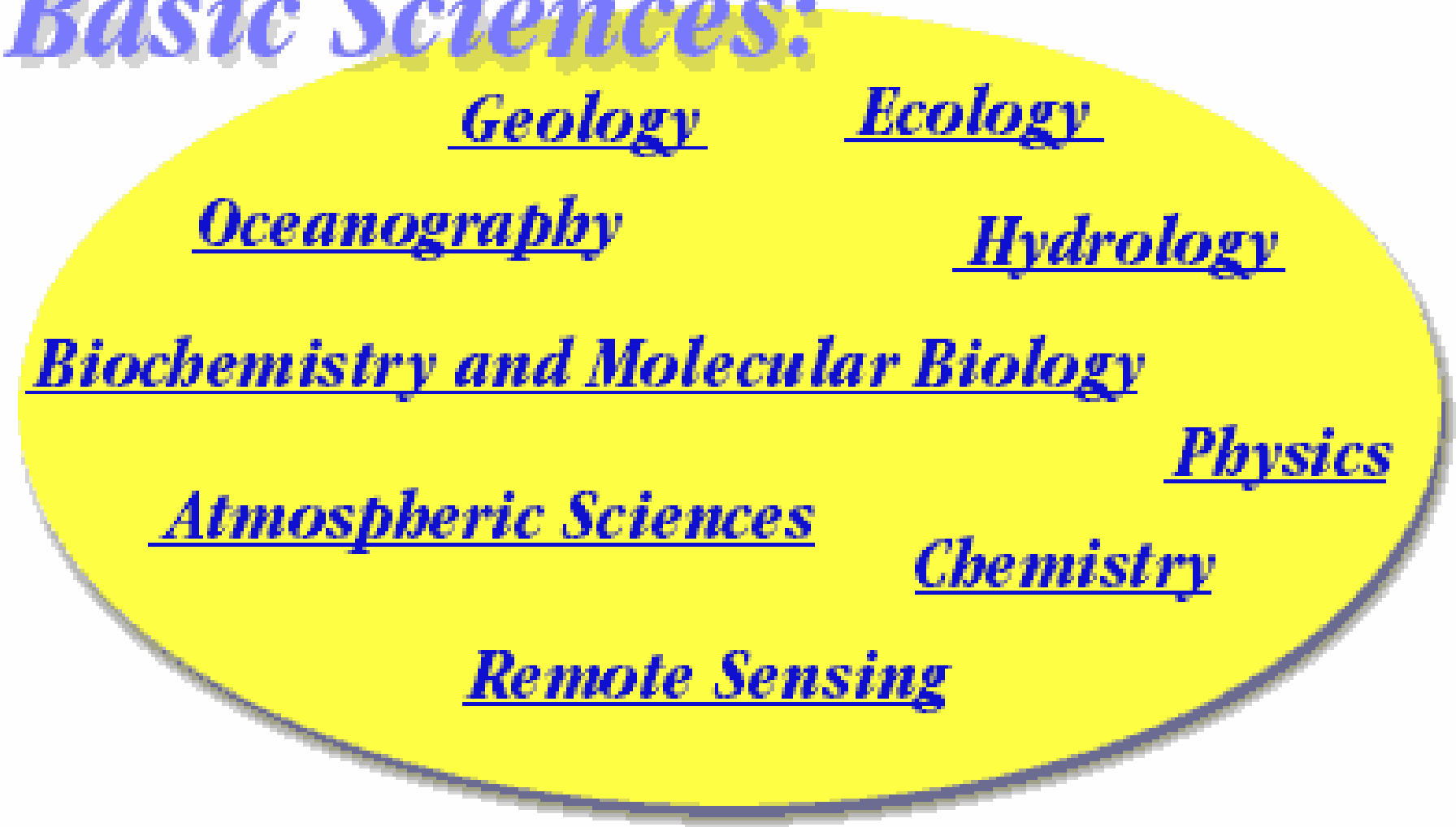

Medical Ecology
Spring 2004


Basic
Science
Medical
Ecology
Applied
Science

# Basic Sciences:




Click on any Basic Science to obtain useful links

# Applied Sciences:

Biostatistics

Medical Sciences

Epidemiology

Anthropology

Agronomy

Environmental Health Sciences

Socio-Medical Sciences

Toxicology

Medical Geography

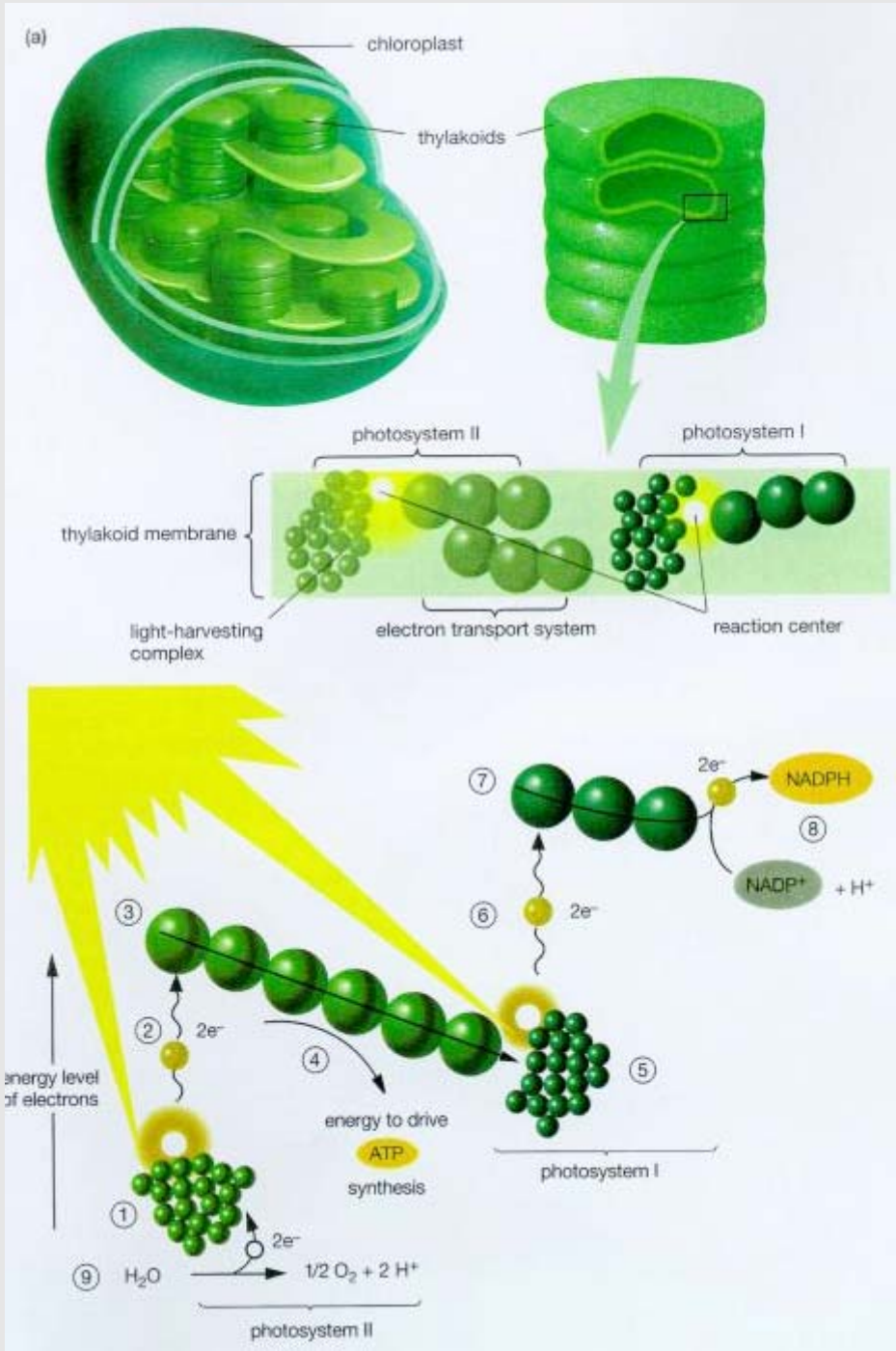
Click on any Applied Science to obtain useful links

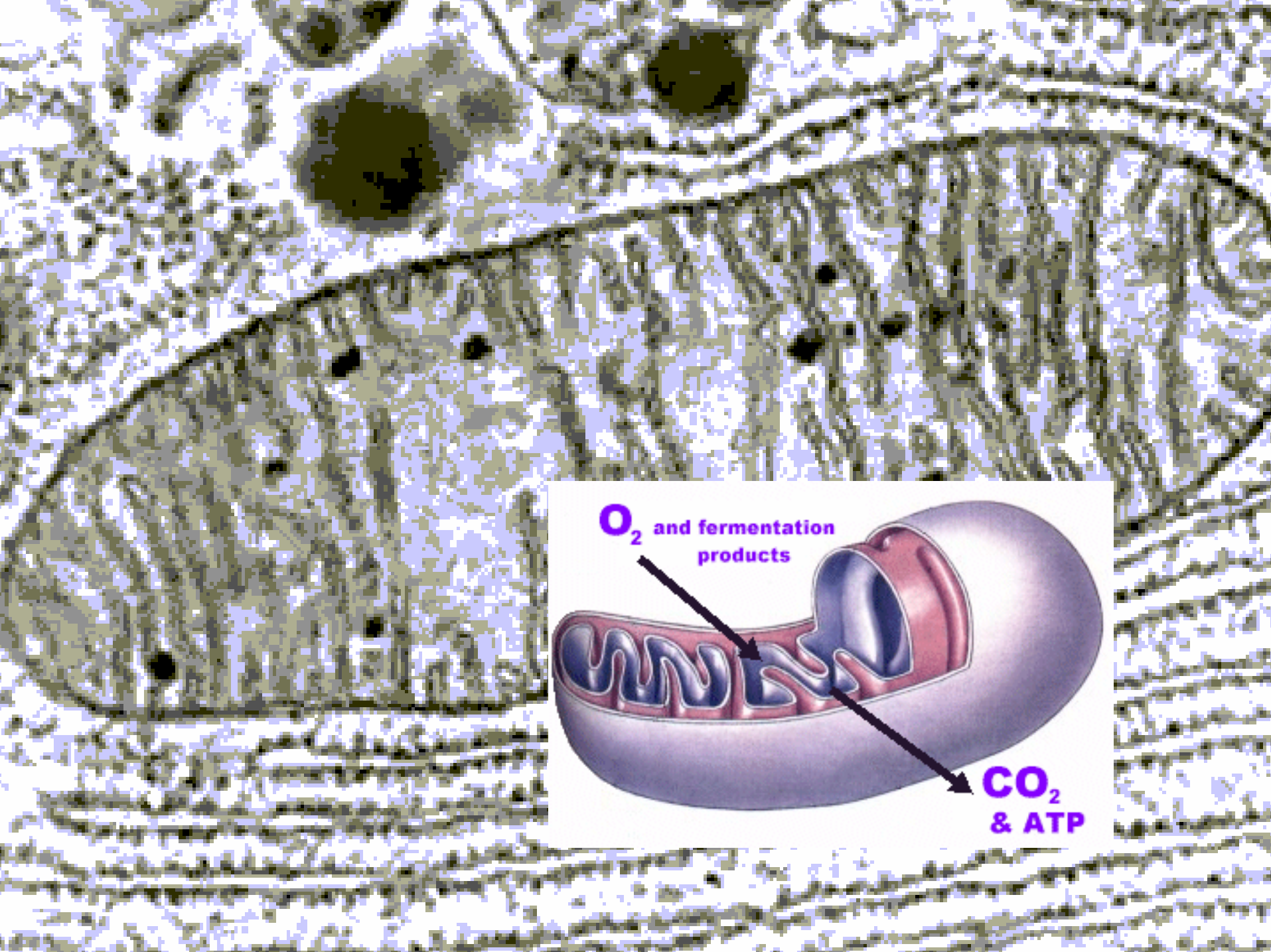
The Atmosphere
Water
Food
Infectious Diseases


Atmosphere

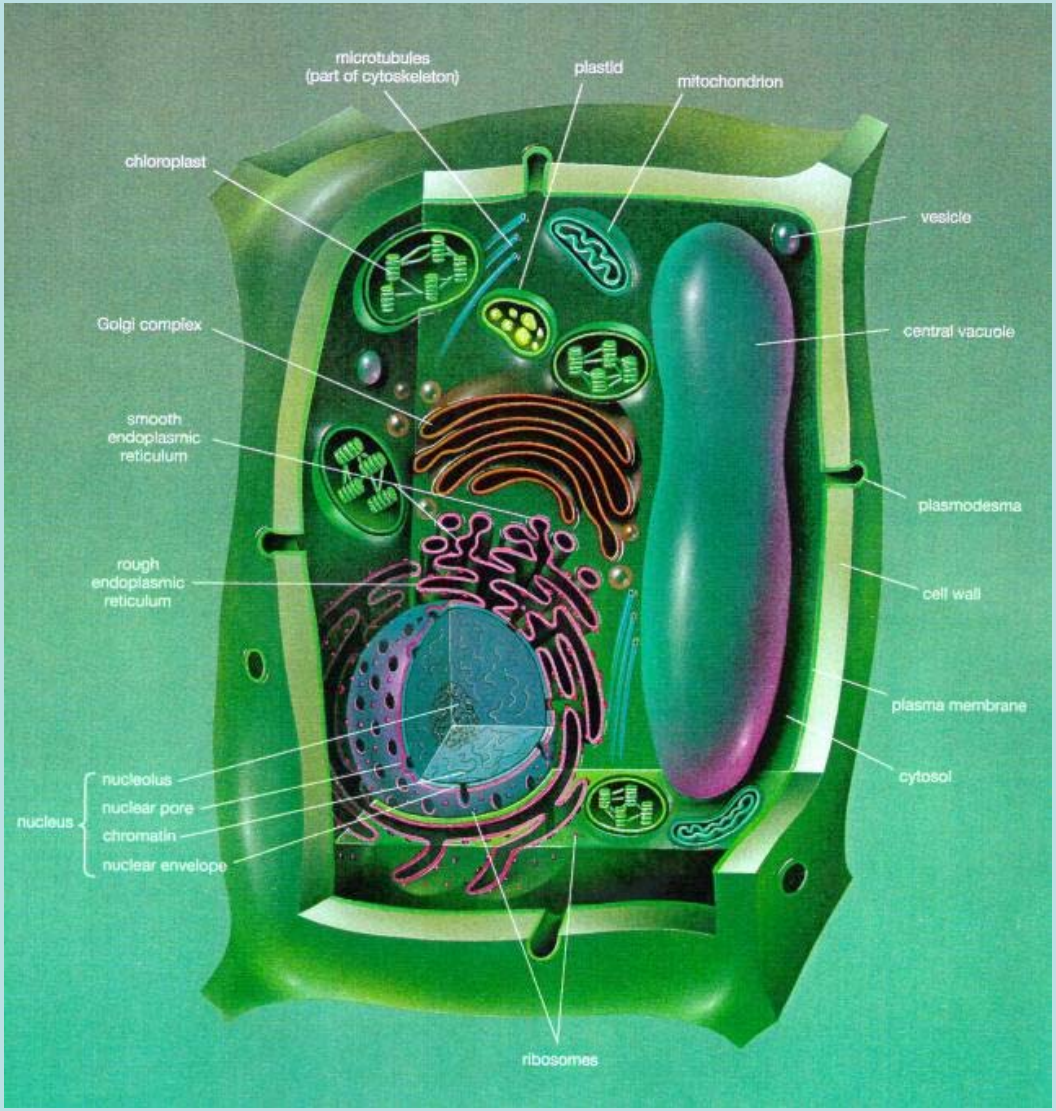
# THE GEOLOGIC TIME SCALE

| Eon | Era | Period | | Epoch | M. Years | Major Event |
|---|---|---|---|---|---|---|
| PHANEROZOIC | CENOZOIC | Quaternary | | Holocene | 0.01 | |
| | | | | Pleistocene | 1.6 | 1st Hominids |
| | | TERTIARY | Neogene | Pliocene | 5.3 | |
| | | | | Miocene | 23.7 | |
| | | | Paleogene | Oligocene | 36.6 | |
| | | | | Eocene | 57.8 | |
| | | | | Paleocene | 66 | |
| | MESOZOIC | Cretaceous | | | 144 | Dinosaurs |
| | | Jurassic | | | 208 | |
| | | Triassic | | | 245 | |
| | PALEOZOIC | Permian | | | 286 | |
| | | Carboniferous | Pennsylvanian | | 320 | |
| | | | Mississippian | | 360 | |
| | | Devonian | | | 408 | |
| | | Silurian | | | 438 | 1st Land Plants |
| | | Ordovician | | | 505 | |
| | | Cambrian | | | 540 | |
| PRECAMBRIAN | Proterozoic Eon | | | | 2500 | 1st Eukaryotes |
| | Archean Eon | | | | 3800 | 1st Prokaryotes |
| | | | | | 4600 | |


