 2 14	.2794	79 4 6	.2778	79 6 4	.2825
78 12 22	.2709	79 2 15	.2801	79 4 7	.2773	79 6 6	.2840
78 12 24	.2721	79 2 16	.2806	79 4 8	.2769	79 6 7	.2858
78 12 25	.2739	79 2 17	.2820	79 4 9	.2764	79 6 10	.2831
78 12 26	.2749	79 2 19	.2837	79 4 10	.2770	79 6 11	.2809
78 12 28	.2776	79 2 20	.2833	79 4 11	.2776	79 6 13	.2797
78 12 29	.2789	79 2 22	.2808	79 4 13	.2811	79 6 14	.2769
78 12 30	.2795	79 2 23	.2800	79 4 16	.2808	79 6 15	.2760

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79 6 19	.2756	79 8 30	.2808	79 11 14	.2892	80 1 25	.2757
79 6 22	.2775	79 8 31	.2799	79 11 17	.2866	80 1 26	.2757
79 6 23	.2769	79 9 2	.2782	79 11 19	.2834	80 1 28	.2774
79 6 26	.2774	79 9 3	.2778	79 11 21	.2796	80 1 29	.2801
79 6 27	.2781	79 9 7	.2793	79 11 22	.2786	80 1 30	.2806
79 7 1	.2801	79 9 8	.2791	79 11 23	.2780	80 2 1	.2844
79 7 2	.2826	79 9 12	.2794	79 11 25	.2773	80 2 2	.2846
79 7 4	.2851	79 9 15	.2801	79 11 26	.2772	80 2 3	.2854
79 7 5	.2857	79 9 16	.2801	79 11 27	.2775	80 2 5	.2850
79 7 8	.2836	79 9 18	.2812	79 11 29	.2763	80 2 6	.2838
79 7 9	.2821	79 9 19	.2829	79 11 30	.2766	80 2 7	.2837
79 7 10	.2797	79 9 20	.2828	79 12 1	.2771	80 2 9	.2806
79 7 12	.2772	79 9 22	.2841	79 12 4	.2812	80 2 10	.2794
79 7 13	.2760	79 9 23	.2848	79 12 5	.2834	80 2 11	.2791
79 7 14	.2745	79 9 24	.2852	79 12 6	.2837	80 2 13	.2804
79 7 16	.2743	79 9 26	.2850	79 12 8	.2875	80 2 14	.2803
79 7 17	.2748	79 9 27	.2834	79 12 9	.2890	80 2 15	.2807
79 7 20	.2762	79 9 28	.2813	79 12 11	.2899	80 2 17	.2809
79 7 21	.2767	79 9 30	.2793	79 12 12	.2910	80 2 18	.2803
79 7 22	.2760	79 10 1	.2789	79 12 13	.2904	80 2 19	.2793
79 7 25	.2762	79 10 4	.2786	79 12 15	.2864	80 2 21	.2778
79 7 26	.2778	79 10 5	.2791	79 12 16	.2847	80 2 22	.2761
79 7 28	.2791	79 10 6	.2797	79 12 17	.2823	80 2 26	.2766
79 7 29	.2784	79 10 8	.2799	79 12 19	.2777	80 2 27	.2790
79 7 30	.2794	79 10 10	.2811	79 12 21	.2757	80 2 29	.2826
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79 8 2	.2780	79 10 13	.2829	79 12 24	.2749	80 3 2	.2825
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79 8 5	.2763	79 10 16	.2854	79 12 28	.2754	80 3 5	.2810
79 8 6	.2764	79 10 17	.2861	79 12 29	.2774	80 3 6	.2800
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79 8 10	.2768	79 10 22	.2859	80 1 1	.2813	80 3 9	.2768
79 8 11	.2769	79 10 24	.2832	80 1 4	.2854	80 3 10	.2768
79 8 13	.2771	79 10 25	.2812	80 1 6	.2881	80 3 12	.2773
79 8 14	.2773	79 10 26	.2810	80 1 9	.2872	80 3 14	.2774
79 8 15	.2778	79 10 26	.2801	80 1 10	.2870	80 3 16	.2763
79 8 17	.2775	79 10 29	.2805	80 1 12	.2868	80 3 17	.2770
79 8 18	.2780	79 10 30	.2813	80 1 13	.2851	80 3 18	.2765
79 8 19	.2787	79 1 1	.2828	80 1 16	.2801	80 3 20	.2776
79 8 22	.2814	79 11 2	.2831	80 1 17	.2797	80 3 21	.2771
79 8 23	.2821	79 11 5	.2835	80 1 18	.2792	80 3 23	.2778
79 8 25	.2825	79 11 6	.2854	80 1 20	.2703	80 3 24	.2789
79 8 26	.2826	79 11 9	.2876	80 1 21	.2753	80 3 25	.2806

Date	Value	Date	Value	Date	Value	Date	Value
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80 3 29	.2842	80 6 2	.2776	80 8 1	.2756	80 9 30	.2808
80 3 30	.2841	80 6 4	.2772	80 8 3	.2741	80 10 2	.2809
80 4 1	.2815	80 6 5	.2776	80 8 4	.2735	80 10 3	.2809
80 4 2	.2797	80 6 6	.2765	80 8 5	.2733	80 10 4	.2808
80 4 3	.2775	80 6 8	.2760	80 8 7	.2744	80 10 6	.2800
80 4 4	.2770	80 6 9	.2771	80 8 8	.2760	80 10 7	.2802
80 4 5	.2767	80 6 10	.2772	80 8 9	.2777	80 10 8	.2812
80 4 7	.2778	80 6 12	.2790	80 8 11	.2808	80 10 10	.2829
80 4 9	.2797	80 6 13	.2803	80 8 12	.2821	80 10 11	.2836
80 4 10	.2807	80 6 14	.2804	80 8 13	.2835	80 10 12	.2842
80 4 11	.2821	80 6 16	.2804	80 8 15	.2845	80 10 14	.2838
80 4 13	.2829	80 6 17	.2821	80 8 16	.2849	80 10 15	.2830
80 4 14	.2826	80 6 18	.2824	80 8 17	.2844	80 10 16	.2822
80 4 15	.2818	80 6 20	.2845	80 8 19	.2829	80 10 17	.2807
80 4 17	.2801	80 6 21	.2849	80 8 20	.2819	80 10 18	.2798
80 4 18	.2800	80 6 22	.2855	80 8 21	.2808	80 10 19	.2795
80 4 19	.2813	80 6 23	.2855	80 8 23	.2780	80 10 20	.2793
80 4 21	.2821	80 6 24	.2849	80 8 24	.2773	80 10 22	.2800
80 4 22	.2816	80 6 25	.2839	80 8 25	.2759	80 10 23	.2796
80 4 25	.2820	80 6 26	.2829	80 8 27	.2752	80 10 24	.2795
80 4 26	.2824	80 6 28	.2806	80 8 28	.2756	80 10 26	.2792
80 4 27	.2816	80 6 29	.2793	80 8 29	.2759	80 10 27	.2795
80 4 29	.2795	80 6 30	.2779	80 8 31	.2774	80 10 28	.2797
80 4 30	.2781	80 7 2	.2760	80 9 1	.2781	80 10 30	.2807
80 5 1	.2793	80 7 3	.2753	80 9 2	.2792	80 10 31	.2814
80 5 3	.2794	80 7 4	.2746	80 9 4	.2813	80 11 1	.2823
80 5 4	.2807	80 7 7	.2748	80 9 5	.2818	80 11 3	.2837
80 5 5	.2816	80 7 8	.2749	80 9 6	.2823	80 11 4	.2840
80 5 7	.2818	80 7 10	.2756	80 9 8	.2825	80 11 5	.2845
80 5 8	.2823	80 7 11	.2764	80 9 9	.2820	80 11 7	.2846
80 5 9	.2834	80 7 12	.2778	80 9 10	.2817	80 11 8	.2843
80 5 13	.2792	80 7 14	.2814	80 9 12	.2815	80 11 9	.2834
80 5 15	.2807	80 7 15	.2830	80 9 13	.2811	80 11 11	.2820
80 5 16	.2815	80 7 16	.2850	80 9 14	.2804	80 11 12	.2805
80 5 19	.2827	80 7 18	.2872	80 9 16	.2792	80 11 13	.2791
80 5 20	.2832	80 7 19	.2882	80 9 17	.2786	80 11 15	.2781
80 5 21	.2849	80 7 20	.2890	80 9 18	.2780	80 11 16	.2779
80 5 22	.2873	80 7 22	.2869	80 9 20	.2772	80 11 17	.2779
80 5 23	.2872	80 7 23	.2853	80 9 21	.2765	80 11 19	.2783
80 5 25	.2875	80 7 24	.2836	80 9 22	.2763	80 11 20	.2790
80 5 27	.2861	80 7 26	.2816	80 9 24	.2770	80 11 21	.2789
80 5 28	.2855	80 7 27	.2806	80 9 25	.2776	80 11 23	.2789
80 5 29	.2843	80 7 28	.2792	80 9 26	.2781	80 11 24	.2784

Date	Value	Date	Value	Date	Value	Date	Value
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80 11 28	.2802	81 1 30	.2817	81 4 10	.2880	81 6 9	.2765
80 11 29	.2809	81 1 31	.2819	81 4 12	.2847	81 6 11	.2777
80 12 1	.2839	81 2 1	.2815	81 4 13	.2838	81 6 12	.2773
80 12 2	.2847	81 2 3	.2814	81 4 14	.2831	81 6 13	.2779
80 12 3	.2845	81 2 4	.2813	81 4 16	.2827	81 6 15	.2778
80 12 5	.2837	81 2 7	.2820	81 4 17	.2838	81 6 16	.2782
80 12 6	.2822	81 2 8	.2810	81 4 18	.2838	81 6 17	.2793
80 12 9	.2793	81 2 9	.2795	81 4 20	.2836	81 6 19	.2787
80 12 10	.2795	81 2 12	.2796	81 4 21	.2815	81 6 20	.2771
80 12 11	.2808	81 2 15	.2786	81 4 22	.2803	81 6 21	.2780
80 12 13	.2832	81 2 16	.2789	81 4 24	.2803	81 6 23	.2781
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80 12 15	.2850	81 2 19	.2793	81 4 26	.2803	81 6 25	.2779
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80 12 21	.2840	81 2 24	.2796	81 5 2	.2850	81 7 1	.2773
80 12 22	.2826	81 2 25	.2802	81 5 3	.2860	81 7 2	.2770
80 12 23	.2826	81 2 27	.2824	81 5 4	.2863	81 7 3	.2763
80 12 25	.2824	81 2 28	.2824	81 5 6	.2854	81 7 5	.2753
80 12 26	.2828	81 3 1	.2820	81 5 7	.2854	81 7 6	.2747
80 12 27	.2827	81 3 3	.2830	81 5 8	.2854	81 7 7	.2743
80 12 29	.2845	81 3 4	.2838	81 5 10	.2829	81 7 9	.2749
80 12 30	.2845	81 3 5	.2836	81 5 11	.2818	81 7 10	.2765
80 12 31	.2847	81 3 7	.2823	81 5 12	.2811	81 7 11	.2778
81 1 2	.2828	81 3 9	.2824	81 5 14	.2818	81 7 13	.2801
81 1 3	.2823	81 3 11	.2820	81 5 15	.2816	81 7 14	.2808
81 1 4	.2799	81 3 12	.2820	81 5 16	.2818	81 7 15	.2813
81 1 6	.2768	81 3 13	.2818	81 5 18	.2803	81 7 17	.2812
81 1 7	.2765	81 3 15	.2806	81 5 19	.2783	81 7 18	.2806
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81 1 10	.2785	81 3 20	.2797	81 5 22	.2788	81 7 21	.2787
81 1 11	.2799	81 3 21	.2799	81 5 23	.2777	81 7 22	.2793
81 1 12	.2806	81 3 24	.2824	81 5 24	.2782	81 7 23	.2808
81 1 14	.2806	81 3 25	.2824	81 5 26	.2796	81 7 25	.2823
81 1 15	.2793	81 3 27	.2814	81 5 27	.2804	81 7 26	.2824
81 1 16	.2785	81 3 28	.2822	81 5 28	.2817	81 7 27	.2822
81 1 18	.2768	81 3 29	.2833	81 5 30	.2807	81 7 29	.2809
81 1 19	.2766	81 4 1	.2838	81 5 31	.2790	81 7 30	.2803
81 1 20	.2774	81 4 2	.2852	81 6 1	.2782	81 7 31	.2786
81 1 22	.2797	81 4 4	.2853	81 6 3	.2771	81 8 2	.2762
81 1 23	.2806	81 4 5	.2862	81 6 4	.2765	81 8 3	.2746
81 1 26	.2817	81 4 6	.2868	81 6 5	.2755	81 8 4	.2742

Date	Value	Date	Value	Date	Value	Date	Value
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81 8 8	.2765	81 10 7	.2836	81 12 8	.2879	82 2 10	.2804
81 8 10	.2786	81 10 9	.2811	81 12 9	.2892	82 2 11	.2790
81 8 11	.2801	81 10 10	.2811	81 12 10	.2893	82 2 12	.2790
81 8 12	.2808	81 10 11	.2800	81 12 12	.2876	82 2 14	.2787
81 8 14	.2812	81 10 13	.2809	81 12 13	.2864	82 2 15	.2780
81 8 15	.2813	81 10 14	.2828	81 12 14	.2823	82 2 16	.2767
81 8 16	.2809	81 10 15	.2834	81 12 16	.2779	82 2 18	.2759
81 8 18	.2831	81 10 17	.2854	81 12 17	.2758	82 2 19	.2759
81 8 19	.2844	81 10 18	.2854	81 12 18	.2751	82 2 20	.2764
81 8 20	.2862	81 10 19	.2851	81 12 20	.2736	82 2 22	.2771
81 8 22	.2877	81 10 21	.2833	81 12 21	.2741	82 2 24	.2781
81 8 23	.2884	81 10 22	.2820	81 12 22	.2754	82 2 26	.2823
81 8 24	.2885	81 10 23	.2815	81 12 24	.2794	82 2 27	.2843
81 8 26	.2883	81 10 25	.2812	81 12 25	.2809	82 2 28	.2850
81 8 27	.2874	81 10 26	.2813	81 12 26	.2819	82 3 3	.2850
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81 8 30	.2847	81 10 29	.2832	81 12 30	.2837	82 3 6	.2845
81 8 31	.2846	81 10 30	.2847	82 1 1	.2825	82 3 7	.2846
81 9 1	.2852	81 10 31	.2858	82 1 2	.2829	82 3 8	.2813
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81 9 4	.2848	81 11 3	.2859	82 1 5	.2832	82 3 12	.2796
81 9 5	.2851	81 11 4	.2857	82 1 6	.2828	82 3 14	.2806
81 9 7	.2862	81 11 6	.2862	82 1 7	.2824	82 3 15	.2806
81 9 8	.2862	81 11 7	.2854	82 1 10	.2777	82 3 16	.2804
81 9 9	.2856	81 11 8	.2851	82 1 11	.2761	82 3 19	.2793
81 9 11	.2835	81 11 10	.2848	82 1 13	.2730	82 3 20	.2785
81 9 12	.2825	81 11 11	.2848	82 1 14	.2731	82 3 22	.2774
81 9 13	.2825	81 11 12	.2844	82 1 15	.2730	82 3 24	.2765
81 9 15	.2829	81 11 14	.2842	82 1 17	.2754	82 3 26	.2791
81 9 16	.2835	81 11 15	.2835	82 1 18	.2761	82 3 27	.2815
81 9 17	.2836	81 11 16	.2810	82 1 19	.2785	82 3 28	.2824
81 9 19	.2843	81 11 18	.2793	82 1 21	.2794	82 3 30	.2836
81 9 20	.2839	81 11 19	.2778	82 1 22	.2788	82 3 31	.2817
81 9 21	.2843	81 11 20	.2774	82 1 23	.2784	82 4 2	.2803
81 9 23	.2834	81 11 22	.2762	82 1 25	.2785	82 4 3	.2799
81 9 24	.2829	81 11 23	.2763	82 1 27	.2801	82 4 4	.2788
81 9 25	.2822	81 11 24	.2772	82 1 29	.2845	82 4 5	.2775
81 9 27	.2833	81 11 26	.2790	82 1 30	.2859	82 4 7	.2783
81 9 28	.2839	81 11 27	.2804	82 1 31	.2877	82 4 9	.2795
81 9 29	.2840	81 11 28	.2820	82 2 2	.2867	82 4 12	.2806
81 10 1	.2846	81 11 30	.2841	82 2 3	.2875	82 4 13	.2800
81 10 2	.2854	81 12 2	.2854	82 2 4	.2849	82 4 15	.2773
81 10 3	.2857	81 12 4	.2859	82 2 6	.2835	82 4 16	.2755

Date	Value	Date	Value	Date	Value	Date	Value
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82 4 19	.2730	82 6 30	.2738	82 9 10	.2793	82 11 25	.2782
82 4 21	.2746	82 7 1	.2738	82 9 12	.2771*	82 11 26	.2779
82 4 23	.2777	82 7 2	.2734	82 9 14	.2743	82 11 27	.2777
82 4 24	.2786	82 7 4	.2730	82 9 15	.2746	82 11 29	.2770
82 4 25	.2786	82 7 6	.2727*	82 9 16	.2742	82 11 30	.2770
82 4 27	.2785	82 7 8	.2725	82 9 18	.2747	82 12 1	.2768
82 4 28	.2782	82 7 9	.2738	82 9 20	.2749	82 12 3	.2778
82 4 29	.2775	82 7 10	.2766	82 9 22	.2754	82 12 5	.2784*
82 5 1	.2761	82 7 12	.2786	82 9 23	.2756	82 12 7	.2799
82 5 3	.2758	82 7 13	.2808	82 9 24	.2764	82 12 9	.2817
82 5 5	.2776	82 7 16	.2865	82 9 26	.2790	82 12 11	.2834
82 5 7	.2778	82 7 17	.2862	82 9 28	.2812*	82 12 13	.2843
82 5 9	.2768	82 7 18	.2863	82 9 30	.2840	82 12 15	.2833
82 5 11	.2753*	82 7 20	.2811	82 10 1	.2844	82 12 17	.2809
82 5 13	.2730	82 7 21	.2788	82 10 2	.2838	82 12 19	.2776
82 5 14	.2723	82 7 22	.2742	82 10 4	.2816	82 12 21	.2748*
82 5 15	.2725	82 7 24	.2715	82 10 6	.2779	82 12 23	.2750
82 5 17	.2741	82 7 26	.2705	82 10 8	.2750	82 12 24	.2758
82 5 19	.2763	82 7 28	.2697	82 10 10	.2747	82 12 25	.2773
82 5 21	.2774	82 7 29	.2693	82 10 12	.2742	82 12 27	.2778
82 5 22	.2774	82 7 30	.2705	82 10 13	.2753	82 12 28	.2773
82 5 23	.2771	82 8 1	.2716	82 10 14	.2757	82 12 29	.2764
82 5 25	.2767	82 8 3	.2720*	82 10 16	.2749	82 12 31	.2756
82 5 27	.2763	82 8 5	.2749	82 10 18	.2738	83 1 1	.2748
82 5 29	.2762	82 8 6	.2785	82 10 20	.2742	83 1 2	.2741
82 5 30	.2758	82 8 7	.2817	82 10 22	.2765*	83 1 4	.2739
82 5 31	.2757	82 8 9	.2843	82 10 24	.2794	83 1 5	.2755
82 6 2	.2752	82 8 10	.2856	82 10 25	.2811	83 1 6	.2769
82 6 3	.2759	82 8 11	.2861	82 10 26	.2832	83 1 8	.2796
82 6 4	.2758	82 8 13	.2845	82 10 28	.2826	83 1 10	.2787
82 6 6	.2751	82 8 14	.2827	82 10 29	.2821	83 1 12	.2770
82 6 7	.2750	82 8 15	.2806	82 10 30	.2809	83 1 14	.2760
82 6 8	.2747	82 8 17	.2757	82 11 1	.2790	83 1 15	.2751
82 6 10	.2750	82 8 19	.2747*	82 11 3	.2769	83 1 16	.2742
82 6 11	.2748	82 8 21	.2726	82 11 6	.2764	83 1 17	.2734
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82 6 14	.2765	82 8 25	.2729	82 11 11	.2764	83 1 21	.2733
82 6 15	.2775	82 8 27	.2740	82 11 13	.2762	83 1 22	.2734
82 6 16	.2779	82 8 30	.2753	82 11 15	.2750	83 1 25	.2720
82 6 18	.2788	82 8 31	.2766	82 11 17	.2748	83 1 26	.2729*
82 6 20	.2791	82 9 2	.2784	82 11 18	.2753	83 1 29	.2745
82 6 22	.2787	82 9 3	.2801	82 11 19	.2763	83 1 30	.2753
82 6 24	.2767*	82 9 4	.2817	82 11 21	.2782	83 2 2	.2772
82 6 26	.2742	82 9 6	.2819	82 11 22	.2787	83 2 3	.2777

