conference summary

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conference on composition and dynamics of the upper atmosphere

A conference on composition and dynamics of the upper atmosphere was held at the University of Texas at El Paso, 6-8 November 1968. The meeting was sponsored by the American Meteorological Society with cosponsorship by the American Institute for Aeronautics and Astronautics and hosted by the University of Texas at El Paso. Approximately 125 attendees took part in the 8 sessions. At the Thursday evening dinner meeting, Dr. Joachim Kuettner spoke on the use of sailplanes in atmospheric probing. The conference was the latest in a series of American Meteorological Society meetings organized by the El Paso Chapter which has shepherded the growth of synoptic rocketry in the stratospheric circulation region.

The first session, chaired by H. J. Mastenbrook of the U. S. Naval Research Laboratory, focused on the measurement and distribution of water vapor in the stratospheric and mesospheric regions. Presentations by Peter M. Kuhn of the ESSA Research Laboratories in Boulder, William R. Kuhn of the University of Michigan, and J. D. Horn of the Atmospheric Sciences Laboratory at White Sands Missile Range treated the implications of water vapor on the absorption and emission of radiant energy, while Harold N. Ballard of the Atmospheric Sciences Laboratory at White Sands Missile Range described a cryogenic sampler technic for acquisition of upper stratospheric air samples for analysis in the laboratory.

Louis J. Battan of the University of Arizona chaired a session dealing with meteor trail radar techniques for wind measurement in the 80-110 km region. Albert D. Frost of the University of New Hampshire gave a resume of current meteor trail techniques, with emphasis on the system at that university. Robert Nowak of Stanford Electronics Laboratories presented a detailed survey of the general techniques which have been employed, with particular emphasis on those techniques which would be most applicable for synoptic probing of the upper atmosphere on a global scale. Alton A. Duff of the Atmospheric Sciences Laboratory at White Sands Missile Range described the meteor trail radar system which has been constructed and is currently being installed at White Sands Missile Range.

The idea that the presence of particulate matter in the upper atmosphere provides a very important natural source of information concerning the structure of the upper atmosphere was considered in the third session under the chairmanship of R. S. Skrivaneck of the Air Force Cambridge Research Laboratories. Richard D.

Cadle of the National Center for Atmospheric Research led the discussion with a general survey of available evidence for particulate material in the upper atmosphere. The importance of circulation and exchange processes was treated by Dalton G. Vincent of Massachusetts Institute of Technology and by E. A. Martell of the National Center for Atmospheric Research. The global distribution of stratospheric dust was discussed by F. Volz of Air Force Cambridge Research Laboratories. Evidence for the extension of local tropospheric circulation systems into the stratospheric region was presented from satellite data by J. A. Weinman of the University of Wisconsin. Observation of particulate material in this region of the atmosphere by infrared and lidar techniques was discussed by S. Pilipowskyj of Scott Air Force Base. The physics of particulate materials in the upper atmosphere clearly has an important role in establishing the structure of that region.

Richard A. Craig of Florida State University chaired a session on ozone, a more or less standard item in synoptic rocket meetings since the ozone interaction with solar ultraviolet radiation provides an important part of the energy which drives the monsoonal stratospheric circulation. Wayne S. Hering of the Air Force Cambridge Research Laboratories drew on the large amount of information collected by the North American Ozone Network over the past several years to present a comprehensive summary of ozone distribution and variation through the year. The considerable interest which has been evidenced over the past several years relative to interaction between ozone and water vapor structures in the upper atmosphere was again brought to the front by a paper on simultaneous measurement of water vapor and ozone in the lower stratosphere by H. J. Mastenbrook of U. S. Naval Research Laboratory. The general global distribution of ozone was treated by Rumun D. Bojkov of the National Center for Atmospheric Research. The diurnal variation of ozone in the upper stratospheric and mesospheric regions between 20 and 70 km, obtained by chemiluminescent ozonesonde deployed from the Arcas rocket vehicle was presented by Jagir S. Randhawa of the Atmospheric Sciences Laboratory. The key role which ozone plays in the stratospheric circulation and the dependence of its concentration structure on other chemical and physical processes in this region indicate that the morphology of the ozonosphere is as yet incomplete.

