

# **2006 WMO/UNEP *Scientific Assessment of Ozone Depletion* and CCSP Product 2.4: Ozone-Depleting Substances**

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*Two separate parts to the talk:*

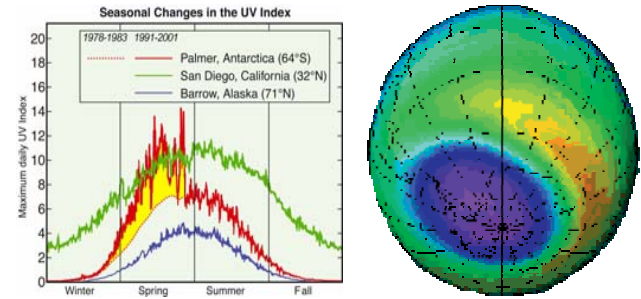
- **The WMO/UNEP ozone assessment.**
- **The Development of CCSP Product 2.4 based on available International assessments.**

QuickTime™ and a  
TIFF (Uncompressed) decompressor  
are needed to see this picture.

# What are the major issues?

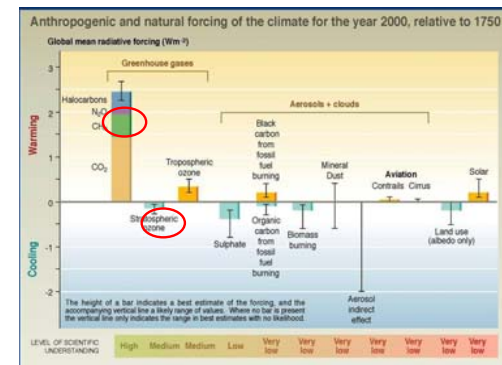
## 1. Stratospheric ozone is a UV-shield:

- Its depletion will increase surface UV, with consequences to health and composition of troposphere.
  - This is not a theory to be tested - it is reality!
  - O<sub>3</sub> hole, trends in O<sub>3</sub> abundance, etc.: need predictions.



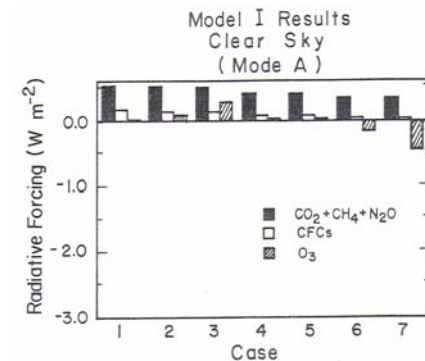
## 2. Stratospheric ozone is an important “climate gas”:

- Its changes influence earth’s climate (circulation, temperatures and composition.)



## 3. Ozone-depleting substances and the substitutes for ODSs (even non-ozone-depleting ones) are also “climate gases”:

- What is the net influence of changing stratospheric O<sub>3</sub> and CFCs simultaneously?
- What are the impacts of substitutes, CFCs, etc.?

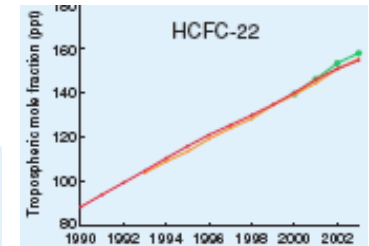
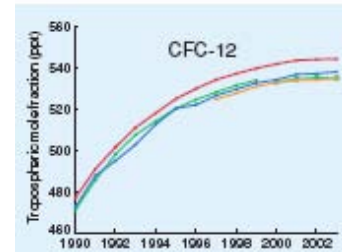


# Major issues, continued

## 4. Accountability phase of Montreal Protocol:

Now that we have phased out CFCs,

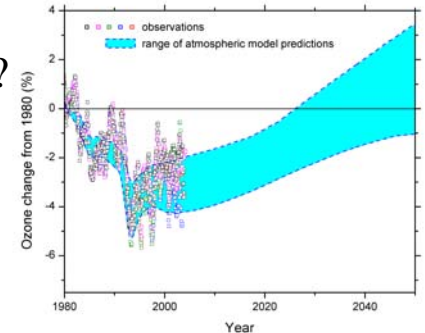
- Are CFCs decreasing in the lower atmosphere?
- Are Halogens decreasing in the Stratosphere?
- Are the ozone-depleting components decreasing in the stratosphere?
- Is stratospheric ozone recovering?  
When will it be back to “normal”?



