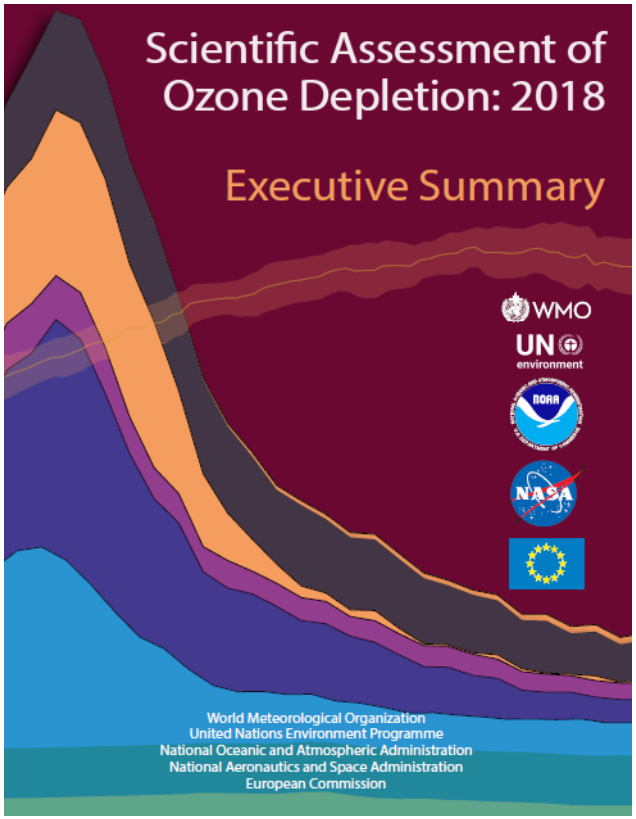
The 2018 WMO/UNEP Scientific Assessment of Ozone Depletion

Co-chairs:
David Fahey
Paul A. Newman
John Pyle
Bonfils Safari

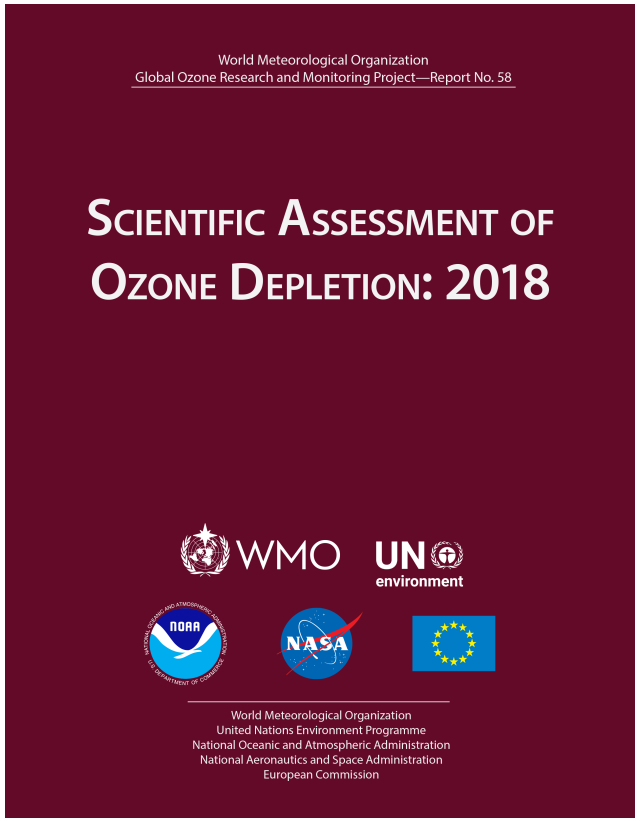
Scientific Steering Committee:
Co-chairs +
Martyn Chipperfield
David Karoly
Doug Kinnison
Malcolm Ko
Michelle Santee

Coordinator:
Sarah Doherty

Executive Summary (67 pgs)
(released 5 November 2018)



Chapter Volume (588 pgs)
(released 4 February 2019)