Date	Value	Date	Value	Date	Value	Date	Value
83 2 5	.2767	83 4 19	.2724	83 7 4	.2732	83 9 7	.2727
83 2 7	.2748	83 4 20	.2720	83 7 5	.2737	83 9 9	.2732
83 2 9	.2728	83 4 22	.2722	83 7 8	.2734	83 9 10	.2742
83 2 11	.2716*	83 4 23	.2731	83 7 9	.2725	83 9 11	.2738
83 2 14	.2695	83 4 24	.2743	83 7 11	.2728	83 9 12	.2729
83 2 15	.2689	83 4 26	.2753	83 7 13	.2723*	83 9 13	.2718
83 2 17	.2696	83 4 27	.2763	83 7 15	.2719	83 9 14	.2717
83 2 18	.2701	83 4 28	.2771	83 7 16	.2729	83 9 15	.2709
83 2 19	.2699	83 4 30	.2763	83 7 17	.2737	83 9 16	.2703
83 2 21	.2699	83 5 2	.2742	83 7 19	.2740	83 9 17	.2701
83 2 23	.2709	83 5 4	.2726	83 7 20	.2742	83 9 18	.2691
83 2 25	.2715	83 5 6	.2707	83 7 21	.2743	83 9 20	.2691
83 2 26	.2724	83 5 8	.2716	83 7 23	.2743	83 9 21	.2687
83 2 27	.2740	83 5 10	.2720	83 7 24	.2737	83 9 22	.2692
83 3 1	.2754	83 5 12	.2726	83 7 25	.2727	83 9 23	.2695
83 3 2	.2755	83 5 13	.2732	83 7 27	.2715	83 9 25	.2708
83 3 3	.2756	83 5 14	.2724	83 7 28	.2703	83 9 26	.2707
83 3 6	.2753	83 5 16	.2725	83 7 29	.2707	83 9 27	.2710
83 3 7	.2734	83 5 17	.2724	83 7 31	.2725	83 9 28	.2709
83 3 9	.2716	83 5 18	.2723	83 8 1	.2732	83 9 30	.2700
83 3 11	.2699*	83 5 20	.2730	83 8 2	.2740	83 10 1	.2699
83 3 13	.2687	83 5 21	.2745	83 8 4	.2736	83 10 2	.2695
83 3 14	.2684	83 5 22	.2754	83 8 6	.2730	83 10 3	.2697
83 3 15	.2694	83 5 24	.2760	83 8 8	.2728	83 10 4	.2710
83 3 17	.2708	83 5 25	.2768	83 8 9	.2723	83 10 7	.2725
83 3 19	.2718	83 5 26	.2767	83 8 10	.2725	83 10 8	.2738
83 3 21	.2714	83 5 28	.2753	83 8 12	.2743	83 10 9	.2748
83 3 22	.2720	83 5 30	.2735	83 8 13	.2757	83 10 10	.2745
83 3 23	.2717	83 6 3	.2723*	83 8 14	.2769	83 10 12	.2744
83 3 25	.2716	83 6 5	.2733	83 8 16	.2772	83 10 13	.2730
83 3 27	.2715	83 6 6	.2732	83 8 18	.2752	83 10 14	.2721
83 3 29	.2716	83 6 7	.2740	83 8 20	.2734	83 10 15	.2710
83 3 30	.2726	83 6 10	.2744	83 8 22	.2717*	83 10 16	.2698
83 3 31	.2720	83 6 11	.2731	83 8 24	.2704	83 10 18	.2692
83 4 2	.2713	83 6 13	.2723	83 8 25	.2706	83 10 20	.2684
83 4 3	.2716	83 6 15	.2724*	83 8 26	.2715	83 10 21	.2691
83 4 4	.2703	83 6 17	.2734	83 8 28	.2719	83 10 23	.2687
83 4 6	.2697	83 6 18	.2745	83 8 29	.2718	83 10 24	.2687
83 4 7	.2692	83 6 19	.2753	83 8 30	.2709	83 10 25	.2683
83 4 10	.2693	83 6 23	.2775	83 8 31	.2707	83 10 27	.2684
83 4 11	.2707	83 6 25	.2761	83 9 1	.2703	83 10 29	.2682
83 4 12	.2711	83 6 27	.2754*	83 9 2	.2706	83 10 30	.2685
83 4 14	.2720	83 6 29	.2733	83 9 3	.2700	83 10 31	.2685
83 4 15	.2719	83 7 1	.2724	83 9 4	.2707	83 11 1	.2689
83 4 16	.2720	83 7 3	.2728	83 9 6	.2714	83 11 2	.2696

Date	Value	Date	Value	Date	Value	Date	Value
83 11 4	.2708	83 12 31	.2671	84 3 2	.2717	84 4 28	.2725
83 11 5	.2720	84 1 2	.2681	84 3 3	.2718	84 4 29	.2726
83 11 6	.2722	84 1 3	.2684	84 3 5	.2713	84 4 30	.2722
83 11 7	.2722	84 1 5	.2685	84 3 7	.2714	84 5 1	.2720
83 11 9	.2712	84 1 6	.2684	84 3 8	.2713	84 5 3	.2707
83 11 10	.2712	84 1 7	.2684	84 3 9	.2709	84 5 4	.2691
83 11 11	.2706	84 1 8	.2682	84 3 10	.2710	84 5 5	.2685
83 11 12	.2692	84 1 9	.2689	84 3 11	.2701	84 5 6	.2673
83 11 13	.2683	84 1 11	.2692	84 3 13	.2699	84 5 9	.2694
83 11 15	.2678	84 1 12	.2690	84 3 14	.2694	84 5 10	.2702
83 11 16	.2669	84 1 13	.2695	84 3 15	.2693	84 5 11	.2710
83 11 17	.2672	84 1 14	.2684	84 3 16	.2707	84 5 12	.2719
83 11 18	.2673	84 1 16	.2680	84 3 18	.2723	84 5 14	.2732
83 11 19	.2666	84 1 19	.2675	84 3 19	.2732	84 5 15	.2734
83 11 21	.2659	84 1 20	.2678	84 3 20	.2735	84 5 16	.2728
83 11 22	.2666	84 1 22	.2683	84 3 21	.2741	84 5 17	.2713
83 11 23	.2664	84 1 23	.2689	84 3 22	.2744	84 5 18	.2709
83 11 24	.2664	84 1 24	.2689	84 3 24	.2734	84 5 20	.2707
83 11 26	.2664	84 1 25	.2694	84 3 25	.2731	84 5 21	.2719
83 11 27	.2664	84 1 26	.2709	84 3 26	.2726	84 5 22	.2726
83 11 29	.2677	84 1 28	.2711	84 3 27	.2717	84 5 23	.2732
83 12 1	.2689	84 1 30	.2711	84 3 28	.2719	84 5 25	.2731
83 12 2	.2699	84 1 31	.2708	84 3 30	.2716	84 5 26	.2731
83 12 3	.2695	84 2 2	.2699	84 3 31	.2716	84 5 27	.2731
83 12 4	.2692	84 2 3	.2694	84 4 1	.2724	84 5 28	.2726
83 12 5	.2700	84 2 4	.2695	84 4 2	.2725	84 5 29	.2717
83 12 7	.2698	84 2 5	.2700	84 4 4	.2732	84 5 30	.2710
83 12 8	.2691	84 2 6	.2706	84 4 5	.2727	84 6 1	.2694
83 12 9	.2701	84 2 8	.2712	84 4 6	.2721	84 6 2	.2701
83 12 10	.2697	84 2 9	.2725	84 4 7	.2716	84 6 3	.2705
83 12 11	.2698	84 2 11	.2725	84 4 9	.2700	84 6 4	.2707
83 12 14	.2697	84 2 12	.2716	84 4 10	.2692	84 6 6	.2708
83 12 15	.2691	84 2 14	.2711	84 4 11	.2687	84 6 7	.2705
83 12 16	.2681	84 2 15	.2701	84 4 12	.2684	84 6 8	.2702
83 12 17	.2677	84 2 17	.2694	84 4 13	.2691	84 6 9	.2705
83 12 19	.2675	84 2 19	.2698	84 4 14	.2703	84 6 10	.2705
83 12 20	.2675	84 2 20	.2701	84 4 16	.2710	84 6 11	.2704
83 12 21	.2670	84 2 21	.2722	84 4 17	.2716	84 6 12	.2703
83 12 22	.2673	84 2 22	.2729	84 4 18	.2723	84 6 13	.2696
83 12 23	.2673	84 2 23	.2743	84 4 19	.2723	84 6 14	.2697
83 12 25	.2665	84 2 25	.2750	84 4 21	.2717	84 6 15	.2702
83 12 26	.2667	84 2 26	.2744	84 4 22	.2711	84 6 17	.2704
83 12 27	.2670	84 2 27	.2745	84 4 24	.2710	84 6 18	.2710
83 12 28	.2669	84 2 28	.2736	84 4 25	.2716	84 6 19	.2711
83 12 30	.2676	84 2 29	.2731	84 4 27	.2722	84 6 20	.2709

Date	Value	Date	Value	Date	Value	Date	Value
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84 6 22	.2699	84 7 19	.2675	84 8 22	.2655	84 9 25	.2656
84 6 23	.2699	84 7 20	.2675	84 8 24	.2656	84 9 27	.2659
84 6 24	.2700	84 7 21	.2674	84 8 26	.2665	84 9 28	.2660
84 6 25	.2689	84 7 23	.2670	84 8 28	.2668	84 9 29	.2663
84 6 26	.2683	84 7 26	.2665	84 8 30	.2671	84 9 30	.2661
84 6 27	.2675	84 7 27	.2666	84 8 31	.2680	84 10 2	.2660
84 6 28	.2673	84 7 28	.2663	84 9 1	.2677	84 10 3	.2663
84 6 30	.2684	84 7 29	.2669	84 9 2	.2683	84 10 4	.2662
84 7 1	.2689	84 7 30	.2672	84 9 5	.2680	84 10 5	.2657
84 7 2	.2696	84 8 1	.2679	84 9 6	.2684	84 10 6	.2661
84 7 4	.2713	84 8 2	.2685	84 9 7	.2680	84 10 9	.2655
84 7 5	.2720	84 8 3	.2684	84 9 8	.2676	84 10 10	.2653
84 7 6	.2719	84 8 4	.2685	84 9 10	.2671	84 10 11	.2650
84 7 7	.2719	84 8 5	.2689	84 9 11	.2664	84 10 12	.2648
84 7 8	.2717	84 8 7	.2687	84 9 12	.2662	84 10 14	.2644
84 7 9	.2710	84 8 8	.2690	84 9 13	.2655	84 10 15	.2647
84 7 10	.2701	84 8 9	.2692	84 9 14	.2651	84 10 16	.2645
84 7 11	.2698	84 8 10	.2694	84 9 16	.2651	84 10 17	.2651
84 7 12	.2691	84 8 11	.2692	84 9 17	.2647	84 10 18	.2652
84 7 13	.2689	84 8 13	.2686	84 9 18	.2645	84 10 20	.2654
84 7 15	.2689	84 8 14	.2681	84 9 21	.2647	84 10 21	.2657
84 7 16	.2688	84 8 16	.2666	84 9 22	.2653	84 10 22	.2655
84 7 17	.2685	84 8 18	.2655	84 9 23	.2656	84 10 25	.2649
84 7 18	.2684	84 8 20	.2650	84 9 24	.2657	84 10 27	.2647

1974 Ottawa	ADJUSTED DAILY SOLAR FLUX 2800 MHz Series C (Multiplied by Ten)											1974 1700 UT
Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	715	718	764	721	985	979	1054*	851	778	931	902	797
2	732	731	765	713	1131*	1001	1127*	852	794	946	920	787
3	733	731	771	716	1155	989	1185*	830	792	934	962	767
4	725	729	790	733	1180	982	1278*	858	810	1005	995	747
5	721	740	786	763	1197	965	1256*	865	815	1133*	976*	732
6	747	754	775	800	1230	950*	1215	880	822	1150	923	719
7	760	774	760	802	1193	928	1109*	858	854	1145*	856	711
8	797	788	770	811	1158	950*	1047*	894	934	1252	820	696
9	849	808	802	878	1100	951	955	875	960	1289	789	696
10	892	805	861	935*	1051	970	882	883	1020	1293*	784	704
11	910*	775	859	998	1043	953*	831	944	1046	1375*	773	762
12	946	765	862	1056*	971	917	833	994	1056	1441	791	779
13	948*	773	845	1028	935	898	833	952	1068*	1266	761	780
14	957	763	819	1163	882	881	833	932	1041	1132*	777	782
15	918	837	829	1229*	849	847	855	921	1036	1037*	800	832
16	900	847	818	1150*	803	862	913	966	1020*	949	825	883
17	892	859	827	1018	758	872	910	988	1003	838	846	883
18	871	875	802	980	752	844	865	951*	1000A	810	885	903
19	858	827	800	875*	730	828	871	888	917	752	960	919
20	844	822	796	823	725	838	867	826	859*	755	956	873
21	797	822	791	795	719	814	901	812*	827	739	962	860
22	835*	822	800	753	722	823	953*	806	810	726	987	844*
23	810	842	798	739	715	802	985	810	746	740	981	830
24	778	809	766	750	716	791	921*	774	728	747	959	801
25	741	786	743	765	724	788	895	757	728	769	945	789
26	715	762	726	749	796	796	931	738	754	807	922	758
27	707	764	718	753	851	824	879	727	770	800	908	743
28	708	758	704	779	874	830	845	718	807	816	866	737
29	707		715	816	894	894*	852	724	907	816	838	741
30	708		721	917	913	931*	859	742	915	827	820	745
31	713		729		951		874	756		867*		761
Mean	804	789	784	867	926	890	955	851	887	971	883	786

* = corrected for burst in progress
A = interpolated

1974 Yearly Mean = 866

1975
Ottawa

ADJUSTED DAILY SOLAR FLUX
2800 MHz Series C (Multiplied by Ten)

1975
1700 UT

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	781	708	707	702	763	714	787	916	870	764	704	721
2	758	723	724	712	811	730	768	954	879	781	714	748
3	771	743	734	722	796	708	771*	970*	878	784	730	743
4	744	754	728	730	796	704	768	1046	928	763	754	741
5	737	765	713	737	784	693	768	1079	944	761	789	774
6	738	811	724	737	759	682	761	1200*	940	751	801	758
7	757	794	719	743	736	681	741	1232	911	743	805	737
8	777	788	725	736	719	675	740	1237	885	740	809	760
9	799	771	738	734	706	677	733	1159	843	754	788	733
10	805	767	733	724	701	688	730	1165	825	743	789	733
11	812	748	730	723	698	681	776	1073	811	733	786	743
12	824	749	742	708	696	684	827	1045*	782*	748	799	734
13	804	737	756*	707	691	679	885*	980	752	790	792	728
14	777	720	750	697	687	685	890	909*	742	800	827	718
15	774	697	734	697	680	689	856	860	741	803	837	718
16	765	714	760	692	685	714	836	828	743	785	876	705
17	747	693	753	696	683	702	812	790	748	789	889	705
18	758	683	742	683	687	702	828	764	762	792	908*	696
19	741	700	729	675	689	710	819	767	762	780	930*	691
20	738	695	719	680	686	725	833	772	765	771	909	697
21	745	689	712	682	697	687	831	800	767	757	866	690
22	736	683	693	678	708	699	827	785	753	742	815	689
23	727	683	676	687	706	729	820	768	761	743	772	696
24	710	686	674	693	706	759	793	770	768	727*	747	714
25	703	694	675	716	702	777	798	806	767	721	737	710
26	705	688	686	721	690	798	800	813	767	719	719	718
27	701	694	673	744	705	815	785	836	757	721	707	725
28	707	686	678	748	706	807	765	833	761	717	704	715
29	704		690	732	710	794	755	847	759	708	709	725
30	705		690	734	710	788	789	862	758	702	706	719
31	701		705		711		819*	867		699		721
Mean	750	724	717	712	716	719	797	927	804	753	791	723

* = corrected for burst in progress

1975 Yearly Mean = 761

1976
Ottawa

ADJUSTED DAILY SOLAR FLUX
2800 MHz Series C (Multiplied by Ten)