(a)
chloroplast
thylakoids
photosystem II
photosystem I
thylakoid membrane
light-harvesting complex
electron transport system
reaction center
2e⁻
NADPH
NADP⁺ + H⁺
2e⁻
2e⁻
energy level of electrons
energy to drive ATP synthesis
2e⁻
H₂O
1/2 O₂ + 2 H⁺
photosystem I
photosystem II


$O_2$ and fermentation products
$CO_2$ & ATP

# Typical Plant Cell



# THE GEOLOGIC TIME SCALE

| Eon | Era | Period | | Epoch | M. Years | Major Event |
|---|---|---|---|---|---|---|
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| | | | Paleogene | Oligocene | 36.6 | |
| | | | | Eocene | 57.8 | |
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| | | Carboniferous | Pennsylvanian | | 320 | |
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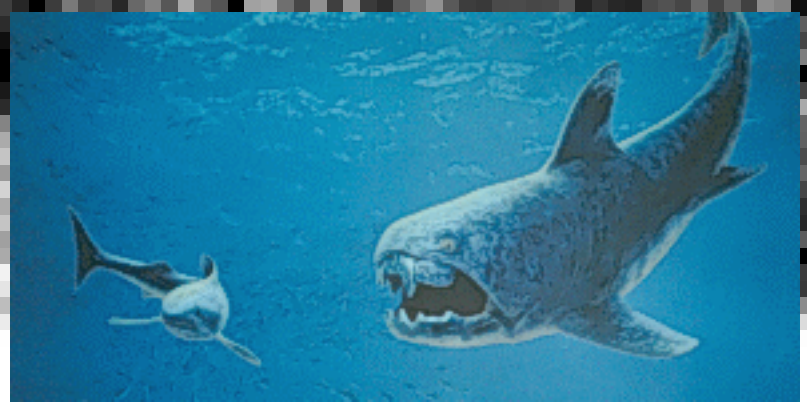
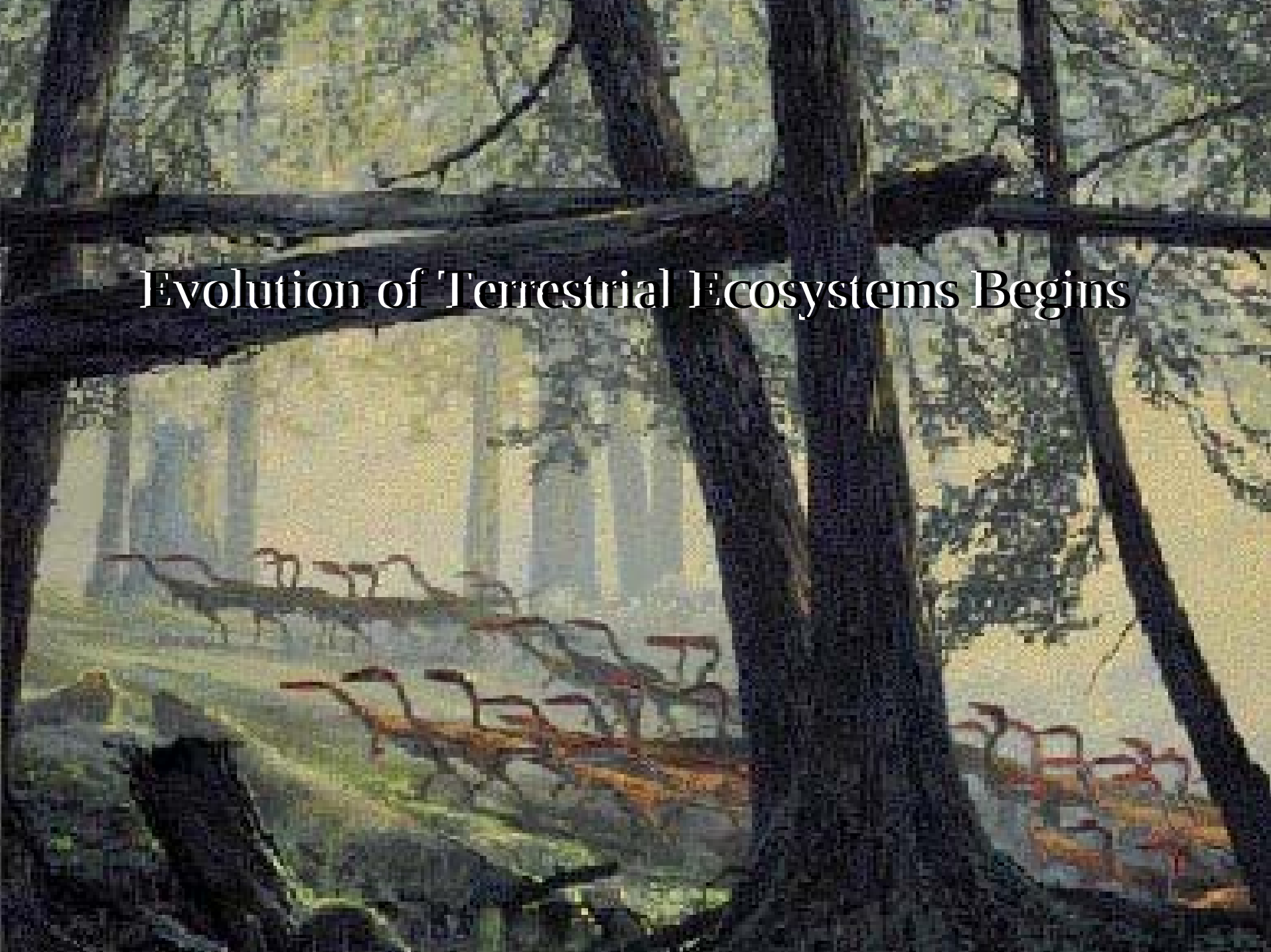
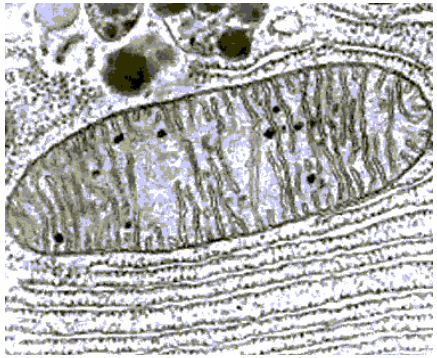
| | Archean Eon | | | | 3800 | 1st Prokaryotes |
| | | | | | 4600 | |

# Atmosphere = 20% oxygen



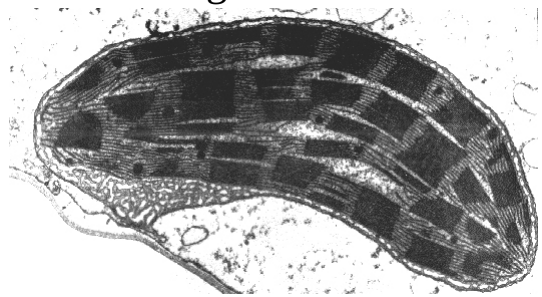

Evolution of Terrestrial Ecosystems Begins

Lynn Margoulis



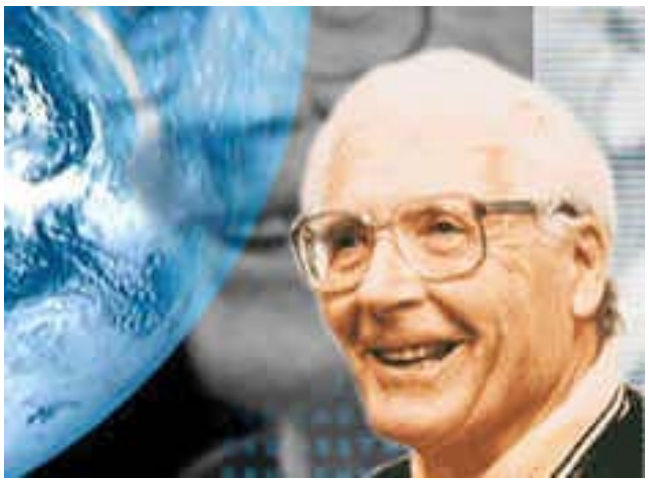
Mitochondrion

Each has a genome

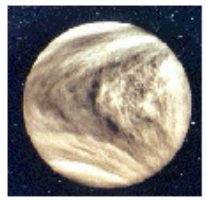
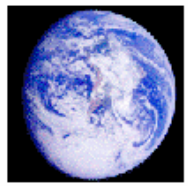
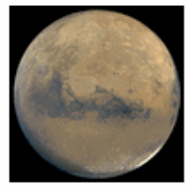


Chloroplast

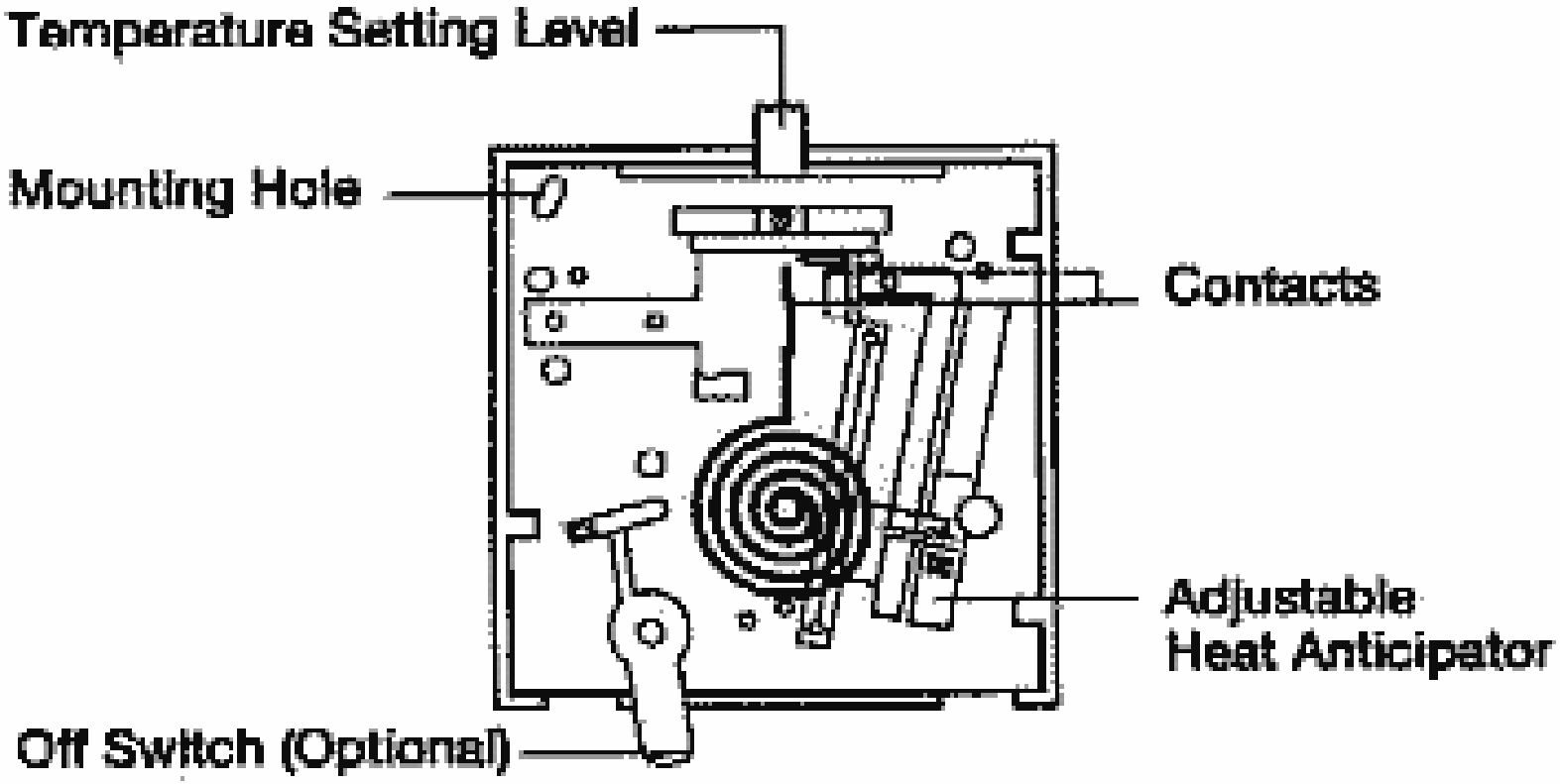
# The Gaia Hypothesis



James Lovelock

| VENUS | EARTH | MARS |
|---|---|---|
|  |  |  |
| N (<2%) CO2 (95%) No oxygen atmosphere in chemical equilibrium | N (77%), CO2( 0.03%) 21% Oxygen atmosphere not in chemical equilibrium | N (<3%) CO2 (95%) No oxygen atmosphere in chemical equilibrium |

# Thermostat


Temperature Setting Level
Mounting Hole
Contacts
Adjustable
Heat Anticipator
Off Switch (Optional)

