Ozone depletion, climate change, and policy

John S. Daniel

How has CSD informed policy discussions associated with the Montreal Protocol? A focus on my involvement

- Provided the first ozone depletion potential (ODP) estimate for N_2O
- Developed new scenarios for HFCs (hydrofluorocarbons)
- Coordinating lead author of Chapter 5 (WMO, 2007, 2011)
- Participation in "policy" chapter of six ozone assessments (1995, 1999, 2003, 2007, 2011, 2015); contributing author (IPCC, 1995, 2001, 2013)
- Calculated future CFC (and other ozone-depleting substance (ODS)) projections (Chapter 5, WMO, 2015), with an analysis of mitigation impacts on ozone depletion (Daniel et al., 2010)
- Contributed ODS information to RCP scenarios used in IPCC AR5 and elsewhere (Meinshausen et al., 2011)
- Developed approach for determining ODPs of short-lived species (Brioude et al., 2010)

Image from NASA

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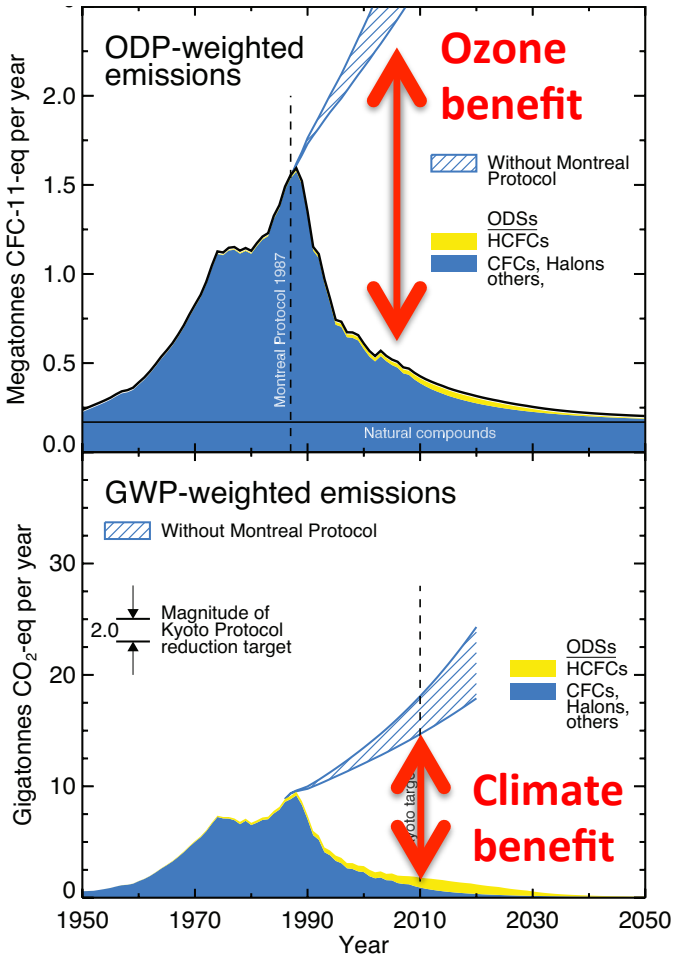
Image from NASA

Success of Montreal Protocol: A Changing Landscape



Adapted from Velders et al., 2007

- The Montreal Protocol yielded substantial ozone and climate co-benefits

- Reduction of long-lived ozone-depleting substance (ODS) emissions implies other emissions are relatively more important if there remains a desire to accelerate ozone recovery (e.g., N_2O)

- Inability to use ODSs in the future implies alternatives must be found for products such as air conditioning, refrigeration, foams, and others (e.g., HFC implications)

Two Examples of High Impact Research

Nitrous oxide (N_2O): The dominant ozone-depleting substance emitted in the 21st century

Ravishankara, A.R., J.S. Daniel, and R.W. Portmann

Science, 2009

- first time an Ozone Depletion Potential (ODP) was calculated for N_2O
- allowed for a direct comparison of ozone-relevant N_2O emission with that of other ozone-depleting substances
- ODPs are widely understood

