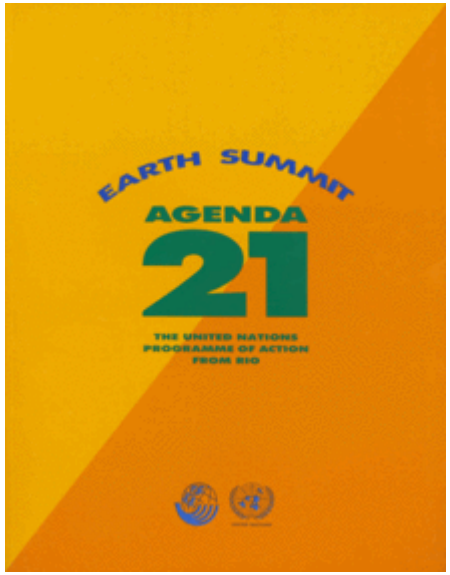


Montreal Protocol & Earth Summit

http://www.ozgurzeydan.com/

Montreal Protocol

- In 1974, Nobel Prize-winning scientists Sherwood Rowland and Mario Molina posited that chlorofluorocarbons (CFCs) could deplete the stratospheric ozone layer.
- Subsequent research confirmed that commonly-used chemicals – many of them components of everyday consumer products - were destroying the ozone layer.
- By 1985, scientists saw a drastic thinning of the ozone layer over Antarctica, an annual phenomenon dubbed the “ozone hole.”
- Research since then has deepened our understanding of the causes and dangerous environmental and human health consequences of ozone depletion, showing that effects appear not just at the poles, but all over the world.

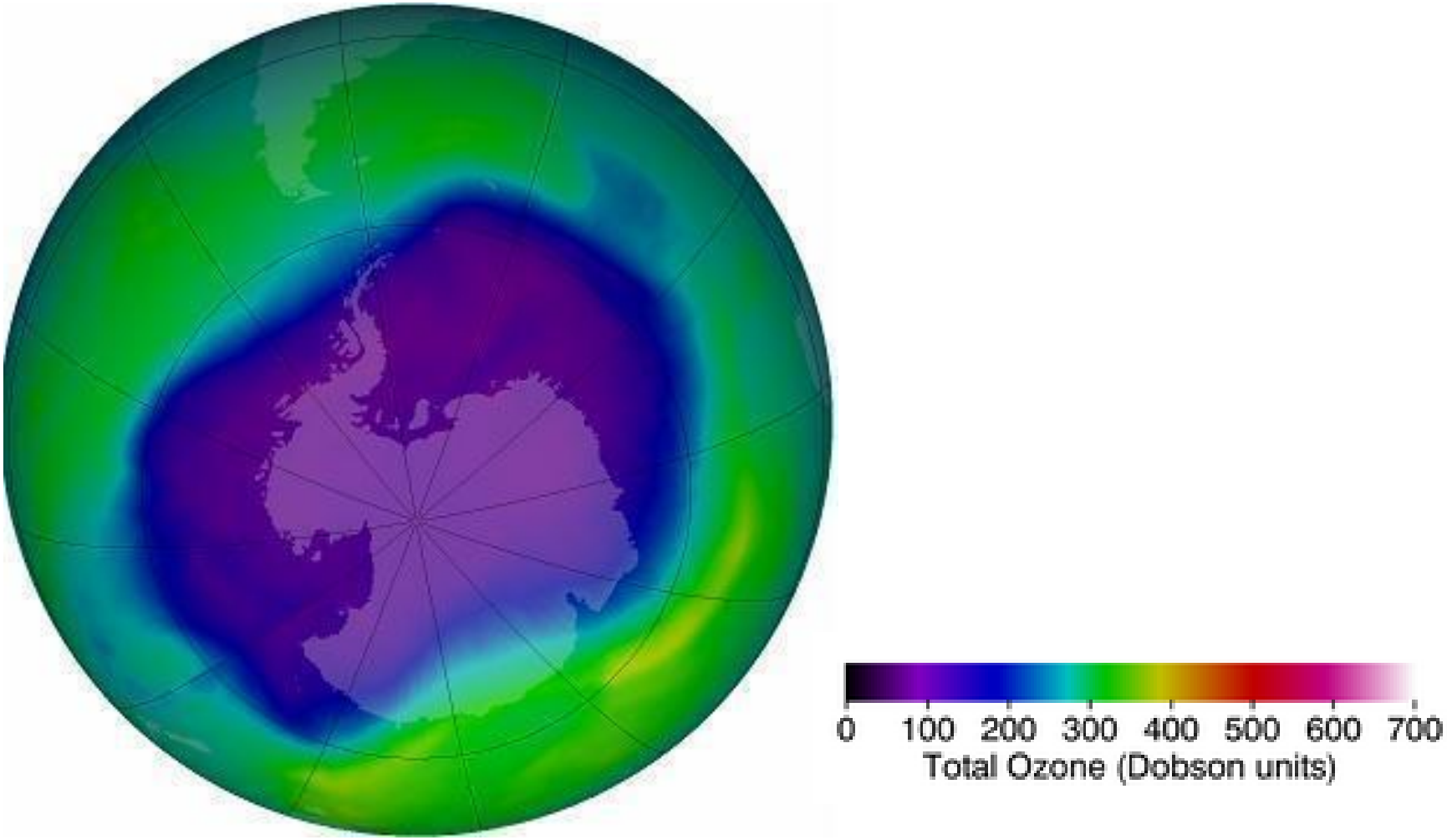
Ozone Layer

- A thinner ozone layer allows more ultraviolet radiation to reach the Earth's surface, exposing humans and living systems to additional ultraviolet (UV) radiation.
- Overexposure to UV can cause a range of health effects, including skin cancer and other skin damage, eye damage leading to cataracts, suppression of the immune system, as well as ecological effects including crop damage, damage to phytoplankton, and potentially the marine food chain.