# One Example Of How Gaia Hypothesis Works:

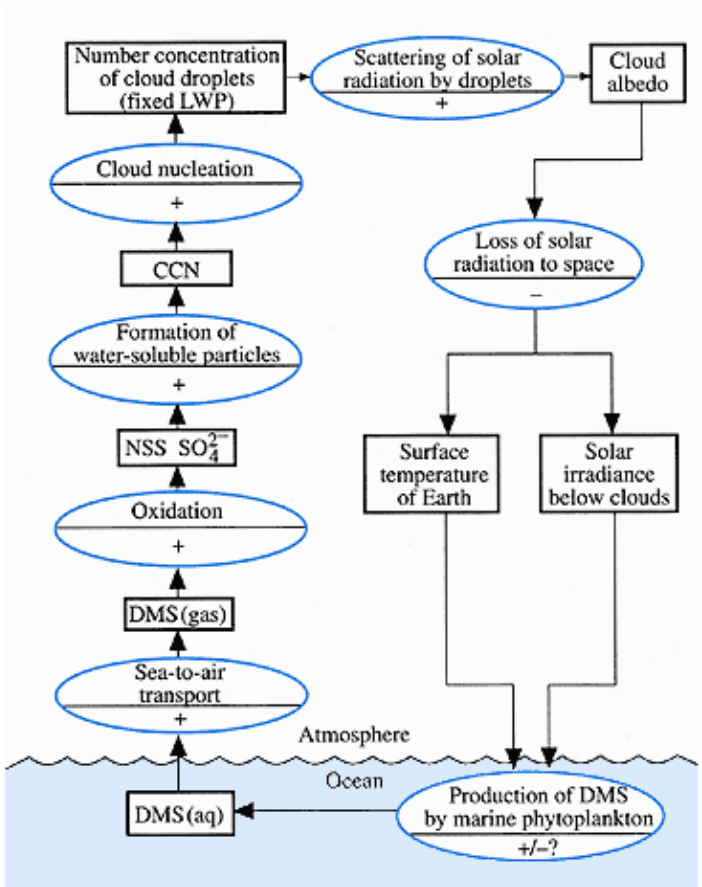
## Cloud Formation

**LWP**= Liquid Water Path

**CNN**= Cloud Condensation Nuclei

**NSS**= Non-sea-salt Sulfate

**DMS**= Dimethyl Sulfide



# The Children's Ecology Project

## The Secret Life of a Cloud:

## Puffy's Story

By Dickson Despommier

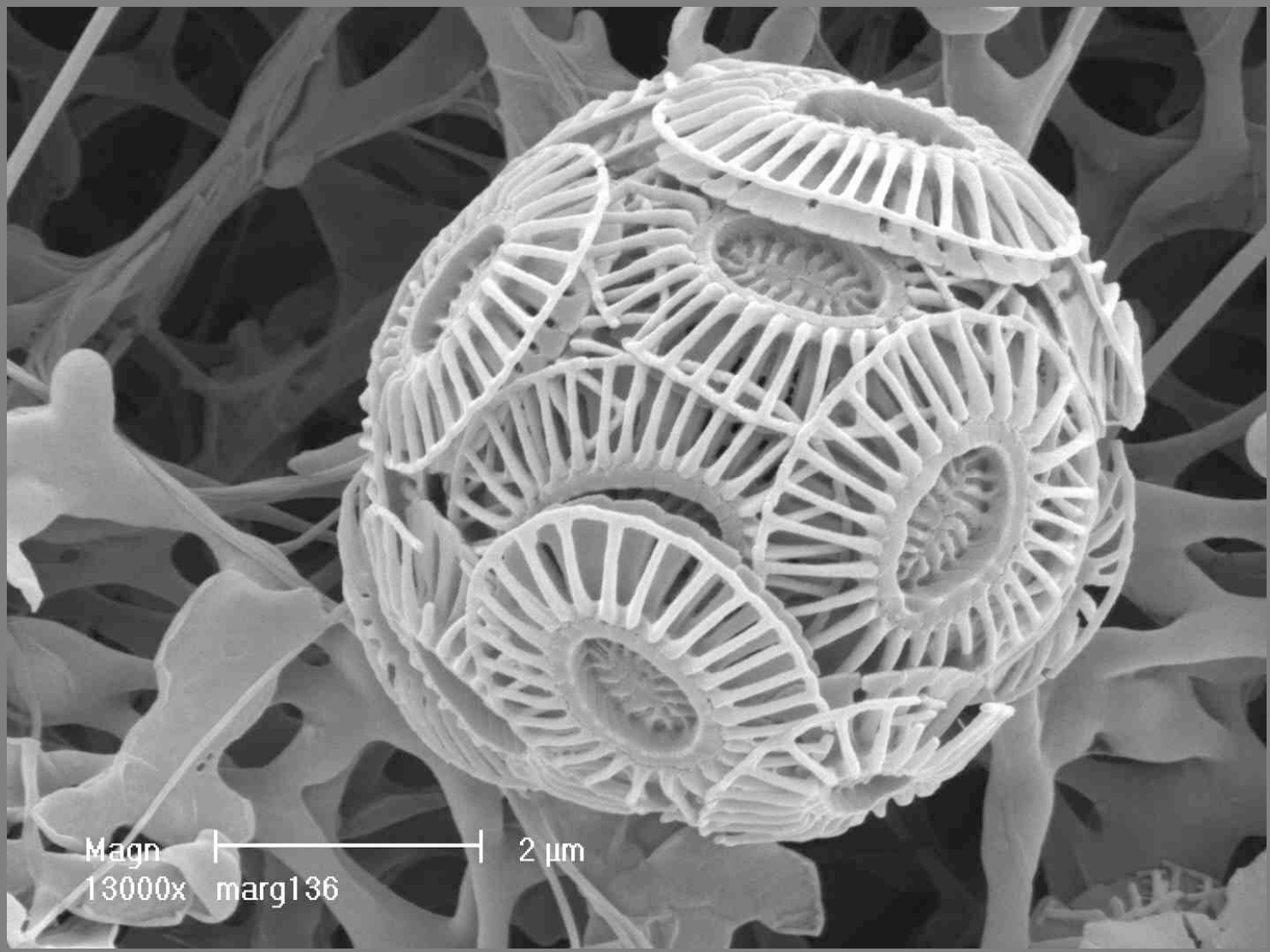

P.O. Box 280
New York, New York 10032

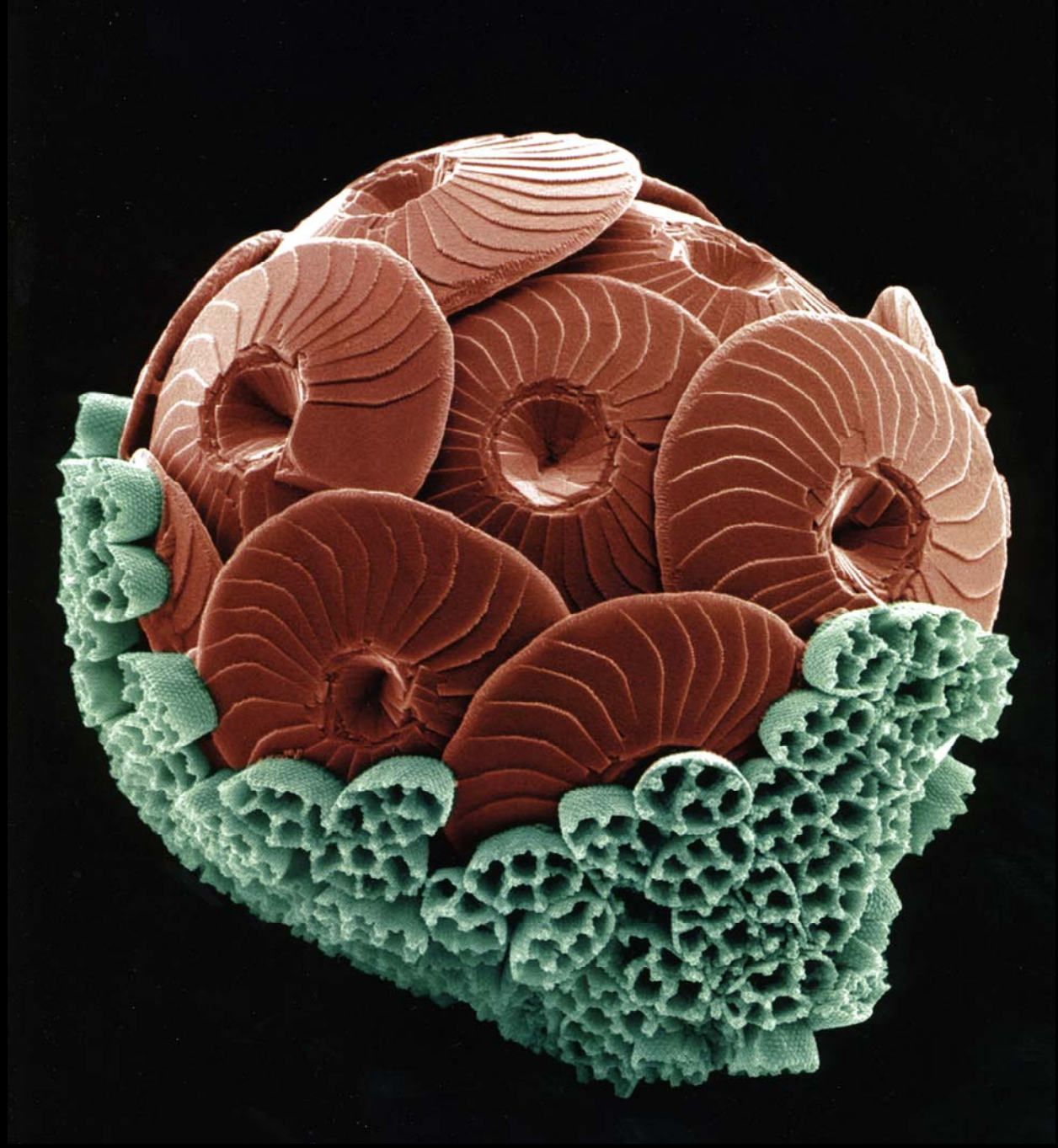
Tel: 212-781-6670
Fax: 212-781-1830

E-mail: ddd1@columbia.edu

Download PDF (43KB)  Download DOC (61KB)