## 5. Climate is changing as we look for $\Delta O_3$ :

What is the influence of climate and its changes on ozone changes?

- How will this help/hinder the “recovery” of global stratospheric  $O_3$ ?
- How will this help/hinder the “recovery” of polar ozone depletion?



## 6. What are the influences of other compositional changes on stratospheric $O_3$ ?

e.g.,  $\Delta CH_4$ ,  $\Delta N_2O$ , ...

## 7. Are our methods for developing good substitutes working well?

e.g., are the very short-lived compounds OK?

**Stratospheric  $\Delta O_3$  is a key part of global climate change – both influence and impact.**

# WMO/UNEP 2006 Ozone Assessment

## There have been many previous assessments:

- Each builds on the previous one – 8 assessments since 1981.

## Reference what's new since the 2002 assessment:

- The “this is an update” message from the previous assessments.

## Chapter structure and length:

- Easy-to-find information.
- Shorter than the previous assessment.

## The Montreal Protocol Parties' interests for the 2006 assessment:

- Observed trends in ODS and their consistency with reported production;
- Ozone-depleting impacts of new (e.g., short-lived) halogen-containing substances;
- Methyl bromide sources and sinks & implications for the ozone layer;
- Relations between ozone depletion and climate change, including feedbacks;
- Changes in global and polar ozone and ultraviolet radiation;
- Future projections and scenarios for ozone & UV (climate impact?)

# A Little Context:

## The International Assessment Process

- What the assessments are:
  - > State of science: What we know & what we don't, framed in policy-useful terms.
  - > Scientific documents, prepared & reviewed by the expert communities (scientists).
  - > Assessed viewpoints, not reviews.
  - > “One-stop shopping”:
    - > Science of the ozone layer
    - > Impacts of ozone change
    - > Technology/economics of options
  - > Well-identified “customers”:
    - > Governments, via the Montreal Protocol
    - > Industry
    - > Public
    - > Scientific community
- What the assessments are not:
  - > They don't make policy recommendations.
  - > They are not research-planning documents, nor do they “push” research projects or needs.  
(They do identify gaps in information that may limit informed decision-making.)
  - > No one assessment report is the “final word”.  
(Both policy and research are endeavors that interact over the years.)

# Description: WMO/UNEP Assessment of Stratospheric Ozone Depletion 2006



## Cochairs

Ayité-Lô Ajavon (Togo);  
Daniel L. Albritton (USA)  
Robert T. Watson (USA)

## Steering Committee

Marie-Lise Chanin (France);  
Susana Diaz (Argentina);  
John Pyle (UK);  
A. R. Ravishankara (USA);  
Theodore Shepherd (Canada)

## CHAPTERS

### Section I

- Chapter 1: Long-Lived Compounds (*Cathy Clerbaux and Derek Cunnold*)
- Chapter 2: Very Short-Lived Halogenated Compounds (*Kathy Law and Bill Sturges*)

### Section II

- Chapter 3: Global Ozone: Past and Present (*Martyn Chipperfield and Vitali Fioletov*)
- Chapter 4: Polar Ozone: Past and Present (*Paul Newman and Markus Rex*)

### Section III

- Chapter 5: Climate-Ozone Connections (*Mark Baldwin and Martin Dameris*)
- Chapter 6: The Ozone Layer in the 21st Century (*Greg Bodeker and Darryn Waugh*)
- Chapter 7: Surface UV Radiation: Past, Present, and Future (*Alkis Bais and Daniel Lubin*)
- Chapter 8: Projections and Impacts (*John Daniel and Guus Velders*)

# Some of the key “new” emphases for the 2006 assessment

- **Influence of climate change on stratospheric changes to date and in the future.**
- **Influence of changes in the stratospheric ozone on climate – in the past and future.**

