

penetrating cosmic rays that reach the earth's surface are secondary particles, or radiation generated in the atmosphere by interactions between primary cosmic rays and the nuclei of air atoms.

It is well known that radiation or streams of particles from the sun are responsible for chemical changes in the upper atmosphere, such as the formation of ozone and for keeping the highly ionized layers known as the ionosphere in an active state, but until rockets and satellites became practical scientific instruments, only deductions from indirect measurements indicated anything about the chemical and physical processes involved. Reflection of radio waves gives the electron density up to about 300 kilometers. The spectroscopy of the night sky and aurora in the visible spectrum tells something about the chemical composition but still leaves large gaps in the knowledge of the chemical composition, the nature of the radiation responsible for the ionization and of the distribution of pressure, density and temperature. Though the average radiation from the sun is very constant, in the ultra-violet and X-ray region and the streams of particles from the sun, the intensity is extremely variable.

For detailed results of the rocket and satellite measurements it is necessary to consult scientific publications but a few highlights may be presented here. The density of the gas at satellite orbit heights in the atmosphere is several times higher than was anticipated. The temperature rises rapidly above a minimum at about 80 kilometers and in fact it is generally becoming accepted that the earth is travelling in the atmosphere of the sun, that is, the solar corona extends to the orbit of the earth.

In an attempt to measure cosmic ray particles, the United States satellite group found a very intense layer of energetic particles starting at about 300 kilometers and increasing in numbers up to the maximum height of their measurements (1,600 kilometers). Many more measurements are necessary to decide whether these are electrons or protons or a mixture of the two and to study their spectrum and the height to which the layer extends. Such measurements as have been presented suggest that a human being travelling at the upper level where measurements are being taken might be exposed to two roentgens per hour. The comparison of this with the usually accepted safety tolerance for continuous exposure of about one-tenth of a roentgen per week indicates the great need for more knowledge.

The rocket and satellite program in countries like the United States, the Union of Soviet Socialist Republics and the United Kingdom was started before the IGY though, without doubt, the IGY organization gave it considerable stimulus in all countries. Certainly the IGY international meetings have created an excellent forum for the exchange of interesting scientific results and recent experience shows the value of such exchanges in reducing serious conflicts between countries of different political ideologies.

Canada's part in the rocket and satellite program has not been negligible even though no specific program was undertaken by this country. The United States has established a unique rocket launching facility at Churchill. This facility is designed for scientific work and during the IGY there has been no military objective included so that the whole range is operating for purely scientific purposes. The Canadian Armed Services act as hosts to the American group and the Defence Research Board's Northern Laboratory at Churchill supplies laboratory space and facilities. The Canadian Armament Research and Development Establishment at Valcartier is using two United States rockets for upper atmosphere investigations in infrared radiation. The Department of Transport takes part in the necessary meteorological work and in communications. The University of Saskatchewan's Aurora Research Group is carrying out some of the ground measurements on aurora to facilitate the actual firing of rockets into auroral displays.

The question of the continuation of the IGY was raised at a meeting of the International Committee on the IGY in Moscow in August 1958. The scientists in some countries feel that the measurements being taken and data exchanged are of such great value that the whole program should be continued at least until the end of 1959, one year longer than