Montreal Protocol

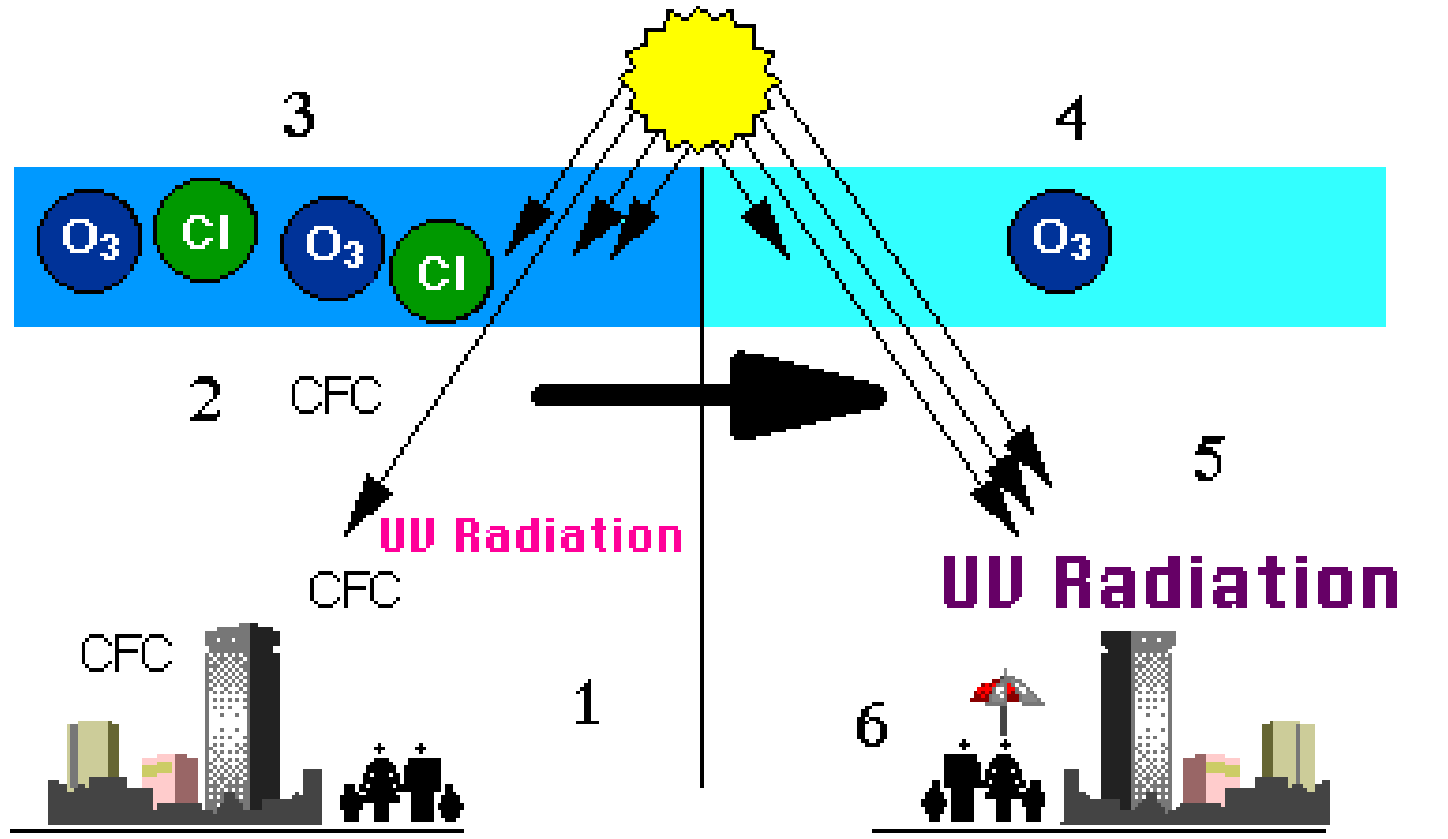
- Recognizing these dangers, on September 16, 1987, world leaders signed the Montreal Protocol.
- The Montreal Protocol on Substances that Deplete the Ozone Layer has been signed by almost every country in the world: more than 190 countries are now Parties to the treaty.
- Across the planet, major corporations continue to make dramatic strides replacing ozone-depleting substances (ODS) with safer substitutes, which will slow and eventually reverse the thinning of the ozone layer as well as provide important climate benefits.

Antarctic Ozone Hole



NASA's Ozone Hole Watch Web Site, Sept. 24, 2006
http://ozonewatch.gsfc.nasa.gov/