1976
1700 UT

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	721	686	678	796	776	684	693	759	763	746	709	702
2	712	686	681	768	742	679	691	778	753	739	691	716
3	713	684	674	762	719	681	695	823	757	738	698	712
4	718	684	674	748	715	684	686	823	759	731	699	713
5	719	676	676	731	711	687	695	842	754	748	709	701
6	717	681	676	713	699	693	696	843	731	747	697	701
7	716	693	680	703	703	690	695	837	730	745	695	697
8	709	684	679	719	702	707	697	820	729	746	693	708
9	694	683	682	741	706	701	697	828	732	748	707	743
10	705	685	685	753	717	710	701	828	758	749	694	768
11	721	684	689	772	725	714	702	804	757	737	705	783
12	769	678	690	782	726	717	698	806	757	733	708	786
13	800	697	709	797	736	720	698	787	743	726	694	781
14	821*	699	701	796	742	737	707	734	747	744	692	810
15	804	696	691	793	769	743	714	728	739	755	711	798
16	781	697	726	807	792	771	698	729	758	770	711	778
17	766	699	744*	805	765	771	694	778	765	780	728	755
18	767	701	791	805	756*	779	706	782	743	773	756	738
19	752	701	816*	798	738	769	702	761	733	766*	746*	729
20	746	700	850	801	730	769	694	745	722	758	729	717
21	721	688	913	781	740	777	701	732	709	735	732	718
22	709	689	830	762*	725	789	701	723	705	754	733	734
23	702	692	870	757	719	765	687	708	720	801	725	737
24	685	696	822*	768	708	752	694	709	725	801	729	742
25	682	684	852	758	698	749	688	706	734	847	727	756
26	682	685	842*	758	695	743	685	701	728	804	721	756
27	672	685	856	746	696	728	694	715	733	774	737	752
28	671	679	871*	734	690	718	694	728	736	738	717	745
29	674	674	840	797	680	713	694	733	719	721	697	748
30	689		824	796*	681	703	707	730	726	721	697	751
31	691		827		687		723	738		704		764
Mean	724	688	759	768	722	728	698	766	739	754	713	743

* = corrected for burst in progress

1976 Yearly Mean = 734

1977
Ottawa

ADJUSTED DAILY SOLAR FLUX
2800 MHz Series C (Multiplied by Ten)

1977
1700 UT

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	738	817*	726	748	772	889	1020	830*	831	938*	944	884
2	765	821	754	763	785	909*	1007	828	842	932	936	912
3	760	809	748	766	819	930*	974	823	872	974	904	937
4	755	787	769	768	814*	942	940	829*	842	988	894	959
5	740	778	776	755	796	902*	880*	864	856	1040*	906	969
6	724	752	776	761	785	906	902	882	849	1035	911	1020*
7	714	746	772	755*	771*	920	852	869	893	1055	902	1055
8	696	786	816	743	779	919*	821	851	916	1038	903	1067
9	684	831	803	748	836	909	790	859	959A	1007	911	1126*
10	688	835	805	765	808	892*	769	872	998	964	931	1147
11	712	846	789	792	808	872	762	876	1046	953	949	1074
12	749	869*	786	802	797	833	758	865	1078	1008	914	1110
13	775	885	779	827	815	842	778	890	1129	985	940	1006
14	745	852	772	834	848	823	768	875	1182	989	979	937*
15	756	844	748	868	850	823	760	869	1207	982	979	925
16	775	857	741	837	851	814	769	873	1204	968	959	925
17	761	896*	741	836	841	824	765	871	1206	949	1004	911
18	754	865	739	808	829	843	769	886	1205	954	1020*	936
19	769	828	740	798*	821	852	769	870	1045	1050	992	910
20	752	811B	723	804*	813	889	801	887	1088	996*	957*	887
21	740	786	728	808	814	924	817	908	1049*	986*	928	878
22	768	759	746	801	829	988*	831	896	1024	939	893	899
23	787	759	747	775	824	994	850	860	993	873	880	912
24	774	742	748	765	792	1074	840	860	1006	883	867	939
25	749	743	740	764	774	1138	860	877	988	881	847	963
26	760	723	751	754	768	1207	860	864	994	886	841	993
27	753	720	745	749	779	1159*	854	854	1000	885	838	983
28	771	726	744	742	791	1134	875	824	1000	903*	856	989
29	761		754	748	817	1119	867	861	994	903	856	1056*
30	763		746	766	899	1069	841	855	977	949	853	1147
31	796		741		920		804	847		959		1202
Mean	749	803	758	782	814	945	837	864	1009	963	916	989

* = corrected for burst in progress

A = interpolated

B = extrapolated

1977 Yearly Mean = 869

1978
Ottawa

ADJUSTED DAILY SOLAR FLUX
2800 MHz Series C (Multiplied by Ten)

1978
1700 UT

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1269*	1391	1363	1300	1814	1491	1429	1060	1598	1390	1520	1666
2	1339	1526	1411	1298	1830	1470*	1276	1060	1717*	1378	1590	1676
3	1302	1566*	1466	1345	1822A	1308	1165	1096	1670	1317	1699	1642
4	1248	1540	1484	1433*	1784	1186	1174	1123	1744*	1320*	1774	1653
5	1192	1590	1545	1467*	1739*	1169	1189	1176	1794	1387*	1812	1695
6	1187*	1561	1628	1453*	1731	1098	1193*	1226	1811	1374	1722*	1645
7	1116	1573	1652	1469	1626*	1106	1289	1282	1775	1416	1746	1785*
8	1028	1570*	1687	1486	1434	1093	1359	1306	1671	1501	1680*	1899
9	970	1552	1837	1561	1351	1065	1471*	1281*	1576*	1558	1649*	1896A
10	935	1487	1791	1554	1295	1084	1560*	1275	1498	1623	1663	2047
11	931	1542	1752	1628*	1338	1132	1632*	1217	1415	1716*	1637	2105
12	921	1590	1698	1562	1382	1164*	1742*	1245	1385	1772	1504	2173A
13	903	1512	1609	1456	1402	1203*	1655	1349	1380	1785	1453	2106*
14	886	1484	1605	1391	1437	1264*	1631	1327	1435*	1801	1363	1970
15	896	1368	1542	1414	1461	1325	1695	1300*	1526	1820	1338	1927
16	864	1302	1433	1376	1478*	1395*	1634	1236	1615	1767*	1288	1805
17	838	1259	1354	1334	1438	1490	1595	1193*	1618	1715	1281	1777
18	847	1249	1323	1341	1356	1535*	1541*	1156	1693*	1694	1274	1615
19	854	1191	1281	1395*	1336	1620*	1486	1116	1688*	1704	1289	1529
20	870	1222	1253	1381	1323*	1742	1429*	1075	1686	1710	1349	1381
21	914	1222	1182	1384*	1327	1854*	1402	1048	1725	1669*	1260	1321*
22	969	1277	1170	1464	1357*	1903A	1270	1060	1715*	1614	1271	1327
23	996	1318	1164	1629	1429*	1967	1234*	1041	1655*	1614	1219	1334
24	1004	1356	1175	1598	1465*	1948	1185	1054	1589	1569	1235	1352*
25	1033	1393	1182	1591*	1476	1835	1137	1042	1572	1561	1247*	1380
26	1127	1348	1125	1667	1528	1824*	1122	1007	1485	1544	1327	1442
27	1164	1375	1141	1728	1506*	1795	1108	1073*	1462*	1507	1444*	1487*
28	1277*	1354	1127	1766*	1471*	1741	1099	1077*	1478	1484*	1541	1641
29	1322*		1111	1852	1486	1674	1092	1162	1481	1498	1622	1662
30	1349		1154*	1821*	1472*	1546*	1092	1241A	1426	1465	1678	1817
31	1333*		1245		1526		1088	1339*		1440		1951
Mean	1061	1418	1403	1505	1497	1468	1354	1169	1596	1571	1482	1700

* = corrected for burst in progress

A = interpolated

1978 Yearly Mean =1435

1979
Ottawa

ADJUSTED DAILY SOLAR FLUX
2800 MHz Series C (Multiplied by Ten)

1979
1700 UT

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1941*	1858	1685	2026*	1804	1895	1863	1491	1758	2128	2116	1619
2	2001	1856	1707	2034	1792A	2068*	2009*	1439*	1801	2115	2095	1720*
3	2035*	1874*	1733	1942	1643	2161*	2134	1451	1808	2047	2075	1951*
4	1927*	1877	1814	1835	1760	2288*	2181	1417	1753*	1977*	2142	2210
5	1949	1974	1801*	1793	1696	2302	2045	1416	1771	1928*	2355	2234*
6	1909	2065	1824	1763A	1711*	2381	2113	1495	1804*	1955	2732*	2234
7	1862	2034	1831*	1667	1780	2381	2072	1511	1863	1970	2869*	2226
8	2001	2072*	1789	1690*	1824*	2427	2067	1527	1836	2003	3101A	2289*
9	1926	1987	1814	1696	1813	2474*	1979*	1573	1874	2095B	3144*	2324
10	1862	1984*	1806	1730	1747	2399	1859	1521*	1846	2087	3670*	2303
11	1795	2022*	1817*	1700*	1786	2296	1786	1544	1815*	2118	3257*	2306*
12	1745	1954	1887	1745	1842	2083	1701	1448	1817	2164	2944	2323
13	1939	1954	1863	1758	1866	1937	1614	1558	1861	2391	2727	2317
14	2000*	2042*	1894	1709	1820	1857	1547*	1582*	1926*	2364	2564	2383
15	1921*	2050*	1813	1681	1819	1760	1511	1676	1938	2307	2397*	2318
16	1899*	2092	1835*	1717	1764	1675	1436	1648	1963*	2323	2306	2163
17	1757	2131	1777	1680	1877	1581	1427	1658	2027*	2260	2318	2022
18	1776	2377B	1886*	1587	1713*	1526	1412	1800	2157	2368	2319	1874
19	1878	2378	1776A	1594	1615	1462	1436	1864	2181*	2373*	2148	1830
20	1972	2301*	1841	1561	1556	1515	1466	2042*	2139*	2367*	2059	1808*
21	2103	2251	1822	1615	1557	1489	1437*	2076*	2184	2301	1898	1767*
22	2269	2233	1811	1597*	1565*	1411	1557	2232	2165	2219	1825	1753
23	2251	1960	1885	1623	1560	1390	1631*	2186	2242*	2149*	1832	1686
24	2085	1828	1883	1619	1592*	1412	1686	2252	2307	2256*	1752*	1602
25	2061	1675	1882	1725	1533*	1478	1645	2293*	2355	2152	1658*	1620
26	1929	1660A	2002	1820	1491	1537	1656	2233A	2299*	2029	1616	1597
27	2054	1627	1879	1951*	1494	1585	1591*	2128	2287*	2112	1557	1536*
28	2096	1636	1886	1921*	1492	1591	1581	2142	2338	2100	1501C	1631
29	2093		1914	1857	1502	1669	1567	1976	2250	2148	1540	1740
30	1941*		1866	1852*	1584	1767*	1603	1878	2319	2137*	1522	1855
31	1937		2014*		1749		1524	1799		2149*		1889
Mean	1965	1991	1840	1750	1689	1860	1714	1770	2023	2164	2268	1972

* = corrected for burst in progress

1979 Yearly Mean =1917

A = interpolated

B = extrapolated

C = may be 4 flux units too low owing to snow on antenna

1980
Ottawa

ADJUSTED DAILY SOLAR FLUX
2800 MHz Series C (Multiplied by Ten)

1980
1700 UT

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1891	2126*	1757	1819	2185	1912	1600*	1319	2132*	1711	2263	2230
2	1999	2179	1729	1811*	2230	1840	1549	1318	2245*	1679*	2342	2133
3	2119*	2257	1702*	1761	2212	1788	1477	1332	2321	1741	2416	1979
4	2124*	2317	1727*	1843*	2231*	1815	1467	1309	2251	1752	2499*	1994
5	2077	2189	1718	2097*	2219	1784	1525*	1326	2156*	1826	2633*	1864
6	2221	2217	1694	2384*	2035	1724	1501	1432*	2109	1853*	2739*	1710
7	2280	2239*	1663	2361*	2034	1657*	1525	1423A	2130	1987*	2727	1764
8	2281*	2187	1649	2417	2002*	1724*	1528	1464	2009	2121*	2662*	1693
9	2409*	2082*	1613	2447*	1936	1743*	1552	1565B	1897	2234*	2554*	1751
10	2530*	2046*	1539	2490	1911	1761	1623*	1735	1887	2327	2572*	1805
11	2557*	2137	1478	2499	1914*	1829	1733	1841	1881	2407	2560*	2035*
12	2451*	2137	1386	2456	1895	1893*	1780	1896	1789	2478*	2332*	2405*
13	2216	2179	1446	2328	1929	1865	1968	1933*	1719	2533*	2268	2442
14	2038	2010	1412	2263	2029	1888*	2097	1917*	1634	2511	2188*	2532
15	2000	2012*	1393	2061*	1998	1864	2184	1919	1538	2370	2052*	2662
16	1886	2002	1373	1924	2029*	1933	2354*	1957	1596	2149	1911	2730
17	1869	1828*	1429	1919	2075*	1974	2502*	1977*	1580	2011	1816*	2548
18	1775	1800*	1474	2014	2143*	2076	2498*	2043*	1544	2006	1749	2551
19	1644	1773	1623	2145*	2342	2198*	2552*	2014	1601*	2033	1724	2385
20	1565	1747	1621	2158	2447*	2279*	2580	1930	1675	2005	1616	2359*
21	1534	1696	1624	2077	2526	2280	2540	1941	1596	2042	1618	2248
22	1582*	1673	1625	1992	2766	2500*	2487	1783*	1786	2053*	1714	2312
23	1667	1601	1724*	1862	2895	2515	2351	1741	1887*	1961	1672	2260
24	1711*	1572*	1724	1863	2902	2459*	2222	1643*	1913	1925	1749*	2236
25	1713*	1657	1825*	1859	2928	2388*	2064	1538*	1838	1829	1764*	2207
26	1788*	1690	1852	1866	2842	2263	1974	1546	1843	1803*	1896	2201
27	1906*	1732	1953*	2006*	2812*	2126	1884	1593	1832*	1772	1853	2203
28	1940	1717*	2035	2037	2808*	1997*	1695	1683	1852	1782*	1914	2315*
29	1970	1767*	1999	2035*	2523	1888	1553	1785	1782*	1864	2061*	2172
30	1979		1943*	2009	2227	1834	1433	1914*	1741	2018	2163	2099
31	2139*		1872*		2006		1365	1987*		2115		1990
Mean	1996	1951	1665	2093	2291	1993	1908	1703	1859	2029	2134	2188

* = corrected for burst in progress

A = interpolated

B = extrapolated

1980 Yearly Mean =1984

1981
Ottawa

ADJUSTED DAILY SOLAR FLUX
2800 MHz Series C (Multiplied by Ten)

1981
1700 UT

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1897	2073	2244*	2108*	1880	1496	1754	1839	2483	2106*	2225*	2307*
2	1814	2101	2306*	2112*	1934	1443	1689	1826	2428	2048*	2413*	2303*
3	1731	2054*	2389*	2212	2065*	1349	1633*	1924	2290	1965	2553*	2386
4	1668	1975	2456*	2197	2212	1338	1659	1906*	2334	1911	2631	2417
5	1618	1878	2273	2262	2375	1360	1525	1788	2487	1936*	2541	2600
6	1574	1854*	2127	2357	2312	1406	1487	1796	2632*	2003	2446	2621
7	1686*	1805*	2014	2423	2342	1467	1498	1730	2625*	2041*	2414	2756*
8	1692	1791	2006*	2688*	2224*	1467*	1524	1784	2663*	2007*	2347*	2878
9	1670	1767	2029	2877	2186	1528	1500*	1805	2565	2054*	2326	2924*
10	1646	1852	2031	2688*	2177*	1571	1565*	1820	2476	2134	2310*	2787
11	1605	1864*	1997	2721	2281*	1548	1674	2064	2408	2200	2170	2667*
12	1566	1906*	1888	2519	2234	1520	1677*	2090*	2342A	2368*	2235	2542*
13	1581	1978	2021	2549*	2213	1526	1742*	2087	2302	2562	2159	2189
14	1539	2003	2089	2565*	2325	1591	1842	2082	2287*	2756	2074	1930
15	1498	1935	2063*	2549*	2239	1647	1945*	2251	2304	2871	1912	1726
16	1525	1869	1949	2475*	2189	1691	2053*	2218*	2275	3024	1812	1574
17	1553	1881*	1815	2427	2076	1712	2008*	2287	2182*	3029	1727	1442
18	1610	1902*	1800	2292	1944	1701	2047*	2441	2165*	2965*	1608*	1363*
19	1654	1788	1751	2149	1866*	1659	2203	2546*	2105*	2786	1570	1297
20	1599*	1883	1827	2009*	1800	1598	2347*	2698	2001	2578*	1520	1339
21	1566	1899*	1895	1961	1804	1536	2281*	2671*	1912	2382	1539	1422
22	1564	1995	1894*	1915	1693*	1661*	2359	2622*	1830	2186	1527	1459
23	1568	2179*	1880*	2049	1596	1712*	2547*	2548	1838	2082	1519	1530
24	1573	2315*	1914	2030*	1698	1746	2616*	2589	1822	2011	1504	1561*
25	1692*	2338	1993	2038*	1772	1836	2597	2548	1820	1860	1591	1621
26	1746	2385	1986*	1988	1738	1939	2731*	2729*	1888	1720	1783*	1662
27	1758*	2354	1976	1947*	1770	1934	2558*	2816*	2028	1712	1903	1768
28	1972*	2249*	2037*	1782*	1813	1916	2236	2753	2009	1824	2064*	1830
29	2042		2124*	1769	1706	1875*	2133	2591	2045	1875	2265*	1836
30	2091		2082	1753	1646*	1790	2042*	2651	2038	2015	2316	1857
31	2091		2140*		1561		1976	2560*		2071		1828
Mean	1690	1995	2032	2247	1989	1619	1982	2260	2219	2228	2033	2014

* = corrected for burst in progress
A = interpolated

1981 Yearly Mean =2026

1982
Ottawa

ADJUSTED DAILY SOLAR FLUX
2800 MHz Series C (Multiplied by Ten)

