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RECENT RESEARCH RESULTS AND ONGOING
AND PLANNED RESEARCH PROGRAMMES

Submitted by

Switzerland

Switzerland

Recent research results, planned and
ongoing activities relevant to the
world plan of action on the Ozone
Layer

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of the co-ordinating committee on the
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1. Stratospheric Ozone

Total ozone measurements at Arosa showed a recovery in 1984 from the all-time minimum in 1983, which was almost certainly due to the El Chichon eruption in 1982. However, the values remained below the long-term mean, as well as below the regression line like all annual mean values since 1980. Again, 1985 showed very low total ozone, the third lowest annual mean in 60 years (after 1983 and 1928). The Payerne soundings demonstrated that the deficit had a slightly higher center of gravity than in 1983 and was now reaching into the middle stratosphere, a fact also shown by the Umkehr observations at Arosa. In winter 1985/86, the total ozone seems to return to normal.

Considering the whole series (since 1926), we find that an analysis starting in 1957 - the date on which a large part of the global ozone observing network went into operation with the IGY - yields a negative trend of 1.85% per year, while for the whole series a trend of only -0.44% is obtained. This is due to the fact that during the first 25 years of observations total ozone was rather increasing. This result shows the importance of long observational series in trying to separate between natural fluctuations and anthropogenic influences on the ozone layer.

At Arosa it is planned to transfer the Umkehr measurements to an automated instrument after two years of parallel work with the manual system in order to avoid a break in the 30-year-long series. The processing of the ozone sounding in Payerne is also being automatized; that will make the data more rapidly available.

2. Intercomparison of "Umkehr-" and microwave radiometer technique

After a first intercomparison campaign in the winter season 1981/82 giving encouraging results, it was decided to repeat this intercomparison over a one-year time span. Again the microwave sensor was operated in Bern at the Institute of Applied Physics and the simultaneous "Umkehr" data were taken in Arosa. The observing geometry was such, that very similar air volumes were observed by both instruments. The results are summarized in the enclosed Figure 1. It should be noted that the "Umkehr" technique is much more affected by adverse weather conditions (cloudiness, precipitation) than the microwave sensor, therefore there may be very little overlap between the two data sets for some months. The corresponding correlation coefficients are 0.86, 0.86, 0.74, 0.61 for layers 6, 7, 8 and 9, respectively.

3. Mesospheric Ozone-Variations observed with a microwave sensor

In spring 1984 (February to May), the day/night variations of the mesospheric ozone concentration (50 - 80 km) was observed using a microwave radiometer operating at 142 GHz. The results are in very good agreement with a recent photochemical theory by Allen, Lunine and Yung (J.G.R. 89, 1984). Figure 2 gives an example of the observed variation from sunset to sunrise.

4. Spaceborne microwave limb-sounder MAS (MM-wave Atmospheric Sounder)

The Institute of Applied Physics, jointly with the Max-Planck-Institute for Aeronomy (FRG), the Naval Research Laboratory (USA) and Pennsylvania State University (USA) develop a mm-wave limb sounder which measures simultaneously pressure, temperature, water vapor, ozone and chlorinemonoxide over the altitude range 20 - 100 km. The MAS is accepted by NASA to be flown on at least three consecutive Earth Environmental Missions (EOM-4, 5, 6) with a first flight scheduled for 1988.

5. Tropospheric ozone

The motor glider flights during the field campaign in summer 1984 showed that in smog situations the high ozone concentrations (twice the natural background or more) are, in the mean, uniformly distributed over the Swiss Plateau and into Southern Germany. This indicates that the smog layer presumably covers most of Middle Europe. Earlier measurements above Arosa showed an extension of the smog layer into the Swiss Alps in the early night, very probably due to a diurnal cycle of air exchange between the Alps and the Plateau.

Note: - The Institute of Applied Physics on behalf of the International Ozone Commission prepared a report on the use of microwave radiometry in ozone research. Copies of this report are available.