Printed copies available in Bangkok

Scientific Assessment of Ozone Depletion: 2018

Topics

Chapter 1: Ozone-Depleting Substances

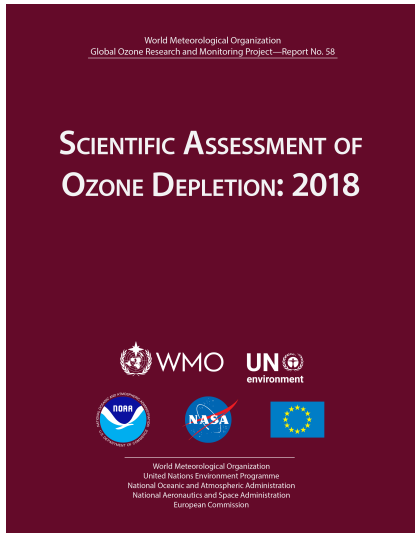
Chapter 2: Hydrofluorocarbons

Chapter 3: Global stratospheric ozone: Past, present & future

Chapter 4: Polar stratospheric ozone: Past, present & future

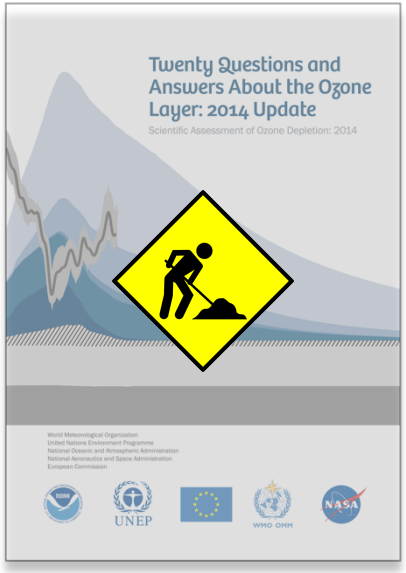
Chapter 5: Stratospheric ozone changes and climate

Chapter 6: Scenarios and Information for Policymakers



20 Questions and Answers about the Ozone Layer: 2018 Update

Expected Fall 2019 (31st MOP)



Executive Summary Highlights

1. Actions taken under the Montreal Protocol have led to decreases in the atmospheric abundance of controlled ozone-depleting substances (ODSs) and the start of the recovery of stratospheric ozone.

2. The Kigali Amendment is projected to reduce future global average warming in 2100 due to hydrofluorocarbons (HFCs) from a baseline of 0.3–0.5 degC to less than 0.1 degC.

