

## Curriculum Vitae,

September, 2013

### Personal Data

Name Dr. Simone Tilmes (Kanera)  
Work Address ACD/CGD, National Center for Atmospheric Research  
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### Education Information

- 2004 Ph.D. in Geophysics and Geography, Johann Wolfgang Goethe University, Frankfurt; Germany, Title: “Chemical Ozone Loss in the Arctic Polar Stratosphere Derived from Satellite Observations”
- 1998 M.S. (Diplom) in Geophysics, University of Cologne, Germany, Title: “Calculation of Dry Deposition Using a Mesoscale Chemistry-Transport-Model (EURAD)”
- 1994: Vor-Diplom in Physics and Geophysics, Westfälische Wilhelmsuniversität in Münster, Germany

### Professional Experience

- 2010-present Project Scientist I and Chemistry Climate Liaison, Atmospheric Chemistry Division and Climate and Global Dynamics Division, National Center for Atmospheric Research, Boulder, Colorado
- 2008-2010 Project Scientist I, Atmospheric Chemistry Division, National Center for Atmospheric Research, Boulder, Colorado
- 2006-2008 Postdoctoral fellow, Advanced Study Program, National Center for Atmospheric Research, Boulder, Colorado
- 2005-2006 Postdoctoral fellow, Deutschen Akademie der Naturforscher, Leopoldina, performed at the National Center for Atmospheric Research, Boulder, Colorado, Subject: “Arctic Ozone Loss and Climate Change: Impact of changing environmental conditions on Arctic Ozone Loss – Simulations with the NCAR ROSE Model“
- 2000-2005 PhD student and Postdoctoral fellow, Institute of Stratospheric Research, Jülich, Germany; Subject: “Chemical Ozone Loss in the Arctic and Antarctic Polar Stratosphere”
- 1999 Scientist at the Department for Research and Development of the Deutscher Wetterdienst, Offenbach, Germany; Subject: “Local Photo-Chemistry at the GAW-Station Hohenpeißenberg, Germany”
- 1995-1998 Undergraduate scientific assistant at the EURAD-Project (European Acid Deposition Model, Institute for Geophysics and Meteorology), University of Cologne, Germany

### **Honors/Awards:**

- Nomination of the UCAR Outstanding Publication Award 2009: Tilmes, S., R. Müller, R. Salawitch (2008) The sensitivity of polar ozone depletion to proposed geo-engineering schemes, *Science* **320**, 1201; DOI: 10.1126/science.1153966
- Awarded for the Postdoctoral Appointment of the Advanced Study Program at the National Center for Atmospheric Research, 2006
- Fellow of the Deutschen Akademie der Naturforscher, Leopoldina Halle, Germany, 2005

### **Community Service**

#### **Internal Committees:**

- Chairperson of the Early Career Scientist Assembly, NCAR, July 2010-present
- Co-Chair of the NCAR Scientist Assembly, Nov 2010-April 2013
- Member of the ACD strategic planning working group, 2012
- Member of the Committee on the Status of Women in Physics (CSWP) Ad-Hoc Organizing Committee, March 2009- December 2009
- Advanced Study Program (ASP) representative on Early Career Scientist Assembly committee, July 2007- July 2008
- Co-chair of the ASP informal social committee, June 2007- June 2008
- Committee Member: Woman in science at NCAR

#### **External Committees / Panels:**

- Dissertation committee member from Lili Xia, Rutgers University. First defense: May 5<sup>th</sup>, 2012
- Member of the NASA SEAC4RS Instrument/Measurement Panel, Washington DC, August 23-26, 2011
- Panel member of the Climate Engineering workshop by the U.S. Government Accountability Office (GAO), Keck Center in Washington, D.C., October 6-7, 2010

#### **Workshop Organizer and Professional Meetings:**

- Panel discussions: Talking with Reporters; Talking with Funders, April 2013
- Career Opportunities at NCAR and Beyond, October 2012
- ECSA-WCRP Workshop: Regional Climate Issues in Developing Countries, October 2011
- Co-Convener of the 'Geo-engineering' Session at the EGU, April 2009 and May 2010, April 2011
- Convener of the 'Geo-engineering' Session at the EGU, April 2008

## Professional reviews

### 1. *Funding agencies*

- SNSF (Swiss National Fond)
- National Aeronautics and Space Administration (NASA)
- National Science Foundation (NSF)
- European Research Council (ERC)
- LinkSCEEM/Cy-Tera Production 2013

### 2. *Journals and Assessment Reports*

- CCMVal and WMO ozone assessments
- Atmospheric Chemistry and Physics
- Atmospheric Environment
- Geophysical Research Letters
- Journal of the Atmospheric Sciences
- Journal of Climate
- Journal of Geophysical Research – Atmospheres
- Nature Climate Change
- Quarterly Journal of the Royal Meteorological Society
- Science

