disposition and the optical characters indicated above, it would follow that the absorption of the light by the molecules would be effective for directions parallel to the radii and would be absent for vibration directions transverse to the radii. If the energy of the light corpuscles thus taken up is passed on to the cones nearest to them, the result would be the perception of light for vibration directions parallel to the radii and the absence of such perception for vibration directions transverse to the radii. In other words, in the field of view corresponding to the foveal region of the retina, we would observe a bright brush running parallel to the direction of vibration in the polarised light and a dark brush running transverse to the direction of vibration. This is actually what is observed.

We may remark that the explanation set forth above would cover the details of the picture actually perceived by the observer. It may be mentioned that a colour filter well suited for such observations is a solution of cuprammonium of which the strength is so adjusted that it cuts off the green, yellow and red of the spectrum completely without any sensible absorption in the blue and the violet. A glass tube three centimetres in diameter and one centimetre long fitted with flat end plates and filled with the solution makes a very efficient filter. With the cell and a polaroid held up against the bright sky, the configuration of the brushes can be very conveniently studied. It is readily verified that the dumbell-shaped brushes are confined to a region in the field of view corresponding to the part of the fovea where the nerve fibres as shown in the anatomical drawings run obliquely. The region corresponding to the very centre of the fovea where the dark bright brushes cross is, of course, never quite dark. Its appearance alters with the orientation of the observing polaroid to a certain extent. This indicates that the molecules of the pigment in this region have preferred orientations.

MEASUREMENT OF THE VERTICAL DISTRIBUTION OF ATMOSPHERIC OZONE BY A CHEMICAL OZONESONDE

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RECENT studies have shown a close relationship to exist between atmospheric ozone and the behaviour of the middle stratosphere, especially at temperate and high latitudes, at times of great dynamic activity. Synoptic observations of the vertical distribution of atmospheric ozone are therefore of great value for the investigations of the general circulation of the stratosphere. It is also of considerable interest to atmospheric physicists working in such fields as radiation, ozone photo-chemistry and climatology. The Umkehr method extensively used in the past for studies of the vertical distribution of atmospheric ozone is indirect, time-consuming and does not provide a detailed and continuous profile. Ozonesondes recently developed for the direct measurement of the vertical distribution of ozone in the atmosphere use optical,[1] electrochemical[2] or chemiluminescent[3] techniques. The present note briefly describes an ozonesonde developed in the Instrument Division of the Meteorological Office, Poona. Results of preliminary soundings at Poona are also presented.

The ozone sensor is a Brewer bubbler type electrochemical cell containing 2 ml. of 2% potassium iodide solution. The cathode is a fine platinum gauze about 5 sq. cm. in area and the anode a piece of silver wire. Ambient air is pumped through the solution at a steady rate by a miniature, constant-volume reciprocating piston pump operated by a miniature 3 V d.c. motor that runs at about 5,000 rpm. A steady polarising potential of 0·42 volts derived from a mercury cell is applied between the platinum cathode and the silver anode in the bubbler. Ozone present in the air sample reacts with the potassium iodide solution as follows:

$$O_3 + 2\,KI + H_2O = O_2 + I_2 + 2\,KOH.$$

The polarising potential produces a thin layer of H_2 at the cathode. Every free iodine molecule liberated by the ozone reacts with the H_2 causing a depolarisation current of two electrons to flow in the external circuit. For amounts of ozone found in the atmosphere currents up to

5 μA are obtainable with a pumping rate of 200 ml./minute.

The telemetering system consists of a temperature-controlled transistorised D.C. amplifier, modulator and UHF transmitter. The amplified bubbler current output from the D.C. amplifier modulates the 72 mc./s. carrier in the range 0 to 200 cycles. The sonde transmits, in addition to the ozone values, the pumping rate, the D.C. amplifier zero, the atmospheric pressure, ambient air temperature, pump temperature and transmitter reference frequency. The various parameters are programmed into the modulator through a commutator operated by the motor through a reduction gearing. The entire system is housed in a thermocole (expanded polystyrene) tube section of 100 mm. wall thickness to prevent the KI solution from freezing. The signal from the sonde is received *via* an omnidirectional antenna on a 72 mc./s. receiver and recorded on a 300 mm. chart on a cycloray recorder.

An ozone source is used to precondition the sonde and to adjust the sensitivity of the instrument. Ozone is produced by irradiation of an air-stream by a quartz mercury lamp. The preflight procedure consists of calibrating the sonde using a simple current generator which supplies 0 to 5 μ amps in one μ amp steps. Just before the flight the sonde is calibrated and the calibration points are recorded on the chart. For about an hour before the flight the intake tube is connected to a strong ozone source and the pump run from an auxiliary battery. Impurities in the intake tube, the pump and the bubbler are oxdised in this manner.