3. There has been an unexpected increase in global total emissions of CFC-11.

4. Sources of significant carbon tetrachloride emissions, some previously unrecognised, have been quantified.

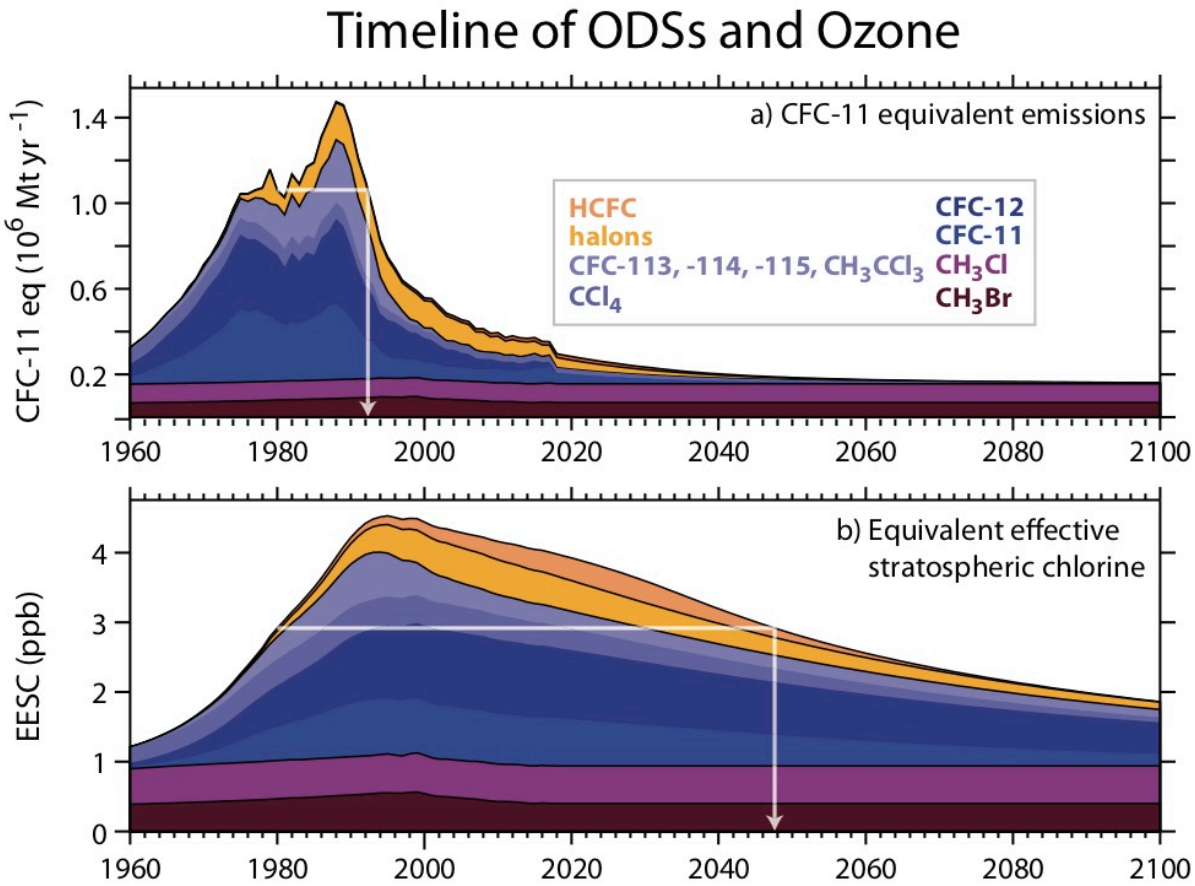
5. Continued success of the Montreal Protocol in protecting stratospheric ozone depends on continued compliance with the Protocol.