1982
1700 UT

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1799	2848*	2313	1722*	1517	1342	1065	1234	1843*	2052	1596	1678
2	1772	2797*	2283	1720*	1474	1351	1069	1382*	1687*	2094*	1545	1663
3	1761	2729*	2301	1699	1477	1415	1094	1535*	1710*	1970A	1474	1816
4	1704	2528*	2383*	1582	1447	1582*	1115	1673	1881*	1823*	1434	1945
5	1655	2452	2454*	1599*	1487	1566*	1141	1809	1794	1639	1364	1959*
6	1668	2452	2300*	1652	1530	1496*	1213	2012	1721	1519	1421	2104
7	1669*	2399	2283	1640*	1510	1586*	1282*	2196	1768	1402	1423	2443
8	1569	2451*	2071*	1621*	1508	1673	1503*	2175*	1785	1369	1448	2417*
9	1644	2317	1922	1673*	1398	1774	1766*	2125	1792	1374	1475A	2586
10	1457	2137	1789*	1771*	1307	1960*	2035*	2095	1656	1348	1529	2735*
11	1363	2111*	1782	1787*	1323	2242	2264*	2050*	1583	1373	1541	2593*
12	1324	2040*	1812	1775*	1323	2383*	2397*	1952*	1525*	1364	1649	2511
13	1275	1949*	1855	1709	1298	2402	2526*	1829*	1513	1439	1612	2390
14	1305	1853	2013	1579	1322	2408	2692*	1768	1474	1404	1595	2356
15	1363	1803	2076*	1522	1321	2358	2740	1730	1490*	1341	1570*	2219
16	1467	1705	2277	1482	1390	2106*	2694*	1614	1473	1298	1633	2132*
17	1526	1625	2304	1459*	1422*	2060*	2733	1651	1470*	1301	1580	2005*
18	1676	1657	2268	1470	1468	2007*	2472*	1664*	1432	1328	1702*	1865
19	1694	1709*	2197*	1451	1559	2075	2347	1592	1426*	1367	1823	1768*
20	1670	1713	2170	1442	1556*	2071	1965	1447	1469	1462*	1892	1592
21	1633	1652	2124	1452	1654*	2107	1737*	1386	1454	1614	2009	1494
22	1529	1637	2137	1569*	1588	1972*	1495*	1388	1462	1682	2311*	1501*
23	1480	1731	2024	1752	1557*	1873	1285	1412	1526*	1773*	1961	1570*
24	1491	1859*	1890	1810	1448*	1682	1178	1429	1654*	1909	1729	1668
25	1693*	1841	1899	1826*	1457	1591*	1082	1585	1703	1968*	1648	1706
26	1827*	2040	1928*	1783	1580	1423	1021	1664	1873	1935	1688*	1687
27	1972	2221	1954*	1673	1715*	1276	978	1804	1914	1877*	1586	1662
28	2347	2240	2006	1610*	1713*	1231	964	1814	1969	1814	1603*	1570
29	2670		1980	1556	1709*	1117	975	1834	2046	1709*	1614	1473
30	2845		1945*	1498*	1428	1085	1124	1745	2024	1667	1648	1425
31	2891		1841		1367		1144	1750*		1651		1344
Mean	1734	2089	2083	1629	1479	1774	1648	1721	1671	1609	1637	1932

* = corrected for burst in progress
A = interpolated

1982 Yearly Mean =1751

1983
Ottawa

ADJUSTED DAILY SOLAR FLUX
2800 MHz Series C (Multiplied by Ten)

1983
1700 UT

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1314	1626	1454	1007	1420	1313	1241*	1511	1105*	1175	983	905
2	1314	1565*	1387	1012	1454	1390*	1254	1454*	1109	1204	976	889
3	1362	1455	1410	1014*	1394	1393	1315	1394*	1064	1231	969	885
4	1382	1568	1437	1008	1329	1492	1372	1365	1105	1251	1031	919
5	1546	1543*	1466	987	1308	1679*	1321	1365	1176	1266*	1051	920
6	1616*	1523	1393	995	1258*	1914	1324	1420	1207	1327	---	971*
7	1633	1422	1323	1022	1174	1795	1327	1419	1186	1339	1085	986
8	1559*	1333	1281	1041*	1270	1737	1279	1410	1185	1311*	1035	983
9	1500	1219	1220	1061	1322*	1595*	1231	1429	1153	1304	992	1082
10	1442	1134	1151	1033	1435*	1505*	1231	1516	1097	1336*	1008	1080
11	1393	1069	1030	1044	1593*	1392	1257	1513	1105	1383	967	1017*
12	1357	998	995*	1077	1604*	1345	1247	1567*	1049*	1337	896	1011
13	1351	955	958	1091	1544	1283	1235	1473	1044	1335*	919	1008
14	1372	917	959	1117	1535*	1264*	1244	1416*	1053	1315*	910	965
15	1410	885	1006*	1036	1457	1287	1246	1358*	1063*	1270	909	922
16	1402	897	1078	1051	1340*	1288*	1213	1321	1063*	1172B	906	935*
17	1380	919	1145	1135	1317*	1307	1200	1268	1051	1109*	856	920
18	1348	972	1177	1207	1376	1305	1164*	1222	1025	1036	844	901
19	1274	946	1183	1250	1468	1338	1195	1177	1012	1052	823	862
20	1205	973	1207	1274	1518*	1369	1251	1187	1004	991	803	836
21	1161	1016	1188*	1333	1498	1440	1281*	1142	1030	893	793	823
22	1135	1062	1172	1397	1520	1489	1389	1108	1060	872	801	829
23	1154	1120	1162	1404	1437	1498	1329*	1108	1126	878	782	830
24	1141	1143	1171	1427	1405	1417*	1363*	1087	1118	886	788	831
25	1227	1203	1142*	1456	1388	1414	1367*	1042	1105*	892	792	824*
26	1326	1262	1147*	1468	1323	1441A	1289*	1058	1146*	891	804	829
27	1336	1383	1096	1496	1305	1371	1231	1037	1198	889	844	835
28	1406	1376	1049	1564*	1331	1294*	1271	1028	1148	904	866	807
29	1489		989	1484	1390	1289	1385*	1057	1145	907	894	811
30	1548		1007	1472	1354*	1268	1443	1040	1130*	926	900	813
31	1619		987		1380*		1531*	1042		962		838
Mean	1377	1196	1173	1199	1402	1430	1291	1275	1102	1118	904	905

* = corrected for burst in progress
A = interpolated
B = extrapolated

1983 Yearly Mean =1198

1984
Ottawa

ADJUSTED DAILY SOLAR FLUX
2800 MHz Series C (Multiplied by Ten)

1984
1700 UT

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	843	1546	1436	1357	1537	1161	1017	840	941	720	695	770
2	874	1420*	1382	1346*	1393*	1113	1036	863	932	748	701	768
3	895	1314	1225	1288*	1231	1096	1048	884	945	752	720	779
4	910	1260	1144*	1295	1135*	1068	1057	857	919	752	722	759
5	882	1142	1093	1187	1149	1046	1044*	857	898	740	717	734
6	856	1118	1095	1121*	1081	989	1003	899	859	732	710	730
7	865	1136	1050	1078	1183	973	1001	924	852	735	701	728
8	923	1272	1038	1007A	1219	946	1011	940	834	746	705	741
9	944	1399	1024	949	1383	936	1045	944	806	735	727	745
10	952	1367*	988	939	1509	923	1013	954	791	741	758	757
11	968	1411*	986	973	1479	932	968	908	778	743	731	789
12	1011	1358*	1023*	1072	1482*	930	947	880	765	739	728	778
13	1021	1284	1147	1137	1514	986	926	865	750	747	716	762
14	992	1203*	1211	1188	1469	1102	922*	840	745	732	720	758B
15	978	1134	1344	1197	1396	1165*	922	826	733	764	729	749
16	966*	1145*	1240	1172	1373	1103	901	831	734	766	707	742
17	952	1165	1291	1229*	1301	1095*	873	810	746	762	710	726
18	950	1222*	1258*	1199	1319	1089	855	791	738	765	717	702
19	934	1284*	1265	1125*	1376	1078	847	762	746	742	723	710
20	1022	1346	1263	1241*	1380	1066	848	756	741	735	748	699
21	1033	1438	1224	1277	1453*	1034*	867	772	751	732	783	697
22	1105	1580	1227	1308	1301	1046	863	757	759	745	782	707
23	1133	1661	1151	1366*	1300	1053	873	760	761	727	793	713
24	1264*	1729*	1130	1429	1269	1036	868	816	762	708	811	718
25	1468	1694*	1116	1524	1257*	1046	859	830	746	702	831	722
26	1648*	1642	1202	1740	1210	1001	834	877	743	694	825	723
27	1723	1543	1291*	1837*	1203	1015	830	904	735	686	825*	720
28	1689	1488	1359	1826*	1185	995	825	886	731	693	811	722
29	1746	1481	1381*	1782*	1210	1003	823	903	717	682	771	721
30	1615		1438	1708	1197A	1011	822	918	724	688	764	714
31	1693		1437		1159		830	931*		698		700
Mean	1124	1372	1208	1297	1311	1035	922	858	789	731	746	735

* = corrected for burst in progress

A = interpolated

B = extrapolated

1984 Yearly Mean =1011

1985
Ottawa

ADJUSTED DAILY SOLAR FLUX
2800 MHz Series C (Multiplied by Ten)

1985
1700 UT

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	684	722	693	722	806*	695	769	805	730	683	690	678
2	678	738	691	726	765	724	791*	804	728	675	688	684
3	677	736	690	725E	726	746	813	792	731	687	680	685
4	678	709	686	719	708	775	804	793	735	683	676	683
5	670	712	675	712	714	843	833	785	722	670	685	697
6	679	706	681	705	750	874	875	779	725	660	700	711
7	681	703	680	703	791	884	977	795	708	659	718	719
8	674	725	687	699	837	889	967*	785	703	658	737	730
9	681	732	687	694	896	898	1009*	749	706	660	729	752
10	674	736	680	697	917	917	1046*	728	703	667	725	756
11	677	732	696	690	899	912	973	684	692	677	747	766
12	684	723	693	696	921	898	929	697	685	669	747	773
13	726	708	695	698	919	892	855	689	707	667	743	756
14	723	706	695	706	907*	853	764	693	704	698	769	764
15	724	702	696	700	920*	838	730	690	711	717	822*	802
16	747	698	701	694	955	809	719	682	703	732	788	837
17	758	709	721	702	923	773	719	679	700	755	774	802
18	741	734*	746	717	927	738	718	686	704	755	773	784
19	754	761	742	717	896	722	717	691	707	777	756	775
20	817*	750	742	723	867	719	717	706	698	794	757	754*
21	849*	742	761*	779	844*	715	712	704	696	847	737	751
22	853	733	759	898	827*	716	710	727	698	943	731	735
23	825	717	773	933*	800	718	711	729	692	932*	728	712
24	782	705	796	890*	783	708	710	721	690	925	719	699
25	739	701	785	952	772	710	756	725	687	885*	703	673
26	710	697	797D	883*	755	700	774	723	684	830	695	663
27	695	689	774D	806	746	702	792	731	677	785*	698	662
28	696	697	777D	781	727	710	812	731	678	767	690	662
29	687		767D	832	725	723	835	731	683	736	691	660
30	683		758D	808	714	748	838	739	683	705	688	663
31	699B		764D		696		824	741		695		666
Mean	721	719	725	757	820	785	813	733	702	742	726	724

* = corrected for burst in progress

B = extrapolated

D = corrected for error in antenna focus

E = corrected for snow on antenna

1985 Yearly Mean = 747

1986
Ottawa

ADJUSTED DAILY SOLAR FLUX
2800 MHz Series C (Multiplied by Ten)

1986
1700 UT

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	670	818	841	718	725	711	689	728	698	712	876*	707
2	676	864*	892	706	743	698	687	723	692	716	841	706
3	684	960	911*	709	738	699	689	729	693	721	808	702
4	695	978*	914	717	716	693	693	716	694	707	823	692
5	707	998	905	719	708	693	711	717	696	711	815	700
6	722	990	897*	719	698	698	739	721	695	724	806	691
7	716	967	876	719	699	700	721	719	699	743	769	682
8	712	943*	851	718	695	702	716	713	694	748	735	691
9	727	925	843	720	698	711	725	713	694	746	719	708
10	722	934*	816	725	709	703	750	705	693	733	704	723
11	719	951	793	724	714	701	747	686	688	732	699	730F
12	712	884	769	731	709	705	735	684	688	753	714	711
13	743	864	743	742	717	704	742	679	690	751	760*	715
14	764	862*	719	760	716	721	746	682	700	750	741	714
15	751	796	697	760	727	713	740	695	715	718	751	709
16	755*	712	689	758	743	707	744	694	705	791	750	708
17	744	683	689	753	753	698	749	689	692	826	738	717
18	731	687	689	744	787	699	746	691	688	863	730	714
19	702	681	688	749	787	696	733	693	687	886	725	710
20	692	681	684	750	796	696	732	707	686	922	725	704
21	679	660	685	742	792	692	725	705	688	915	741	706
22	673	677	691	751	792	697	732	701	683	944	745	714
23	670	677	698	821	788	696	716	696	687	979	758	708
24	669	686	695	874	795	684	712	691	688	973	770	700
25	680	701	696	857	811	685	709	693	694	944	755	700
26	677	720	708	842*	771	682	711	699	685	942	743	697
27	672	752	702	834	747	686	716	691	689	943	736	694
28	700	770	704	801	743	683	725	688	703	936	731	692
29	712		715	770	743	683	740	688	715	914	724	692
30	737		715	747	725	683	736	693	716	898	709	696
31	766		715		732		726	696		892		681
Mean	709	815	762	756	742	697	725	701	694	824	755	704

* = corrected for burst in progress

F = uncorrected for interference during calibration

1986 Yearly Mean = 740

1987
Ottawa

ADJUSTED DAILY SOLAR FLUX
2800 MHz Series C (Multiplied by Ten)

1987
1700 UT

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	716	692	728	725	793	778	760	910	853*	842	991	876
2	705	698	733	719	802	779	744	897	855	848	1050	865
3	691	700	716	724	828	764	737	871	875	856*	980	858
4	690	683	733	740	844	773	732	840	896	892	1011*	851
5	703	675	737	776	861	761	734	816	935*	901	992	868
6	693	677	756	894	879	758	733	852	956*	895	949	857
7	697	691	755	944	881	760	741	895*	995*	909	944	853
8	682	689	769	948	891	770	761	938	1019	950	927	887
9	680	692	736	1005	873	768	763	948	1009	927	903	912
10	674	693	714	1000	895	781	763	940	978	1011	892	901
11	680	685	705	1013	864	807	757	998*	954	1008*	926	911
12	689	678	695	986	854	821	755	1000	911	1022	926	915*
13	697	680	696	993	874	823	751	1018*	897	1055	929	911
14	711	683	711	977	912	806	766	1024	868	1133*	923	915
15	715	693	705	978	936	804	788	1013	850	1178I	937	920*
16	707	684	710	953*	982	813	809	1027	835	1111	950	934*
17	708	681	712	973	967	818	815	1012	840	1060	968	922
18	706	698	725	940	985	829	825	1004	824	1065	1000	902
19	700	695	715	917	1001	824	851	990	827	1004	1066	884
20	689	696	738	856	998	811	938	1012	849	956	1122	869
21	712*	707	742	783	999	826	956	966	830	893	1153	907
22	736*	704	738	765	1010	871	1026*	944*	813	882	1178	881
23	721	705	755	765	949	875	1156	918	804	870	1151	882
24	716	721	759	786	985	891	1150	896	803	871	1094	899
25	715	735	757	758	968	863	1149	899	779	923	1049	962*
26	726	739	756	743	923	843	1098*	873	764	969	1013	968*
27	699	740	754	748	875	789	1054	851	802	1059	949	1014
28	708	727*	750	743	851	792	1025	813	823	1062	923	1025
29	706		753	736E	793	766	973	799	835	1027	907	1014
30	698		746	768	779	759H	940	785	819	1042	891	992
31	687		719G		773		919	832		978		997
Mean	702	698	733	855	898	804	870	922	870	974	990	915

* = corrected for burst in progress

E = corrected for snow on antenna

G = corrected for ice on antenna

H = measured at Penticton

I = 1700 UT calibration taken at 1915 UT

1987 Yearly Mean = 853

1988
Ottawa

ADJUSTED DAILY SOLAR FLUX
2800 MHz Series C (Multiplied by Ten)

1988
1700 UT

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1001	1055	998*	1272	1088	1493*	1944*	1809	1913	1794	1572*	1505
2	937	1043	991	1265	1131*	1476	1989	1876	1789	1970	1565*	1494
3	1012	1036	1019*	1276	1164*	1495	1902	1722*	1773	2004	1640	1473
4	982	1031	1026*	1226	1274	1509	1810	1636	1659	1892	1597	1427
5	995	1026	1067*	1146	1211	1512	1712	1592	1663	1910	1638	1546*
6	1017	1036	1076	1168	1165	1590	1567	1634	1524	1934	1612	1577
7	1021	1053	1073	1200	1129	1646	1524	1704	1454	1824	1516	1529*
8	1056	1025	1041*	1218*	1167	1683	1424	1869	1389	1726	1435	1641
9	1006*	1010	1015	1218*	1219	1659*	1377	1824	1280	1765	1524	1652
10	1009	1002	992	1272	1164	1498	1383	1818	1176	1778	1477	1612*
11	1017*	996	1029	1280*	1146	1378	1377*	1782	1219	1682	1538	1764
12	1075*	1013	1035	1306*	1116	1259	1379	1612	1270	1484	1506*	1739
13	1081*	1029	1078	1346	1059	1150	1413*	1597	1248	1575	1578*	1811
14	1137	1026	1089*	1463	1052	1117	1501	1516	1302	1504	1732*	2044*
15	1124	1004	1126*	1435	1034	1135	1507	1440	1261	1491	1611*	2120
16	1218*	1010	1141*	1476	1033	1217	1533*	1378	1285	1523	1861*	2321
17	1164*	1062	1174	1455	1037	1248	1528*	1456	1353	1750	1756	2417
18	1109	1125	1161	1453	1067	1257	1523	1285	1395	1623	1618	2435
19	1142	1090	1161*	1385	1048	1194	1421	1239	1386	1640	1512	2402
20	1127	1065	1163*	1349	1061	1185	1413	1181	1514	1660	1466	2388
21	1116	1047	1175*	1276	1126	1228*	1458	1161	1578	1659	1529	2452
22	1045	1025	1176	1201	1140	1244*	1412	1149	1786	1662	1531	2466
23	1047	1002	1209*	1115	1222	1293	1446	1217A	1778*	1711	1357	2348
24	1022	996	1230*	1056	1198	1357*	1386	1337	1786	1684	1380	2216
25	949	964	1285*	1067	1238*	1537	1409	1443	1774	1621	1375	2105
26	935	967	1275*	1038	1278	1576*	1497	1571	1720	1554	1374	1930
27	1016	963	1280*	1019	1300	1605	1615	1668	1796*	1618	1409	2019
28	1030	971	1298	1016	1301	1832	1754	1740	1710	1560	1388	2016
29	991	1033	1317	1021	1402	1895	1859	1890	1720	1559	1376	1967
30	1001		1283	1048	1428	1874*	1883	1900	1731	1542*	1358	1795
31	1031		1306*		1536*		1925	1945		1604		1776
Mean	1046	1024	1138	1236	1179	1438	1576	1580	1541	1687	1528	1935

* = corrected for burst in progress

1988 Yearly Mean =1411

A = interpolated - interference during calibration

1989
Ottawa

ADJUSTED DAILY SOLAR FLUX
2800 MHz Series C (Multiplied by Ten)

