



INTERNATIONAL ATOMIC ENERGY AGENCY
UNITED NATIONS EDUCATIONAL, SCIENTIFIC AND CULTURAL ORGANIZATION



INTERNATIONAL CENTRE FOR THEORETICAL PHYSICS
34100 TRIESTE (ITALY) - P.O. B. 586 - MIRAMARE - STRADA COSTIERA 11 - TELEPHONES: 294281/2/3/4/5
CABLE: CENTRATOM - TELEX 460392-I

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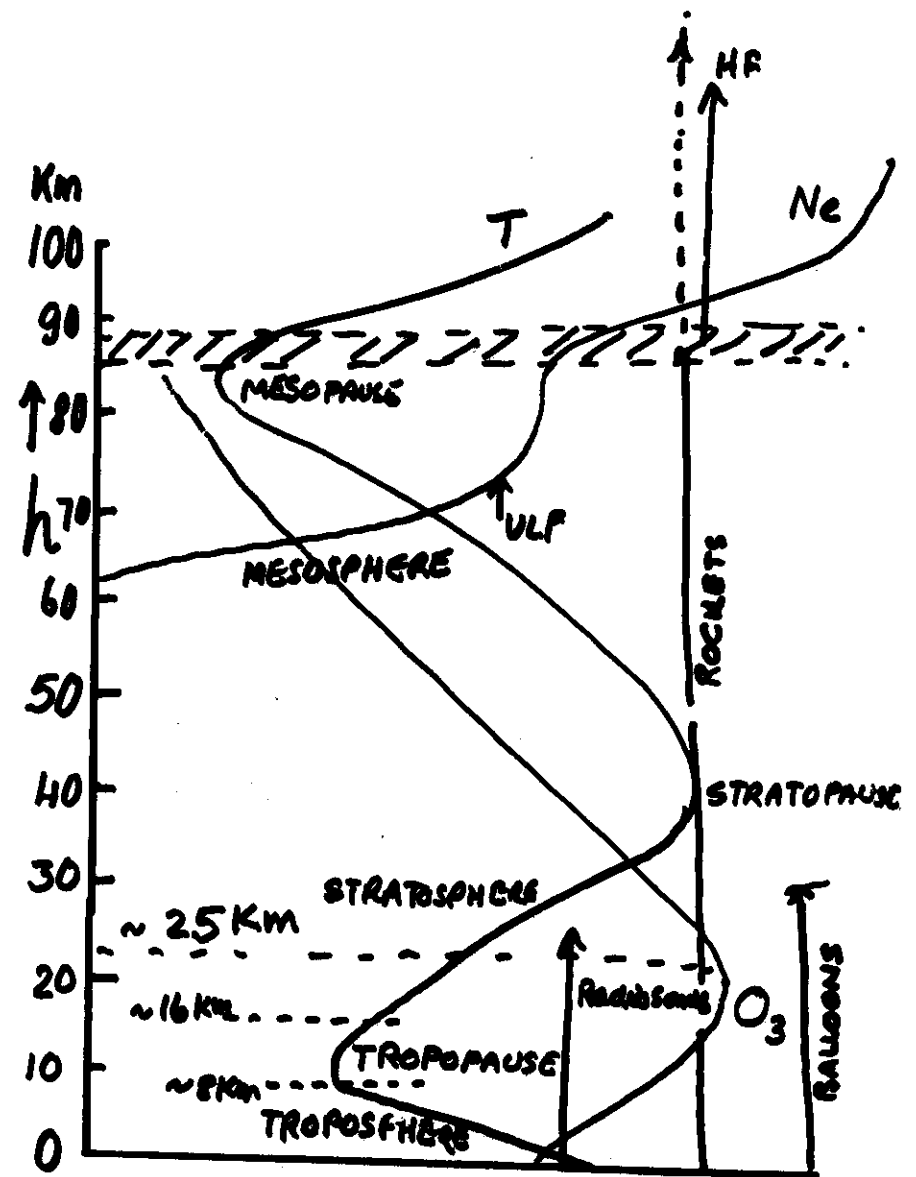
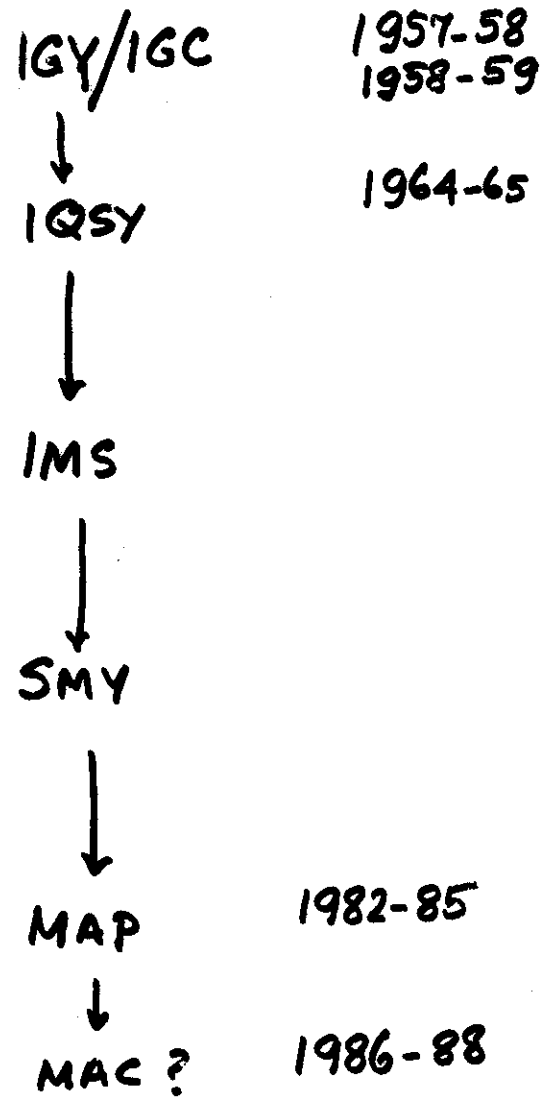
AUTUMN COURSE ON GEOMAGNETISM, THE IONOSPHERE
AND MAGNETOSPHERE