Summary Highlights

ODS emissions and concentrations

- Total emissions of ODSs continue to decline

- Atmospheric chlorine and bromine levels continue to decline

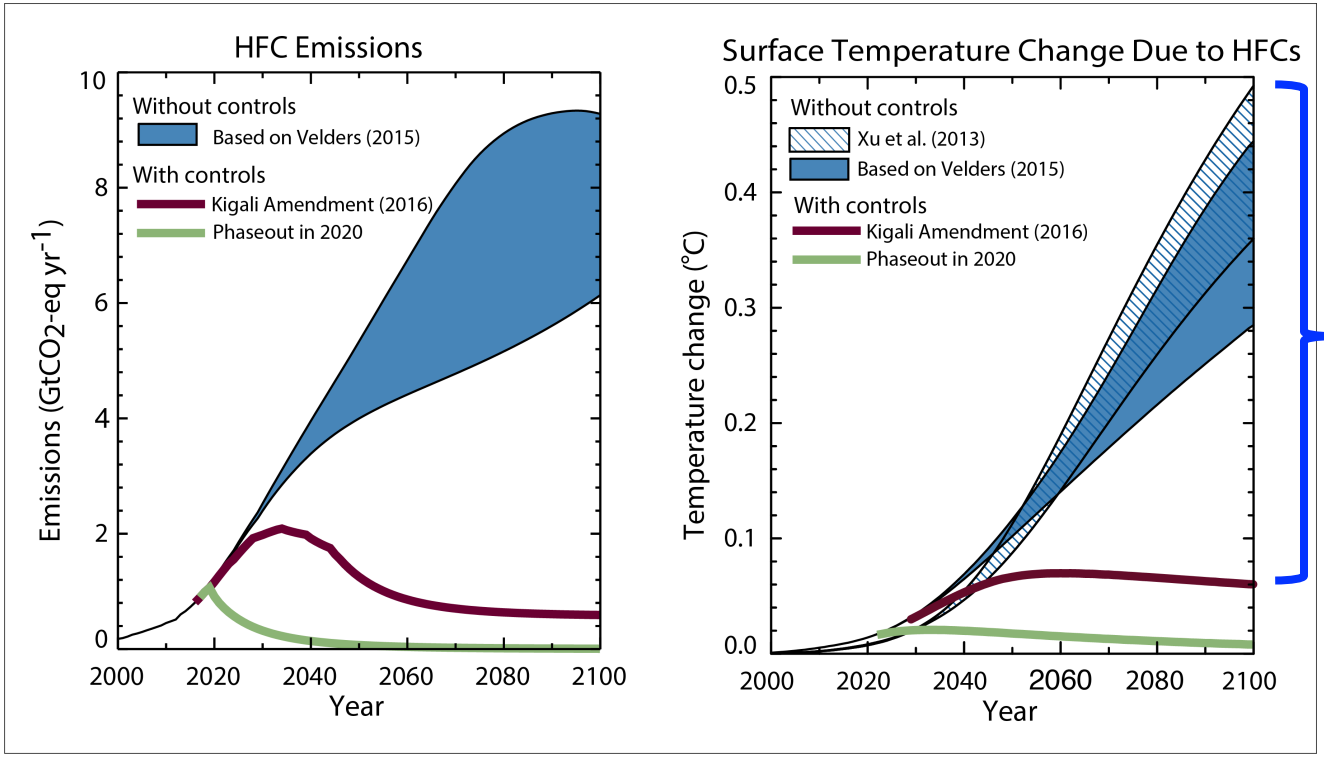


- *Unreported emissions of CFC-11 do not yet change these conclusions because stratospheric total chlorine has been increased by 0.5%.*

Figure ES-1

Summary Highlights

Impact of the Kigali Amendment



Avoidance of 0.2 to 0.4˚C

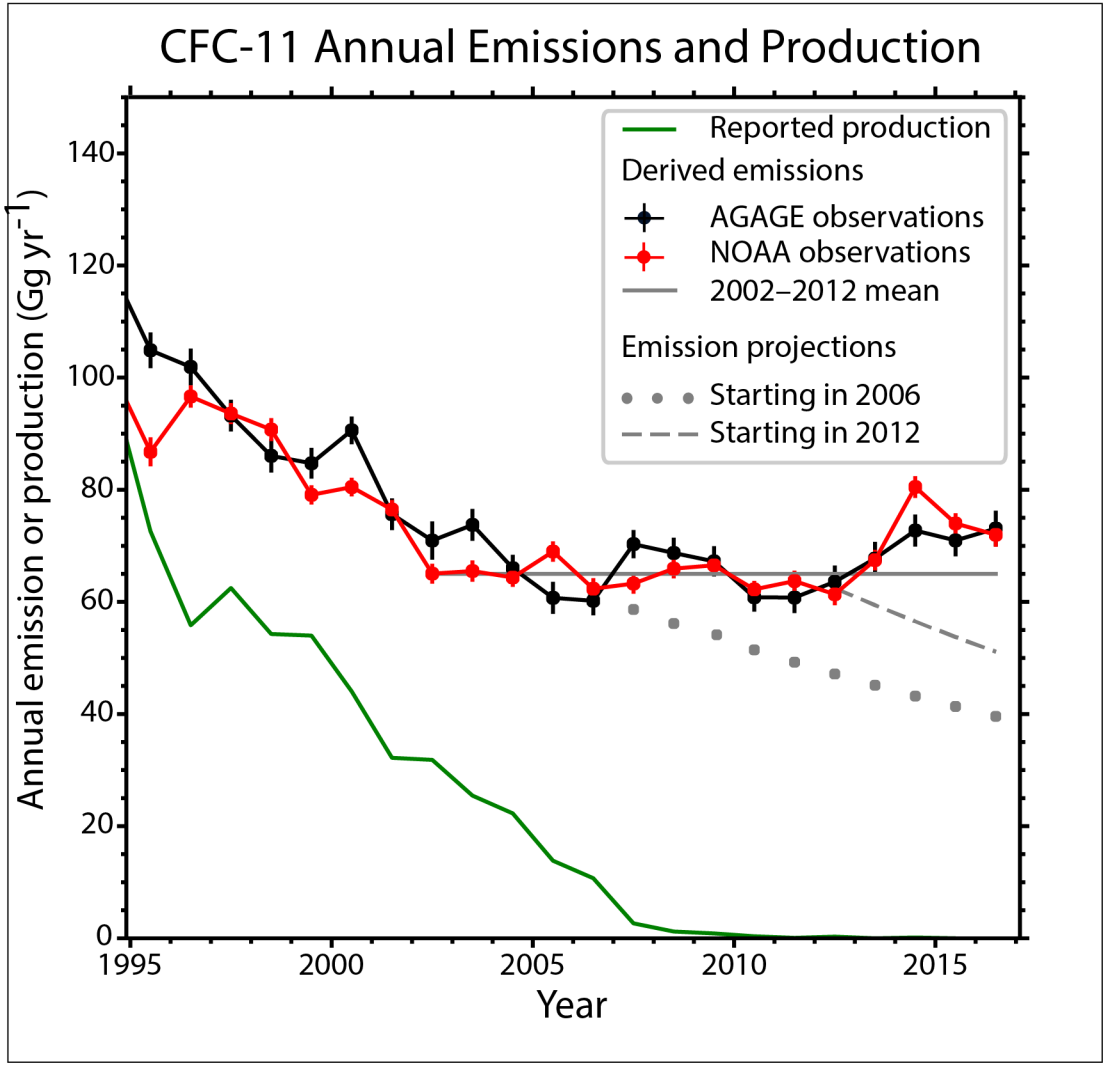
2020 Phaseout avoids an additional ~ 0.06 degC.