The large contribution of projected HFC emissions to future climate forcing

G.J.M. Velders, D.W. Fahey, J.S. Daniel, M. McFarland, S.O. Andersen

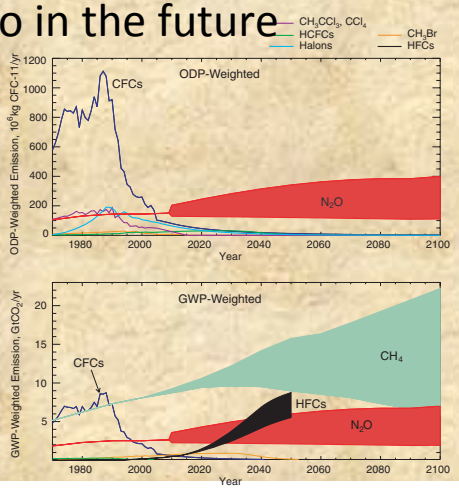
PNAS (Proceedings of the National Academy of Sciences), 2009

- worked with partners in industry, EPA, and academia to estimate future demand for refrigeration, A/C, foams, etc.
- built on knowledge of current regulations and controls to project future HFC emissions
- evaluate potential future climate impacts

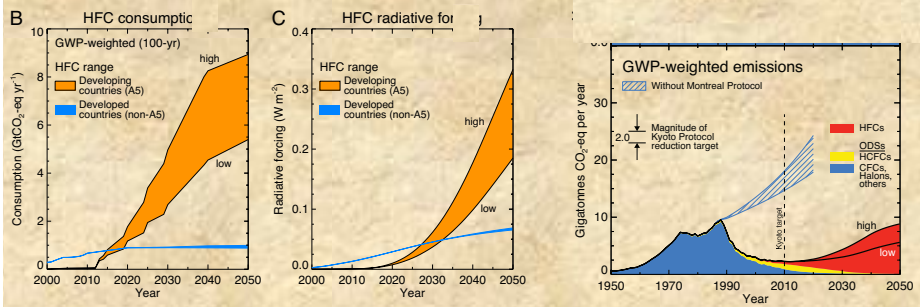
CSD Author

What Did We Find?

- N_2O is currently the largest ODP-weighted emission, and is expected to remain so in the future

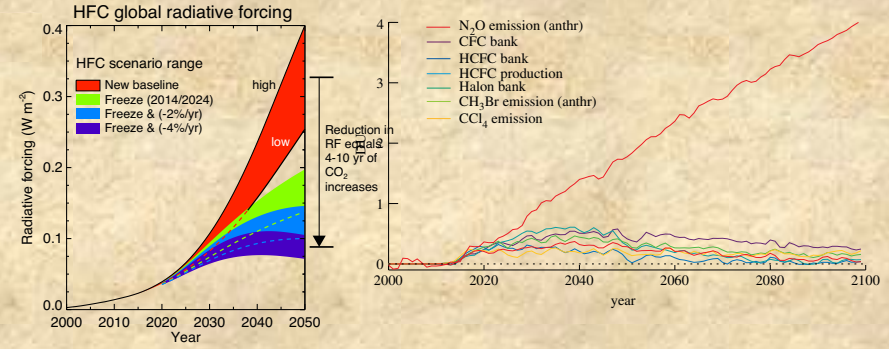


- Without policy intervention, HFCs could negate a significant amount of the future climate benefits projected to arise from the Montreal Protocol controls



Informing Policy More Directly

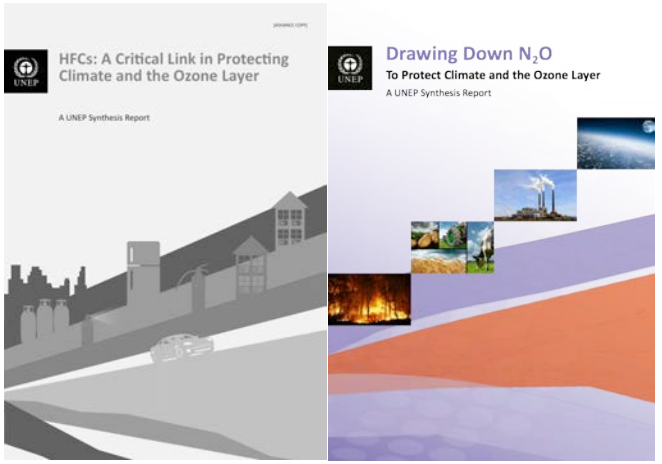
- Provide assessment of mitigation options
- Instrumental in motivating and informing policy discussions involving controlling HFCs under the Montreal Protocol