The complete sonde with the batteries weighs about 2 kg., the weight being considerably reduced by the use of transistors and smaller power supply units.

Data from the sounding is checked by measurement at the ground by a chemical method with Ehmert's apparatus.

The results of two soundings taken on 29-9-1964 and 2-11-1964 at Poona are shown in Fig. 1 where the partial pressure of ozone in μ mb. is plotted against pressure in mb. in the left diagram. On the right the vertical profile of

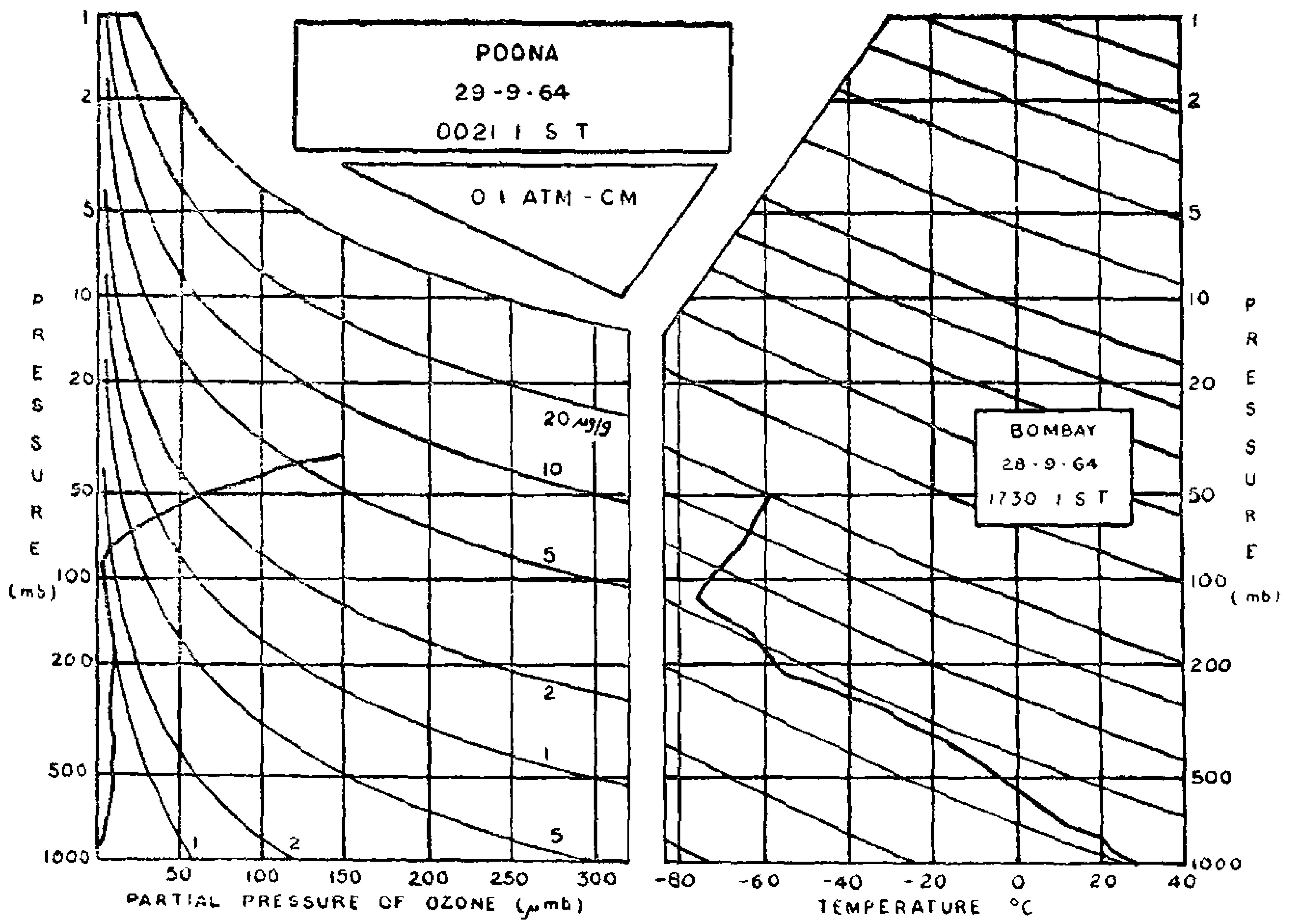

FIG 1(a) – OZONESOUNDING AT POONA ON 29·9·64

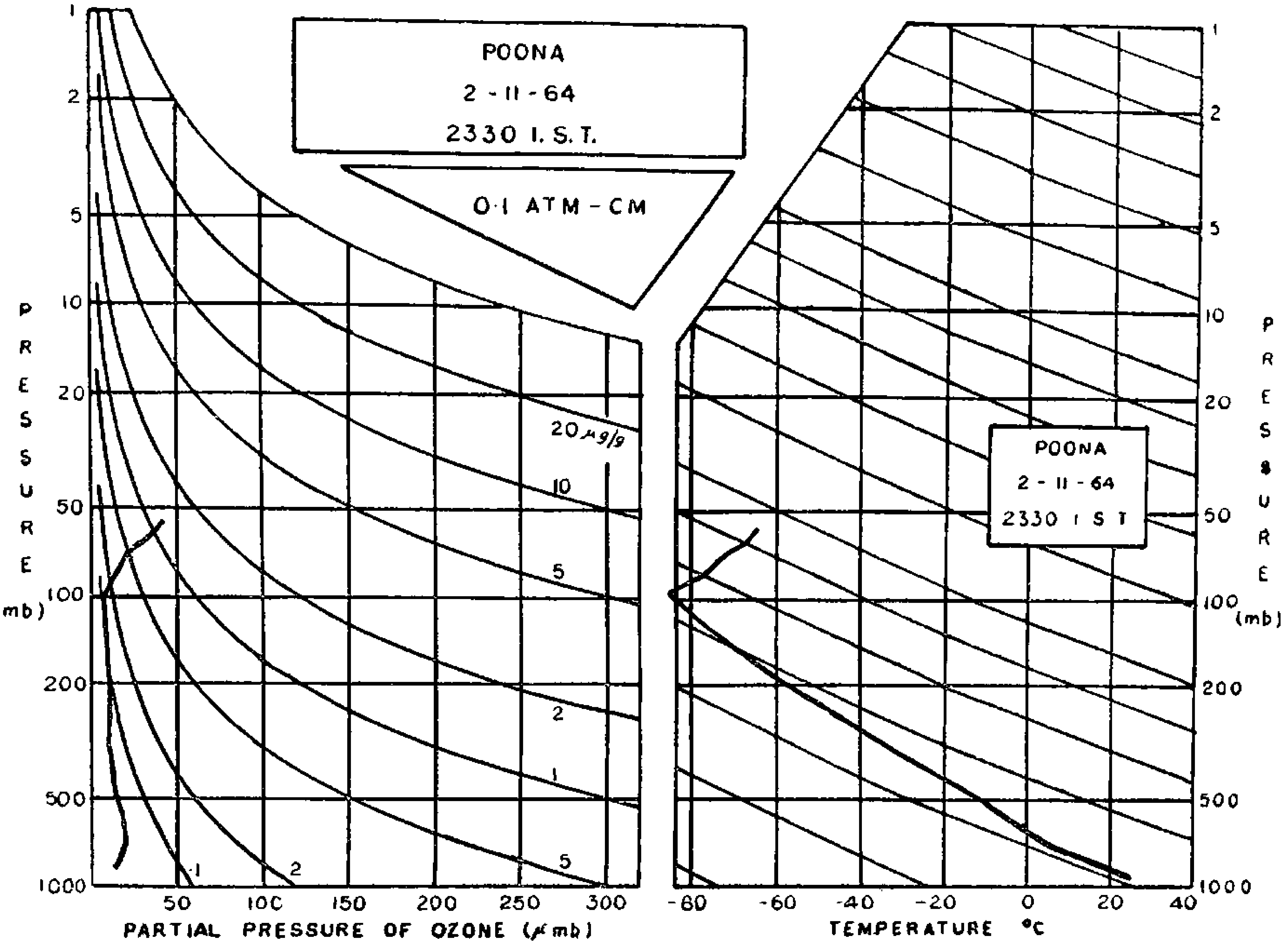

FIG 1(b) - OZONESOUNDING AT POONA ON 2-11-64

temperature is given for the days for Poona and Bombay. The partial pressure of ozone is relatively small at all levels below the tropopause and increases rapidly with height above the tropopause, reaching a maximum at about 25 km. The marked increase at 600 mb. on 2-11-1964 is associated with the anticyclonic subsidence of upper tropospheric air observed on that day. In general the vertical distribution of atmospheric ozone is closely related to the wind field and thermal structure of the atmosphere. Ascent and descent values are in satisfactory agreement.

The ozonesonde was developed at Poona in connection with the programme of upper atmospheric observations to be made during the IQSY. With systematic observations at a number of stations and from a study of the seasonal and latitudinal variations of the vertical distribution of ozone it should be possible to arrive at a better understanding of the mechanism of ozone changes in the lower latitudes. A detailed and critical study of the performance of the sonde will be published elsewhere.

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