1989
1700 UT

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1795*	1848	1688*	1738*	1805	1916*	2040	1985	2238	1984	2114	2237*
2	1937	1712	1737	1835	1845*	2082*	1934	2017	2333	2085	2160	2137
3	1892	1858*	1690	1965*	1906	2033*	1925*	2202	2430*	2224	2176	2056
4	1957*	1834	1636	1889	1982	2213*	1898	2257	2450	2341	2239	2129
5	2016	1951	1835	1911	1937	2132*	1834*	2415	2733	2232	2354	2097
6	1987	2053*	2011J	1965	1959*	2122*	1923	2403	2884	2205	2553	2097
7	2395	2105	1903*	1998	2006	2053	1935	2406	3034	2257	2073*	2215
8	2602	2439	2026	2071	2124	2229	1889	2336	3021	2101	2709	2036
9	2513	2593	2042*	1940	2051*	2419	1881	2339*	3115	2109	2572	1946
10	2500	2698	2124*	1823	2087	2509*	1841	2326	3033	1955	2463*	1771
11	2547*	2570	2324*	1807	1989	2703	1932	2436	2993	1915	2491	1717
12	2632	2573	2376*	1813	1972	2858*	1907	2561*	2922	2032	2535	1649
13	2917*	2584	2530	1853*	1975	3192	1840*	2639	2493	2242	2403	1632
14	2749	2607	2638J	1981	1931*	3272	1839	2713	2449	2259	2430	1618
15	2801	2413	2558J	1995	1958	3347*	1857	2817	2260	2254	2165	1655
16	2921	2411	2616J	2039	1886	3209*	1839	2598	2337	2370	2162	1641
17	2667*	2339*	2407	2106*	1870	3037*	1841	2629	2162	2253	2150	1760
18	2712	2138	2342	2041	1849	2715	1892	2650	2086	2213*	2216J	1859
19	2416	2140	2211	2097	1886	2706	1937	2491	1970*	2147J	2292	1882
20	2220*	2022*	2182*	1925	2031	2493*	1924	2364	1731	2054	2237	1893
21	1982*	2178	2135*	1961	2119*	2428	1950	2257	1618	2062	2294	1899
22	2036	2139	2225	1936*	2039	2331	2009	2054	1593	2178	2220	1999
23	2056	2147*	2161*	1831*	2122	2387	1965	1913	1575	2104	2134	2138
24	2110	2134	1932*	1890	2100	2276	1911	1820	1570	2142	2088	2310
25	2273	2038*	1862*	1797	1946*	2216	1804	1597	1668	1833*	2160	2480*
26	2063	1903*	1716*	1769	1880	2330	1698	1610	1822*	1717	2343	2526
27	2111	1686*	1626	1769	1766	2275	1728	1596	1994	1769	2394	2748
28	2071	1635	1573	1832	1735	2274	1707	1741	1943	1730	2313	2464
29	2005		1558	1895	1736	2230	1809	1803*	2047*	1720	2151	2427*
30	1873		1598	1806	1830	2174	1851	1920*	2020	1863	2409	2582*
31	1875		1675		1942		1882	2089*		2020*		2367
Mean	2278	2170	2030	1909	1944	2472	1878	2225	2284	2074	2300	2063

* = corrected for burst in progress

J = no calibration due to burst

1989 Yearly Mean =2134

10.7cm. Adjusted monthly mean solar radio flux
During 1979 - 1999

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JULY	AUG	SEP	OCT	NOV	DEC
1979	196.5	199.1	184.0	175.0	168.9	186.0	171.4	177.0	202.3	216.4	226.8	197.2
1980	199.6	195.1	166.5	209.3	229.1	199.3	190.8	170.3	185.9	202.9	213.4	218.8
1981	169.0	199.5	203.2	224.7	198.9	161.9	198.2	226.0	221.9	222.8	203.3	201.4
1982	173.4	208.9	208.3	162.9	147.9	177.4	164.8	172.1	167.1	160.9	163.7	193.2
1983	137.7	119.6	117.3	119.9	140.2	143.0	129.1	127.5	110.2	111.8	90.4	90.5
1984	112.4	137.2	120.8	129.7	131.1	103.5	92.2	85.8	78.9	73.1	74.6	73.5
1985	72.1	71.9	72.5	75.7	82.0	78.5	81.3	73.3	70.2	74.2	72.6	72.4
1986	70.9	81.5	76.2	75.6	74.2	69.7	72.5	70.1	69.4	82.4	75.5	70.4
1987	70.2	69.8	73.3	85.5	89.8	80.4	87.0	92.2	87.0	97.4	99.0	91.5
1988	104.6	102.4	113.8	123.6	117.9	143.8	157.6	158.0	154.1	168.7	152.8	193.5
1989	227.8	217.0	203.0	190.9	194.4	247.2	187.8	222.5	228.4	207.4	230.0	206.3
1990	203.4	174.1	187.0	186.6	194.0	176.3	186.6	228.1	179.3	180.9	180.3	198.5
1991		243.0	230.0	198.8	190.3	206.8	212.0		180.6	201.3		
1992		232.1	171.3	158.5	125.4	116.7	132.2	122.1	116.8	130.8		
1993	117.2	139.1	135.0	116.7	114.9	112.8	102.2	96.0	87.9	99.7	93.8	101.5
1994		99.6	90.4	79.1	79.9	77.3	80.5	76.1	79.0	87.7		
1995	80.0	83.5	84.2	78.2	77.1	78.1	76.3	75.7	72.8	77.5	72.6	70.3
1996		71.5	70.74	69.30	70.1	69.6	71.21	72.4	69.4	69.2		
1997		73.8	73.50	74.50	74.6	71.7	71.1	79.0	96.25	84.92		
1998	90.4	91.1	108.0	109.00	109.0	111.8	117.7	139.4	139.8	116.6	137.1	145.5
1999	138.1	138.6	124.9	118.0	151.0	175.2	171.0					

MONTHLY MEAN SUNSPOT NUMBERS. YEAR : 1987 - 1997

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JULY	AUG	SEP	OCT	NOV	DEC
1987	10.4	2.4	14.7	39.6	33.0	17.4	33.0	38.7	33.9	60.6	39.9	27.1
1988	59.0	40.0	76.2	88.0	66.1	101.8	113.8	111.6	120.1	125.1	125.1	179.2
1989	161.3	165.1	131.4	130.6	138.5	196.2	126.9	168.9	176.7	159.4	173.0	165.5
1990	177.3	130.5	140.3	140.3	132.2	105.4	149.4	200.3	125.2	145.5	131.4	129.7
1991	136.9	167.5	141.9	140.0	121.3	169.7	173.7	176.3	125.3	144.1	108.2	144.4
1992	150.0	161.1	106.7	99.8	73.8	65.2	85.7	64.5	63.9	88.7	91.8	82.6
1993	59.3	91.0	69.8	62.2	61.3	49.8	57.9	42.2	22.4	56.4	35.6	48.9
1994	57.8	35.5	31.7	16.1	17.8	28.0	35.1	22.5	25.7	44.0	18.0	26.2
1995	24.2	29.9	31.1	14.0	14.5	15.6	14.5	14.3	11.8	21.1	9.0	10.0
1996	11.5	4.4	9.2	4.8	5.5	11.8	8.8	14.4	1.6	0.9	17.9	13.3
1997	5.7	7.6	8.7	15.5	18.5	12.7	10.4	24.4	51.3	22.8	39.0	41.2

DAILY SUNSPOT NUMBERS 1974

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yr Day
12	13	24	22	47	33	79	37	8	61	18	0	1974 01
15	10	14	20	70	41	87	23	8	53	27	0	1974 02
13	7	0	19	85	52	90	12	16	46	39	9	1974 03
12	7	10	22	98	67	93	17	37	60	45	16	1974 04
8	0	14	21	100	62	95	18	40	85	36	17	1974 05
0	0	19	23	102	72	93	26	44	83	25	8	1974 06
0	7	20	28	98	65	78	32	38	84	22	7	1974 07
24	15	14	38	96	59	59	34	32	97	14	0	1974 08
29	21	20	56	88	64	40	43	63	107	7	0	1974 09
43	22	30	66	69	59	26	48	74	114	24	9	1974 10
48	20	37	71	62	48	22	54	80	110	27	21	1974 11
54	22	38	74	49	38	22	67	80	92	24	31	1974 12
45	48	30	77	38	44	28	69	74	76	16	34	1974 13
70	26	39	83	32	41	38	66	67	63	8	33	1974 14
73	45	34	87	23	32	49	59	64	48	16	35	1974 15
64	48	23	77	16	25	54	57	68	41	20	40	1974 16
63	49	20	67	8	25	52	52	71	28	20	36	1974 17
55	47	28	55	0	27	53	44	66	16	18	34	1974 18
53	43	21	45	0	28	47	43	51	9	34	43	1974 19
48	39	15	42	0	20	50	32	31	11	40	40	1974 20
33	35	16	35	0	16	55	28	13	12	40	40	1974 21
36	38	28	25	7	11	58	34	0	9	44	37	1974 22
28	31	25	17	9	11	60	34	7	7	44	28	1974 23
14	29	21	18	7	15	57	28	11	7	37	26	1974 24
0	17	16	19	0	15	59	25	11	8	29	9	1974 25
8	19	10	20	20	8	60	8	13	16	25	8	1974 26
0	37	9	28	18	8	54	8	19	30	23	8	1974 27
8	33	17	15	28	18	51	8	23	27	13	20	1974 28
0		19	22	18	30	42	14	38	22	7	16	1974 29
0		24	16	7	47	41	8	58	22	7	19	1974 30
0		26		30		38	15		16		13	1974 31
27.6	26.0	21.3	40.3	39.5	36.0	55.8	33.6	40.2	47.1	25.0	20.5	Mean

Yearly Mean = 34.5

DAILY SUNSPOT NUMBERS 1975

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yr Day
30	0	0	0	26	7	23	37	14	15	0	7	1975 01
30	18	9	0	33	11	18	36	16	8	0	23	1975 02
28	27	14	0	34	8	22	46	19	9	7	20	1975 03
19	27	13	0	32	7	16	78	29	10	18	23	1975 04
18	20	14	0	30	7	23	93	25	8	22	21	1975 05
23	26	14	0	20	7	33	104	24	10	27	18	1975 06
29	34	7	7	14	0	23	102	24	9	30	20	1975 07
29	29	18	17	0	0	19	89	23	16	33	18	1975 08
37	22	20	15	0	0	16	83	17	15	30	8	1975 09
32	18	20	7	8	0	23	80	10	8	26	0	1975 10
30	13	18	0	0	9	29	72	10	8	30	0	1975 11
28	18	15	0	0	0	33	45	16	10	24	0	1975 12
32	9	15	0	0	0	43	52	19	21	22	0	1975 13
13	8	17	0	7	0	46	34	17	26	29	7	1975 14
20	8	24	0	7	8	43	31	8	21	28	7	1975 15
19	8	30	0	8	19	39	26	14	18	28	7	1975 16
16	0	28	0	0	17	25	19	14	16	30	9	1975 17
20	0	22	0	8	12	32	16	18	18	33	8	1975 18
20	0	20	0	0	15	36	8	13	15	36	7	1975 19
23	7	14	0	0	0	28	22	30	10	35	0	1975 20
16	8	9	0	0	7	30	23	27	7	31	0	1975 21
16	0	0	0	8	0	27	7	23	0	23	0	1975 22
15	0	0	7	8	12	19	14	0	0	12	0	1975 23
7	12	0	8	7	20	30	8	0	7	11	18	1975 24
7	9	0	7	0	24	33	11	0	0	9	14	1975 25
7	0	7	7	0	33	30	16	0	0	7	8	1975 26
0	0	0	22	7	38	29	18	0	0	0	0	1975 27
7	0	0	21	13	36	26	10	0	0	0	0	1975 28
7		0	16	0	23	20	10	0	0	0	0	1975 29
7		0	20	0	22	27	21	7	0	0	0	1975 30
0		8		8		34	21		0		0	1975 31
18.9	11.5	11.5	5.1	9.0	11.4	28.2	39.7	13.9	9.1	19.4	7.8	Mean

Yearly Mean = 15.5

DAILY SUNSPOT NUMBERS 1976

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yr Day
0	0	0	23	30	0	9	10	17	30	0	0	1976 01
0	0	0	23	23	0	8	16	20	28	0	0	1976 02
0	0	0	21	25	0	10	17	12	30	0	0	1976 03
0	0	0	13	8	0	8	13	11	30	0	0	1976 04
0	0	0	12	21	0	8	16	17	25	0	0	1976 05
0	0	10	9	10	0	10	14	10	24	0	0	1976 06
0	0	12	0	10	0	7	24	9	30	0	7	1976 07
0	0	7	0	9	10	0	27	9	7	0	19	1976 08
0	0	10	8	8	10	0	31	18	14	0	22	1976 09
0	0	12	10	10	7	0	24	22	0	0	19	1976 10
0	0	13	15	16	7	0	23	24	0	0	22	1976 11
20	0	13	17	17	8	0	28	20	13	0	16	1976 12
26	13	13	17	23	8	0	26	18	17	0	12	1976 13
34	16	22	19	30	15	0	15	10	23	0	32	1976 14
20	18	16	19	17	18	0	8	16	25	7	34	1976 15
22	11	11	19	12	15	0	15	14	28	7	36	1976 16
22	8	30	22	18	18	0	19	8	31	14	34	1976 17
20	15	43	27	8	24	0	22	8	24	20	24	1976 18
18	10	47	27	20	23	0	25	7	20	13	15	1976 19
16	12	48	30	20	20	0	20	0	19	12	8	1976 20
11	8	44	37	13	30	0	17	0	15	8	9	1976 21
10	7	36	20	7	31	0	8	0	22	13	9	1976 22
10	0	26	17	15	22	0	9	7	28	11	9	1976 23
0	0	22	16	8	25	0	15	7	30	10	17	1976 24
0	0	22	17	0	18	0	10	16	30	9	22	1976 25
0	0	38	26	7	17	0	14	17	29	9	25	1976 26
7	7	45	23	0	9	0	7	18	24	8	16	1976 27
0	0	43	21	0	11	0	8	18	19	8	17	1976 28
8	0	38	24	0	11	0	9	23	15	8	19	1976 29
8		32	32	0	10	0	10	30	8	0	19	1976 30
0		26		0		0	9		0		12	1976 31
8.1	4.3	21.9	18.8	12.4	12.2	1.9	16.4	13.5	20.6	5.2	15.3	Mean

Yearly Mean = 12.6

DAILY SUNSPOT NUMBERS 1977

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yr Day
20	15	0	7	15	44	42	17	22	43	44	20	1977 01
32	19	8	11	14	43	45	15	29	37	40	20	1977 02
25	19	8	10	22	43	42	24	29	47	25	31	1977 03
25	16	8	7	23	49	39	19	25	47	22	47	1977 04
24	18	8	7	18	40	40	23	20	48	25	58	1977 05
13	7	9	8	16	39	40	26	26	55	27	58	1977 06
0	7	8	7	12	41	25	28	25	57	34	55	1977 07
0	26	20	0	19	38	20	25	18	52	27	45	1977 08
0	21	20	0	25	33	17	30	30	47	31	58	1977 09
0	25	19	0	29	29	23	25	40	38	25	75	1977 10
14	28	19	8	34	27	9	23	45	28	26	71	1977 11
22	48	14	12	35	22	8	29	51	33	27	62	1977 12
23	68	8	16	26	20	10	40	48	53	28	44	1977 13
22	61	7	22	33	25	7	40	47	48	31	37	1977 14
24	45	0	29	26	8	0	42	53	54	39	41	1977 15
18	49	0	31	25	8	0	38	56	53	49	39	1977 16
30	47	8	32	20	8	0	36	53	51	51	29	1977 17
26	37	0	29	12	21	0	40	60	50	54	33	1977 18
7	25	0	22	0	33	7	35	59	54	52	40	1977 19
0	14	0	12	11	21	8	33	60	54	38	23	1977 20
15	9	0	20	14	28	8	33	58	42	32	23	1977 21
24	9	10	19	7	40	23	38	42	35	28	17	1977 22
34	9	9	18	7	57	30	15	41	30	24	23	1977 23
35	8	7	8	7	60	38	19	48	29	18	31	1977 24
20	8	14	0	0	74	42	25	46	28	10	35	1977 25
14	8	8	14	7	71	42	34	49	30	9	41	1977 26
0	0	9	8	13	74	37	38	54	38	14	50	1977 27
13	0	16	11	16	65	26	36	61	37	9	45	1977 28
11		16	10	20	50	16	40	64	42	10	58	1977 29
8		8	9	30	45	10	36	60	45	23	64	1977 30
10		8		40		8	31		52		67	1977 31
16.4	23.1	8.7	12.9	18.6	38.5	21.4	30.1	44.0	43.8	29.1	43.2	Mean

Yearly Mean = 27.5

DAILY SUNSPOT NUMBERS 1978

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yr	Day
90	128	102	70	85	119	64	42	136	96	109	110	1978	01
94	120	92	68	89	98	61	48	167	112	122	110	1978	02
104	130	95	71	93	78	51	38	159	105	125	117	1978	03
103	142	98	75	92	60	48	62	162	100	129	115	1978	04
91	137	84	94	89	51	54	74	177	73	121	104	1978	05
79	129	75	92	85	31	63	66	177	74	108	122	1978	06
55	122	90	88	75	39	84	58	147	95	112	138	1978	07
39	90	99	105	63	45	105	62	120	103	118	148	1978	08
36	97	94	126	62	36	108	64	109	121	108	152	1978	09
15	102	92	125	60	29	115	67	99	149	120	144	1978	10
20	112	88	120	63	57	127	58	84	158	118	170	1978	11
26	115	78	109	66	62	111	71	72	158	99	188	1978	12
33	96	73	105	74	62	114	93	92	156	90	165	1978	13
37	82	72	91	74	64	109	93	113	170	78	150	1978	14
34	65	74	90	78	89	102	77	133	166	59	140	1978	15
27	64	74	95	91	94	110	52	143	163	77	143	1978	16
26	58	74	99	86	103	98	50	136	143	92	146	1978	17
14	57	74	103	89	115	84	50	156	135	93	132	1978	18
8	56	65	111	84	109	77	42	159	154	85	95	1978	19
8	58	59	115	74	109	76	30	163	151	76	84	1978	20
19	65	77	114	76	154	77	30	171	144	68	68	1978	21
28	73	84	115	74	158	48	36	148	125	77	63	1978	22
40	76	88	119	73	158	38	45	156	116	55	59	1978	23
40	91	85	106	82	154	38	48	163	104	61	65	1978	24
38	94	74	136	85	135	30	55	168	96	85	81	1978	25
49	90	60	115	88	152	13	45	152	102	101	93	1978	26
67	85	52	99	97	143	22	57	142	115	118	110	1978	27
78	88	49	83	93	130	31	57	126	117	118	122	1978	28
90		48	78	103	115	48	59	122	137	111	135	1978	29
103		45	75	107	103	39	72	94	128	103	159	1978	30
118		58		113		36	100		111		177	1978	31
51.9	93.6	76.5	99.7	82.7	95.1	70.4	58.1	138.2	125.1	97.9	122.7	Mean	