The Process of Ozone Depletion



http://www.epa.gov/ozone/science/process.html

Production of Ozone

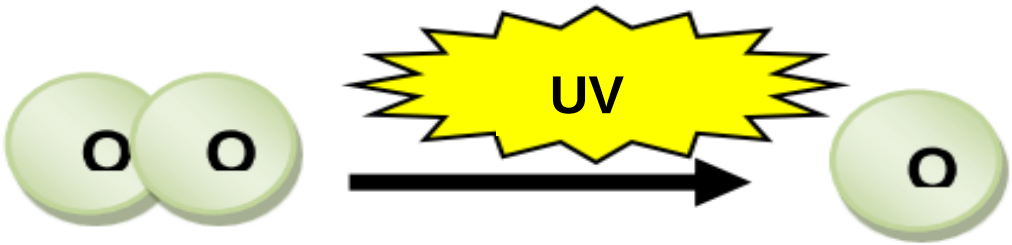
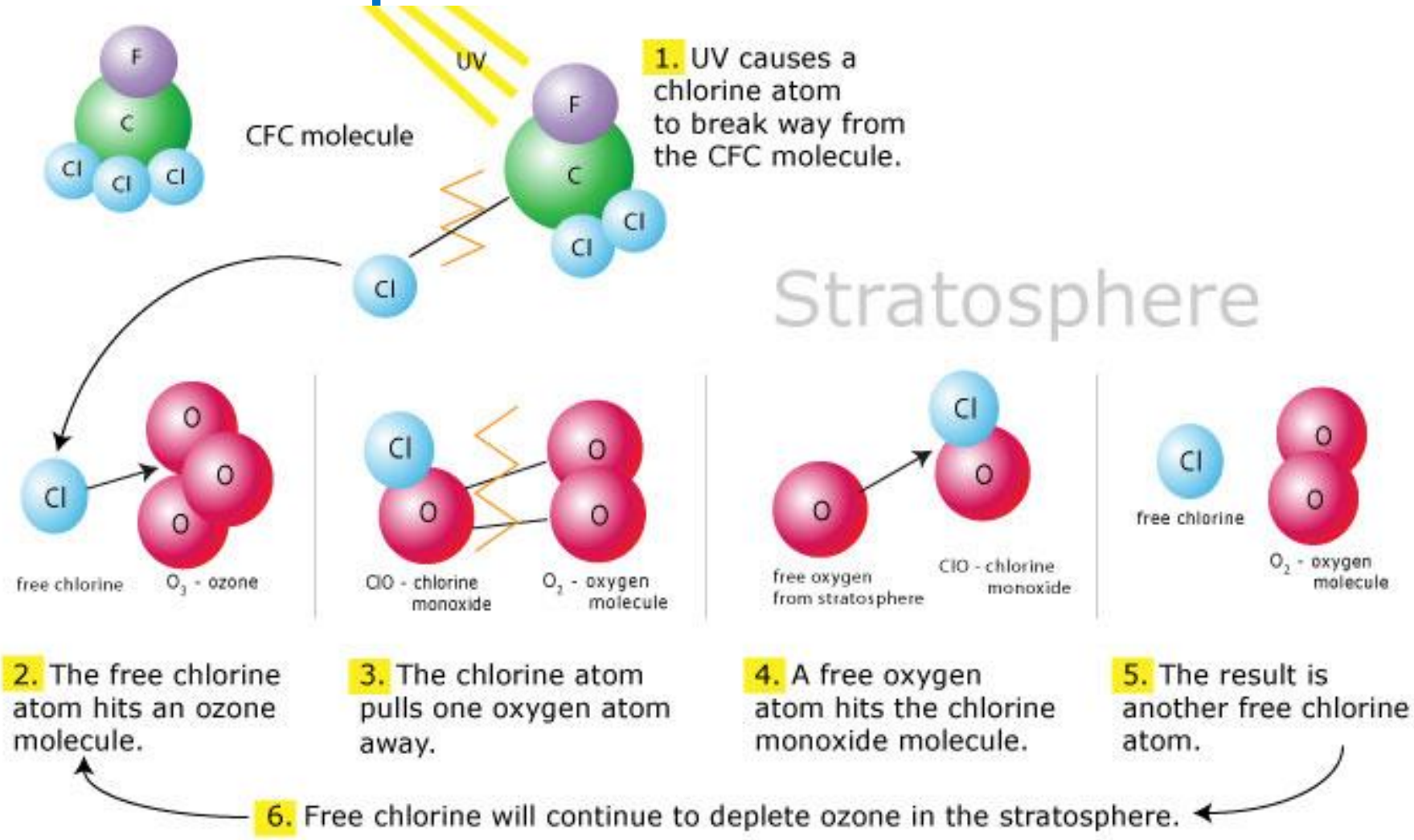