## Multiple issues impact future ozone:

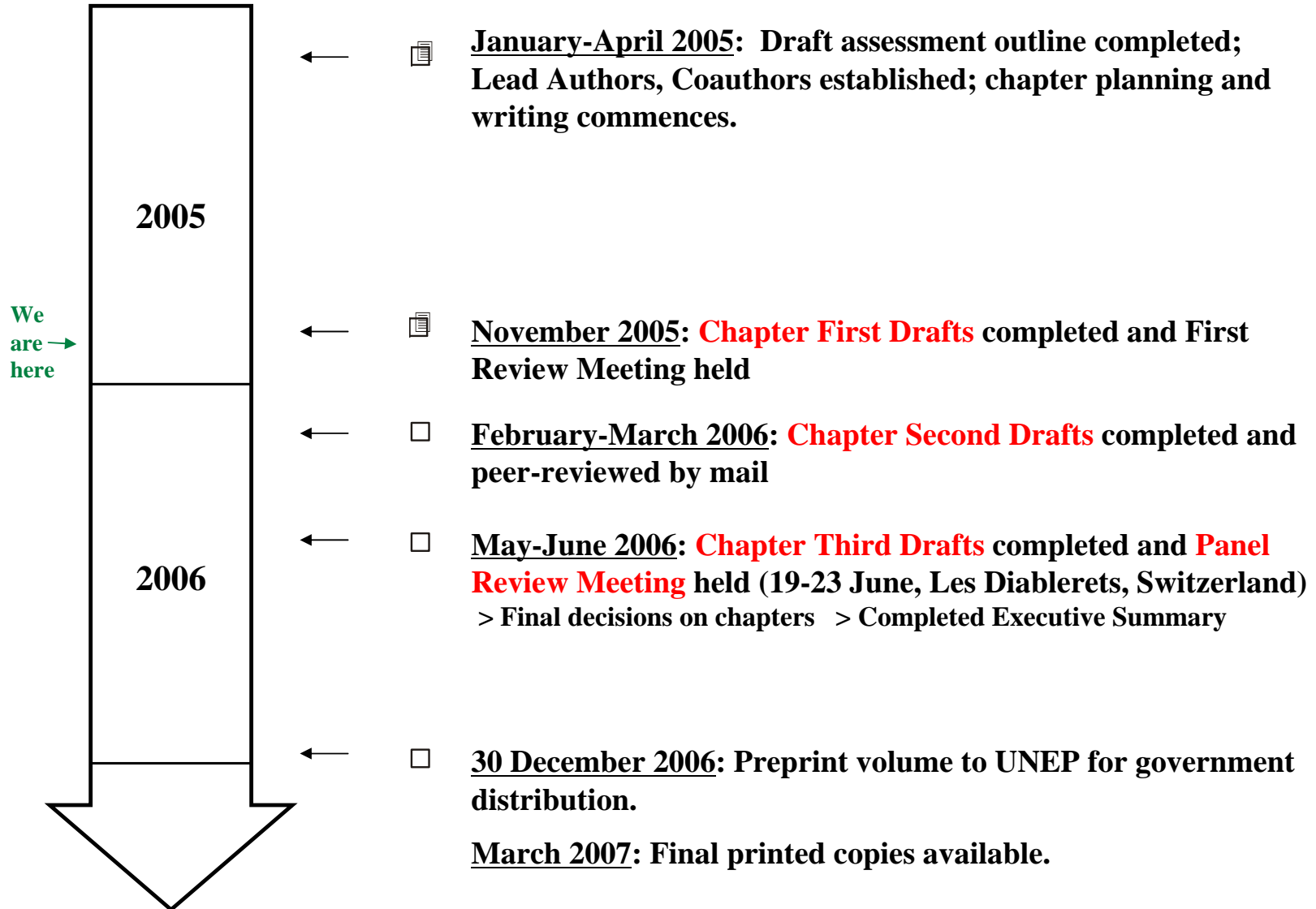
- > Ozone Depleting Substances –  
Montreal Protocol... Implications... Future Decisions? } **A longstanding issue...  
Previous assessments.**
- > **Climate Change** –  
natural and anthropogenic... GHGs... temperature, transport, H<sub>2</sub>O,... → **Stand-alone  
chapter(s) on  
this issue.**
- > Other compositional changes –  
(due to climate change or other reasons)