(21 September - 12 November 1982)

THE MIDDLE ATMOSPHERE - PHYSICS, CHEMISTRY AND OPPORTUNITIES
FOR INTERNATIONAL COOPERATION.

A.P. MITRA
National Physical Laboratory
Hillside Road
New Delhi - 110012
India

These preliminary lecture notes, intended only for distribution to participants, are available from Room 230.



WHY MAP 2

3

- REGION LEAST EXPLORED
- AVAILABILITY OF NEW TECHNIQUES
emission and absorption spectra
- MIDDLE ATMOSPHERE AS
A LINK BETWEEN UPPER AND
LOWER ATMOSPHERE
The climate problem
- THE OZONE PROBLEM
Possible anthropogenic influence
- MINOR SPECIES AS IN KEY
ROLES IN MANY ATMOSPHERIC
PHENOMENA
 - OH as supreme scavenger
 - NO as primary source of
D region
 - O₃ in evolution of life
 - CH₄ as producer and destroyer
ozone
- Middle Atmospheric Ionization
Global Electrical circuit
Electrical coupling upper/lower atm.
Nucleation possibilities

4

MINORS IN CLIMATE PROBLEMS

MANY "GREENHOUSE" SPECIES

CO ₂	330 → 660 pm (warms in troposphere, cools in stratosphere)	~ 2°K ~ 1°K
H ₂ O	x 2	~ 0.5°K
CH ₄	x 2	~ 0.5°K
NH ₄	x 2	~ 0.5°K
CFMs	x 2	~ 0.5°K