Figure 1a: *Formation of atomic oxygen*

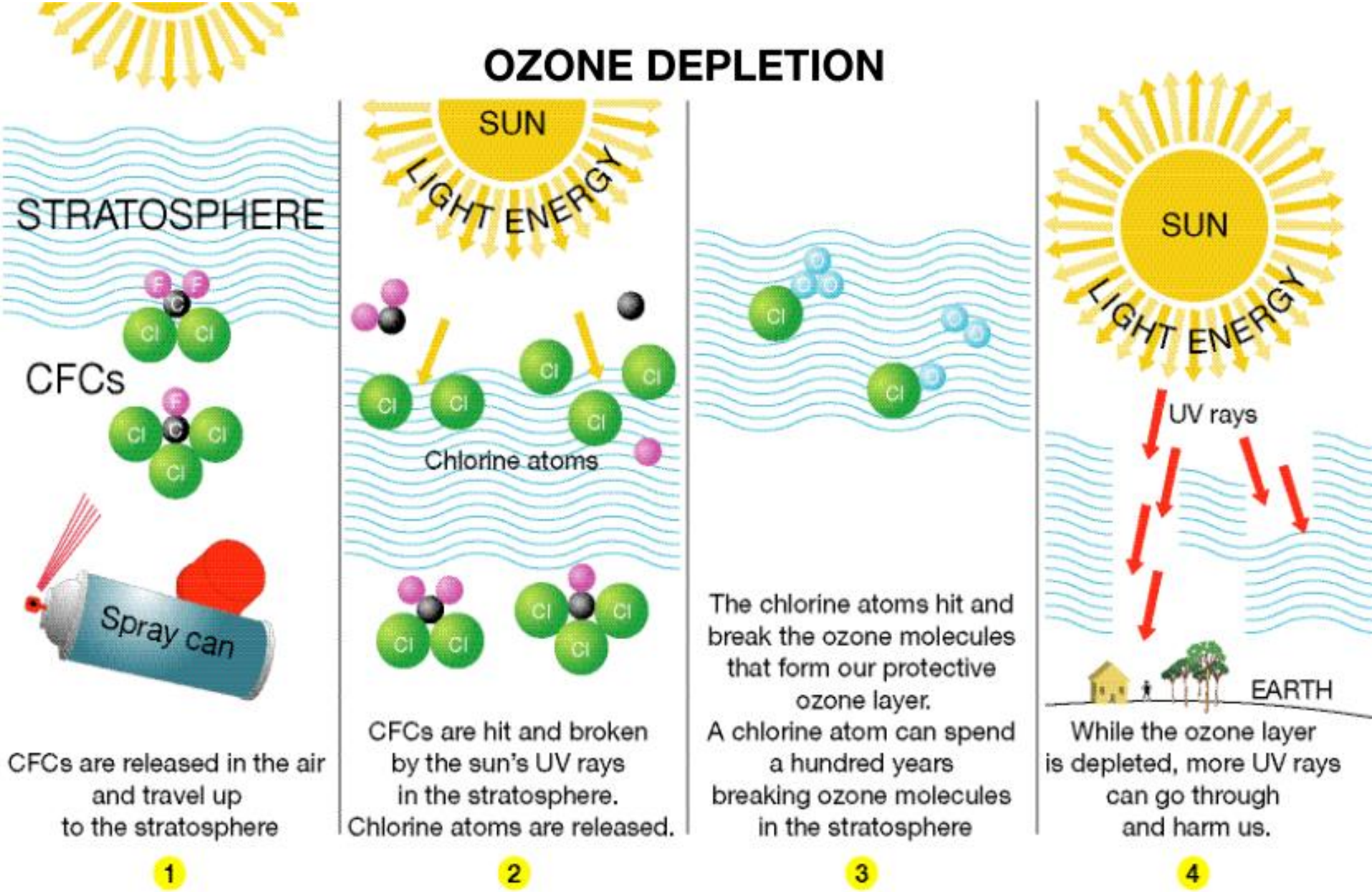
Figure 1b: *Production of ozone*

Chlorine-catalyzed Ozone Depletion Mechanism



http://www.learner.org/courses/envsci/unit/text.php?unit=11&secNum=10

OZONE DEPLETION



CFCs are released in the air and travel up to the stratosphere

1

CFCs are hit and broken by the sun's UV rays in the stratosphere. Chlorine atoms are released.

2

The chlorine atoms hit and break the ozone molecules that form our protective ozone layer.
A chlorine atom can spend a hundred years breaking ozone molecules in the stratosphere

3

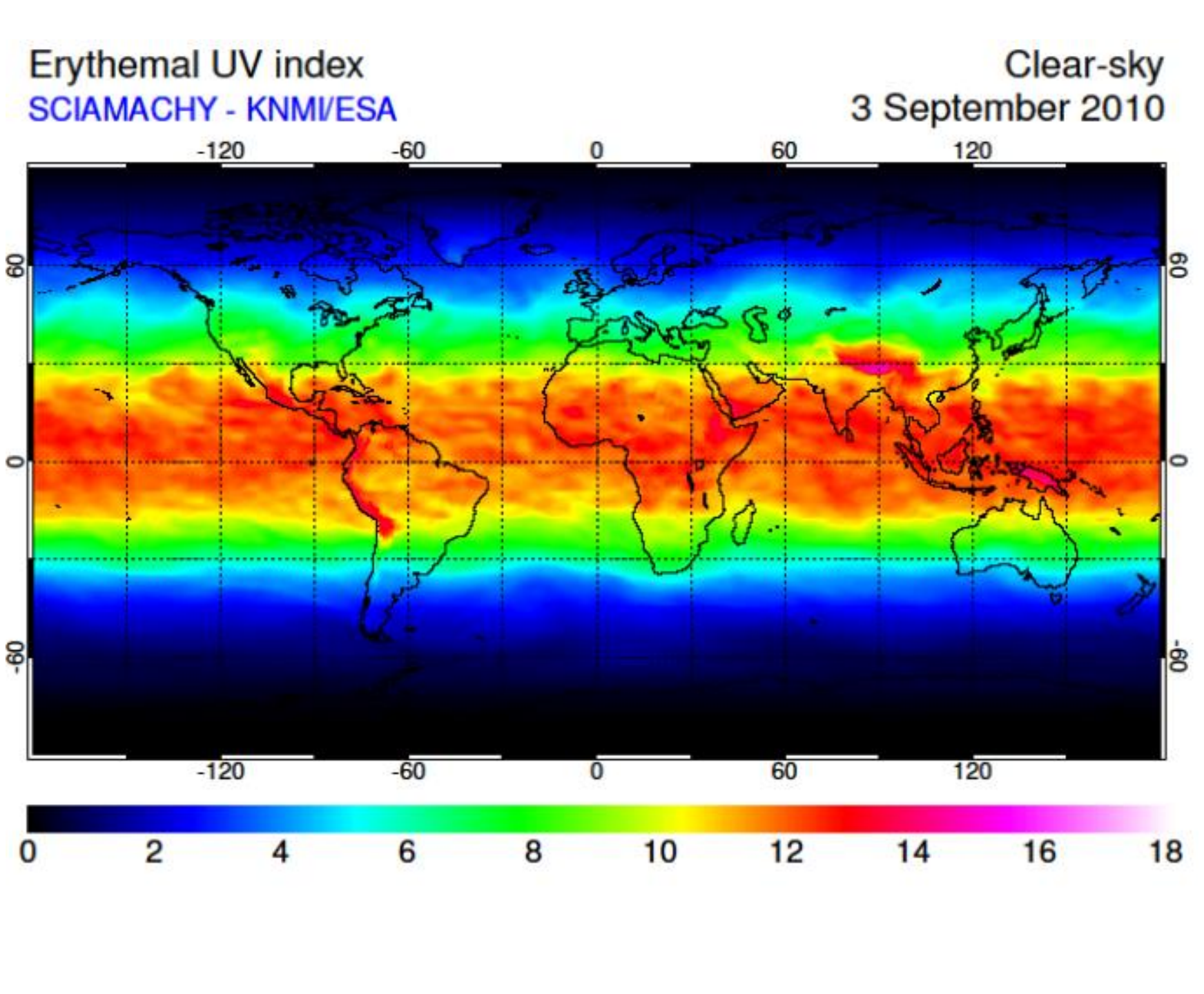
While the ozone layer is depleted, more UV rays can go through and harm us.