## Some of the key questions for this assessment

- **How are the stratospheric ozone abundances and distributions changed in a changed future climate?**
- **What is the interplay between changes in ODS and changes in climate?**
- **How does the changing composition and changing climate influence the stratospheric ozone levels in the future?**



# Overall Timetable & Major Milestones



# The Context for CCSP Product 2.4

## Stratospheric ozone is a global and multifaceted issue:

- >  $\Delta$  UV
- >  $\Delta$  Climate
- >  $\Delta$  Tropospheric composition

## International assessments provide one “scientifically vetted”, universally-accepted, way to assess the state-of-understanding in this area.

- \_\_\_> There are (will be) multiple recent assessments available to draw upon:
  - IPCC/TEAP “Special Report on Ozone and Climate (SROC; 2005)
  - WMO/UNEP O<sub>3</sub> Assessment (final copies in early 2007)
  - IPCC Fourth Assessment Report (2007)

These are the assessments to which we have contributed science and assessment efforts!



**Use the findings from assessments to figure out what is implied: S&AP 2.4**

# SAFEGUARDING THE OZONE LAYER AND THE GLOBAL CLIMATE SYSTEM

Issues Related to Hydrofluorocarbons  
and Perfluorocarbons



Intergovernmental Panel on Climate Change  
Technology and Economic Assessment Panel



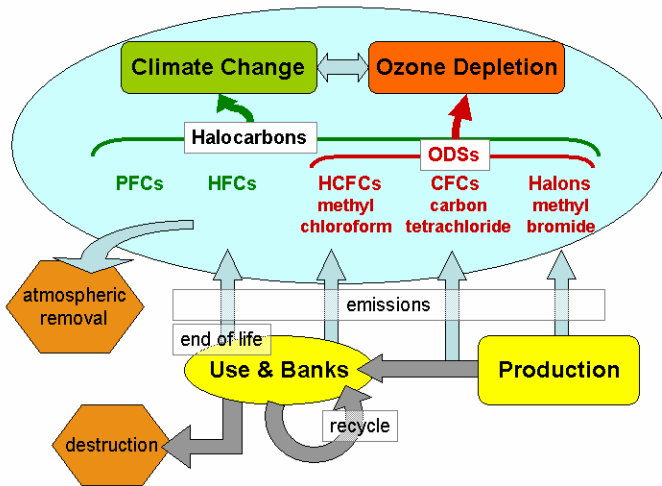
Thanks to Susan Solomon for  
the information and slides.

IPCC (2005)  
Joint IPCC  
WG1/WG3/TEAP  
Special Report  
published in 2005.

Provides information on  
some key issues:

- > Banking
- > Combined effects of  
ODS and their  $\Delta O_3$ .

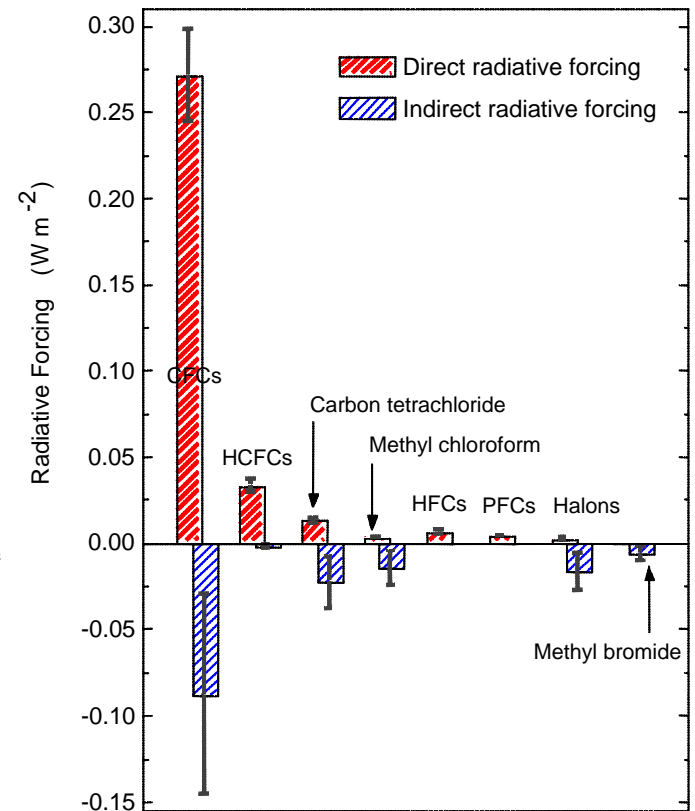
# Examples of some key findings from SROC



- Banking of ODSs is a major issue.
- What are its manifestations and consequences?