# Coccolithic Phytoplankton

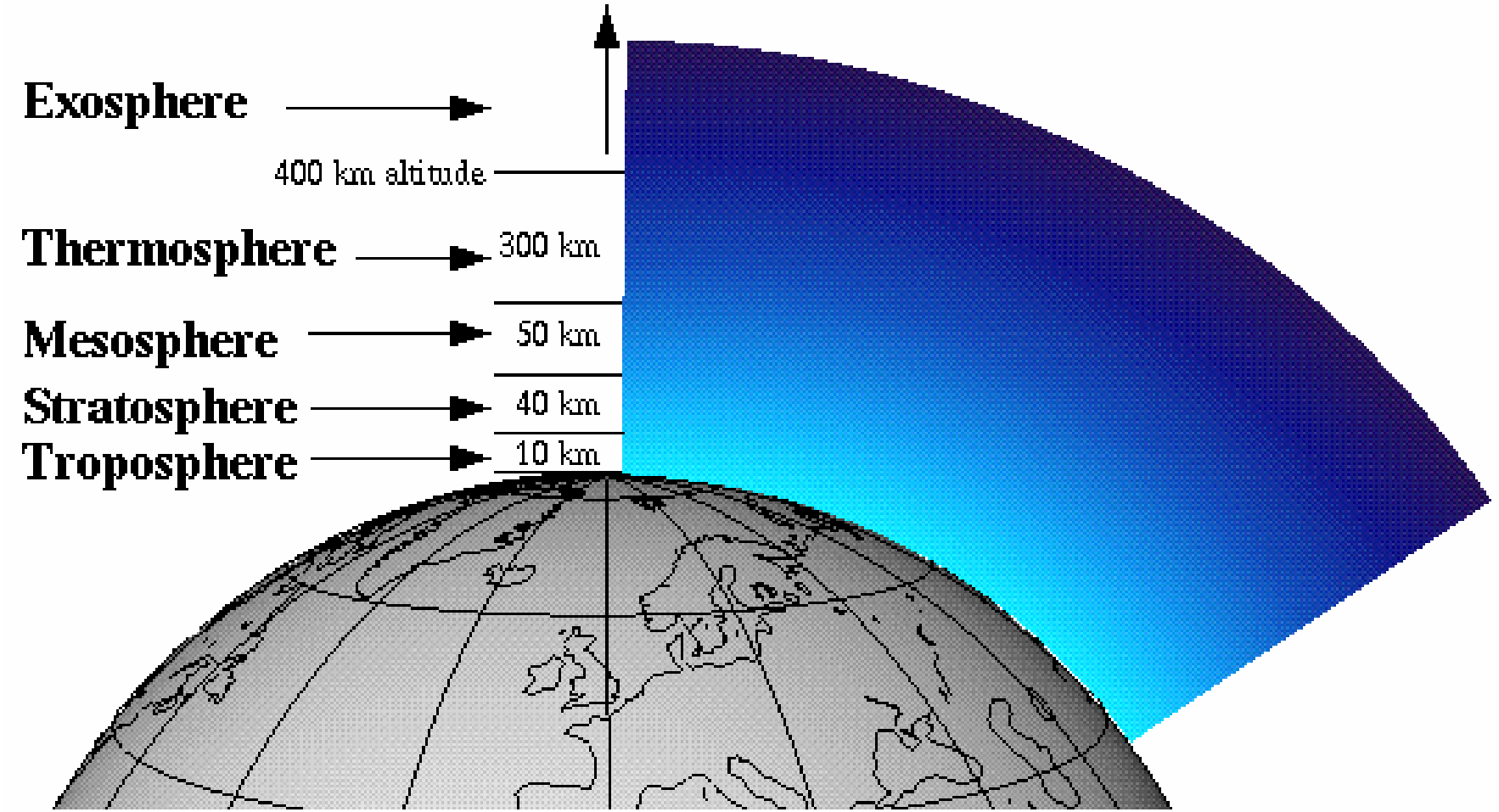




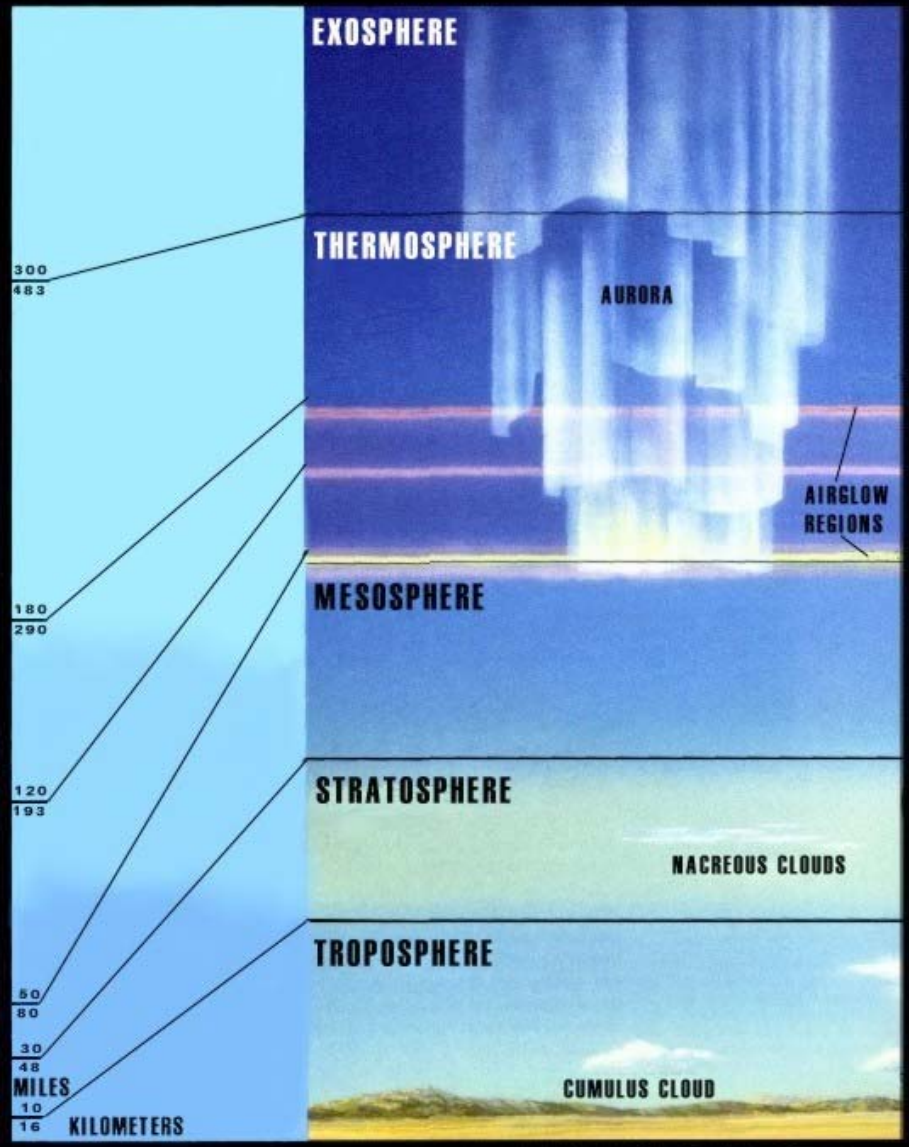
# *Emiliania huxleyi* Home Page

http://www.soes.soton.ac.uk/staff/tt/

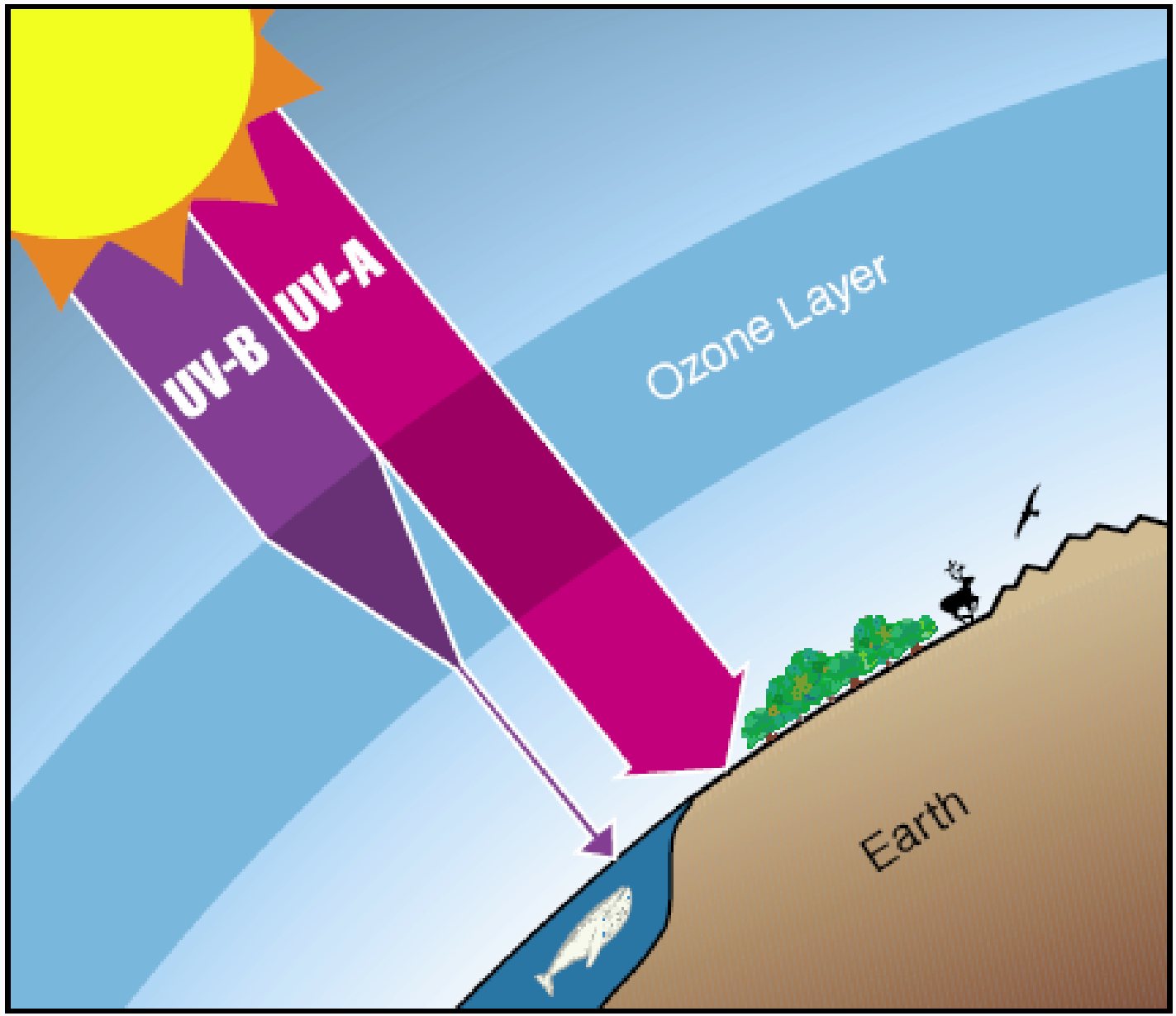
# Layers Of The Atmosphere



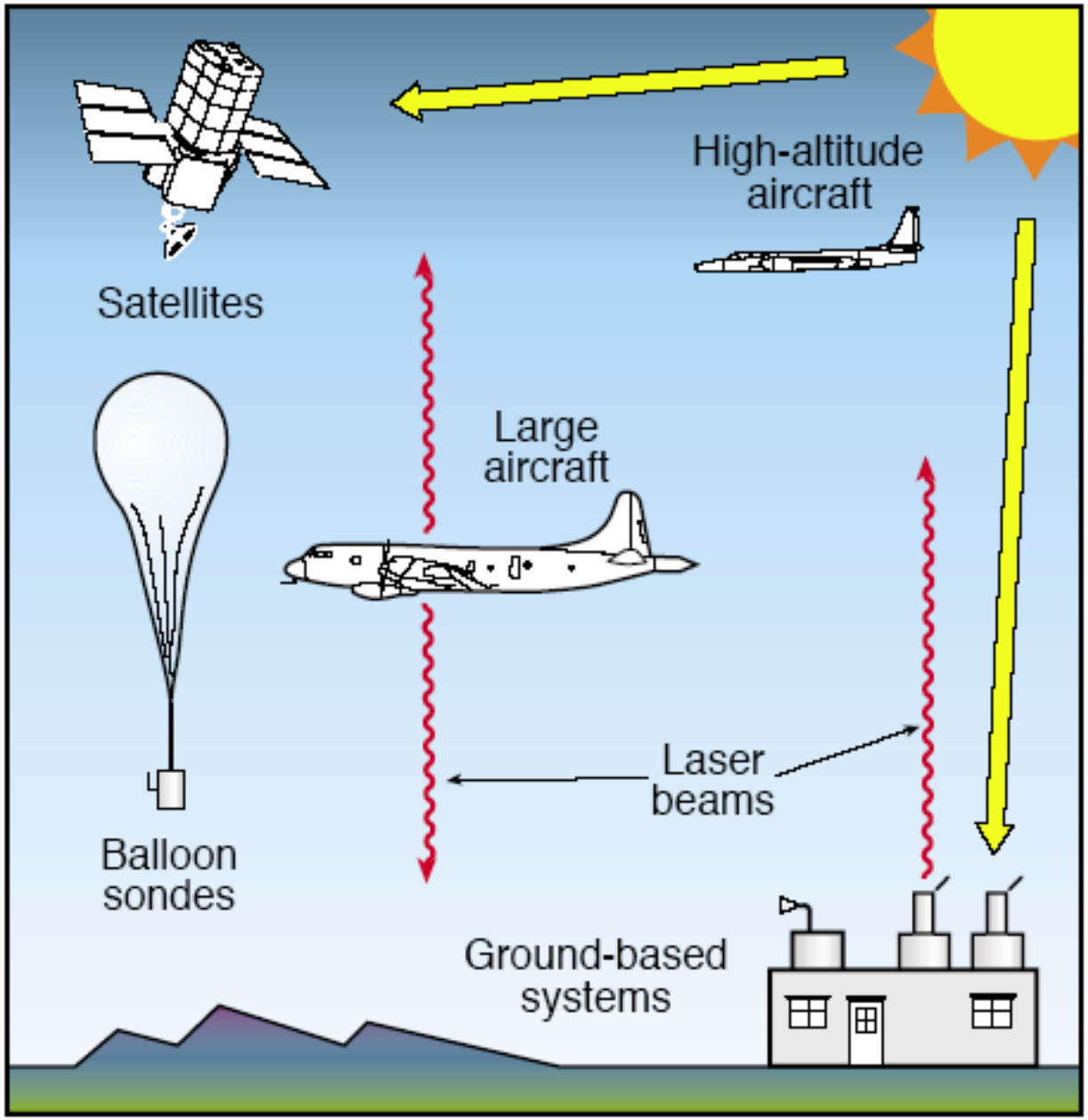
# THE ARCHITECTURE OF THE ATMOSPHERE



# UV Protection by the Ozone Layer

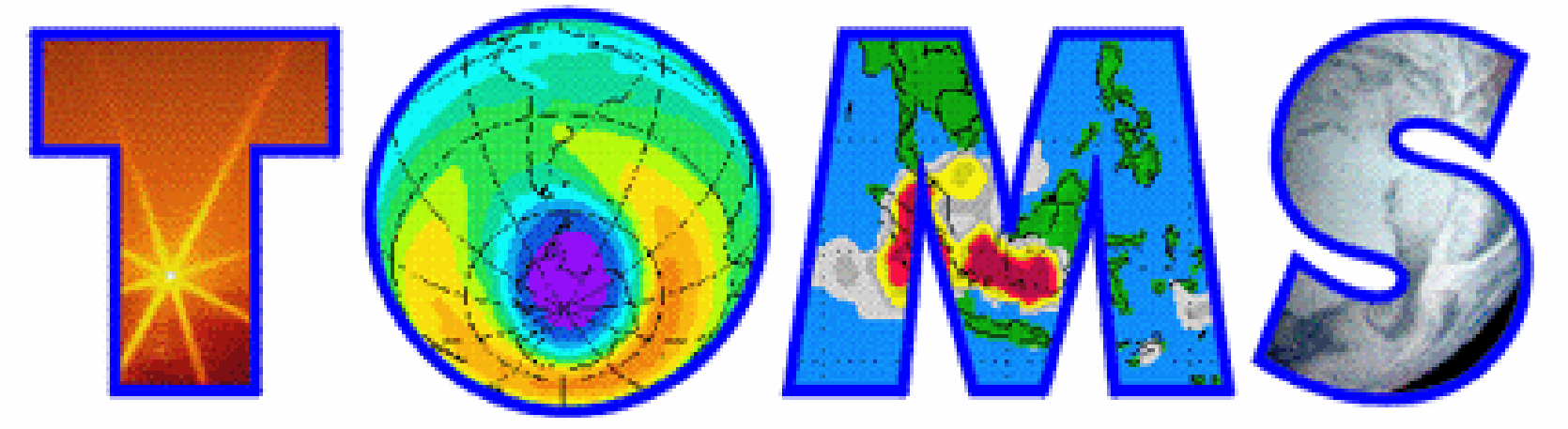


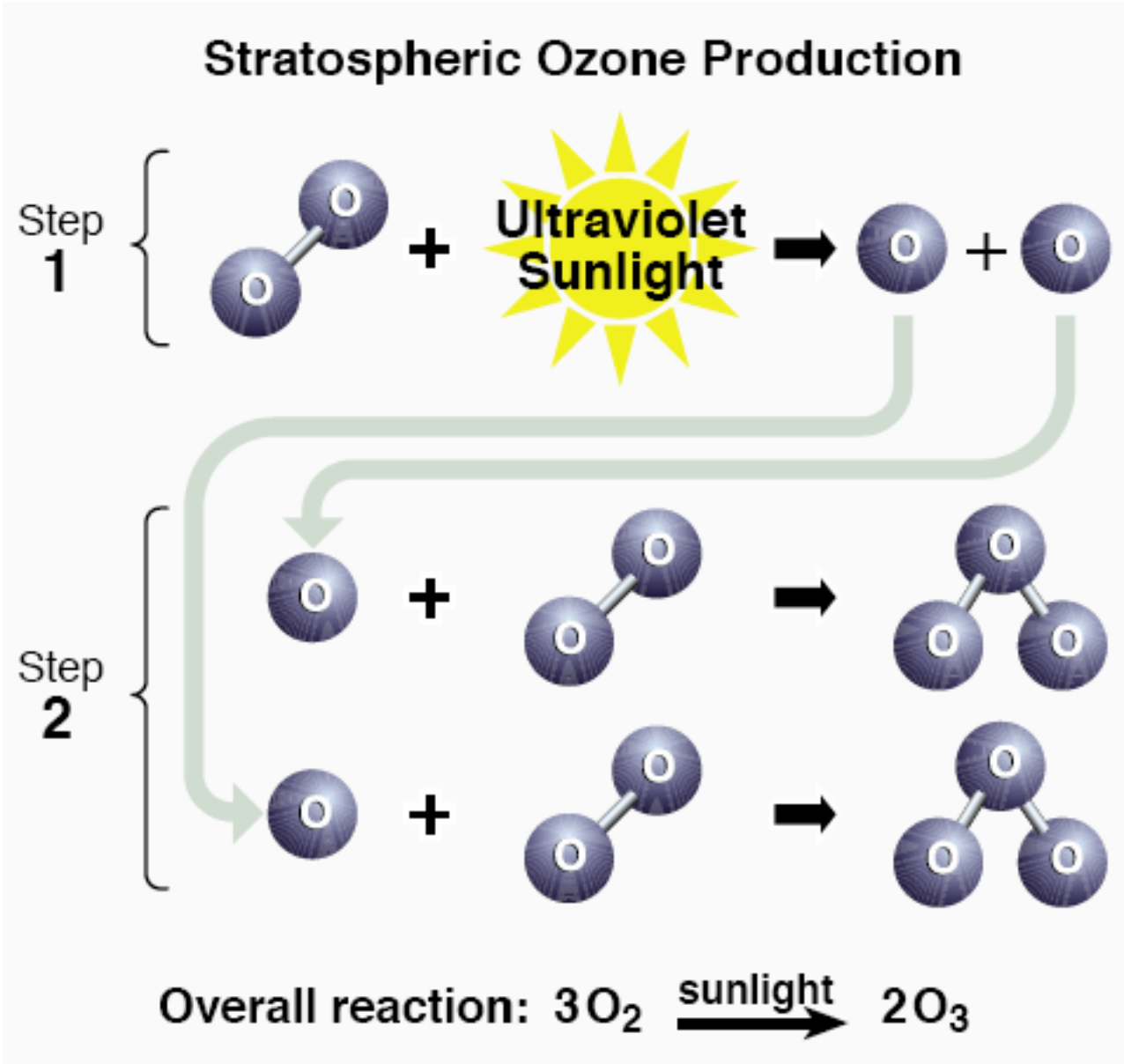
# Measuring Ozone in the Atmosphere

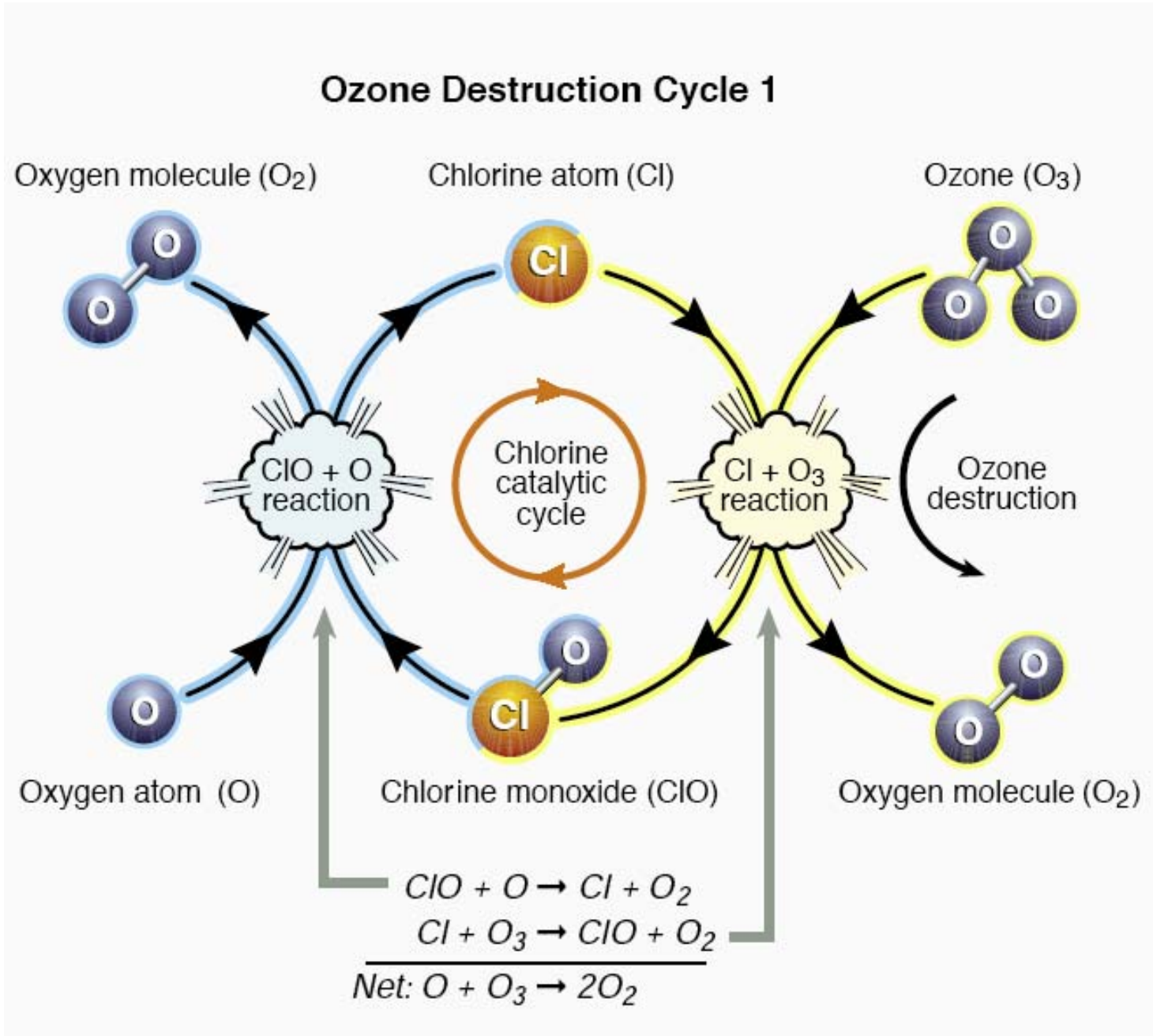


# Total Ozone Mapping Spectrometer

Code 916 : Atmospheric Chemistry and Dynamics Branch




Stratospheric Ozone Production
Step 1
Ultraviolet Sunlight
Step 2
Overall reaction: 3O2 sunlight 2O3


Ozone Destruction Cycle 1
Oxygen molecule ($O_2$)
Chlorine atom (Cl)
Ozone ($O_3$)
ClO + O reaction
Chlorine catalytic cycle
Cl + $O_3$ reaction
Ozone destruction
Oxygen atom (O)
Chlorine monoxide (ClO)
Oxygen molecule ($O_2$)
$ClO + O \rightarrow Cl + O_2$
$Cl + O_3 \rightarrow ClO + O_2$
Net: $O + O_3 \rightarrow 2O_2$

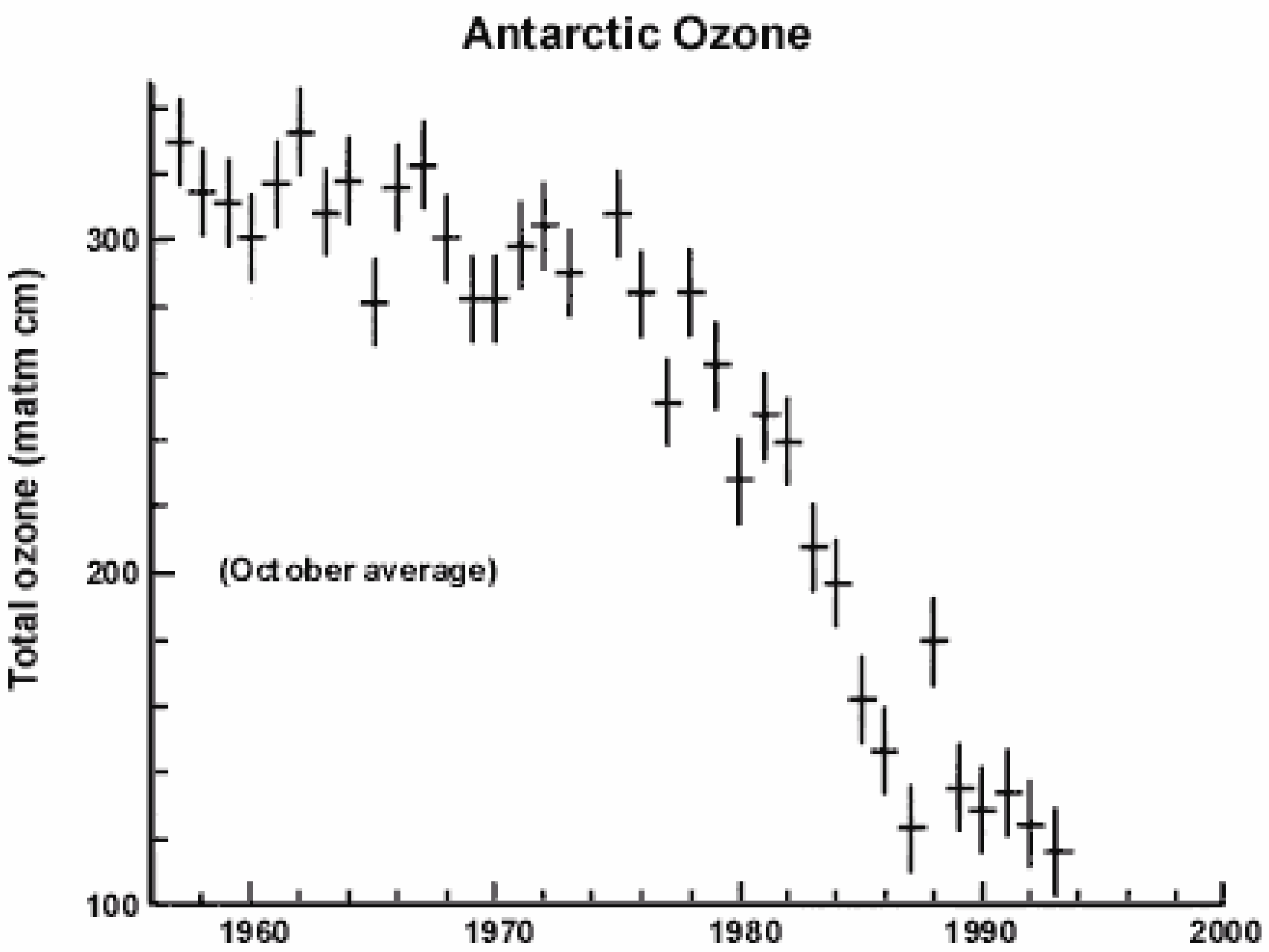
# The Nobel Prize in Chemistry 1995

"for their work in atmospheric chemistry, particularly concerning the formation and decomposition of ozone"

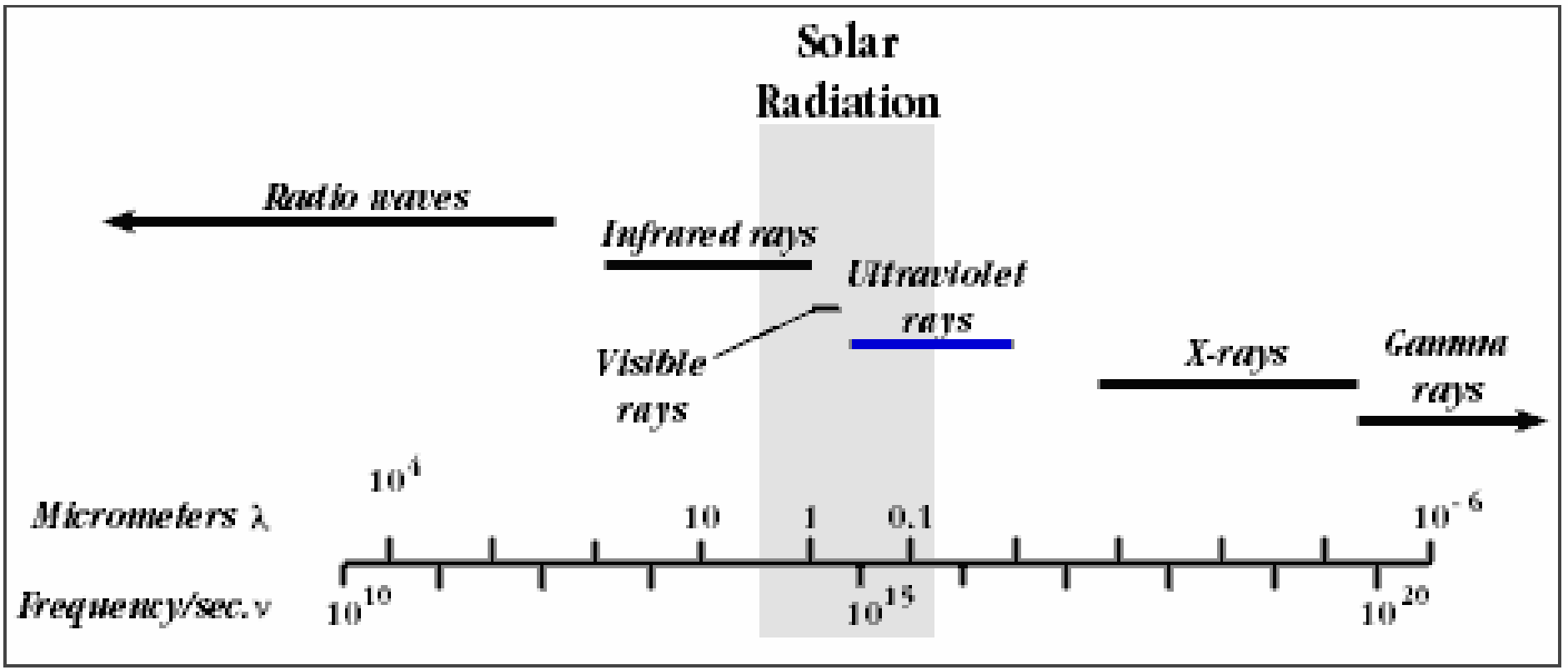
**Paul J. Crutzen**

**Mario J. Molina**

**F. Sherwood Rowland**


Antarctic Ozone
Total ozone (matm cm)
300
200