4

UNEP www. ozzyozone.org

Colours used in the UV Index

Exposure Category	Colour	UVI Range
Low		< 2
Moderate		3 - 5
High		6 - 7
Very High		8 – 10
Extreme		11+


Erythemal UV index
SCIAMACHY - KNMI/ESA
Clear-sky
3 September 2010
-120
-60
0
60
120
60
0
-60
0
2
4
6
8
10
12
14
16
18

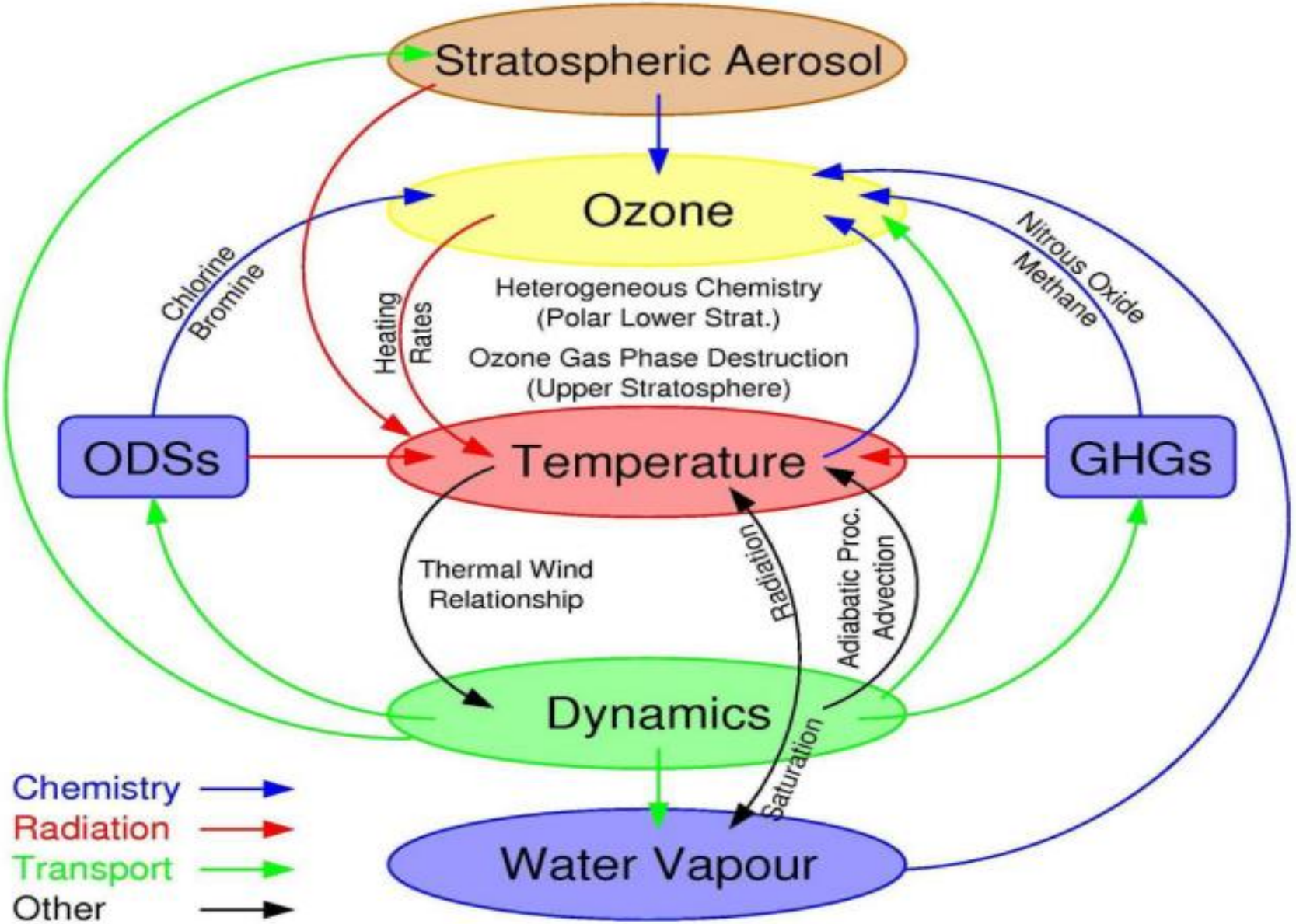
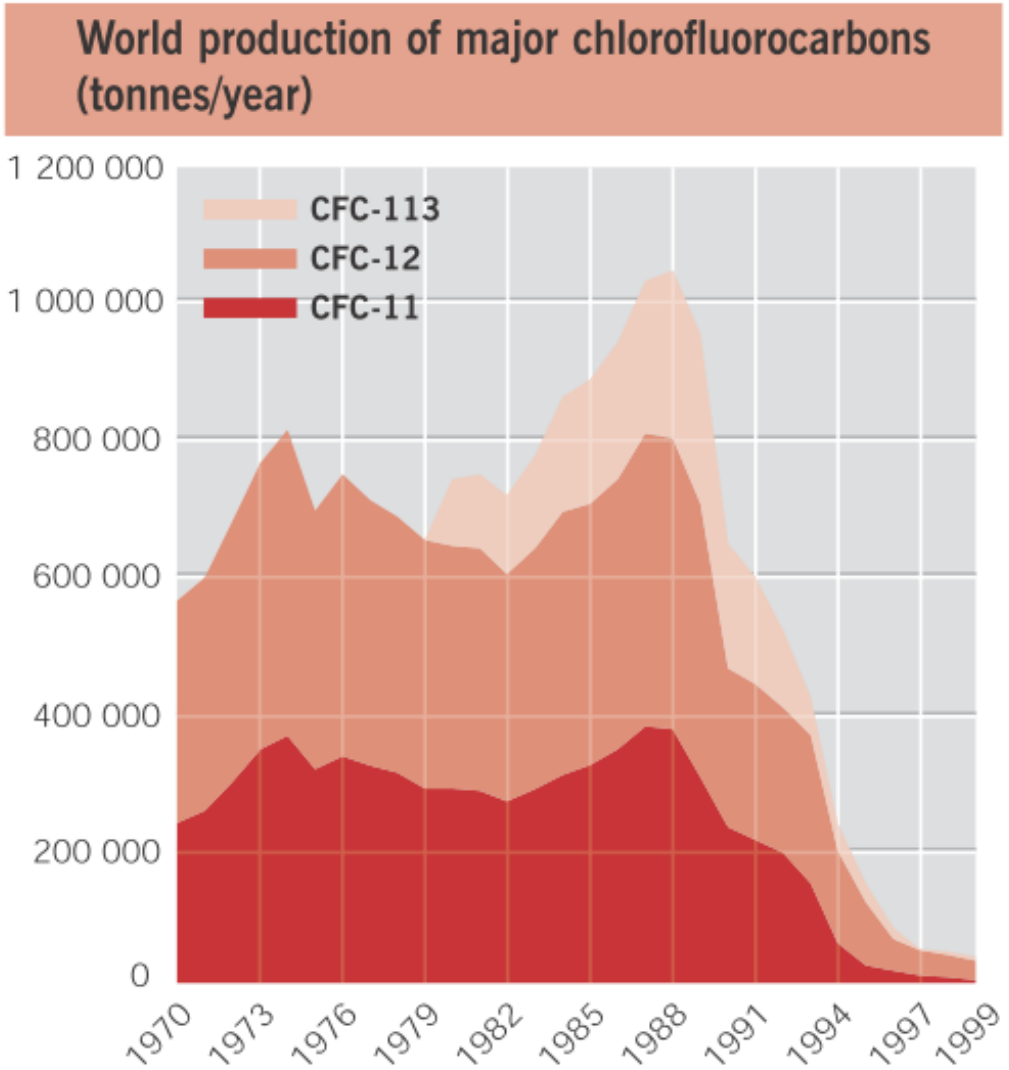