Atmospheric wave motions constitute a major part of the new meteorology which emphasizes the considera-

tion of the atmosphere as a unified environment. This session was chaired by J. K. Angell of the ESSA Research Laboratories. A review of the literature relative to atmospheric wave motions was delivered by Morton G. Wurtele, University of California at Los Angeles. Observations of tropospheric waves were treated by G. E. Bristow, Canadian Department of Transport, with reference to the Colorado Mountain Wave Clear Air Turbulence Project, while the more global planetary waves of midlatitudes and tropics were considered by Robert E. Dickenson of the National Center for Atmospheric Research and by J. M. Wallace of the University of Washington. David D. Houghton of the National Center for Atmospheric Research presented a numerical model for linearized gravity and acoustic waves. The probable importance of wave motions in establishing the physical structure of the upper atmosphere and the progress indicated by the reports presented at this meeting point clearly toward this subject as a major item for discussion at future meetings.

Walter Orr Roberts of the University Corporation for Atmospheric Research chaired the general session on the Stratospheric Circulation. The papers presented ranged from climatological studies of the type presented by Lloyd V. Mitchell of the U. S. Air Force Environmental Technical Applications Center to consideration of the energy budgets during a "minor breakdown" as presented by J. D. Mahlman of the U. S. Naval Postgraduate School. The antarctic winter stratospheric circulation was treated by Cantrell L. Craig of the Schellenger Research Laboratories, and special analyses of specific stratospheric warming events were presented by Kenneth W. Johnson of the Weather Bureau, and by Ben H. Williams of the Atmospheric Sciences Laboratory. J. M. Wallace of the University of Washington presented new data on the diurnal tides in the tropospheric and lower stratospheric wind fields, while a new concept of the quasi-biennial oscillation of the stratosphere was presented by James R. Holton of the University of Washington.

Horace R. Byers of the Texas A&M University chaired a general session which provided a wide ranging viewpoint of the structure and dynamics of the atmosphere. James R. Scoggins of Texas A&M University presented a review of the measurements of winds by balloon methods, indicating the trials and tribulations of this technique as well as defining the best data which can currently be obtained with the most sophisticated instrumentation available. Marvin A. Geller of the Massachusetts Institute of Technology discussed the effects of temperature structure on tidal motions, and J. S. Lambert of the Schellenger Research Laboratories discussed techniques for obtaining the vertical structure of solar ultraviolet absorption in the ozonosphere. Charles H. Murphy of the U. S. Army Ballistic Research Laboratories reported on seasonal variation of iono-

spheric winds over Barbados which were obtained through use of the 16" Harp gun probe system. Empirical relationships between the zonal stratospheric circulation winds at 50 km and the 500 mb southwest "cut-off" low were discussed by Max C. Bolen of the University of Texas at El Paso, and preliminary results from a stable balloon platform flown at 50 km altitude were reported by Bruce T. Miers of the Atmospheric Sciences Laboratory. Robert Olsen of the Atmospheric Sciences Laboratory presented data on the seasonal and diurnal variability of density in the stratosphere and mesosphere over White Sands Missile Range, and a new look at temperature structure of the lower stratosphere was provided by Marvin D. Kays of the Atmospheric Sciences Laboratory.

The final session, labeled mesospheric structure, was chaired by S. Matsushita, High Altitude Observatory at Boulder. After a comprehensive summary of the physics of that region with particular emphasis on the electrical structure, by Matsushita, a description of the wave structure of the mesosphere obtained from grenade soundings was presented by J. S. Theon of the Goddard Space Flight Center. G. J. Fraser of the National Center for Atmospheric Research discussed the atmospheric circulation and observed wave motion in the 60 to 100 km region in the Southern Hemisphere, and Leon B. Katchen of Goddard Space Flight Center presented a comparison of upper atmospheric temperature observations with temperatures predicted from tidal theory. New information on the general circulation of the arctic mesosphere in summer was presented by James E. Morris of the Atmospheric Sciences Laboratory, and the distribution of wind shears obtained from the high resolution sensors of the Meteorological Rocket Network were discussed by Henry A. Salmela of Air Force Cambridge Research Laboratories.

The meeting provided an excellent forum for research scientists engaged in synoptic study of the meteorology of the upper atmosphere. Emphasis was on consideration of the results which have been achieved from broad scale synoptic studies of the stratospheric circulation and from detailed treatment of such parameters as internal waves and interaction between the neutral and electrified atmospheres. An extreme attention to problems of measurement was generally missing, with the implication that these problems had been resolved adequately to get on with the business of determining the meteorological structure of the stratospheric circulation. The presentations at this meeting provided strong indication that synoptic exploration of the upper atmosphere has achieved a proficiency which is comparable to that which is current in the lower atmosphere and in the ionospheric regions, resulting for the first time in the capability of atmospheric scientists to look at the physics of the Earth's entire atmosphere.

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