100
(October average)
1960
1970
1980
1990
2000

Electromagnetic Spectrum of Energy



# CRS Issue Brief for Congress



# IB97003: Stratospheric Ozone Depletion: Implementation Issues

**Larry Parker**

**Resources, Science, and Industry Division**

**July 12, 2000**

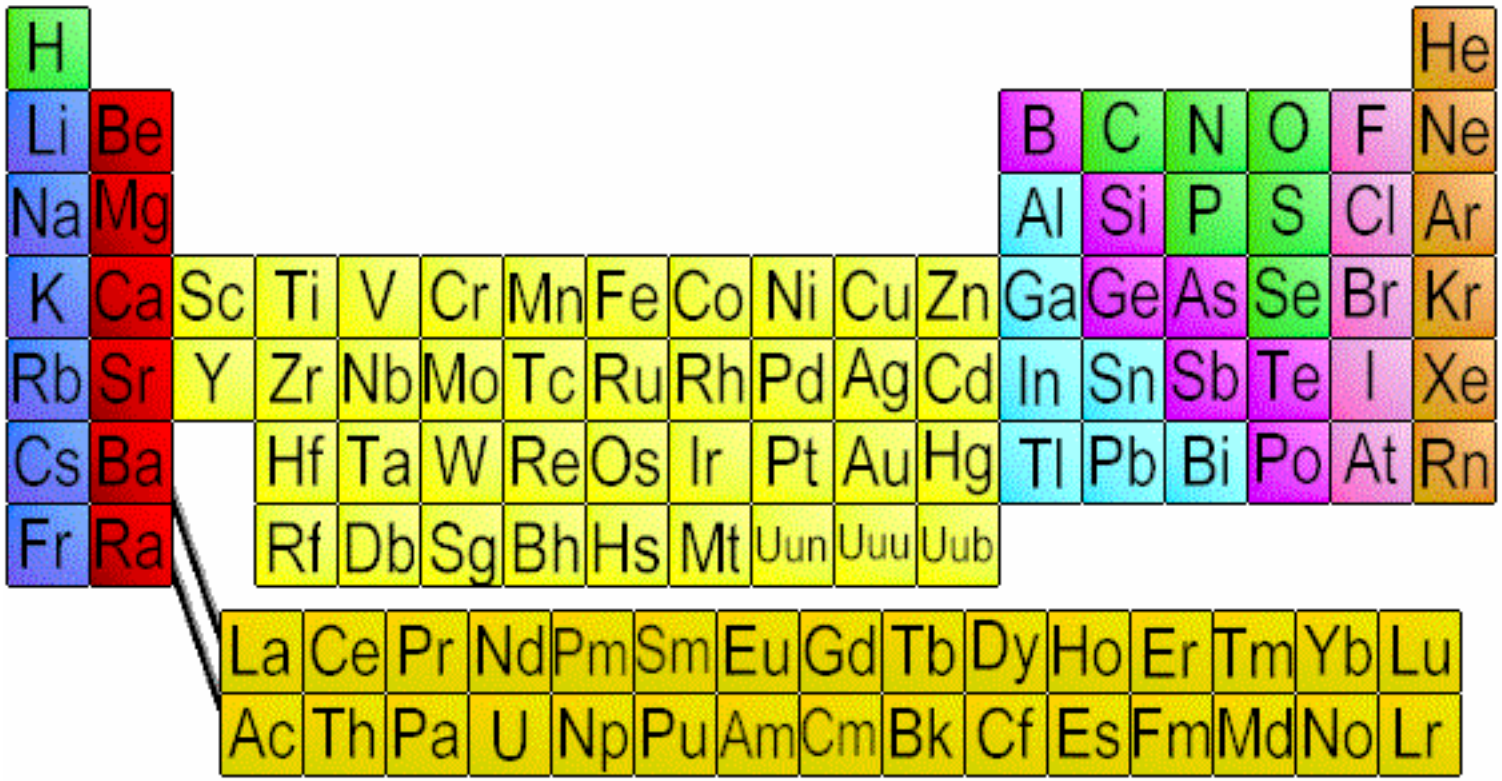
**Table 1. Relative Ozone Depletion Potential (RODP), Global Warming Potential (GWP), and Atmospheric Lifetimes**

| Compound | RODP* | GWP** | Lifetime (years) |
|---|---|---|---|
| CFC - 11 *** | 1.0 | 50 | 50 |
| CFC - 12 *** | 1.0 | 102 | 108 |
| CFC - 113 *** | 0.8 | 85 | 88 |
| CFC - 114 | 1.0 | 300 | 180 |
| CFC - 115 | 0.6 | 1700 | 385 |
| HCFC - 22 | 0.055 | 1600 | 13 |
| HCFC - 123 | 0.016 | 90 | 1.4 |
| HFC - 134a | 0 | 1300 | 18 |

## Montreal Protocol

The Montreal Protocol on Substances that Deplete the Ozone Layer was adopted in 1987 as an international treaty to eliminate the production and consumption of ozone-depleting chemicals, with developing countries benefiting from a ten-year grace period.

# Periodic Table Of The Elements



# Principal Steps in the Depletion of Stratospheric Ozone

1

## Emissions

**Halogen source gases** are emitted at Earth's surface by human activities and natural processes.

2

## Accumulation

**Halogen source gases** accumulate in the atmosphere and are distributed throughout the lower atmosphere by winds and other air motions.