Stratospheric Aerosol
Ozone
Chlorine
Bromine
Heating Rates
Heterogeneous Chemistry
(Polar Lower Strat.)
Ozone Gas Phase Destruction
(Upper Stratosphere)
Nitrous Oxide
Methane
ODSs
Temperature
GHGs
Thermal Wind
Relationship
Radiation
Adiabatic Proc.
Advection
Dynamics
Saturation
Water Vapour
Chemistry
Radiation
Transport
Other

Figure 12b: *Schematic of ozone focused stratospheric chemistry-climate interactions. Links between components of the chemistry-climate system are indicated with arrows representing chemistry (blue), radiation (red), transport (green) and other mechanisms (black). A simple example is ozone depletion in the upper stratosphere leading to lower temperatures. Lower temperatures slow down the gas phase destruction of ozone, thus reducing the amount of ozone depletion. Feedback cycles not originating from ozone, but e.g. dynamics, are possible as well: "Dynamics" moderates the distribution of GHGs (e.g. the meridional gradient of N_2O, nitrous oxide), this changes temperature directly (radiation) and indirectly (chemistry, via a change in ozone) and the changing temperature will alter the dynamics (e.g. via the thermal wind relationship) and ozone (e.g. in a colder upper stratosphere ozone gas phase destruction will slow down leading to increased ozone values). The feedback loops involving volcanic aerosol in the stratosphere are sporadic and currently not important.*

Questions and Answers about the Environmental Effects of the Ozone Layer Depletion and Climate Change: 2010 Update



World production of the three major CFCs peaked in about 1988 and has since declined to very low values