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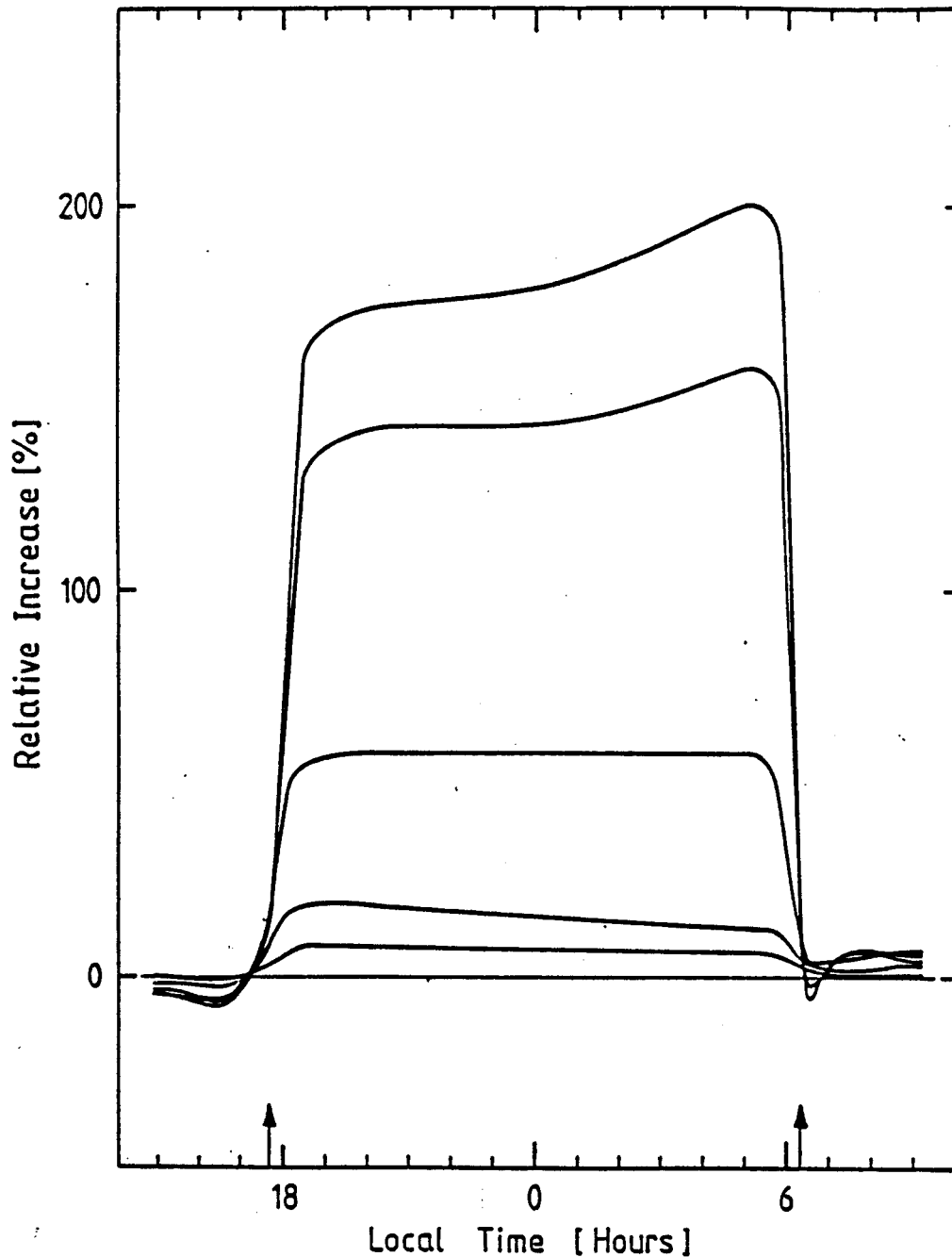


Figure 1: Comparison of ozone concentration measured by the microwave sensor (solid line) compared with correlative data from the "Umkehr" instrument (dashed line), the long-time mean established by the "Umkehr" instrument in Arosa (crosses), and the long-time mean (circles) extracted from spaceborne instruments (NIMBUS 7, LIMS and SBUV, AE-2 SAGE, SME UVS and IR). The numbers give the standard "Umkehr" layers (6 at 11 mb, 7 at 5.5 mb, 8 at 2.8 mb, 9 at 1.4 mb and 10 at 0.7 mb).