- The Kigali Amendment is projected to reduce future global average warming in 2100 due to HFCs from a baseline of 0.3–0.5˚C to less than 0.1˚C

Figure ES-4

Summary Highlights

Unexpected increase in global total emissions of CFC-11



- **CFC-11 global emissions** derived from AGAGE (**black**) and NOAA (**red**) network measurements and a model using a CFC-11 lifetime of 52 years.
- Production history reported to UN Environment for all uses (**green**), the average of annual emissions over the 2002 – 2012 period (**grey line**), and scenario projections through 2006 or 2012 (**dotted and dashed grey lines**).

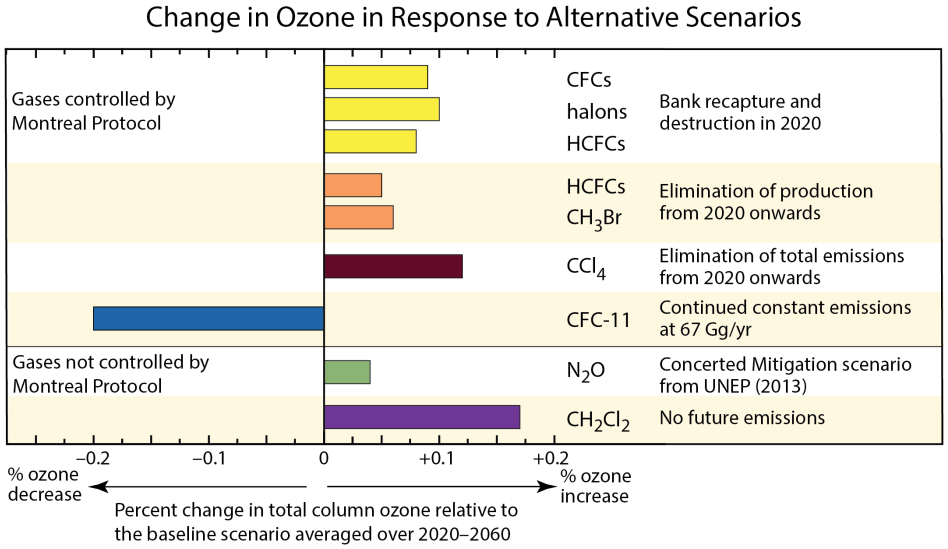
Figure ES-2

Summary Highlights

Policy Options

- Options available to hasten the recovery of the ozone layer are limited, mostly because actions that could help significantly have already been taken.
- Remaining options would individually lead to small-to-modest ozone benefits.
- Largest potential changes to ozone and climate emissions come from CFC-11, CH_2Cl_2, HFCs, and N_2O changes .