Source: AFEAS 2001

GEO: Global Environment Outlook 3
http://www.grida.no/publications/other/geo3/

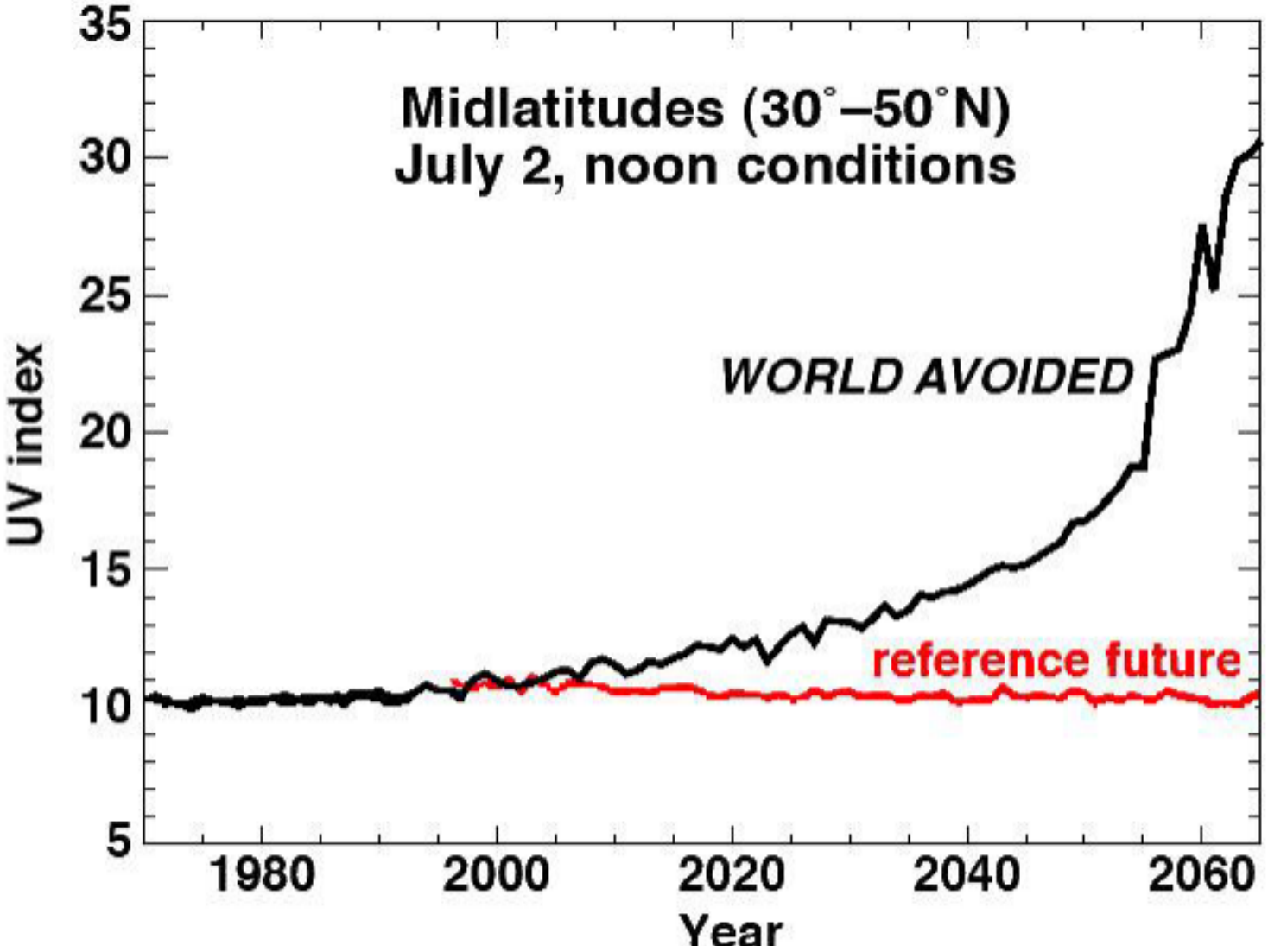


Figure 13b: Prediction of the UV Index indicating what could have happened in the absence of a Montreal Protocol from Figure 5.11 Scientific Assessment of Ozone Depletion: 2010.

http://us-cdn.creamermedia.co.za/assets/articles/attachments/29653_898_executivesummary_emb.pdf)

The 1987 Montreal Protocol on Substances that Deplete the Ozone Layer

- Full text available at:
- https://treaties.un.org/doc/Treaties/1989/01/19890101%2003-25%20AM/Ch_XXVII_02_ap.pdf

https://www.unenvironment.org/ozonaction/who-we-are/about-montreal-protocol

Global environmental agreements relevant to climate change, stratospheric O_3

- 1985 Vienna Convention for the Protection of the Ozone Layer
- 1987 Montreal Protocol on Substances that Deplete the Ozone Layer
  - 1990 London Amendment
  - 1992 Copenhagen Amendment
  - 1997 Montreal Amendment
  - 1999 Beijing Amendment
  - 2016 Kigali Amendment

(Global Environment Outlook 6)