Science to "Actionable" Information

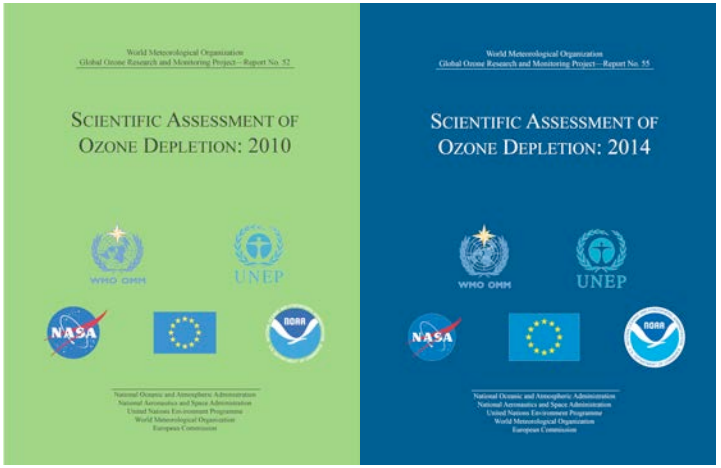
Special UNEP Reports

- CSD role in leadership/authorship
- International collaborators
- Informs international discussions/policy



International Assessments

- Strong CSD presence in both assessments (leadership and authorship)
- Elevated discussions about N_2O and HFCs
- ODS scenarios also informed RCP scenarios, which were used in IPCC AR5, plus elsewhere



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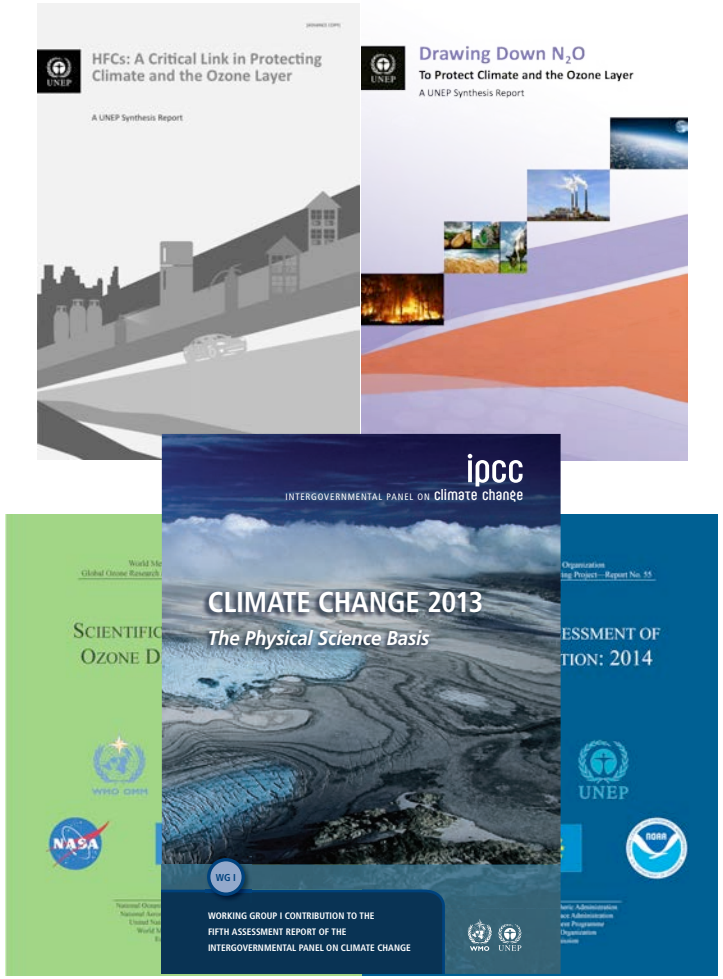

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Future Plans

- Continue providing leadership and scientific input to ozone and climate assessments
- Ensure that future scenarios remain current and relevant for ozone depletion and climate change policy discussions
- Continue to evaluate the policy implications of interactions between ozone depletion and climate change to help identify win-win policy options