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**1. INTRODUCTION AND  
NEW INTERNATIONAL EQUATORIAL OBSERVATORY (NIEO)**

**1.1 THE MIDDLE ATMOSPHERE PROGRAM: AN OVERVIEW**

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The Middle Atmosphere Program (MAP) took place from January 1, 1982 through December 31, 1986, and was followed by Middle Atmosphere Cooperation (MAC) through to the end of 1988. The inception and organization of the program are described, together with some of the salient features of its results.

**REGIONS OF THE ATMOSPHERE**

**Troposphere 0-17 km  
Stratosphere 17-50 km  
Mesosphere 50-85 km  
Thermosphere 85 km**

**Middle atmosphere consists of the stratosphere and mesosphere.**

**RELEVANCE OF THE STRATOSPHERE**

**Ozone layer effects  
Chlorofluorocarbon effects  
Clear air turbulence  
Radioactivity residence times  
Scatter communication**

**RELEVANCE OF THE MESOSPHERE**

**Modeling for aerospace applications  
Communication by meteors, etc.  
Radio absorption effects**

**AIMS OF MAP**

**"Under the aegis of MAP, scientists will collaborate internationally**

- 1. To determine the structure and composition of the atmosphere in the regions of the stratosphere and mesosphere, i.e., in the approximate altitude range 15 to 85 km; especially in regard to important minor species.**
- 2. To determine the interaction of radiation from the sun, the earth and the atmosphere with the middle atmosphere.**
- 3. To investigate the motions of the middle atmosphere on all scales, including the interactions with the troposphere and magnetosphere, and to monitor these motions on a continuing basis."**

**SOURCES OF ENERGY IN THE SOLAR-TERRESTRIAL SYSTEM**

**Tides, gravity waves, planetary waves, solar ultraviolet radiation, solar X-radiation, cosmic rays, magnetospheric electric fields, energetic particle precipitation, global electrical circuit.**

### MAP STEERING COMMITTEE

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### MAP STUDY GROUPS AND CHAIRMEN

MSG-1: Tropospheric-Stratospheric Coupling, Chemical and Dynamical, J. R. Holton  
 MSG-2: Transport of Trace Constituents, J. D. Mahlman  
 MSG-3: Tides, Gravity Waves and Turbulence, M. A. Geller  
 MSG-4: Electrodynamics of the Middle Atmosphere, H. Volland  
 MSG-5: Ions and Aerosols, F. Arnold and M. P. McCormick  
 MSG-6: Scientific Aspects of an International Equatorial Observatory, S. Kato  
 MSG-7: Penetration of Solar Radiation into the Atmosphere, J. E. Frederick  
 MSG-8: Atmospheric Chemistry, G. Witt  
 MSG-9: Measurement of Middle Atmosphere Parameters by Long Duration Balloon Flights,  
 J. E. Blamont

### PRE-MAP PROJECTS AND CHAIRMEN

PMP-1: Coordinated Study of the Middle Atmosphere in Winter, K. Labitzke  
 PMP-2: Equatorial Wave Dynamics, I. Hirota  
 PMP-3: Study of Photochemical Processes in the Upper Stratosphere and Mesosphere by  
 Complementary Spacecraft, *in situ*, and Ground Measurements, J. Gille  
 PMP-4: Presentation of Meteorological and Chemical Variables in the Format of Monthly  
 Mean Zonal Cross Sections, J. Barnett  
 PMP-5: Solar Spectrum Irradiance Measurements, P. C. Simon

### MAP PROJECTS AND COORDINATORS

AMA: Antarctic Middle Atmosphere Program, T. Hirasawa  
 ATMAP: Atmospheric Tides in the Middle Atmosphere Program, J. M. Forbes  
 DYNAMICS: Dynamics of the Middle Atmosphere in Winter, K. Labitzke  
 GLOBMET: Global Meteor Observation System, R. G. Roper  
 GLOBUS: Global Budget of Stratospheric Trace Constituents, D. Offermann  
 GOSSA: Global Observations and Studies of Stratospheric Aerosols, M. P. McCormick  
 GRATMAP: Gravity Waves and Turbulence in the Middle Atmosphere Program, D. C. Fritts  
 MAC-EPSILON: The project is planned as a case study of middle atmosphere turbulence by  
 measure of instrumented sounding rockets, meteorological rockets and ground-based  
 observations, E. V. Thrane  
 MAC-SINE: Middle Atmosphere Cooperation - Summer in Northern Europe, E. V. Thrane  
 MAE: Middle Atmosphere Electrodynamics, R. A. Goldberg  
 MASH: Middle Atmosphere of the Southern Hemisphere, A. O'Neill  
 NIEO: New International Equatorial Observatory, S. Kato  
 OZMAP: Observations of, and Sources of the Spatial and Temporal Variability of Ozone in the  
 Middle Atmosphere on Climatological Time Scales, D. F. Heath  
 SSIM: Solar Spectral Irradiance Measurements, P. C. Simon  
 SUPER CAMP: This project is a follow-on of CAMP (Cold Arctic Mesopause Project) and  
 will focus on a study of the middle atmosphere above the northern polar region from  
 50° to 80° during the summer, in the effort to understand latitudinal variability of  
 vertical transport, wave dissipation, and its implications on densities of minor  
 constituents, E. Kopp  
 WINE: Winter in Northern Europe, U von Zahn

### MAP HANDBOOK TOPICS AND VOLUME NUMBERS

Study Group Reports: 1, 3, 8, 11, 17, 21  
 Technique Handbooks: 13, 15, 19  
 Project Reports: 1, 3, 4, 8, 11, 12, 17, 21  
 National Plans and Reports: 1, 4, 8, 9, 11, 17, 21  
 Steering Committee Minutes: 3, 4, 8, 11, 17, 21, 26  
 MAP Assembly Proceedings: 4, 17  
 Directories: 6, 24  
 Regional Definition Group Reports: 4  
 Symposium Papers: 2, 10, 18, 25  
 Workshop Reports: 8, 9, 11, 12, 14, 17, 20, 21  
 Data Presentation Handbooks: 5, 12, 16, 22

### SCIENTIFIC DESIDERATA

For winds studies; for tidal studies; for gravity waves; for turbulence studies; for studies of mesoscale effects and for studies of chemistry.

### PROBLEMS WITH CURRENT TECHNIQUES

Height coverage; height resolution; time resolution; measurement of spectral parameters; monostaticity; and poor geographical distribution.

### FUTURE PROGRAMS OF OBSERVATION

MAP/MAC now concluding  
 MAC-EPSILON  
 Definition and purpose of MAS  
 Relationship to GIS and STEP  
 New equatorial observatory  
 Upgrading of existing facilities  
 Data analysis phase

### DIVIDENDS FROM MAP

- More groups working
- Greater international communication
- Prototype for small international programs
- Increased funding agency awareness
- Scientific interest in stratosphere added to operational interest
- Increased awareness of interdisciplinary aspects
- Satellite groups now driven by user pressure

### LESSONS FROM MAP

- Clear definition of area
- Early preparations for national participation
- Study groups to define needs
- Pre-projects to exercise cooperative efforts
- Project structure not imposed from above
- Workshops actively encouraged
- Publications must be uniform and timely
- Alertness for new techniques
- Unite techniques in campaigns
- Take advantage of all symposium opportunities
- MAP area now fully defined and flourishing