Yearly Mean = 92.5

DAILY SUNSPOT NUMBERS 1979

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yr Day
158	116	116	131	108	121	158	115	165	213	224	122	1979 01
158	113	138	134	106	145	168	96	141	187	157	156	1979 02
191	138	141	135	103	154	205	121	148	167	155	187	1979 03
157	123	142	138	112	178	219	110	157	156	172	218	1979 04
146	134	135	109	113	207	232	93	139	168	166	232	1979 05
173	146	144	91	122	226	249	104	139	168	203	206	1979 06
163	144	146	77	148	222	223	110	170	179	240	212	1979 07
172	142	143	69	157	220	219	132	192	190	280	262	1979 08
165	139	146	61	162	224	191	115	190	210	279	280	1979 09
163	137	140	75	145	205	163	92	177	178	302	260	1979 10
157	137	156	94	148	186	155	84	167	183	295	242	1979 11
159	138	170	107	158	199	145	87	156	189	248	261	1979 12
151	152	169	113	163	172	142	91	175	201	183	235	1979 13
157	163	159	116	203	149	127	112	186	213	218	230	1979 14
178	161	155	117	207	117	121	135	177	198	186	225	1979 15
164	159	130	119	187	103	107	115	163	185	166	215	1979 16
164	160	142	107	184	122	109	124	155	214	238	180	1979 17
146	162	142	98	148	126	109	143	177	224	172	151	1979 18
138	166	138	79	109	110	135	176	195	221	174	138	1979 19
177	181	131	68	107	111	158	187	191	214	153	126	1979 20
192	171	134	68	114	124	151	218	184	209	124	124	1979 21
188	155	140	79	121	108	152	216	178	191	116	111	1979 22
200	127	139	76	117	96	154	206	219	179	142	116	1979 23
209	99	118	72	119	90	143	203	236	161	162	130	1979 24
209	88	114	85	124	120	144	201	252	153	155	143	1979 25
173	108	114	118	123	132	142	182	261	145	141	116	1979 26
167	97	117	125	118	112	146	189	256	136	115	93	1979 27
157	95	114	132	110	128	132	174	239	142	119	98	1979 28
153		123	132	113	124	148	158	235	184	98	121	1979 29
149		135	120	96	154	150	150	233	190	116	139	1979 30
130		147		120		144	168		223		135	1979 31
166.6	137.5	138.0	101.5	134.4	149.5	159.4	142.2	188.4	186.2	183.3	176.3	Mean

Yearly Mean = 155.4

DAILY SUNSPOT NUMBERS 1980

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yr Day
153	195	181	168	121	152	101	78	208	151	188	171	1980 01
158	178	168	145	149	124	108	63	226	135	218	176	1980 02
148	185	151	133	140	128	97	65	232	139	204	152	1980 03
160	182	136	123	166	141	85	65	233	121	217	146	1980 04
184	178	130	154	192	150	96	53	188	96	201	131	1980 05
207	209	132	179	145	131	98	72	179	116	196	126	1980 06
212	220	120	194	147	149	97	64	136	135	175	108	1980 07
221	203	101	199	157	150	87	90	140	173	201	124	1980 08
249	172	103	229	168	164	84	125	108	186	158	117	1980 09
219	140	69	214	144	177	86	130	119	235	158	145	1980 10
245	148	67	245	142	172	87	181	125	260	144	148	1980 11
210	128	70	251	143	166	98	174	128	256	120	178	1980 12
181	131	71	252	150	161	105	172	133	213	103	185	1980 13
178	140	68	203	166	136	128	193	100	232	108	213	1980 14
146	159	52	182	148	129	161	192	83	224	105	217	1980 15
166	163	36	154	148	134	198	196	98	202	112	237	1980 16
145	132	67	126	173	129	211	190	93	158	109	198	1980 17
130	122	63	127	215	146	241	195	114	142	113	183	1980 18
118	129	119	134	218	166	220	185	137	137	125	166	1980 19
115	125	108	164	230	179	227	179	150	167	112	171	1980 20
121	114	105	143	233	191	229	152	134	155	107	170	1980 21
123	99	130	122	244	196	201	139	147	164	119	178	1980 22
124	100	149	95	246	190	184	154	158	140	112	177	1980 23
120	116	175	112	256	193	155	122	178	127	128	191	1980 24
107	121	176	133	229	179	151	109	168	118	127	200	1980 25
127	152	191	159	220	166	138	101	209	119	140	208	1980 26
120	175	205	150	223	185	117	98	231	134	168	206	1980 27
130	197	221	149	190	188	127	124	181	136	167	206	1980 28
122	181	191	145	185	149	118	158	166	173	148	208	1980 29
145		182	138	150	97	108	184	149	184	153	187	1980 30
164		174		138		81	194		178		182	1980 31

159.6 155.0 126.2 164.1 179.9 157.3 136.3 135.4 155.0 164.7 147.9 174.4 Mean

Yearly Mean = 154.6

DAILY SUNSPOT NUMBERS 1981

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yr Day
159	148	161	153	112	62	149	121	205	216	165	193	1981 01
141	132	182	170	133	59	140	105	183	206	222	197	1981 02
122	150	169	148	156	44	140	112	160	219	218	212	1981 03
113	126	173	151	152	58	112	109	170	189	221	212	1981 04
94	133	141	146	162	55	112	113	195	195	233	219	1981 05
71	172	147	132	192	57	85	102	220	169	199	234	1981 06
95	158	130	152	171	58	66	107	205	171	192	244	1981 07
108	129	142	195	177	46	62	115	208	185	184	249	1981 08
126	124	124	199	168	58	65	121	190	177	134	258	1981 09
120	157	127	199	148	59	99	138	196	144	147	253	1981 10
123	172	130	200	169	72	130	136	164	131	146	263	1981 11
126	185	128	193	183	79	139	140	138	123	160	240	1981 12
123	143	127	197	149	86	153	134	132	171	158	185	1981 13
106	142	128	180	140	99	145	140	148	187	178	159	1981 14
106	124	110	212	141	111	150	153	129	212	139	113	1981 15
81	129	128	197	127	109	161	134	138	223	126	66	1981 16
72	120	109	213	124	119	171	125	129	219	103	80	1981 17
79	131	95	214	119	104	161	148	145	210	108	79	1981 18
78	138	95	203	100	90	151	175	156	189	90	74	1981 19
88	133	120	199	77	71	145	188	137	183	82	57	1981 20
99	131	135	154	99	87	122	222	175	145	82	65	1981 21
99	128	134	122	106	106	129	220	172	145	73	75	1981 22
115	98	130	103	93	119	162	200	137	118	65	86	1981 23
113	124	125	92	96	109	196	178	135	109	59	68	1981 24
115	137	142	119	93	127	213	189	142	101	60	62	1981 25
120	148	133	90	105	127	206	215	153	92	60	100	1981 26
135	175	126	81	99	133	218	222	181	75	77	104	1981 27
142	170	165	72	93	123	208	214	195	92	130	136	1981 28
165		160	100	92	138	159	194	191	131	148	132	1981 29
158		152	106	83	161	156	233	190	152	165	112	1981 30
143		132		92		152	216		156		126	1981 31
114.0	141.3	135.5	156.4	127.5	90.9	143.8	158.7	167.3	162.4	137.5	150.1	Mean

Yearly Mean = 140.4

DAILY SUNSPOT NUMBERS 1982

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yr Day
92	258	168	145	63	70	50	55	115	132	80	88	1982 01
94	241	174	115	57	83	41	68	124	164	88	125	1982 02
112	232	175	151	46	94	33	68	146	143	75	132	1982 03
109	221	177	137	58	104	42	81	176	120	100	137	1982 04
112	219	163	112	63	111	39	97	160	109	100	137	1982 05
86	230	165	117	64	108	32	128	141	55	76	174	1982 06
94	226	146	130	69	115	33	144	117	54	98	175	1982 07
97	232	140	131	89	127	42	150	115	55	86	184	1982 08
98	211	116	132	47	142	61	161	94	54	102	152	1982 09
85	181	122	138	53	147	110	155	81	88	109	166	1982 10
46	158	119	152	58	138	146	157	86	87	112	171	1982 11
52	156	135	142	75	144	187	138	78	92	83	194	1982 12
51	162	155	133	78	139	219	113	81	98	98	172	1982 13
58	142	153	136	58	137	222	100	104	88	116	160	1982 14
81	134	140	127	52	125	246	100	129	71	116	166	1982 15
76	111	156	122	69	128	263	86	133	65	100	140	1982 16
111	120	180	108	76	136	272	93	127	54	108	118	1982 17
139	103	168	91	89	134	270	105	107	33	117	102	1982 18
143	107	167	87	110	134	234	97	117	56	122	79	1982 19
134	119	160	93	112	139	192	77	104	70	118	63	1982 20
134	120	153	91	98	143	138	79	102	95	131	87	1982 21
121	100	146	109	121	146	99	90	95	100	141	88	1982 22
93	97	144	138	107	116	74	71	97	128	120	96	1982 23
70	120	122	145	110	112	27	79	109	145	96	100	1982 24
82	128	152	149	88	92	25	101	118	142	75	122	1982 25
119	136	147	150	117	94	29	98	138	135	73	116	1982 26
125	154	182	126	130	49	22	115	133	131	71	126	1982 27
168	163	179	90	119	36	19	132	132	103	74	120	1982 28
216		169	85	112	32	23	134	144	101	82	98	1982 29
211		162	79	77	38	38	144	160	96	76	79	1982 30
237		132		82		60	120		73		69	1982 31
111.2	163.6	153.8	122.0	82.2	110.4	106.1	107.6	118.8	94.7	98.1	127.0	Mean

Yearly Mean = 115.9

DAILY SUNSPOT NUMBERS 1983

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yr Day
60	103	109	53	114	61	62	131	46	29	17	26	1983 01
65	85	93	70	104	72	59	128	56	51	22	23	1983 02
55	88	86	61	94	73	61	105	59	63	37	15	1983 03
63	94	93	53	85	68	87	103	69	74	51	14	1983 04
82	82	113	36	95	77	80	79	84	65	66	17	1983 05
103	71	88	49	88	85	79	49	78	75	74	39	1983 06
109	72	77	64	92	104	79	60	72	87	84	41	1983 07
126	63	68	59	98	100	82	70	68	99	90	48	1983 08
100	39	74	59	110	100	69	69	74	106	70	71	1983 09
83	26	55	64	114	86	59	63	70	121	68	82	1983 10
90	21	49	69	101	73	68	88	65	136	56	76	1983 11
77	18	32	65	114	66	86	103	41	122	43	66	1983 12
89	11	12	64	132	72	85	104	36	100	36	66	1983 13
92	10	24	64	125	88	88	97	36	80	29	52	1983 14
77	24	44	53	130	92	92	93	42	72	28	50	1983 15
89	17	63	54	99	84	93	80	33	61	38	35	1983 16
102	22	74	63	93	79	96	72	35	60	31	46	1983 17
86	32	88	75	99	78	98	71	45	63	36	36	1983 18
93	33	82	110	88	103	96	54	40	46	26	31	1983 19
81	32	82	90	105	117	101	40	32	26	12	25	1983 20
74	39	87	87	110	117	109	52	36	18	18	21	1983 21
73	33	70	83	104	136	114	50	38	22	0	15	1983 22
59	40	66	91	102	143	95	51	42	22	0	20	1983 23
58	50	60	92	111	122	105	35	46	20	0	22	1983 24
75	67	48	123	98	122	85	52	42	18	0	21	1983 25
77	70	70	118	100	110	58	53	50	20	7	23	1983 26
75	88	72	126	85	92	49	51	51	12	10	12	1983 27
89	98	48	146	68	83	40	55	48	15	12	10	1983 28
99		44	142	88	68	73	63	43	16	19	11	1983 29
101		54	137	68	63	89	59	33	15	21	13	1983 30
110		37		60		110	45		16		9	1983 31
84.3	51	66.5	80.7	99.2	91.1	82.2	71.8	50.3	55.8	33.3	33.4	Mean

Yearly Mean = 66.6

DAILY SUNSPOT NUMBERS 1984

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yr Day
10	110	74	103	109	48	33	14	45	7	16	19	1984 01
16	82	78	94	89	44	36	17	50	8	14	22	1984 02
17	67	66	88	69	45	61	19	61	11	11	19	1984 03
18	61	54	81	52	34	80	25	58	11	14	19	1984 04
21	66	65	61	38	30	72	18	53	0	12	16	1984 05
29	76	49	70	27	23	61	24	32	0	0	21	1984 06
37	79	51	50	35	34	64	27	21	0	11	18	1984 07
38	94	64	33	54	31	74	32	20	12	13	23	1984 08
50	115	60	36	72	26	63	35	13	14	13	21	1984 09
44	123	46	12	85	31	74	31	10	17	21	15	1984 10
48	118	65	21	94	37	57	29	9	22	27	28	1984 11
51	108	72	28	100	39	54	31	9	16	21	29	1984 12
48	82	79	24	118	41	44	28	9	10	16	28	1984 13
46	77	88	32	111	50	34	27	0	9	15	28	1984 14
44	80	112	59	85	80	30	23	8	14	13	26	1984 15
46	53	117	60	97	83	25	23	12	19	11	30	1984 16
51	51	105	56	83	73	21	18	0	24	11	24	1984 17
49	50	95	73	70	62	26	17	0	25	14	12	1984 18
51	54	90	82	74	51	22	11	10	25	13	11	1984 19
69	54	103	69	70	53	18	16	0	17	27	11	1984 20
76	76	98	68	65	43	12	12	9	19	36	14	1984 21
64	100	87	55	77	48	22	10	10	12	36	12	1984 22
70	121	89	59	83	54	25	19	8	11	41	11	1984 23
70	117	80	80	86	58	38	24	8	9	47	16	1984 24
99	117	97	99	75	44	30	36	7	10	59	21	1984 25
105	101	97	124	87	49	25	49	0	10	44	20	1984 26
99	78	96	121	86	40	9	41	0	8	39	14	1984 27
106	78	98	125	69	41	9	37	0	0	39	16	1984 28
110	88	94	120	74	50	12	34	0	8	30	15	1984 29
102		107	107	70	42	16	27	8	11	20	10	1984 30
82		113		63		12	36		14		10	1984 31
57.0	85.4	83.5	69.7	76.4	46.1	37.4	25.5	15.7	12.0	22.8	18.7	Mean

Yearly Mean = 45.9

DAILY SUNSPOT NUMBERS 1985

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yr Day
0	18	13	25	19	10	21	35	7	0	0	0	1985 01
0	22	13	21	15	0	27	25	0	0	0	16	1985 02
0	25	9	23	14	11	30	27	0	0	0	13	1985 03
0	22	0	17	18	26	32	27	0	0	0	0	1985 04
0	20	0	23	16	35	38	20	0	0	16	18	1985 05
0	16	0	19	14	37	43	14	0	0	19	26	1985 06
0	7	0	11	32	38	71	12	0	0	19	15	1985 07
11	16	14	9	44	42	67	12	0	0	18	12	1985 08
14	24	15	9	56	42	82	17	0	0	25	16	1985 09
0	19	13	0	49	58	82	12	0	0	15	15	1985 10
0	13	16	0	49	66	61	12	7	0	17	18	1985 11
13	10	18	0	33	54	45	12	0	0	19	19	1985 12
16	11	14	0	32	45	25	0	9	11	30	18	1985 13
26	13	10	10	32	36	9	0	9	13	44	30	1985 14
25	11	0	0	32	37	8	0	9	15	48	47	1985 15
26	10	11	0	31	27	9	14	9	25	39	66	1985 16
29	12	20	0	38	23	11	12	8	19	43	63	1985 17
26	10	35	10	41	18	11	11	10	20	37	52	1985 18
27	19	27	9	40	10	11	12	10	31	30	40	1985 19
55	27	19	11	37	9	11	10	9	44	28	24	1985 20
59	27	9	17	36	9	10	9	8	50	18	17	1985 21
50	25	15	31	34	9	10	0	7	72	12	11	1985 22
39	16	22	28	32	12	18	0	0	67	10	0	1985 23
33	11	36	30	25	13	12	0	0	63	0	0	1985 24
20	11	30	37	19	12	10	0	0	55	0	0	1985 25
9	11	33	37	13	10	13	8	0	40	0	0	1985 26
8	10	27	31	12	8	12	8	0	27	0	0	1985 27
0	9	36	27	12	8	36	10	0	14	0	0	1985 28
9		25	26	10	9	51	9	7	11	0	0	1985 29
0		29	26	8	11	46	8	7	0	0	0	1985 30
17		23		8		40	9		0		0	1985 31
16.5	15.9	17.2	16.2	27.5	24.2	30.7	11.1	3.9	18.6	16.2	17.3	Mean

Yearly Mean = 17.9

DAILY SUNSPOT NUMBERS 1986

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yr Day
0	18	16	9	15	7	0	12	9	12	44	0	1986 01
0	33	33	10	26	0	0	11	9	14	35	0	1986 02
0	52	34	10	15	0	11	11	8	23	37	0	1986 03
0	55	32	0	12	0	14	11	8	24	37	0	1986 04
0	53	33	0	10	0	18	11	0	24	35	0	1986 05
0	47	33	0	0	0	29	10	11	22	31	0	1986 06
0	52	38	0	0	0	29	8	13	27	24	0	1986 07
0	54	29	9	0	9	29	9	12	20	15	0	1986 08
0	47	22	0	0	0	17	8	10	32	10	12	1986 09
0	35	20	9	0	8	36	0	8	29	9	20	1986 10
0	37	18	13	0	0	39	0	8	23	9	23	1986 11
0	25	13	14	0	0	36	0	0	26	0	22	1986 12
13	22	8	13	0	0	25	0	0	22	14	24	1986 13
16	16	0	26	0	0	16	0	0	0	12	13	1986 14
13	11	10	25	10	0	28	0	0	0	12	0	1986 15
10	0	0	21	12	0	26	9	0	11	12	11	1986 16
0	0	0	13	13	0	28	8	0	16	12	9	1986 17
0	0	0	15	22	0	14	0	0	22	12	0	1986 18
0	0	0	13	27	0	13	0	0	31	12	0	1986 19
0	10	12	16	27	0	18	11	0	39	12	0	1986 20
0	10	13	22	30	0	21	12	0	47	11	11	1986 21
0	10	10	20	27	0	22	12	0	57	10	16	1986 22
0	10	15	42	24	0	14	14	0	71	18	16	1986 23
0	8	14	58	24	0	0	9	0	76	12	13	1986 24
0	11	10	43	22	8	0	9	0	68	0	9	1986 25
7	9	10	43	28	0	0	9	0	60	0	0	1986 26
0	15	11	33	19	0	12	9	0	65	13	0	1986 27
0	10	13	23	18	0	13	9	0	61	0	0	1986 28
0		11	28	19	0	17	9	8	63	8	0	1986 29
10		11	27	13	0	19	9	9	62	0	0	1986 30
10		0		12		17	9		50		11	1986 31
2.5	23.2	15.1	18.5	13.7	1.1	18.1	7.4	3.8	35.4	15.2	6.8	Mean

