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**COSPAR
INTERNATIONAL
REFERENCE
ATMOSPHERE: 1986**

**Part II: Middle Atmosphere
Models**

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FOREWORD

The Committee on Space Research (COSPAR) International Reference Atmosphere (CIRA) 1986 is the fourth in the series. It is published by Pergamon as two volumes.

Part I: Thermosphere Models was published in early 1989.

Part II: Middle Atmosphere Models, published in 1990, is described here.

At the XVIII Plenary Meeting of COSPAR, 1990 Commission C approved that CIRA Part III: Middle Atmosphere Minor Constituents Reference Atmosphere, should be prepared by a Working Group under the Chairmanship of Dr. G. H. Keating (USA), with Dr. P. Rees (UK) as Vice-Chairman.

Historical Development

The first CIRA appeared in 1961 and contained the first models of the atmosphere which were based on direct observational data, namely air density data. These data were derived from the drag on artificial satellites, following the launching into orbit of Sputnik I in October 1957 and the subsequent launches of OSO and USA satellites. Due to the rapid increase in data from rockets and satellites and the development of theoretical upper atmosphere models, a revised CIRA was published in 1965. This volume contained a mean atmospheric profile from 30 to 200 km, tables of atmospheric structure and its variations in the region 30 to 100 km, and tables of air latitude atmospheric properties, including diurnal variations, for the region 170 to 200 km, using a theoretical model to extend the limited observational data base.

The 1972 edition of CIRA resulted in 1972. By this time, there had been a considerable increase in the data on which the middle atmosphere models were based, however, the biggest advance was in the understanding and specification of the major causes of variations of thermospheric properties. Based on the development of thermospheric models (M. Nicolet), using temperature profiles and the concept of diffusive equilibrium, families of isothermal models were developed, designed by temperature profiles, with the atmospheric temperature as the principal parameter. These properties were partially dependent on local time, season, solar activity, geomagnetic activity and 11-year solar variability. L.G. Jacobis provided tables for the altitude region 100 to 200 km. G.V. Groves prepared similar tabulations of atmospheric properties for the region 35 to 110 km as functions of latitude and time of year. Because the values of the Jacobis and Groves' models were not consistent at 110 km, J.S.W. Chaffin prepared a single, continuous, mean atmospheric profile extending from 35 to 200 km.

Improvements in CIRA 1986

Since 1972, satellite remote soundings of the middle atmosphere have provided global coverage of this region, perhaps the biggest single advance in data availability. In-situ satellite measurements of temperature, composition and winds in the middle and upper atmosphere have also added contributions to new data on the upper thermosphere. Data from ground-based MST radar and coherent scatter radar measurements of temperature and winds have also made major contributions at particular locations. Space-borne and ground-based optical measurements have widely contributed to a great improvement in our knowledge of upper atmosphere structure. It should however be noted that the experimental global-scale data base on the middle atmosphere and lower thermosphere is still extremely limited. In the atmosphere where many new satellite, ground-based and in-situ observations of temperature, composition have become available, the satellite data have the particular advantage of providing in most cases uniform global coverage without weighting to particular locations. Some analyses of synchronous measurements of geopotential height and

... have been used to derive the new CIRA model. The model is based on the analysis of the data base and is presented in Part I of this volume. The model is presented in Part I of this volume. The model is presented in Part I of this volume.

Improvements in the use and presentation of the CIRA 1986 models

... of the data base. Part II for the 100-110 km region shows how existing data have been used to derive the model. Part II for the 100-110 km region shows how existing data have been used to derive the model.