- Different types of gases make different contributions to positive and negative forcing.

- > Positive direct forcing due to ODSs only:  $0.32 \pm 0.03 \text{ W/m}^2$ .
- > Negative indirect forcing due to ozone depletion:  $-0.15 \pm 0.10 \text{ W/m}^2$ .

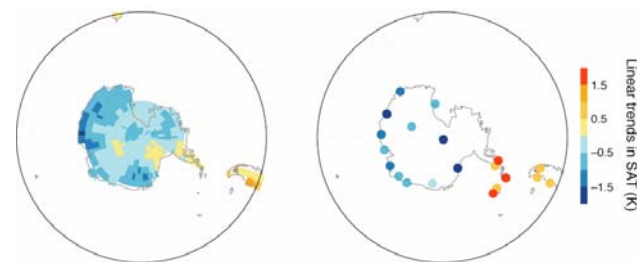
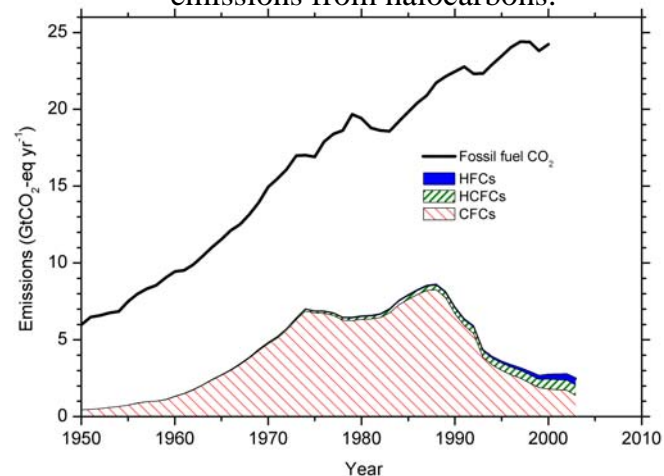


# A few key findings from SROC report, continued

- The fraction of “CO<sub>2</sub>-equivalent emissions” from ODSs is decreasing.
  - ~7.5 Gt near 1990, about 33% of that year's CO<sub>2</sub> emissions from global fossil fuel burning.
  - ~2.5 Gt near 2000, about 10% of that year's CO<sub>2</sub> emissions from global fossil fuel burning.

- Cooling due to ozone depletion and warming due to greenhouse effects of ODSs may not occur in the same places and times.

Combined CO<sub>2</sub>-equivalent emissions from halocarbons:



## What the WMO/UNEP 2006 report will provide

- An assessment of the ODSs in the current and future stratosphere.
- The expected levels of stratospheric ozone in the 21st century
- An assessment of the impact of changes in climate on the future of the ozone layer.
- An evaluation of the substitutes for ozone depleting gases and their impact on the radiative forcing of the atmosphere.
- The efficacy of using short-lived substitutes for ODSs.

# IPCC 2007 Climate Change Assessment

- A broad report that addresses the science of climate change.
- The assessment will place the stratospheric ozone changes in the broad context of climate change.
- Expected to be available in 2007.

## CCSP S&A Product 2.4: Stratospheric ozone – A plan

- Prospectus: scope and details of the product- under development.
- Assemble a collection of Federal Scientists to “crystallize” the findings of the 3 International reports (SROC, WMO/UNEP 2006, and IPCC 2007) in policy-relevant terms and in the context of U.S. needs.
- Write report (mid-2007).
- Review as a CCSP product (end of 2007).
- Publish as a CCSP product (early 2008).



*A good example of how we can take advantage of the international assessments (for which we contribute science and assessment time!) for our needs.*