3

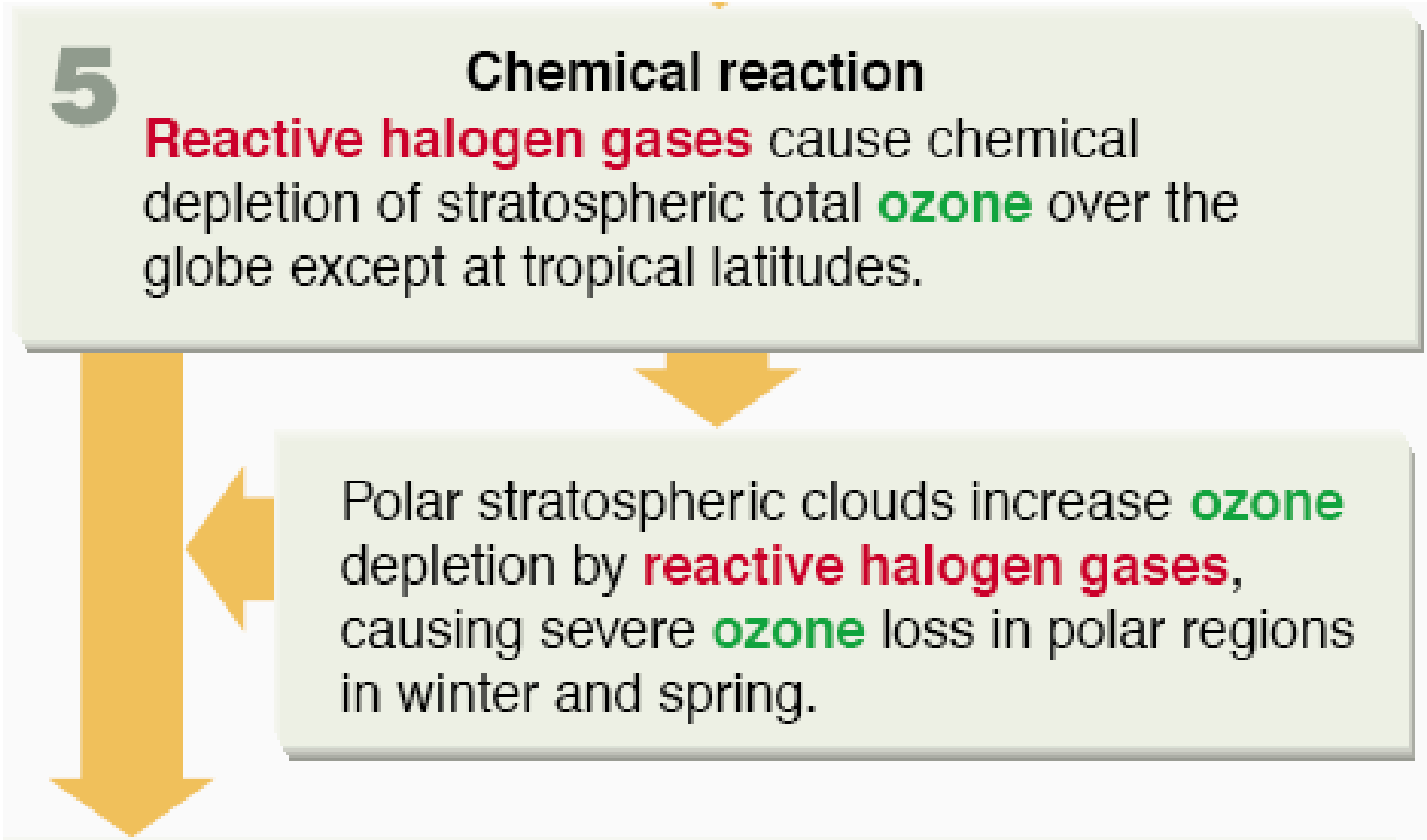
## Transport

**Halogen source gases** are transported to the stratosphere by air motions.

4

## Conversion

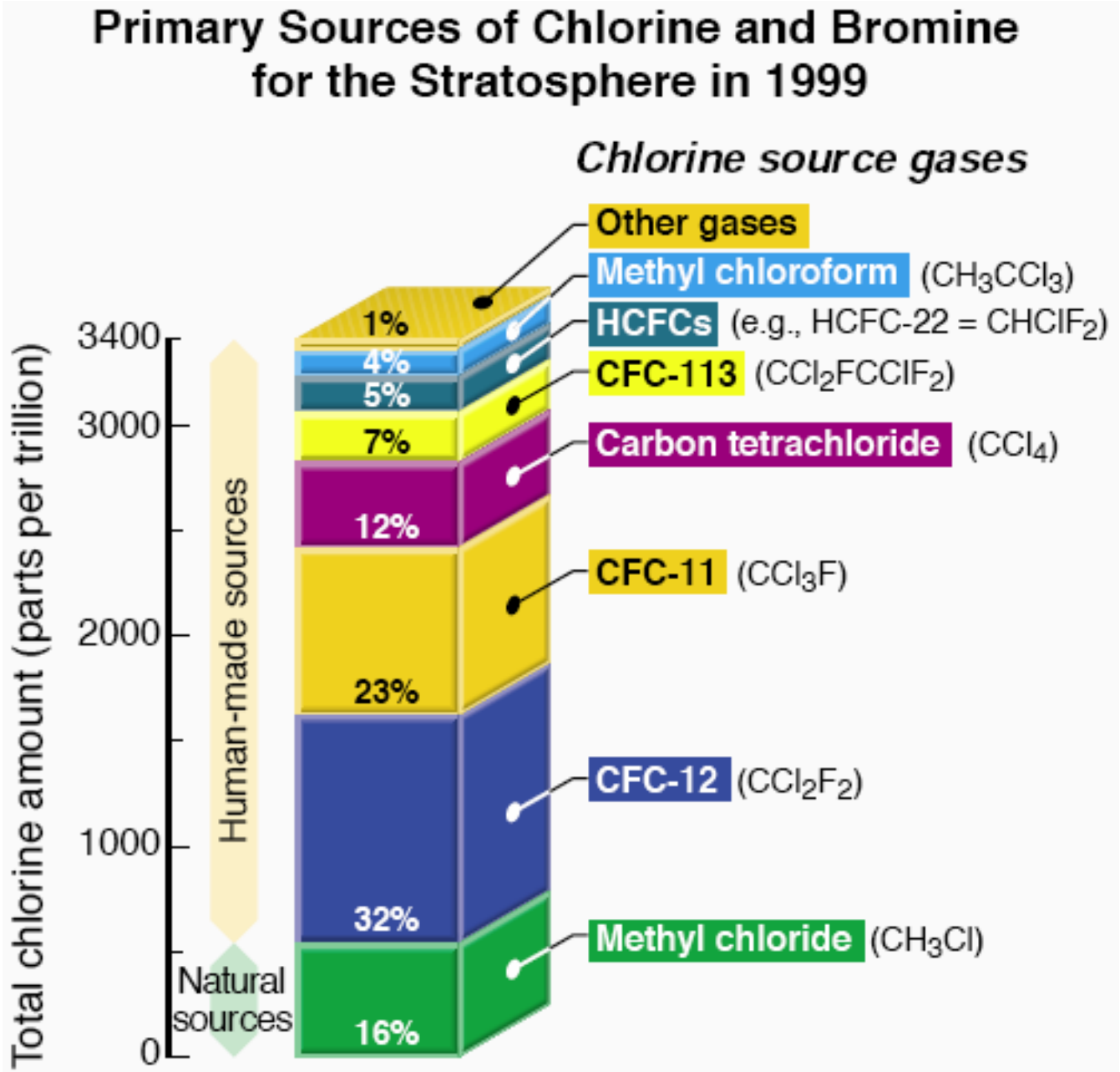
Most **halogen source gases** are converted in the stratosphere to **reactive halogen gases** in chemical reactions involving ultraviolet radiation from the Sun.

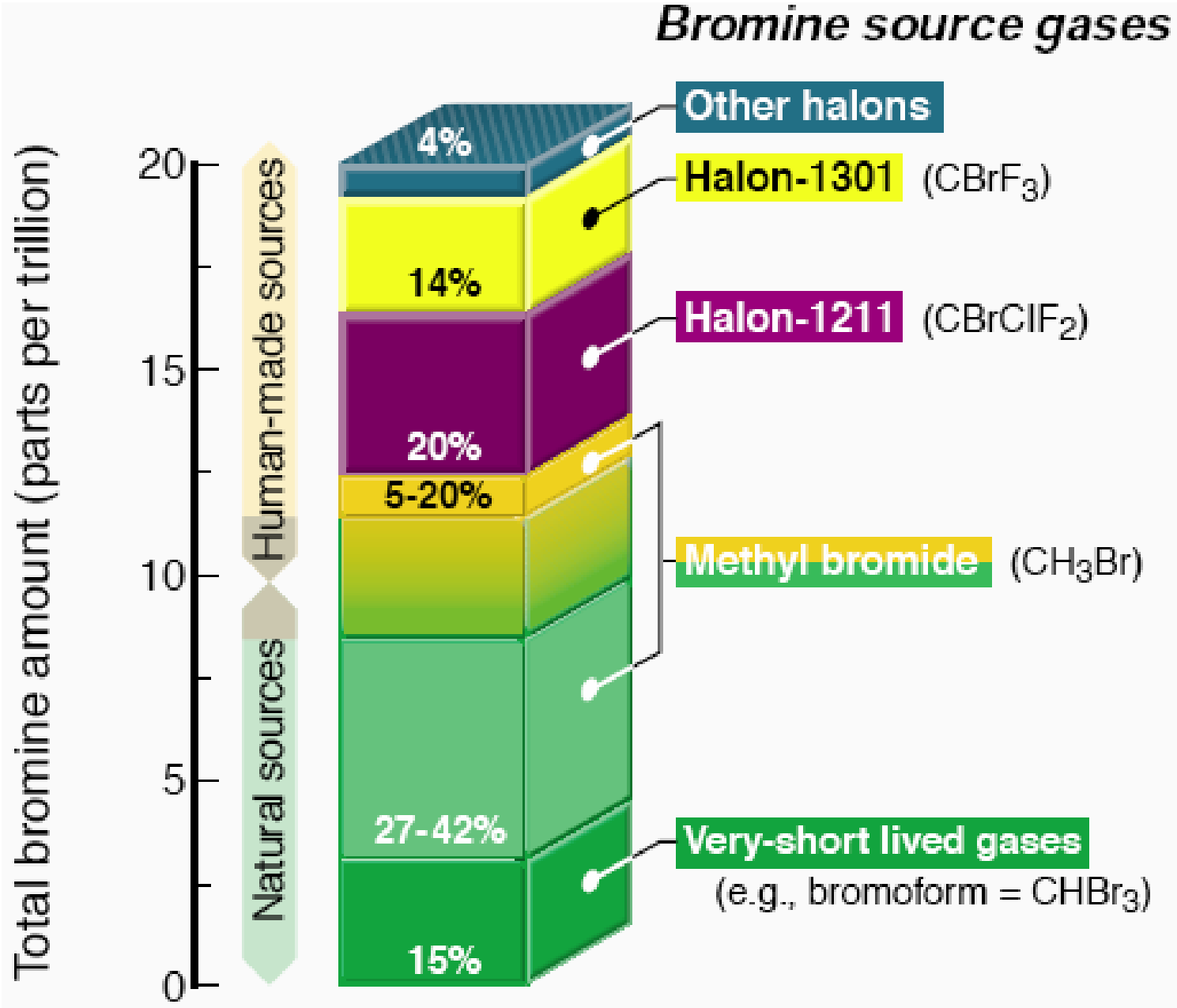

5
Chemical reaction
Reactive halogen gases cause chemical depletion of stratospheric total ozone over the globe except at tropical latitudes.
Polar stratospheric clouds increase ozone depletion by reactive halogen gases, causing severe ozone loss in polar regions in winter and spring.

6

## Removal

Air containing **reactive halogen gases** returns to the troposphere and these gases are removed from the air by moisture in clouds and rain.


Primary Sources of Chlorine and Bromine for the Stratosphere in 1999
Chlorine source gases
Other gases
Methyl chloroform ($CH_3CCl_3$)
HCFCs (e.g., HCFC-22 = $CHClF_2$)
CFC-113 ($CCl_2FCClF_2$)
Carbon tetrachloride ($CCl_4$)
CFC-11 ($CCl_3F$)
CFC-12 ($CCl_2F_2$)
Methyl chloride ($CH_3Cl$)
1%
4%
5%
7%
12%
23%
32%
16%
Total chlorine amount (parts per trillion)
3400
3000
2000
1000
0
Human-made sources
Natural sources


Bromine source gases
Total bromine amount (parts per trillion)
20
15
10
5
0
Human-made sources
Natural sources
4%
14%
20%
5-20%
27-42%
15%
Other halons
Halon-1301 ($CBrF_3$)
Halon-1211 ($CBrClF_2$)
Methyl bromide ($CH_3Br$)
Very-short lived gases
(e.g., bromoform = $CHBr_3$)

THE SECRETARIAT
OF THE MULTILATERAL FUND
FOR THE IMPLEMENTATION
OF THE MONTREAL PROTOCOL

UNEP


UNEP

Methyl Bromide Alternatives Project

# MAP to a Healthy Harvest

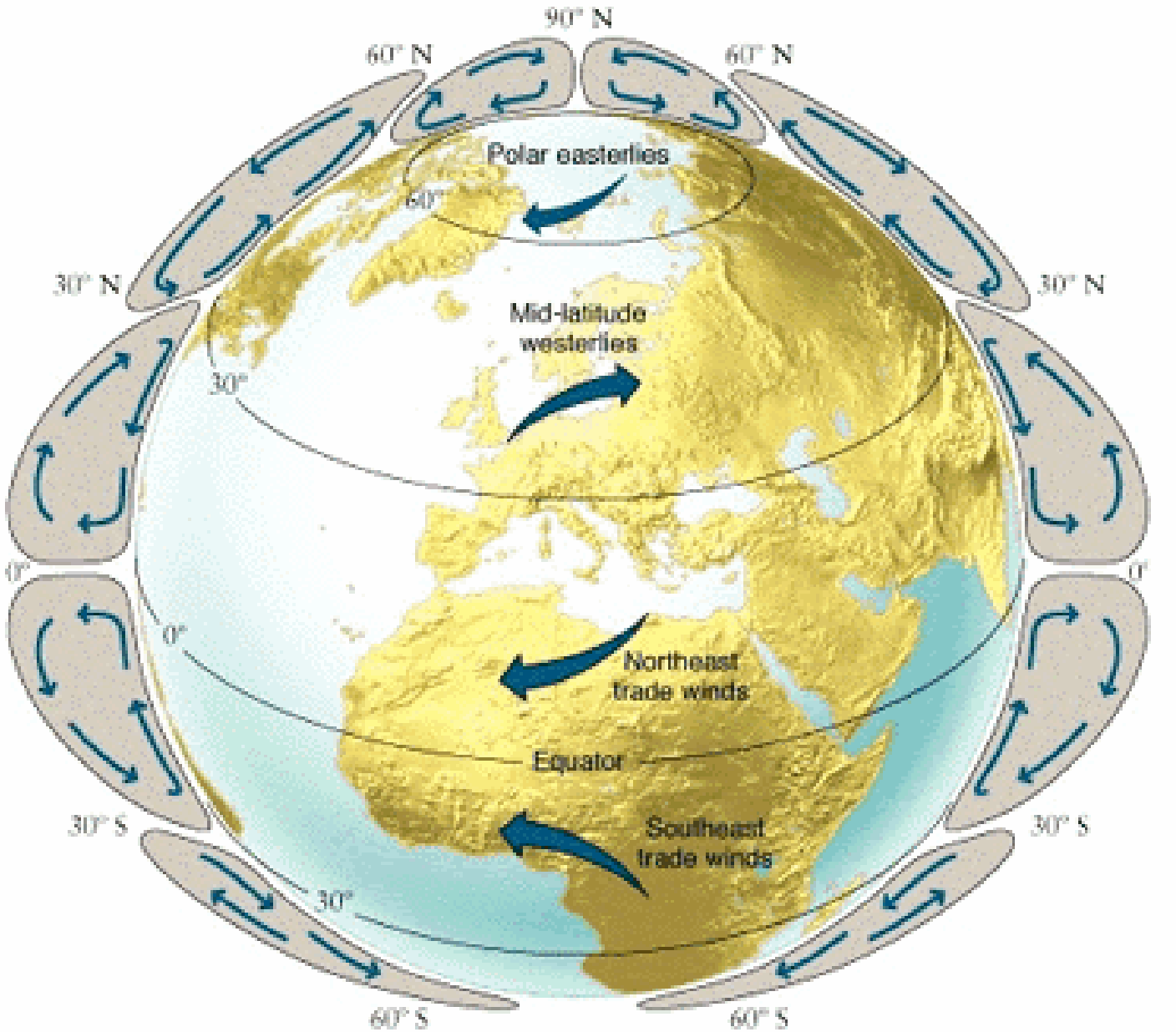
## Methyl bromide alternatives projects

*Los Angeles, California*
Before the Clean Air Act was enacted.