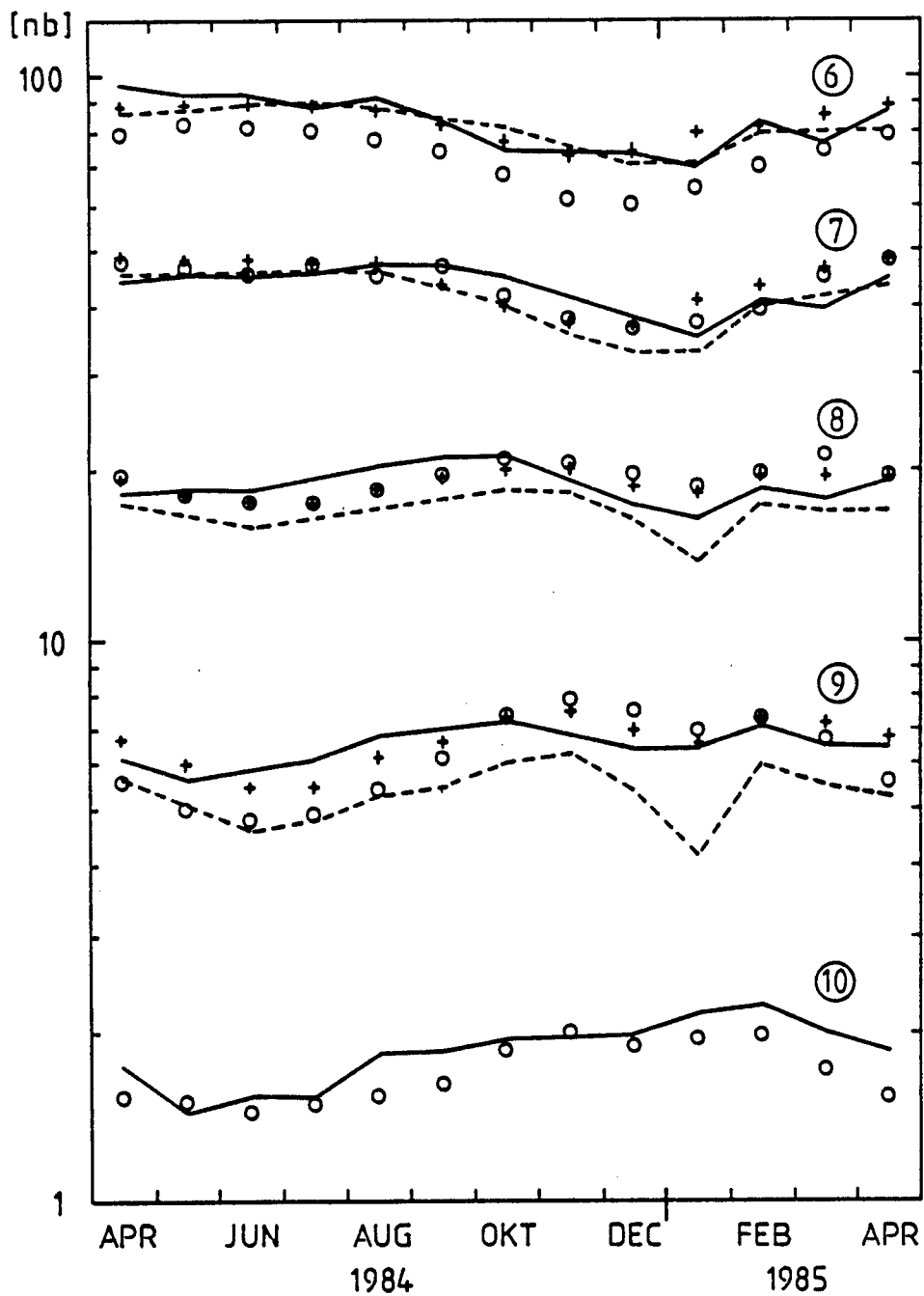


Figure 2: Night-time increase, normalized to the mean day-time value, for the ozone layers at 74 ± 8 , 66 ± 7 , 60 ± 7 , 54 ± 7 , and 49 ± 6 (from top to bottom). Arrows mark sunset and sunrise respectively at the ground.