Reducing tropospheric ozone with methane controls:

Impact on Arctic radiative forcing

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Projected changes in tropospheric $O_3$ burden by 2030

Stevenson et al., JGR, 2006

Multi-model mean 2000 burden is 344±39 Tg
CLE scenario: Changes in emissions and O₃ burden

Anthropogenic emission changes in CLE (2030-2005):

CH₄ +29% (+96 Tg CH₄ yr⁻¹)  NOₓ +19% (+5.3 Tg N yr⁻¹)
CO  -10% (-44 Tg CO yr⁻¹)   VOC  +3% (+3 Tg C yr⁻¹)

2005 to 2030 transient simulations in MOZART-2 CTM [Horowitz et al., 2003]
2000-2004 NCEP meteorology; 1.9°x1.9°; 28 vertical levels

ANNUAL MEAN TROPOSPHERIC O₃ COLUMNS (DU)

31 DU
340 Tg O₃
global burden

+1DU increase
in Arctic

increase from
2005 to 2030:
+1.6 DU
+18 Tg O₃
Arctic O₃ columns highest in winter and spring; Radiative forcing largest spring and summer
Apply methane controls relative to CLE baseline scenario

Anthropogenic CH$_4$ Emissions (Tg yr$^{-1}$)

Control scenarios reduce 2030 emissions relative to CLE by:
A) -75 Tg (18%)
B) -125 Tg (29%)
C) -180 Tg (42%)

+ 2030 simulation with CH$_4$ set to 700 ppb pre-industrial level
Methane controls reduce global radiative forcing

Radiative Forcing in 2030 relative to CLE 2030

Methane control scenarios:
- A
- B
- C
- Zero

Radiative forcing:
- Ozone
- Methane

Values:
- Ozone: -0.08, -0.16, -0.24, -0.75
- Methane: -0.08, -0.16, -0.24, -0.75

SCENARIO B – CLE BASE 2030
CHANGE IN TROP O$_3$ COLUMNS

TUROPOSPHERIC OZONE FORCING

DU mW m$^{-2}$
Methane Controls: Impact on Arctic O₃ radiative forcing

SCENARIO B

MAM

JJA

ZERO ANTHROP. CH₄

-19 mW m⁻²

-21 mW m⁻²

-86 mW m⁻²

-97 mW m⁻²
TF HTAP multi-model assessment: The Arctic as a receptor region?

Co-Chairs: Terry Keating (U.S. EPA), André Zuber (EC)
www.htap.org

Intercontinental Source-Receptor Regions

http://aqm.jrc.it/HTAP

20% decreases in anthrop. emissions in HTAP regions:
- NO$_x$, CO, NMVOC
- aerosols and precursors
- mercury
- POPs
Also 20% decrease in global CH$_4$ concentration

~ 13 modeling groups have already delivered results for Experiment 1

◊ Opportunity to assess impact of several species from major NH source regions on the Arctic in a consistent way across models
Summary: Impact of methane controls on Arctic ozone radiative forcing

Annual mean changes in the Arctic from 2005 to 2030

TROPOSPHERIC OZONE COLUMN (DU)

OZONE RADIATIVE FORCING (mW m⁻²)

Additional decrease in radiative forcing from lower CH₄ abundances

INCREASING METHANE CONTROL ♦