**Clean Air Act**
of 1963

*Los Angeles, California*
Ten years after the Clean Air Act was enacted.

# Global Atmospheric Circulation



# Total Ozone Mapping Spectrometer

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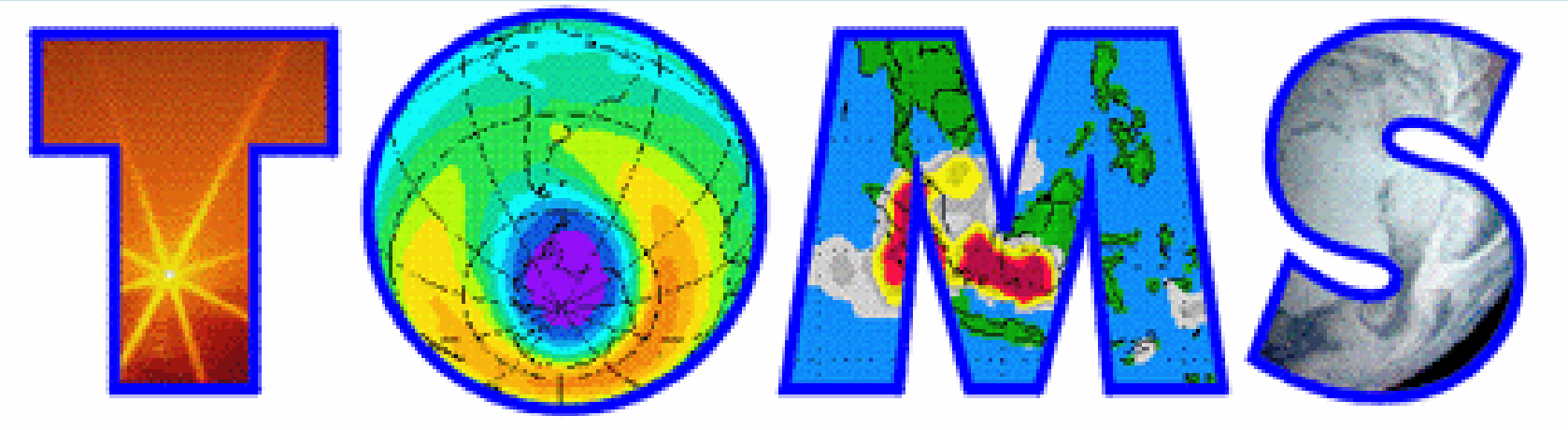
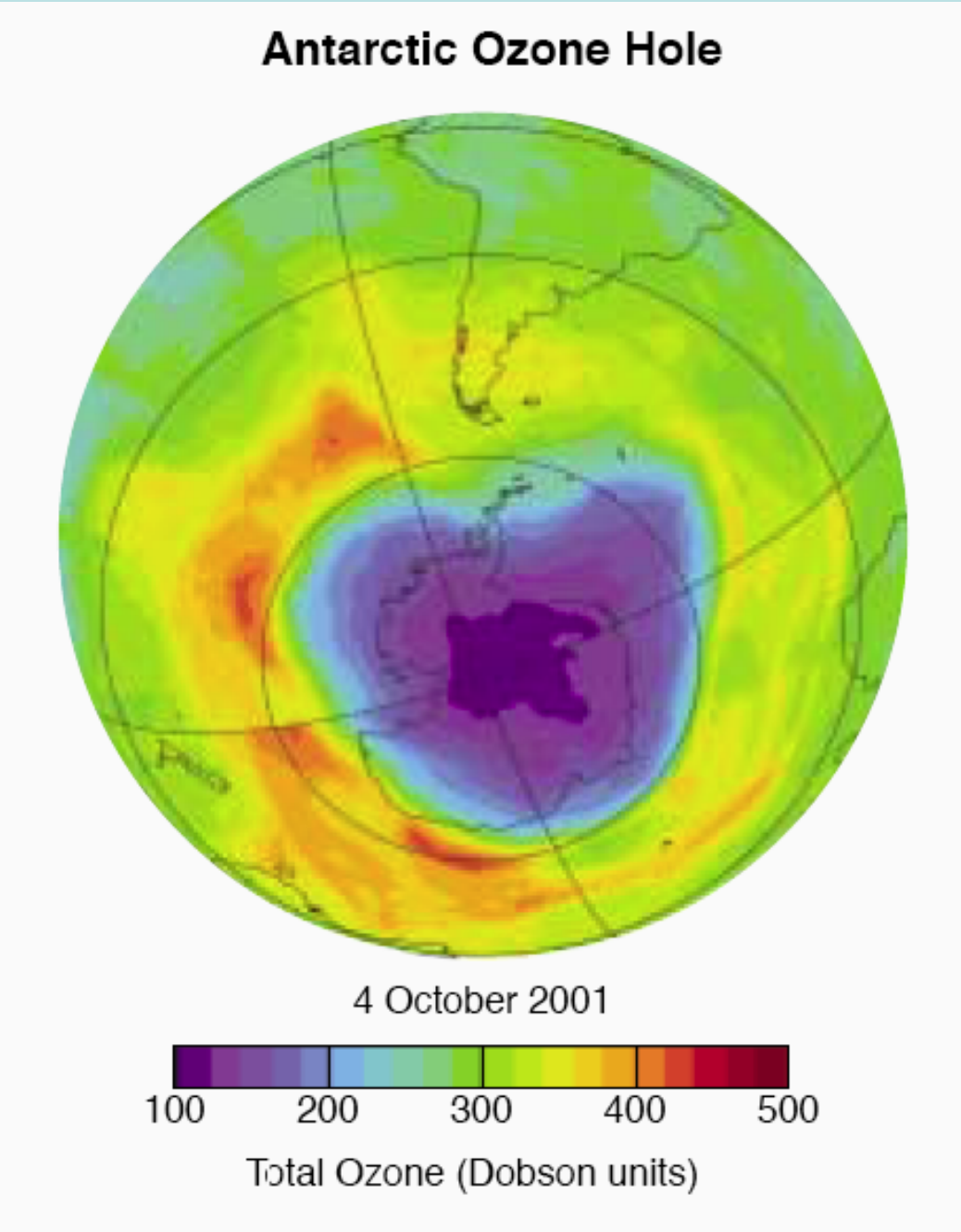
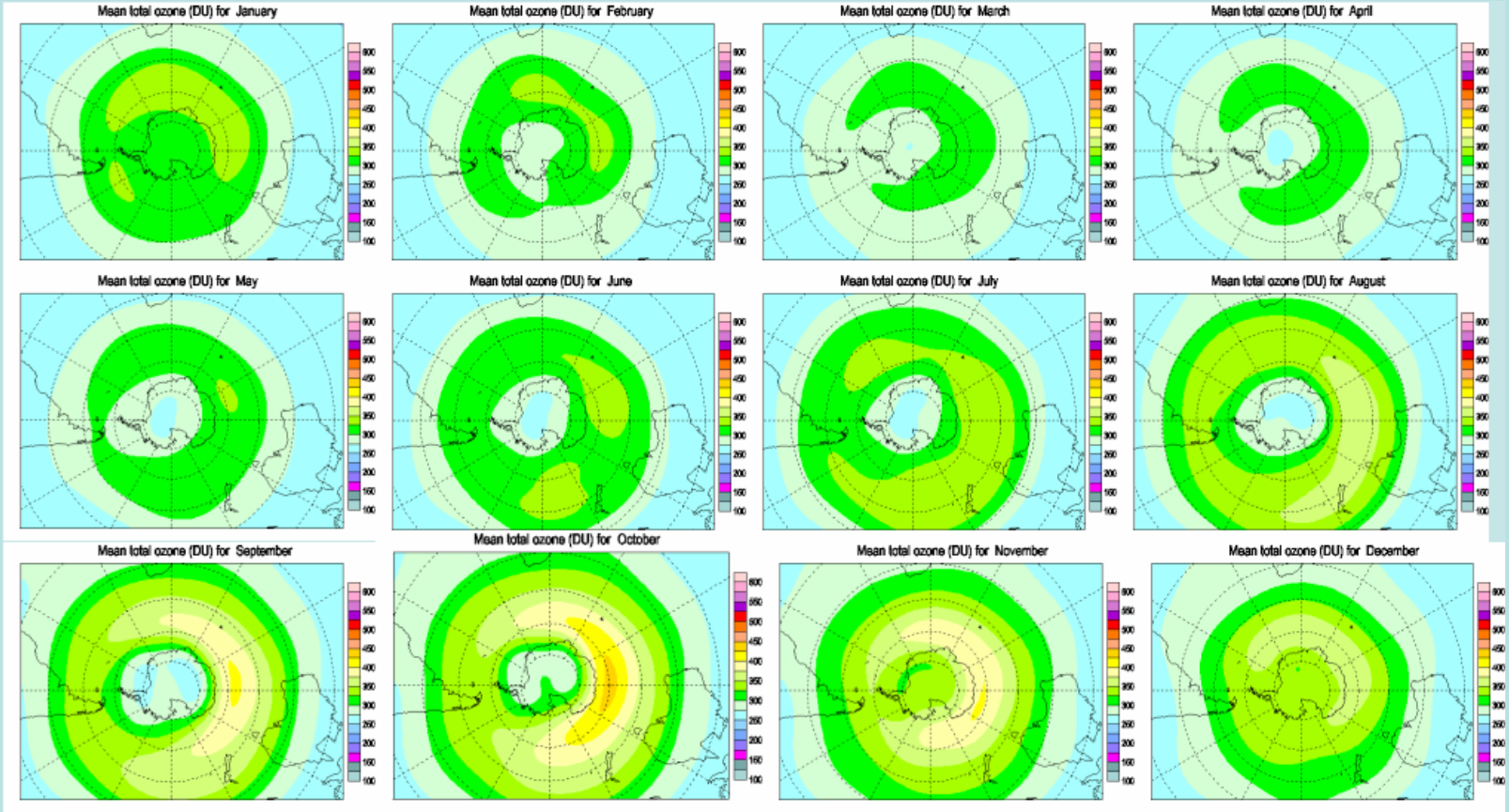





http://www.cmdl.noaa.gov/ozwv/ozsondes/spo/ozppp2001.html

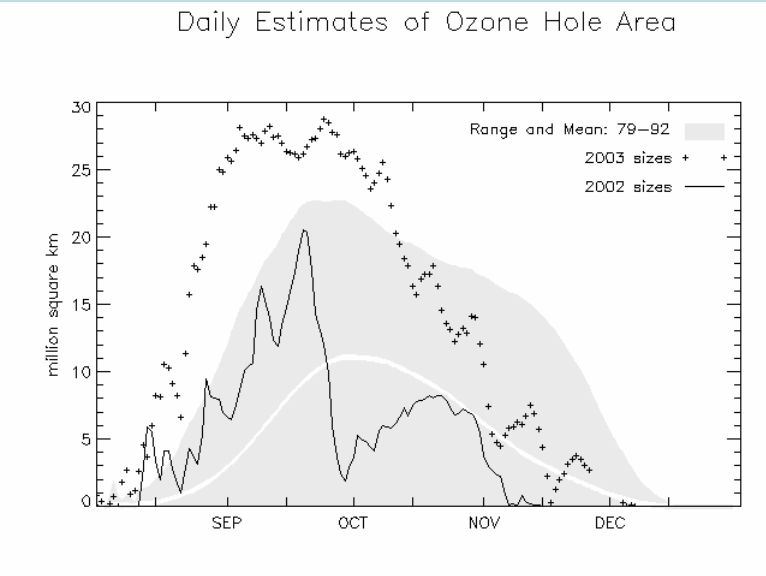
These maps show the mean 1978-1988 level estimated using Total Ozone Mapping Spectrometer (TOMS)data for all areas except the Antarctic and from the pre-1980 level estimated using Dobson data over the Antarctic.