Medal of Honor for the protection of the Ozone Layer

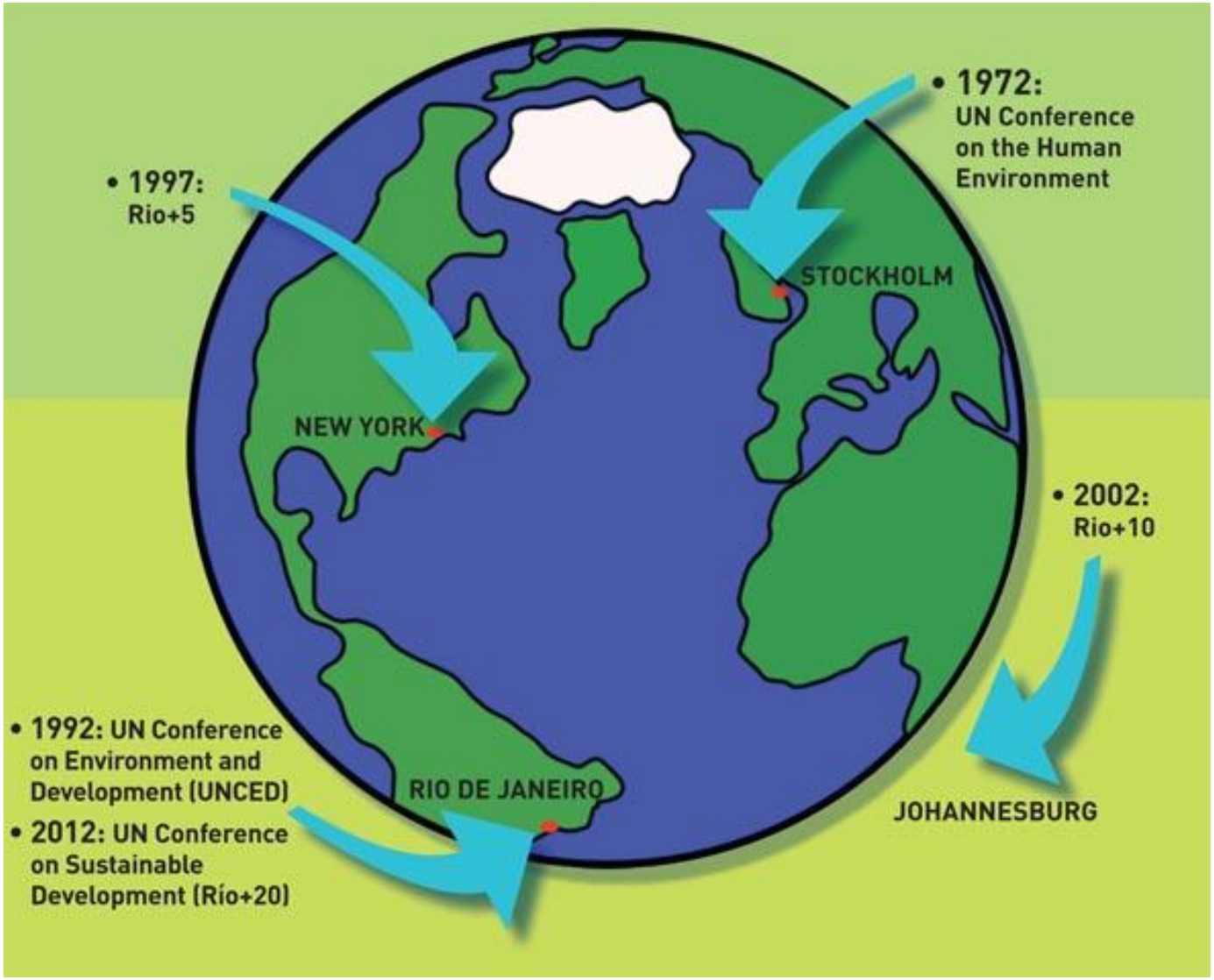
http://csb.gov.tr/ozon-tabakasini-koruma-onur-madalyasi-turkiye-nin-bakanlik-faaliyetleri-984

The Earth Summit

- United Nations Conference on Environment and Development (UNCED), Rio de Janeiro, 3-14 June 1992
- 172 governments participated.
- Principal themes were environment and sustainable development.

http://www.un.org/geninfo/bp/enviro.html

The Earth Summit



http://tunza.mobi/articles/earth-summits-and-multilateral-environmental-agreements/

The Earth Summit

- Twenty years after the first global environment conference, the UN sought to help Governments rethink economic development and find ways to halt the destruction of irreplaceable natural resources and pollution of the planet.
- The Summit's message: that poverty as well as excessive consumption by affluent populations place damaging stress on the environment.

http://www.un.org/geninfo/bp/enviro.html

Results: eco-efficiency guiding principles for business and governments

- Patterns of production — particularly the production of toxic components, such as lead in gasoline, or poisonous waste — are being scrutinized in a systematic manner by the UN and Governments alike;
- Alternative sources of energy are being sought to replace the use of fossil fuels which are linked to global climate change;
- New reliance on public transportation systems is being emphasized in order to reduce vehicle emissions, congestion in cities and the health problems caused by polluted air and smog;
- There is much greater awareness of and concern over the growing scarcity of water.

Resulting Documents

1. Agenda 21
2. The Rio Declaration on Environment and Development
3. The Statement of Forest Principles
4. The United Nations Framework Convention on Climate Change
5. The United Nations Convention on Biological Diversity

http://www.un.org/geninfo/bp/enviro.html

Agenda 21

- Agenda 21 addresses today's pressing problems and aims to prepare the world for the challenges of the next century.
- It contains detailed proposals for action in social and economic areas (such as combating poverty, changing patterns of production and consumption and addressing demographic dynamics), and for conserving and managing the natural resources that are the basis for life - protecting the atmosphere, oceans and biodiversity; preventing deforestation; and promoting sustainable agriculture

http://www.un.org/geninfo/bp/envirp2.html

Rio Declaration on Environment and Development

- Consists of 27 principles.
- Formally not binding.
- Full text available at:
- https://cil.nus.edu.sg/databasecil/1992-rio-declaration-on-environment-and-development/

Rio Declaration

- People are entitled to a healthy and productive life in harmony with nature.
- Development today must not threaten the needs of present and future generations.
- Nations have the right to exploit their own resources, but without causing environmental damage beyond their borders.
- Environmental protection shall constitute an integral part of the development process.

http://www.sustainable-environment.org.uk/Action/Rio_Declaration.php

Rio Declaration

- Eradicating poverty and reducing disparities in living standards in different parts of the world are essential if we are to achieve sustainable development whilst meeting the needs of the majority of the people.
- Environmental issues are best handled with the participation of all concerned citizens.
- The polluter should, in principle, bear the cost of pollution.
- Sustainable development requires better scientific understanding of the problems. Nations should share knowledge and technologies to achieve the goal of sustainability.

http://www.sustainable-environment.org.uk/Action/Rio_Declaration.php

Follow-up Mechanisms

- Commission on Sustainable Development
- Inter-agency Committee on Sustainable Development
- High-level Advisory Board on Sustainable Development

http://www.un.org/geninfo/bp/enviro.html

After Rio

- "Rio+5", Earth Summit+5 in 1997
- "Rio+10", World Summit on Sustainable Development in Johannesburg in 2002
- "Rio+20", the United Nations Conference on Sustainable Development in 2012.

Further Reading…

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From Human-Environment Interaction to Environmental Informatics (II): the Sustainability evolution as requirement of Knowledge-based Society

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https://www.researchgate.net/publication/326015946_From_Human-Environment_Interaction_to_Environmental_Informatics_II_the_Sustainability_evolution_as_requirement_of_Knowledge-based_Society