See also Table 6-5



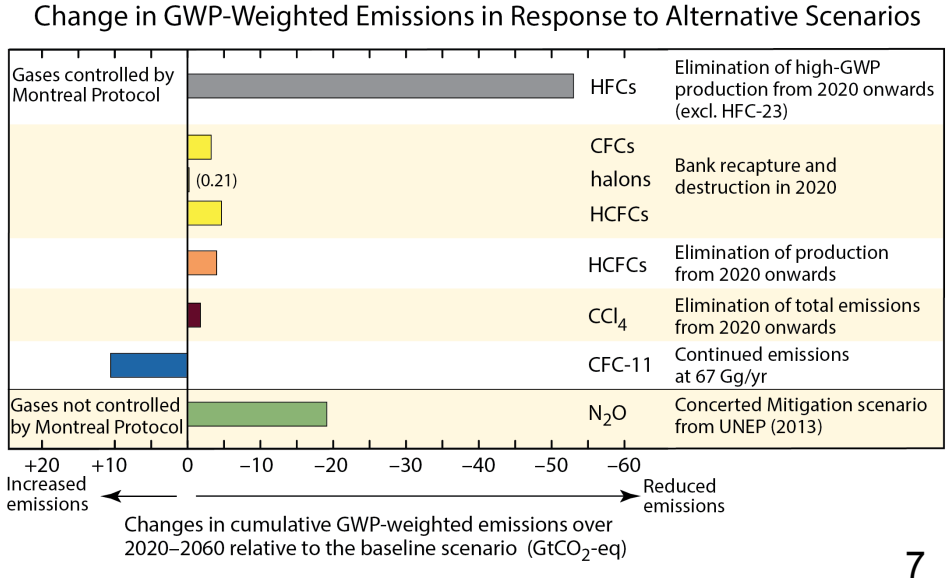


Figure ES-9

2022 Ozone Assessment: Potential areas of focus

General topics

- Distribution and trends in ODSs and stratospheric ozone
- Changes in the Antarctic ozone hole
- Changes in ozone recovery dates
- Updates on the connections between stratospheric ozone and climate change
- Updates on policy options

Specific areas of focus

1. Interpretation of continued CFC-11 observations for global and regional emissions
2. Interpretation of continued HFC and HCFC observations for global and regional emissions
3. Interpretation of continued very short-lived substances (VSLS) observations to derive anthropogenic global and regional emissions (e.g., DCM)
4. Trends and variability in methyl bromide (CH_3Br) concentrations and emissions
5. Trends in minor CFCs (e.g., CFC-114a and CFC-115) and other ultra trace substances
6. New information about the budget of carbon tetrachloride (CCl_4)
7. Potential impact on stratospheric ozone from solar radiation management (SRM) proposals/scenarios and other sources (e.g., rockets, supersonic transport)