Yearly Mean = 13.4

□

DAILY SUNSPOT NUMBERS 1987

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yr Day
19	0	13	14	39	15	13	45	33	34	56	17	1987 01
15	0	23	12	40	11	0	47	38	25	57	16	1987 02
13	0	15	10	27	0	0	39	37	31	57	16	1987 03
12	0	16	13	23	0	0	33	38	58	46	15	1987 04
11	0	24	28	24	10	0	31	39	54	47	19	1987 05
10	0	23	47	27	0	0	32	44	48	27	24	1987 06
11	0	24	56	34	0	9	38	56	39	31	34	1987 07
0	0	22	64	25	0	12	45	67	55	43	36	1987 08
0	0	14	69	23	0	13	39	64	50	42	41	1987 09
0	7	11	77	25	0	11	47	59	51	30	34	1987 10
0	0	9	80	26	11	0	56	58	63	28	22	1987 11
0	0	0	80	23	21	0	48	44	53	25	13	1987 12
0	0	0	79	22	14	0	47	25	74	18	20	1987 13
8	8	10	77	13	10	0	49	20	92	23	26	1987 14
9	7	11	78	39	11	13	49	21	101	22	42	1987 15
0	0	11	60	50	12	17	55	24	101	33	40	1987 16
13	0	22	41	68	14	14	46	25	91	46	39	1987 17
13	0	21	36	54	24	17	43	30	86	48	39	1987 18
9	0	12	29	65	13	23	45	35	82	51	28	1987 19
9	0	12	12	46	22	38	51	38	79	49	26	1987 20
14	7	15	19	41	29	67	48	32	61	51	14	1987 21
20	7	17	26	38	38	87	34	23	50	70	24	1987 22
23	0	19	25	40	37	102	39	26	33	83	17	1987 23
14	0	19	35	38	38	92	35	25	22	56	13	1987 24
13	7	16	25	37	38	88	35	12	29	42	25	1987 25
14	9	12	21	37	41	85	34	12	40	47	27	1987 26
13	8	11	11	35	33	77	24	19	70	21	29	1987 27
20	8	12	14	21	41	60	23	22	79	11	28	1987 28
15		13	20	17	25	60	13	26	82	20	30	1987 29
14		15	30	15	14	62	10	26	85	16	42	1987 30
11		15		12		63	20		62		43	1987 31
10.4	2.4	14.7	39.6	33.0	17.4	33.0	38.7	33.9	60.6	39.9	27.1	Mean

Yearly Mean = 29.4

DAILY SUNSPOT NUMBERS 1988

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yr	Day
47	63	68	110	69	95	139	142	137	109	126	128	1988	01
31	68	66	96	84	96	145	143	144	117	114	114	1988	02
25	68	72	94	76	100	142	146	129	129	121	139	1988	03
23	74	77	74	101	105	129	135	148	128	104	122	1988	04
32	58	64	66	103	125	119	120	128	130	129	149	1988	05
40	43	61	62	77	145	108	123	93	123	124	149	1988	06
58	44	65	84	50	141	103	144	97	128	114	144	1988	07
57	46	67	92	63	151	106	160	88	131	95	111	1988	08
62	50	49	115	74	173	82	171	74	125	110	122	1988	09
68	38	36	107	87	144	78	152	76	146	131	133	1988	10
75	26	20	115	65	108	102	135	81	148	155	152	1988	11
67	14	39	118	56	77	109	133	88	169	159	175	1988	12
76	23	53	120	44	47	103	122	91	150	147	187	1988	13
91	28	62	138	37	53	121	128	94	131	139	213	1988	14
90	33	63	145	44	65	121	121	89	109	156	225	1988	15
83	42	74	157	53	81	111	91	89	108	181	226	1988	16
72	35	99	144	57	76	124	67	79	125	196	232	1988	17
68	55	95	137	44	67	136	47	97	134	175	222	1988	18
73	66	105	108	20	70	105	57	113	133	147	223	1988	19
85	51	85	88	20	77	106	57	153	119	112	218	1988	20
78	27	81	79	25	95	103	40	168	117	145	210	1988	21
66	15	76	72	30	92	106	21	168	109	131	255	1988	22
47	13	74	43	40	91	116	26	190	104	117	235	1988	23
44	23	83	30	48	93	81	43	172	121	116	199	1988	24
33	19	92	40	54	111	76	76	149	124	89	183	1988	25
44	15	93	44	63	107	76	93	151	119	73	174	1988	26
54	31	103	36	66	111	101	142	157	120	69	175	1988	27
67	40	109	41	70	116	117	146	143	119	86	196	1988	28
59	52	104	39	74	121	157	164	111	128	86	194	1988	29
56		108	47	83	121	161	163	106	115	107	178	1988	30
57		120		86		146	151		111		172	1988	31
59.0	40.0	76.2	88.0	60.1	101.8	113.8	111.6	120.1	125.1	125.1	179.2		Mean

Yearly Mean = 100.2

DAILY SUNSPOT NUMBERS 1989

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yr	Day
148	141	127	104	93	136	128	171	147	129	153	198	1989	01
173	144	107	122	94	148	149	196	171	150	160	182	1989	02
146	164	103	140	85	158	129	193	180	167	191	203	1989	03
120	133	98	115	97	157	120	213	204	186	216	182	1989	04
155	127	90	106	85	171	101	227	212	209	228	192	1989	05
142	127	103	139	105	145	120	220	230	189	245	184	1989	06
165	132	98	170	134	130	149	215	267	168	233	217	1989	07
155	161	109	185	149	143	141	218	261	166	215	167	1989	08
165	172	133	153	137	168	116	218	296	187	214	161	1989	09
190	192	163	122	123	192	104	200	270	178	203	148	1989	10
211	190	155	106	120	203	136	202	280	191	179	104	1989	11
229	216	140	96	115	218	111	188	264	154	173	99	1989	12
206	219	162	92	129	253	116	207	248	148	153	107	1989	13
189	208	181	103	123	251	116	197	215	159	140	100	1989	14
177	191	165	120	148	264	92	203	207	189	132	84	1989	15
164	195	187	130	154	265	91	177	180	209	124	101	1989	16
155	209	168	144	161	233	99	192	159	206	124	120	1989	17
160	163	164	137	177	216	113	189	155	184	134	123	1989	18
140	164	148	160	191	235	138	202	152	159	124	131	1989	19
126	169	158	165	195	232	149	209	137	140	141	127	1989	20
114	149	155	175	168	187	170	203	111	152	159	111	1989	21
165	142	155	167	156	174	197	160	109	158	162	150	1989	22
171	134	145	128	180	196	195	133	103	145	157	201	1989	23
142	153	155	135	196	215	168	129	75	131	160	191	1989	24
144	189	131	132	173	227	132	105	80	121	175	209	1989	25
152	163	117	125	157	237	111	82	93	109	184	221	1989	26
157	147	102	118	163	206	99	57	101	97	183	240	1989	27
172	128	89	109	130	187	75	50	111	116	183	249	1989	28
169		95	107	121	182	112	70	134	131	164	213	1989	29
157		78	114	122	156	125	94	150	156	182	214	1989	30
140		91		111		132	116		157		201	1989	31

161.3 165.1 131.4 130.6 138.5 196.2 126.9 168.9 176.7 159.4 173.0 165.5 Mean

Yearly Mean =157.6

Name of the Station :- Meteorological Office, Jalpaiguri (FMO)

JUNE'98

Date	Minm Temp. in °c 0830 hrs.	Maxm. Temp. in °c 1730 hrs.	24 hrs. Rainfall in mm 0830 hrs.
1	24.1	31.2	023.4
2	24.6	31.1	005.8
3	25.2	33.2	001.0
4	24.9	32.2	000.0
5	25.5	33.4	000.8
6	22.9	34.4	040.2
7	25.7	33.2	000.0
8	26.2	33.2	000.0
9	26.6	32.2	000.0
10	25.5	31.0	000.0
11	25.4	27.6	Tr.
12	25.3	31.4	029.2
13	24.3	27.2	007.0
14	25.1	34.9	076.4
15	25.0	35.6	040.0
16	26.0	34.9	000.0
17	27.2	33.5	001.8
18	24.5	32.6	018.2
19	25.0	28.9	090.0
20	25.3	31.3	054.4
21	25.1	29.1	125.5
22	24.9	31.4	084.6
23	25.3	32.7	045.2
24	26.0	34.0	021.6
25	26.2	29.1	014.6
26	25.8	29.2	013.9
27	26.1	30.9	026.5
28	25.3	33.2	058.3
29	26.2	33.2	004.9
30	25.3	29.7	0082.0

JULY'98

Date	Minm Temp. in °c 0830 hrs.	Maxm. Temp. in °c 1730 hrs.	24 hrs. Rainfall in mm 0830 hrs.
1	26.4	34.0	011.4
2	26.7	34.8	008.4
3	26.9	32.3	002.1
4	25.7	33.9	040.7
5	25.4	32.9	061.4
6	25.7	29.5	026.3
7	25.5	26.6	019.9
8	25.1	28.2	100.4
9	25.4	31.4	037.4
10	25.6	33.6	010.4
11	25.7	31.7	015.4
12	25.3	32.1	043.6
13	25.5	28.4	000.4
14	24.9	28.7	017.8
15	25.0	28.2	065.4
16	24.7	27.2	059.1
17	24.8	29.7	017.6
18	25.4	31.0	013.9
19	25.4	30.0	083.0
20	25.3	28.1	060.5
21	24.8	29.5	051.2
22	25.7	30.2	008.5
23	24.9	29.6	037.3
24	24.9	28.5	019.0
25	24.4	29.9	044.8
26	24.5	30.2	043.8
27	24.9	29.0	112.0
28	25.4	34.7	005.1
29	25.7	32.1	012.8
30	26.6	33.2	000.9
31	25.2	33.1	017.1

Name of the Station :- Meteorological Office, Jalpaiguri (FMO)

AUGUST'98

Date	Minm Temp. in °c 0830 hrs.	Maxm. Temp. in °c 1730 hrs.	24 hrs. Rainfall in mm 0830 hrs.
1	25.2	32.9	021.9
2	25.1	27.1	210.4
3	24.5	31.0	058.5
4	25.6	31.2	006.8
5	26.4	34.6	000.1
6	26.5	33.2	003.0
7	26.1	33.8	002.1
8	26.7	33.7	001.0
9	24.7	33.7	093.2
10	25.7	33.5	038.6
11	24.9	32.4	034.6
12	26.2	29.8	000.3
13	25.2	29.5	023.7
14	24.9	29.5	053.2
15	25.0	27.60	076.9
16	25.0	31.6	066.6
17	25.2	27.8	051.2
18	23.8	29.2	014.2
19	24.2	33.0	043.7
20	24.9	27.9	097.0
21	25.4	32.7	005.4
22	25.8	34.4	000.0
23	25.1	31.2	096.2
24	25.9	29.2	006.0
25	25.1	32.0	138.8
26	24.6	31.0	104.0
27	24.7	32.4	023.0
28	25.2	32.6	057.5
29	25.1	29.8	026.0
30	25.5	31.8	028.8
31	25.0	29.1	096.2

SEPTEMBER'98

Date	Minm Temp. in °c 0830 hrs.	Maxm. Temp. in °c 1730 hrs.	24 hrs. Rainfall in mm 0830 hrs.
1	25.6	28.6	3.4
2	24.8	25.8	075.8
3	23.1	25.6	217.8
4	23.1	30.2	30.6
5	24.3	30.2	133.8
6	24.3	31.4	056.1
7	24.6	34.2	000.0
8	25.4	33.9	000.0
9	25.6	32.4	000.0
10	25.8	32.8	000.4
11	25.8	32.4	000.0
12	26.2	34.3	000.0
13	26.1	34.7	000.0
14	25.6	34.9	000.0
15	25.7	35.2	000.0
16	25.6	36.0	000.0
17	27.8	30.3	000.0
18	24.7	34.4	003.2
19	25.9	35.6	000.0
20	24.4	31.5	126.8
21	24.2	31.6	027.8
22	25.0	31.0	000.6
23	25.2	32.5	001.0
24	26.5	28.4	Tr
25	24.5	33.2	098.2
26	26.2	34.5	000.4
27	26.1	32.3	012.4
28	24.5	27.5	014.6
29	23.3	34.6	012.8
30	25.2	35.0	000.0

Name of the Station :- Meteorological Office, Jalpaiguri (FMO)

OCTOBER'98

Date	Minm	Maxm.	24 hrs.
	Temp.	Temp.	Rainfall
	in °c	in °c	in mm
	0830 hrs.	1730 hrs.	0830 hrs.
1	24.7	32.9	Tr
2	25.7	30.3	000.0
3	23.8	32.2	018.3
4	23.5	30.6	011.8
5	23.0	34.7	002.6
6	23.5	34.9	000.0
7	24.6	36.0	000.0
8	25.6	35.7	000.0
9	25.3	36.1	000.0
10	25.3	35.0	000.0
11	25.0	34.5	000.0
12	23.8	33.7	048.0
13	23.7	34.0	017.0
14	23.4	34.0	004.7
15	23.5	33.0	002.4
16	23.9	33.0	000.0
17	24.4	32.3	000.0
18	24.8	34.1	000.0
19	24.2	30.7	000.9
20	23.5	30.6	044.0
21	22.5	27.6	000.0
22	22.9	29.0	000.2
23	22.9	29.5	003.4
24	22.6	32.9	000.3
25	23.7	33.3	020.3
26	23.2	32.4	005.6
27	22.1	32.2	000.0
28	21.7	31.6	000.0
29	21.8	31.4	000.0
30	19.9	31.4	000.0
31	22.6	30.7	000.0

NOVEMBER'98

Date	Minm	Maxm.	24 hrs.
	Temp.	Temp.	Rainfall
	in °c	in °c	in mm
	0830 hrs.	1730 hrs.	0830 hrs.
1	20.2	31.5	000.0
2	22.0	32.3	000.0
3	20.0	32.1	000.0
4	19.0	31.5	000.0
5	18.8	32.1	000.0
6	18.2	32.2	000.0
7	17.1	32.1	000.0
8	17.2	32.0	000.0
9	19.4	31.0	Tr.
10	19.5	27.4	001.1
11	18.5	30.6	000.7
12	18.4	31.8	000.0
13	17.5	30.7	000.0
14	16.2	31.0	000.0
15	15.5	27.5	000.0
16	19.9	28.6	Tr.
17	20.1	27.2	Tr.
18	19.5	30.0	Tr.
19	18.3	32.3	000.0
20	19.1	32.1	000.0
21	21.0	32.8	Tr.
22	22.2	28.1	Tr.
23	20.3	30.0	Tr.
24	20.5	30.7	000.0
25	18.5	30.4	000.0
26	15.8	29.8	000.0
27	17.6	31.0	000.0
28	17.0	32.0	000.0
29	17.0	32.1	000.0
30	-	31.5	000.0

Name of the Station :- Meteorological Office, Jalpaiguri (FMO)

DECEMBER'98

Date	Minm Temp. in °c 0830 hrs.	Maxm. Temp. in °c 1730 hrs.	24 hrs. Rainfall in mm 0830 hrs.
1	16.7	30.6	000.0
2	16.1	29.8	000.0
3	16.5	29.5	000.0
4	16.6	29.5	000.0
5	15.9	29.1	000.0
6	16.4	29.5	000.0
7	16.3	29.8	000.0
8	16.1	29.2	000.0
9	16.6	29.0	000.0
10	15.9	25.6	Tr.
11	15.0	27.5	Tr.
12	14.3	29.2	000.0
13	14.6	31.0	000.0
14	12.7	29.1	000.0
15	13.9	29.0	000.0
16	11.6	28.2	000.0
17	12.2	28.1	000.0
18	11.6	27.7	000.0
19	11.6	28.6	000.0
20	11.5	27.9	000.0
21	12.1	27.5	000.0
22	11.4	26.6	000.0
23	11.3	27.5	000.0
24	10.5	28.5	000.0
25	10.3	29.0	000.0
26	10.5	28.0	000.0
27	10.7	27.5	000.0
28	10.0	27.0	000.0
29	10.3	27.0	000.0
30	09.6	25.6	000.0
31	10.9	26.5	000.0

JANUARY'99

Date	Minm Temp. in °c 0830 hrs.	Maxm. Temp. in °c 1730 hrs.	24 hrs. Rainfall in mm 0830 hrs.
1	11.2	25.2	000.0
2	12.0	26.7	000.0
3	10.5	27.2	000.0
4	11.3	27.4	000.0
5	10.6	26.0	000.0
6	10.7	25.0	000.0
7	10.8	26.4	000.0
8	09.6	25.5	000.0
9	11.8	20.9	000.0
10	11.6	18.8	000.2
11	9.7	21.0	000.0
12	8.8	24.7	000.0
13	9.0	25.6	000.0
14	08.9	26.7	000.0
15	10.0	27.2	000.0
16	09.6	26.8	000.0
17	09.2	21.3	000.0
18	08.1	20.6	000.0
19	08.3	21.7	000.0
20	08.4	26.7	000.0
21	09.6	27.1	000.0
22	10.0	27.0	000.0
23			
24	11.2	27.5	000.0
25	12.0	26.7	000.0
26	12.3	24.6	000.0
27	11.9	25.5	000.0
28	12.1	27.7	000.0
29	13.0	27.6	000.0
30	12.8	25.1	000.0
31	09.2	25.8	000.0

Name of the Station :- Meteorological Office, Jalpaiguri (FMO)

FEBRUARY'99

Date	Minm Temp. in °c 0830 hrs.	Maxm. Temp. in °c 1730 hrs.	24 hrs. Rainfall in mm 0830 hrs.
1	10.4	26.8	000.0
2	11.2	28.9	000.0
3	11.6	29.2	000.0
4	11.7	29.1	000.0
5	14.7	25.3	Tr.
6	12.6	25.6	Tr.
7	13.9	28.6	000.0
8	14.0	30.7	000.0
9	13.8	30.6	000.0
10	15.8	29.6	000.0
11	15.6	31.1	000.0
12	15.4	31.6	000.0
13	15.6	31.3	000.0
14	15.0	30.1	000.0
15	16.3	30.9	000.0
16	16.4	31.8	000.0
17	16.5	29.5	000.0
18	16.1	29.9	000.0
19	17.2	28.8	000.0
20	18.2	29.1	000.0
21	16.5	28.8	000.0
22	15.0	28.8	000.0
23	16.8	28.3	000.0
24	16.2	29.6	000.0
25	17.0	29.8	000.0
26	18.1	31.3	000.0
27	17.3	31.1	000.0
28	13.7	30.1	000.0