## Education and Outreach:

- Chemistry-Climate Liaison Community Support: 2010-present
- Lecturer for the Community Earth System Model (CESM) NCAR, 2012 and 2013, Tutorial on Chemistry, Aerosols, and WACCM, led practical sessions for CAMChem and WACCM
- Lecturer and practical session lead for the CESM Chemistry Tutorial (2011, 2012)
- Presenter for Cafe Scientific: Talk on Geoengineering, May 11, 2010, Millennium Hotel, Boulder, organized by Darin Toohey
- Attendant of the Asilomar Conference on Climate Interventions to discuss guidelines for politics and scientist with regard to geo-engineering/climate intervention activities. March 22-25, 2010 Monterey California
- Presenter at the Environmental Defense Fund Science Day on Geoengineering February 3<sup>rd</sup>, 2010, San Francisco
- Tutorial at LARC, University of Colorado, Boulder, about the tracer-tracer correlation method in polar regions February 13, 2009
- Telephone and Radio interviews and work with the press after the publication of the Geoengineering paper in science express, 2008-09:  
**In the News:** At least 126 media pick-ups including some notable outlets: NPR, the BBC, Washington Post, Sydney Morning Herald, USA Today, Physics Today, European/German newspapers (Tagesspiegel), The Times of India, and the Associated Press and Agence France-Presse wire services. Press coverage of this paper still occurs occasionally.

- Stratospheric Injections to Counter Global Warming Could Damage Ozone Layer (NCAR)
- Staff Notes: A close look at one - geoengineering scheme
- NSF: Windows to the Universe: Injecting Sulfate Particles into Stratosphere Could Have Drastic Impact on Earth's Ozone Layer
- Interviews and press coverage on different papers
- Interviews from Mesa Elementary TAG Student on being a scientist at NCAR
- Interview from Larry Kotch grad student from York about geoengineering
- Interview Farah Khosravi within her scientific journalism training on Geoengineering
- Jury for the Peak to Peak Science Fair, 2007, 2008, 2009 and 2010 and Mesa Elementary school 2010
- May 5<sup>th</sup>, 2007 taking part in the Girls Scout activity

#### **Student and Postdoc support:**

- Student support of Lili Xia, Rutgers University, to setup geoengineering model simulations
- Student support of Arezoo Khodayari, University of Illinois, 2011-2013, on Aviation 2006 NOx-Induced Effects on Atmospheric Ozone and HOx in Community Earth System Model (CESM), 2012/2013
- 2009-2011: Support of PhD Student Braekebusch, who investigated chemical ozone loss using SD-WACCM using a passive ozone technique and tracer-tracer correlations together with Doug Kinnison.
- Summer 2009: Support of Master Student Dalon Stone, Texas University, using SD-WACCM to compare WACCM results and START08 aircraft observations

#### **Professional meetings (invited only):**

- Planning meeting for the Coupled Model Intercomparison Project phase 6 (CMIP6), August 5-9, Apsen, 2013 Apsen, represented GeoMIP overview
- Kick-off meeting of the German Research Foundation (DFG) funded priority program on „Climate Engineering: Risks, Challenges, Opportunities?“, June 3, 2013, Berlin, Germany
- ADAM (Airborne Data for Assessing Models), University of Maryland University College, August 3<sup>rd</sup>, 2010
- March 22-25, 2010: Asilomar Geoengineering Conference in Monterey to discuss guidelines for politics and scientist with regard to geoengineering/climate intervention activities.

#### **Campaigns:**

Co-Investigator of the Stratosphere-Troposphere Analyses of Regional Transport Experiment (START08) aircraft campaign: 04/2008 – 07/2008

## Proposals:

### ROSES-Proposals:

- Understanding Lower Stratospheric Transport and How it Affects the Composition of the Extratropical Lowermost Stratosphere. Principal Investigator (PI): Thomas Birner, Team Member Role: Collaborator (**not funded**) ROSES-2010
- Proposal Title: The Impact of Short Lived Halogen Species on the Troposphere and Stratosphere, Principal Investigator (PI): Douglas Kinnison, Team Member Role: Collaborator, **funded**
- Photochemistry of Atmospheric Ozone, Principal Investigator (PI): Ross Salawitch, Team Member Role: Collaborator, ROSES-2011
- Proposal Title: Bromine and Air Quality, Principal Investigator (PI): Ross Salawitch, Team Member Role: Collaborator, ROSES-2013

### Internal:

- FY11 NCAR Directorate Diversity Fund: WORLS - Seminar Series, **funded**
- FY12 NCAR Directorate Diversity Fund: Education and Measurement of Air Quality in Nigeria, Africa, **not funded**

## Publications:

### Journals:

#### 2002:

1. R. Müller, S. Tilmes, J.-U. Groö, D. S. McKenna, M. Müller, U. Schmidt, G. C. Toon, R. A. Stachnik, J. J. Margitan, J. W. Elkins, J. Arvelius, and J. M. Russell III (2002), Chlorine activation and chemical ozone loss deduced from HALOE and balloon measurements in the Arctic during the winter of 1999-2000, *J. Geophys. Res.*, **107**, 8302, doi:10.1029/2001JD001423, page 1–12