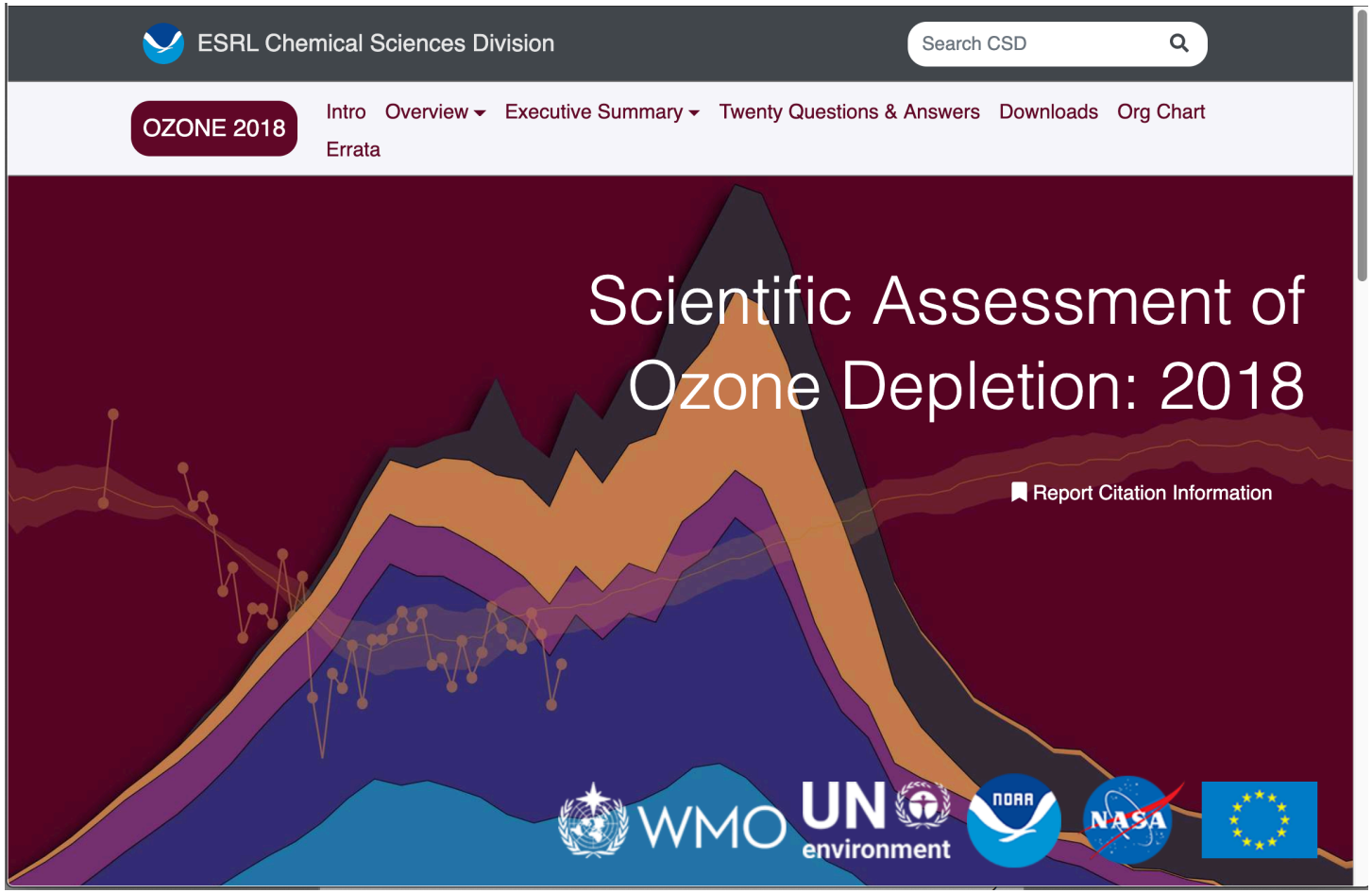
Solar Radiation Management (SRM) in the stratosphere

Solar radiation management = type of geoengineering or climate intervention = deliberate change in global radiative forcing to mitigate climate change

- Intentional long-term geoengineering applications that substantially increase stratospheric aerosols (*i.e., stratospheric SRM*) to mitigate global warming by reflecting sunlight would alter the stratospheric ozone layer.
- The estimated magnitude and even the sign of ozone changes in some regions are uncertain because of the high sensitivity to variables such as the amount, altitude, geographic location, type of injection and the halogen loading.
- An [long-term] increase of the stratospheric sulfate aerosol burden in amounts sufficient to substantially reduce global radiative forcing would delay the recovery of the Antarctic ozone hole.
- Much less is known about the effects on ozone from geoengineering solutions using non-sulfate aerosols.

Executive Summary, p. ES-32 and Chapter 6

2018 Ozone Assessment Website



https://www.esrl.noaa.gov/csd/assessments/ozone/2018/

Google: *noaa 2018 ozone*

Final Comments

• The SAP Co-Chairs are grateful for the participation and cooperation of the international science community that produced the 2018 Assessment documents.

• We look forward to important challenges in conducting the 2022 assessment.

Thank you for your attention