MARCH'99

Date	Minm Temp. in °c 0830 hrs.	Maxm. Temp. in °c 1730 hrs.	24 hrs. Rainfall in mm 0830 hrs.
1	14.0	30.7	000.0
2	12.5	29.6	000.0
3	14.2	32.0	000.0
4	15.3	32.0	000.0
5	15.8	31.6	000.0
6	17.3	31.7	000.0
7	19.3	32.0	000.0
8	21.2	32.6	000.0
9	19.6	33.0	000.0
10	19.5	35.0	000.0
11	16.5	32.4	000.0
12	17.1	34.2	000.0
13	16.0	33.9	000.0
14	14.2	29.9	000.0
15	15.3	30.8	000.0
16	16.2	30.4	000.0
17	16.7	32.2	000.0
18	18.0	33.0	000.0
19	19.5	31.8	000.0
20	15.8	30.1	000.0
21	16.0	29.4	000.0
22	15.7	32.2	000.0
23	15.5	32.8	000.0
24	16.1	32.6	000.0
25	17.5	34.2	000.0
26	19.4	29.7	000.0
27	17.6	29.6	005.4
28	17.0	31.6	000.0
29	18.9	33.7	000.0
30	20.3	34.1	000.0
31	22.7	28.2	001.8

Name of the Station :- Meteorological Office, Jalpaiguri (FMO)

APRIL '99

MAY '99

Date	Minm	Maxm.	24 hrs.
	Temp.	Temp.	Rainfall
	in °c	in °c	in mm
	0830 hrs.	1730 hrs.	0830 hrs.
1	22.3	32.4	Tr.
2	24.0	30.8	000.0
3	24.0	32.8	000.0
4	22.9	34.4	000.0
5	24.4	33.5	000.0
6	23.1	32.4	000.0
7	21.4	30.8	000.0
8	20.8	32.6	000.0
9	18.3	26.6	025.0
10	21.4	31.4	001.8
11	23.3	32.7	000.0
12	24.7	34.3	000.0
13	26.4	34.7	000.0
14	23.1	30.1	012.6
15	20.9	33.2	039.2
16	24.2	34.8	000.0
17	20.3	35.3	000.0
18	19.9	33.6	000.0
19	23.1	31.8	000.0
20	23.4	33.2	000.0
21	24.5	35.0	000.0
22	26.2	33.7	000.0
23	25.2	30.8	Trace
24	23.9	32.7	000.5
25	25.8	33.6	000.0
26	24.4	33.2	002.7
27	23.8	31.8	004.5
28	24.1	28.4	000.0
29	23.3	30.6	000.0
30	22.5	30.0	019.8

Date	Minm	Maxm.	24 hrs.
	Temp.	Temp.	Rainfall
	in °c	in °c	in mm
	0830 hrs.	1730 hrs.	0830 hrs.
1	23.4	29.8	001.2
2	21.7	30.8	012.2
3	22.6	30.6	019.8
4	22.8	28.2	008.8
5	21.8	26.9	028.6
6	23.4	28.9	000.8
7	23.2	31.4	000.0
8	24.2	33.6	000.0
9	21.1	29.0	111.2
10	22.1	32.4	000.0
11	23.4	32.5	000.0
12	23.8	32.1	000.0
13	23.0	33.0	000.0
14	21.1	26.6	069.9
15	21.1	30.3	000.9
16	23.0	32.3	007.3
17	24.8	33.3	000.0
18	25.7	34.4	000.0
19	24.6	34.9	000.0
20	24.2	32.4	002.9
21	25.2	34.2	Trace
22	24.5	34.1	000.0
23	25.0	34.6	019.0
24	24.0	28.8	312.8
25	25.2	29.6	083.0
26	25.3	30.7	011.4
27	26.0	32.0	005.4
28	24.9	29.3	031.7
29	24.4	29.9	075.6
30	25.4	33.0	003.2
31	24.2	34.4	001.2

1.7 Brief description of the subsequent chapters

CHAPTER - 2 : A study of the variation of Daily ozone concentration in Antarctica with daily solar Ultraviolet flux

Atmospheric ozone is a very minor constituent, but it plays an important role to absorb the solar ultraviolet radiations ($200 \text{ nm.} < \lambda < 320 \text{ nm.}$) which are lethal to man and other living organism, at the same time it is also very much harmful to the abiotic environment of our planet. But Global ozone assessment by world meteorological organisation (WMO) confirmed that atmospheric ozone concentration is declining through out the world, which may cause severe environmental hazards.

The purpose of this chapter is to investigate the variation of daily and monthly O_3 concentration in Antarctica (South pole) at Halleybay (73.5° S , 26.7° W) and at Mc Murdo (78° S , 166° E) with daily solar UV flux and monthly mean U.V. flux. A critical study has been made and the following important results are obtained.

The monthly correlation coefficient between daily mean O_3 concentration and daily mean U.V. flux is controlled by October values, for other months, it is negligible. The seasonal correlation coefficient between daily mean O_3 concentration and daily mean U.V. flux is controlled by Antarctic spring (Sept, Oct) value, for other seasons it is negligible. The seasonal correlation coefficient between monthly mean O_3 concentration and monthly mean U.V. flux is controlled by its Antarctic spring, for other seasons it is negligible. The seasonal correlation coefficients between monthly mean O_3 concentration and yearly mean O_3 concentration, or monthly mean O_3 concentration and yearly mean U.V. flux or monthly mean U.V. flux are also controlled by their Antarctic spring values. Most of the correlation coefficients during spring are significant at 5% level. It is concluded that the atmospheric O_3 depletion in Antarctica is independent of solar U.V. radiation.

The results are tabulated, Graphs are plotted and the related publication of research results given as reference.

CHAPTER - 3 : Cause of south polar O_3 depletion and hazards on ecology

It is known that Solar ultraviolet radiation is responsible for atmospheric ozone formation as well as ozone destruction. Some evidence suggests it is also destroyed by man-

made pollutants. In this chapter to study the causes of South polar (Antarctic) ozone depletion, and attempt has been made to study whether the solar U.V. radiation itself is responsible for this O₃ depletion. For this a linear regression analysis has been performed between the daily values of the solar U.V. flux and daily relative sunspot number. The linear regression analysis on least square principle shows two components of solar U.V. flux for a month one is variable component and other is basic component. Each of two components are calculated for every month and correlation coefficients between each of two components of solar U.V. flux and ozone concentration have been calculated for every seasons for the stations Halleybay (73.5° S, 26.7° W) and Syowa (69° S, 39.58° E) at two different locations in Antarctica. It is found that the seasonal correlation coefficients between O₃ concentration for both stations of Antarctica and each of two components of solar U.V. flux during Antarctic spring (Sept, Oct) are positive and maximum, also most of the correlation coefficients during spring are significant at 5% level. Thus, with increase of variable and basic components of solar U.V. flux, which indicate solar activity, the ozone concentration should increase and viceversa. However present work suggests that the spring values of O₃ concentration over Antarctica were falling during successive years. Therefore if solar U.V. radiation is responsible for this declining trend of spring value of ozone concentration, then the correlation coefficient should be high negative in spring. But the result shows just reverse. Thus the components of U.V. radiation which are associated with solar activity are not responsible for the antarctic ozone depletion. Also some impacts of O₃ depletion on environment has been reviewed from the published work.

CHAPTER - 4 : Southern high latitude O₃ depletion, its variation with solar flux and hazards on nature

In chapter "Two" the analysis has been performed directly between Antarctic O₃ concentration and gross solar U.V. flux. In chapter "three" the analysis has been made by dividing the solar U.V. flux in their two components to study the impact of solar activity on Antarctic O₃ concentration. But both the studies were confined with in the available satellite data of solar U.V. flux (six years data set of Nimbus 7). In this chapter for further confirmation of the observation an attempt has been made to perform the analysis for at least eleven years, to give a better understanding of the impact of solar cycle variation.

In absence of long period solar U.V. data a proxy data for eleven years has been chosen in addition with six years solar U.V. data. Solar 10.7 cm radio flux data are used as the proxy data of solar U.V. flux. Though radio flux is not chemically responsible for creation or destruction of atmospheric ozone. But the significance of choosing the 10.7 cm radio flux as the proxy of U.V. flux has been analysed and found both the solar flux data are well correlated. Calculated correlation coefficient between solar U.V. flux and solar 10.7 cm. radio flux is positive and very high (0.95). Which is definitely significant at 5% level.

The purpose of this chapter is to investigate the covariation of southern high latitude O₃ concentration at Halleybay (73.5° S, 26.7° W) and McMurdo (78° , 166° E) with the components of solar radio flux and solar U.V. flux respectively. Investigation to assess the possible hazards on nature have also been made. The critical analysis indicates the possibility of the following results. The seasonal correlation coefficients of O₃ concentration (Stations Halleybay and McMurdo) with each of two components of both the solar flux during winter to spring are maximum. However present work indicates that the dramatic decrease of Antarctic ozone concentration occurs during southern late winter to spring. Thus conclusion may be made that the variable and basic components of solar radiations which are associated with solar activity and steady background solar radiation are not responsible for the southern high latitude O₃ depletion, and if this trend of O₃ depletion continues, it may create so many hazards on nature.

CHAPTER - 5 : Antarctic ozone sink, its covariation with solar parameter and possible effects on environment

The experimental observations shows that the loss of ozone concentration in antarctica is about 60 to 70% of total column ozone, which has been designated as “ozone hole”, the possible consequences of which on the enviroment are known. Decrease in atmospheric ozone concentration allows enhanced solar U.V. radiation (mainly U.V.-B, Wavelength range 280 nm. to 320 nm.) which is very much harmful to the biosphere as well as ecosystem. This harmful U.V. radiation can affect severely plants and crops, aquatic life, Humans and animals. It can also affect climatic condition of the earth.

In this chapter a study has been made about the man-made pollutants (chemicals), natural phenomena and transportation of ozone by stratospheric wind to investigate their role

in atmospheric ozone depletion. Also at the same time the effect of ozone depletion on abiotic and biotic environments are scrutinised from the available published standard data.

In previous three chapters, the analysis has been performed between ozone concentration of three antarctic stations in different locations with the solar gross U.V. flux, components of solar U.V. flux and with the eleven years data of solar 10.7 cm radio flux. The results are identical.

In this chapter for more critical analysis of previous observations, a twelve years solar radio flux data has been considered with the twelve years ozone concentration data of Antarctic Station McMurdo (78° S, 166° E). In chapter "two" and "four" the data available from McMurdo station has been considered with gross value of solar U.V. flux and components of solar U.V. flux for six years only. To have the more confirmative observations of the effect of eleven years solar cycle variation with the proxy data of solar U.V. radiation on ozone concentration at McMurdo, the present analysis has been made. The result shows that the correlation coefficients between O₃ concentration at McMurdo and each of two components of solar 10.7 cm. radio flux are mainly controlled by their late winter to spring values. Thus the O₃ depletion in Antarctica is independent of solar parameters and at the same time it can severely affect the environment of our planet. Also some suggestions have been made to control global ozone depletion.

CHAPTER - 6 : Arctic ozone destruction, cause Investigation and related hazards on Earth's environment

The status of ozone layer in the northern polar region were first investigated by Prof. Dobson from Oxford University during 1926 to 1929 at Abisko (68° N), Lerwick (60° N), Spitzbergen (78° N). But the systematic ozone observations were started in July 1935 by Dr. Kaare Langlo who later become Deputy Secretary of world Meteorological organisation. Geneva.

Existing recent observations show a 10 to 15% loss of total column ozone in the Arctic region.

It is reported by UNEP (United Nations Environment Programme) that 10% decrease in atmospheric ozone has been estimated to increase the risk on human population as increase of cataract by 5% per annum, the risk of malignant melanoma may increase 10% and the risk

of non malignant melanoma may increase 26%. It can also affect the climatic condition.

In this chapter the ozonedata of Arctic station Barrow (71.22° N, 156.30° W) are considered for the period February'79 to August'99 to study the ozone concentration variation for the above mentioned period. To investigate the relative cause of north polar ozone destruction, the analysis has been performed with the solar U.V. flux for the period February'79 to October'84. In absence of long period solar U.V. data, further analysis has been made with the proxy data of solar U.V. flux (Solar 10.7 cm raiddo flux) for the period February'79 to July'99.

The results of the analysis show that a loss of 8.35 to 9% in autumn during the priod 1980 to 1999, in total column ozone. Also a loss of 16 to 19.36% in spring during the period 1980 to 1997, in total column ozone and these are alarming and can create many hazards on Environment.

The seasonal correlation coefficients are mainly controlled by their autumn values, when the ozone concentration in the region is minimum, and the conclusion may be made that the arctic ozone destruction at Barrow is independent of solar parameters, similar to the case of Antarctica.

CHAPTER - 7 : Mid-Latitude Ozone covariation with derived solar Ultraviolet radiation and possible environmental consequences

In the previous chapter "two" to "six" the studies have been made for polar regions i.e in Antarctica (South Pole) and Arctica (North Pole). In the pesent chapter an attempt has made to study the mid latitude Ozone covariation in both the hemispheres with analytically extrapolated solar U.V. data. To investigate the covariation of atmospheric Ozone concentration of mid latitude stations (Bucharest 44.48°N, 26.13°E and Lauder 45.03°S, 169.68°E) and solar U.V radiation, a regression analysis has been performed between relative sunspot number and solar U.V flux in order to derive the long period solar U.V. data. The correlation coefficient between sunspot number and solar U.V flux is positive and high (0.82%) which is definitely significant at the 5% level. From the scatter diagram between relative sunspot number and solar U.V data, a straight line is obtained and a linear empirical equation using the least square principle has been obtained, from this equation the values of U.V flux for the period 1987 to 1997 are derived. O₃ concentration for two midlatitude

stations are considered for the analysis and the following important results are found. The variation between the observed and derived U.V data are below 1 to 2% only. The correlation coefficients between O₃ concentration and U.V radiation are insignificant and they are not at the 5% level.

It is concluded that the O₃ depletion at mid latitudes are independent of solar parameter. The consequences of O₃ depletion on environment may be severe as the Ozone concentrations at both the stations of both the hemispheres are declining. Further an attempt has been made to study the cause of Ozone depletion in mid latitudes for both the hemispheres and it is found that the increased sulphate aerosol in upper atmosphere due to the volcanic eruption of mountain Pinatubo in 1991, other man made pollutants (NO_x, ClO_x etc.) have potential to decrease atmospheric Ozone in the region. Moreover, the Ozone depleted air transported from polar regions may also influence the Ozone concentration in mid-latitudes.

To controll Ozone depletion some suggestions have been made.

CHAPTER - 8 : Tropical Ozone deficit at DumDum (India), its correlation with Solar U.V. radiation and possible effects on Biosphere

It is observed from the world Ozone data of the "WOUDC" for different latitudes that the atmospheric (mainly stratospheric) Ozone concentration is maximum in Arctic geographical belt, midium value of Ozone concentration found in the Antarctica region and low value of Ozone concentration found in equatorial-tropical geographical belt. Though Ozone is formed in the stratosphere mainly near the equator/Tropics and after formation it is carried to higher latitudes by the stratospheric wind. Further the water vapour content is high in the stratosphere over the equator/Tropics, which may destroy Ozone. In addition if chemical loss takes place then the situation will be most deadly for this regions. As in the tropical/equatorial region Ozone layer thickness is significantly small and obviously the solar U.V radiation penetration thus maximum throughout the year. The effect of this high dosage of U.V. radiation on the environment of this region need to be studied and the scientists and Govt. organisations of this regions should be largely involved in the process. In fact this high dosage of U.V. radiation (mainly $280 < \lambda < 320$) may influence human health such as cataracts, viral infections, damage of natural immune system, skin cancer etc, and it can also effect the climatic condition of the region.

- This chapter deals with the Ozone concentration in Tropical station DumDum (22.38°N, 88.28°E) and the analysis has been performed with respect to gross value of U.V flux, variable and basic components of solar U.V flux and the results of analysis are as follows.

A loss in yearly average Ozone concentration during the period 1979 to 1996 is found to be 5.04%. The Ozone concentration is found to be minimum for late autumn to early winter. The correlation coefficients between O₃ concentration and solar U.V flux during late autumn to winter are quite significant. It is concluded that O₃ deficit at DumDum in India is independent of solar U.V radiation and also it may influence public health and climate.

CHAPTER - 9 : The Sub-Himalayan column Ozone variation with Meteorological parameters and its possible impact on Environment at Jalpaiguri

In this chapter the impact of atmospheric Ozone change on environment (impact on climate) at Jalpaiguri (26.32°N, 88.46°E) has been analysed.

The ozone data of Jalpaiguri has been obtained from the "NASA" internet website. From the "NASA" "TOMS" over pass files it is possible to obtain the ozone data for any location, at the 1 degree latitude by 1.25 degree longitude resolution of the gridded ozone data. The daily total column ozone data for the period June'98 to May'99 has been obtained for each day, one by one, by inserting day, month, year, latitude and longitude in the particular windows. The meteorological data used are daily maximum and minimum temperatures and daily total rainfall for the above mentioned period are obtained from the Director, Meteorology office, Jalpaiguri.

The analysis shows a high negative correlation between daily ozone concentration and daily maximum, minimum temperature, daily total rainfall. The correlation coefficients are at the 5% significance level, which predict that the atmospheric ozone depletion may affect seriously the future environment at subhimalayan Jalpaiguri. There are possibilities to have more warm climate. The winter may be shorter. Monsoon may have more rainfall, resulting in water logging in the vicinity if the drainage system is not improved.

CHAPTER - 10 : A mathematical derivation of atmospheric ozone concentration at Jalpaiguri, its variation and effect on environment

In the previous chapter in absence of long period ozone data of Jalpaiguri it could not be possible to confirm whether ozone concentration at Jalpaiguri is declining year to year.

The ozone data of Jalpaiguri (26.32° N, 88.46° E) only for few months are available in the NASA website (Since December 1997), which have been obtained. In order to derive long period ozone data, a regression analysis has been performed between ozone data of Jalpaiguri (26.32° N, 88.46° E) and ozone data of DumDum (22.38° N, 88.28° E) with a pair of 146 Number of data. The correlation coefficient between the two variables is positive and very high (0.82) which is definitely at the 5% significance level.

The covariance coefficients are 0.063 and 0.065 respectively. From the scatter diagrams between Jalpaiguri ozone concentration data and DumDum ozone concentration data a straight line is obtained and a linear empirical equation from the least square principle has been obtained which gives the following interesting results; The derived ozone data by the equation for the period 1979 to 1999 confirms a loss of 5.35 to 7.76% in winter, 5.78 to 8.5% in summer, 4 to 4.9% in rainy and autumn at Jalpaiguri. Which may increase the possibility of climatic change, the risk of skin cancer, cataract etc, and may cause severere harm to the ecosystem if present trend continues. Also the result of this chapter, strengthen the findings of previous chapter. Further a prediction for future ozone concentration at Jalpaiguri has been made mathematically.

CHAPTER - 11 Summery, conclusions, findings and future scope of work :

In this chapter the present dissertation work has been summerised and concluded. The findings of the work have been presented and compared. Some steps to controll atmospheric ozone depletion and about the awareness of harmful solar U.V. related damages, among the common people and its protection have been suggested. Also some discussion in brief have been made about the future scope of work.

CHAPTER - 12 Bibliography, Appendix, List of Published / Accepted papers :

In this chapter the related publication of research works have been presented as references. In appendix some representative calculations are shown and few statistical methods are discussed. At the end, the list of published / accepted papers for publication are presented.