O₃

NOT CLEAR
STRATOSPHERE AND TROPOSPHERE
PLAY DIFFERENT ROLES
DISTRIBUTION IMPORTANT

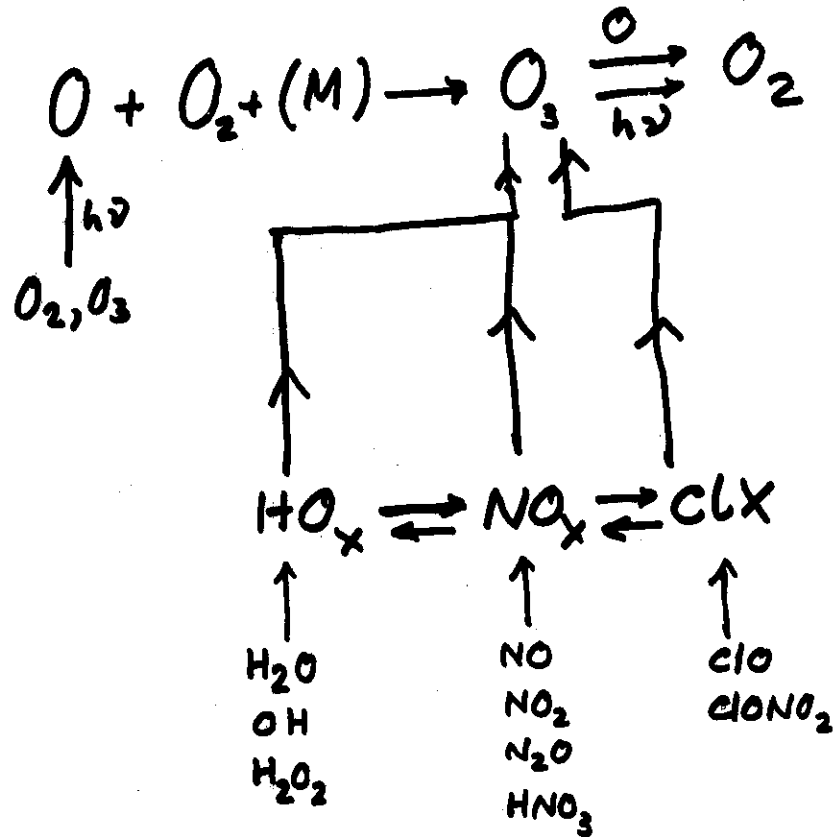
AEROSOLS

TROPOSPHERE COOLING
STRATOSPHERE WARMING

VIRTUAL CO₂ FACTOR

$$= \text{CO}_2 \text{ EFFECT} \times \boxed{1.6}$$

THE OZONE PROBLEM



HUMAN INFLUENCES ON THE OZONE PROBLEM

ANTHROPOGENIC SOURCES

SST's (mid. subsonic)	NO_x
NITROGEN FERTILIZERS	NO_x
NUCLEAR EXPLOSIONS	NO_x
AEROSOL SPRAYS (CFM's)	Clx
SPACE SHUTTLES	Clx
BIOMASS BURNING	$CO_2, CO, \text{HYDRO CARBONS}$

NATURAL SOURCES

VOLCANIC ERUPTIONS	Clx
SOLAR PROTON EVENTS	NO_x
LIGHTNING DISCHARGES	NO_x CO
UV	modulation of most minerals

THE CRITICAL ROLE OF MINOR SPECIES

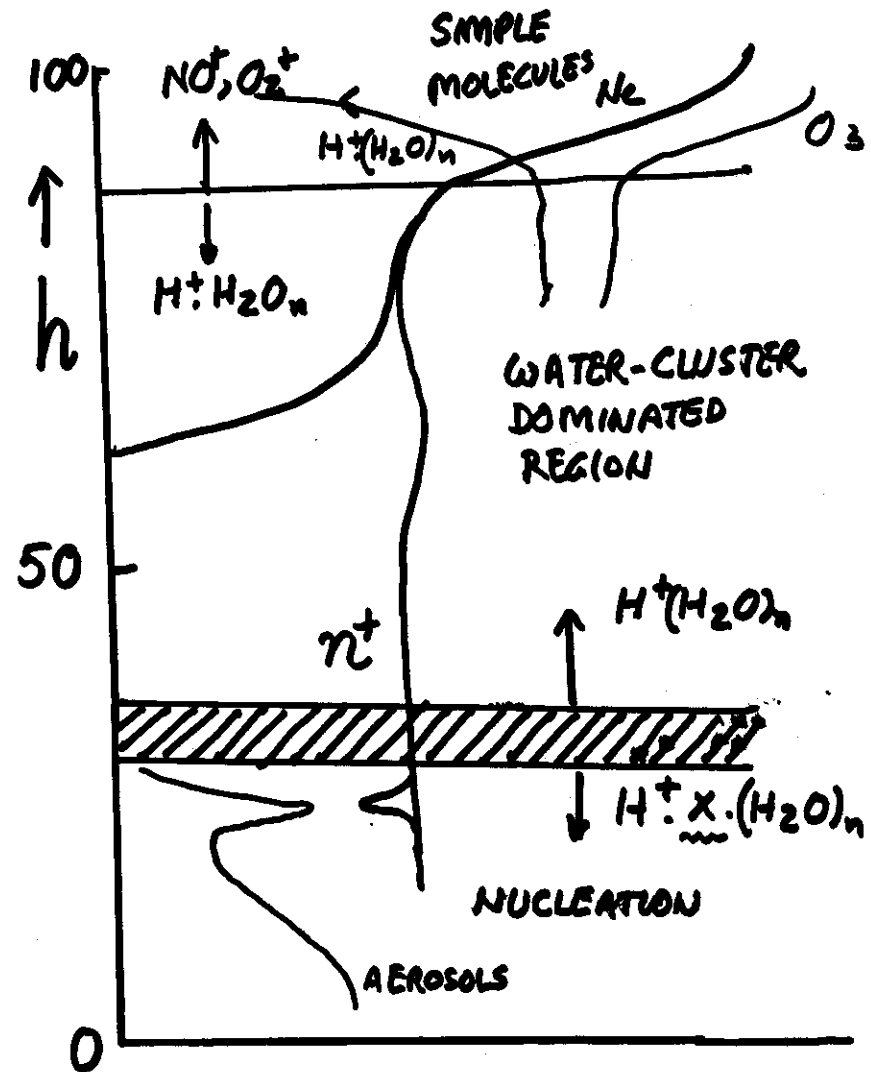
H_2O → Greenhouse molecule
→ AS a producer of OH

O_3 → Evolution of life
UV filter
→ Climate

NO → D region
→ Ozone modulator
→ Deforestation problems

CH_4 → Producer or destroyer of ozone

ClX → ozone depletion



Campaign
modus ↑

- Is solar constant is constant?
- Does 2000-3000 Å rad. vary with solar activity?
- Particle events?

- a) Equatorial waves
- b) Tides
- c) Planetary waves

- a) Electric fields $\rightarrow$ Marston global electrical circuit
- b) 'Holes' through aerosol layering
- c) Nucleation processes

- a) The ozone problem
- b) Biomass burning problem
- c) CNPS cycle

- a) Is stratosphere limited to high latitudes only?
- b) Tropopause height changes as a monsoon?