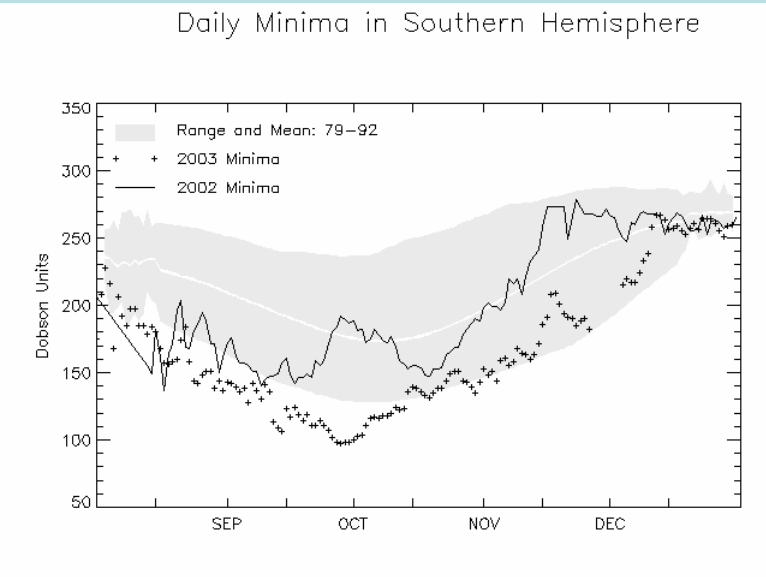


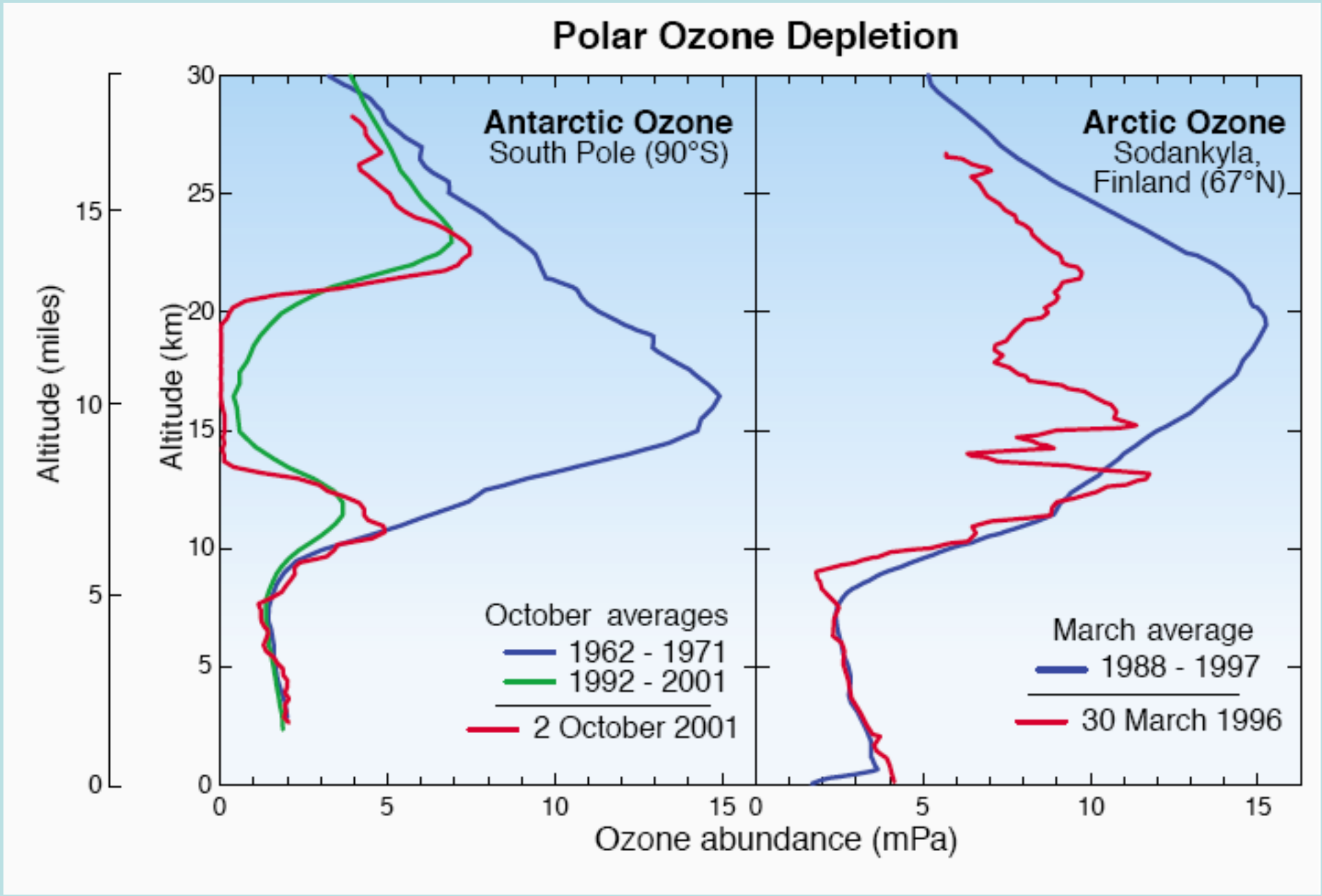
# Ozone Hole over Antarctica

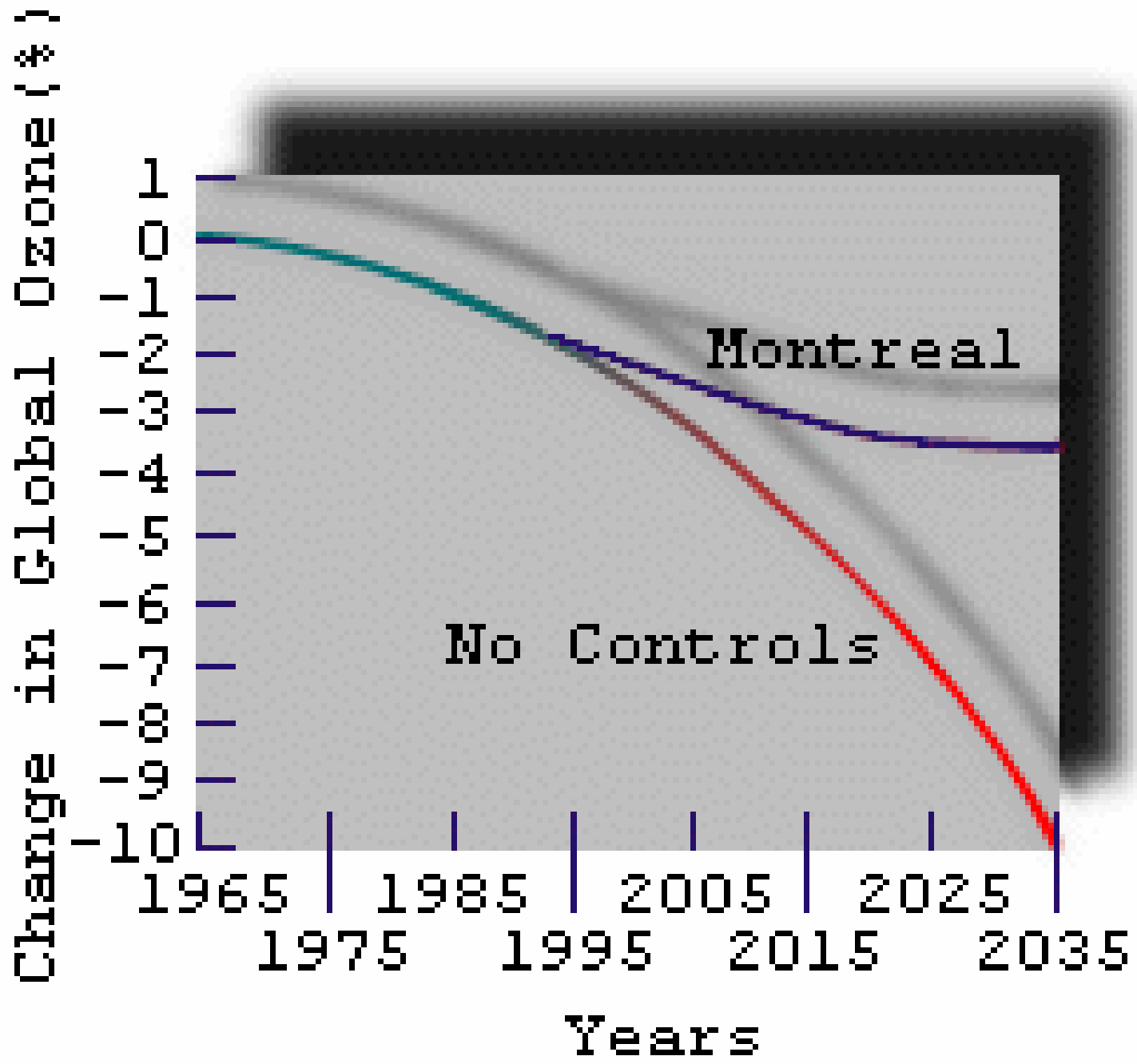
http://www.sdsc.edu/tmf/Examples/Ozone/ozone.html

# Ozone Hole Monitoring




Polar Ozone Depletion
Antarctic Ozone
South Pole (90°S)
Arctic Ozone
Sodankyla,
Finland (67°N)
October averages
1962 - 1971
1992 - 2001
2 October 2001
March average
1988 - 1997
30 March 1996
Altitude (miles)
Altitude (km)
Ozone abundance (mPa)
0
5
10
15
20
25
30


Change in Global Ozone(%)
1
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
Montreal
No Controls
1965
1975
1985
1995
2005
2015
2025
2035
Years

## Reference archives

1.Envirolink Click on the Ozone folder. Note in particular the FAQ's by rparson(Robert Parson, Univ.of Colorado), they are by far the **best tutorials on Ozone depletion on the entire net!**

2.NOAA has written up several research summaries on History and overview of Ozone shield, Stratospheric Ozone and Tropospheric Ozone ; all written at a laymans level.

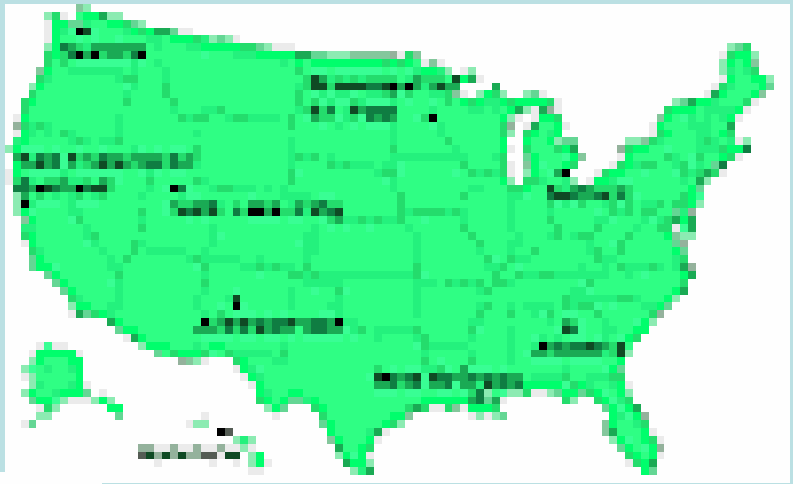
3. Earthwatch Radioscripts on Ozone :Earthwatch ph# is (608)263-3063, and I have found them to be quite helpful in giving further information and contacts used in their broadcasts.

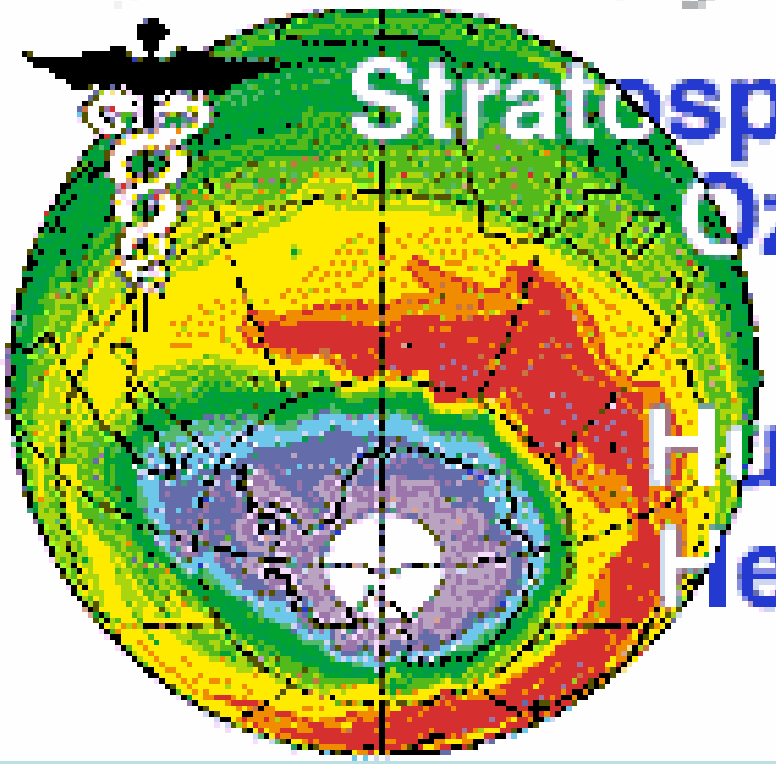
4. NSF index this is the National Science Foundation's search index; type in 'ozone' and hit the enter key.

5. Galaxy directory service for EINET Contains a wide assortment of articles on different aspects of the depletion problem and the remedies for it; not necessarily the best place to start if you are just starting to learn about the problem. 7. Ozone lesson-plans from the University of Kansas Nice summaries of lesson plans which teach about the Ozone problem. You can download details of these lessons if you have Claris works.

9. CIESIN (Consortium for International Earth Science Information Networks) homepage this file has a nice summary of many the various protocals and international meetings that have been conducted in order to combat ozone depletion.

CIESIN
Columbia University

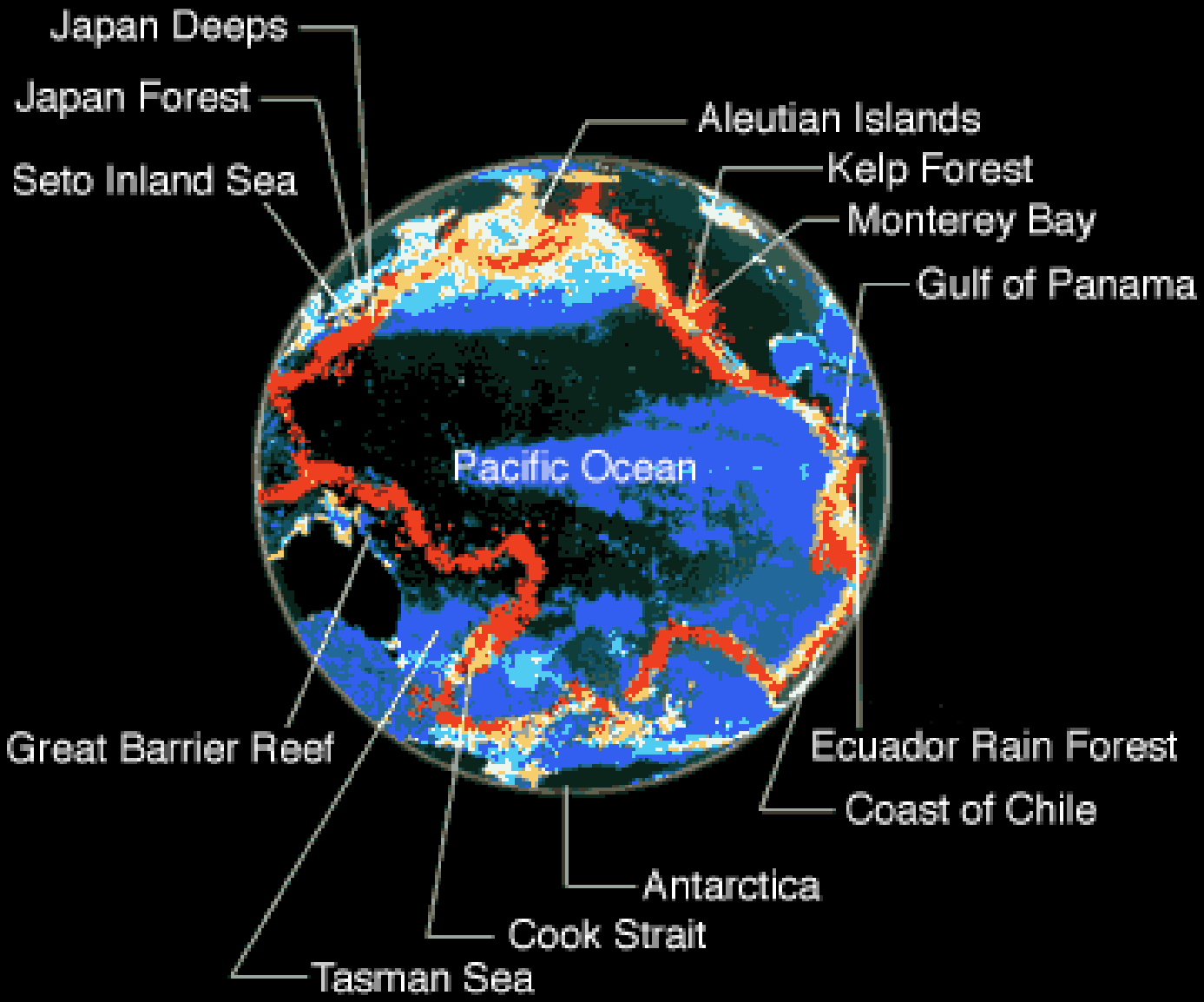




Stratospheric
Ozone
and
Human
Health

SEDAC

http://sedac.ciesin.org/ozone/docs/uvd-home.html


Japan Deeps
Japan Forest
Seto Inland Sea
Aleutian Islands
Kelp Forest
Monterey Bay
Gulf of Panama
Pacific Ocean
Great Barrier Reef
Ecuador Rain Forest
Coast of Chile
Antarctica
Cook Strait
Tasman Sea