#### 2003:

2. S. Tilmes, R. Müller, J.-U. Groö, D. S. McKenna, J. M. Russell III, and Y. Sasano (2003), Calculation of chemical ozone loss in the Arctic winter 1996-1997 using ozone-tracer correlations: comparison of ILAS and HALOE results, *J. Geophys. Res.*, **108**, 4045, doi:10.1029/2002JD002213, page 1–15
3. S. Tilmes, R. Müller, J.-U. Groö, M. Höpfner, G. C. Toon and J. M. Russell III (2003), Very early chlorine activation and ozone loss in the Arctic winter 2002-2003, *Geophys. Res. Lett.*, **30**, 2200, 10.1029/2003GL018792, page 1–4

#### 2004:

4. S. Tilmes, R. Müller, J.-U. Groö and J. M. Russell III (2004), Ozone loss and chlorine activation in the Arctic Winters 1991–2003 derived with the tracer-tracer correlations, *Atmos. Chem. Phys.*, page 2167-2238

#### 2005:

5. R. Spang, J. J. Remedios, S. Tilmes and M. Riese (2005), MIPAS Observation of Polar Stratospheric Clouds in the Arctic 2002/3 and Antarctic 2003 winters *Adv. Space. Res.*, A1.1-0077-04
6. R. Müller, S. Tilmes, P. Konopka and J.-U. Groö, and H.-J. Jost (2005), Impact of mixing and chemical change on ozone-tracer relations in the polar vortex,

*Atmos. Chem. Phys.*, **5**, doi:1680-7324/acp/2005-5-3139

**2006:**

7. **S. Tilmes**, R. Müller, J.-U. Groöß, R. Spang, T. Sugita, H. Nakajima and Y. Sasano (2006), Chemical ozone loss and related processes in the Antarctic winter 2003 using tracer-tracer correlations *J. Geophys. Res.*, **111**, D11S12, doi:10.1029/2005/2005JD006260
8. M. von Hobe, A. Ulnovsky, C. M. Volk, J. U. Groöß, **S. Tilmes**, P. Konopka, G. Günther, A. Werner, N. Spelten, V. Yushkov, F. Ravegnani, C. Schiller, R. Müller, F. Stroh (2006), Severe ozone depletion in the cold Arctic winter 2004-05, *Geophys. Res. Lett.*, **33**, L17815, doi:10.1029/2006GL026945
9. **S. Tilmes**, R. Müller, A. Engel, M. Rex, J.M. Russell (2006), Chemical ozone loss in the Arctic and Antarctic stratosphere between 1992 and 2005, *Geophys. Res. Lett.*, **33**, L20812, doi:10.1029/2006GL026925
10. **S. Tilmes**, R. Müller, J.-U. Groöß and H. Nakajima, Y. Sasano (2006), Development of chemical ozone loss during the setup phase of the polar vortex, *J. Geophys. Res.*, D11S12, doi:10.1029/2005JD006726

**2007:**

11. P. E. Huck, **S. Tilmes**, G. E. Bodeker, W. J. Randel, A. J. McDonald, An improved measure for ozone depletion in the Antarctic stratosphere, (2007), *J. Geophys. Res.*, **112**, D1110, doi:10.1029/2006/2006JD007860
12. **S. Tilmes**, D. E. Kinnison, R. R. Garcia, R. Müller, F. Sassi, B. Boville, Evaluation of Heterogeneous Processes in the Polar Lower Stratosphere in WACCM3 (2007), *J. Geophys. Res.*, **112**, D23307, doi:10.1029/2006JD008315
13. R. Müller, **S. Tilmes**, J.-U. Groöß, A. Engel, H. Oelhaf, G. Wetzell, Nathalie Huret, Michel Pirre, Valery Catoire, Geoff Toon, Hideaki Nakajima (2007), Impact of mesospheric intrusions on ozone-tracer relations in the stratospheric polar vortex, *J. Geophys. Res.*, **112**, D23307, doi:10.1029/2006JD008315

**2008:**

14. **S. Tilmes**, R. Müller, R. Salawitch, U. Schmidt, C. Webster, H. Oelhaf, J. Russell III (2008), Chemical ozone loss in the Arctic winter 1991-92, *Atmos. Chem. Phys.*, **8**, 1963-1983
15. **S. Tilmes**, R. Müller, R. Salawitch (2008), The sensitivity of polar ozone depletion to proposed Geo-engineering schemes, *Science*, **320**, 1201-1205
16. R. Müller and **S. Tilmes** (2008), Comment on “Middle atmosphere CO, N<sub>2</sub>O, HNO<sub>3</sub>, and temperature profiles during the warm Arctic winter 2001–2002” by G. Muscari et al., *J. Geophys. Res.*, **113**, doi:10.1029/2007/JD009709
17. P. J. Rasch, **S. Tilmes**, R. P. Turco, A. Robock, L. Oman, C.-C. Chen, G. L. Stenchikov (2008), An Overview of Geo-engineering of Climate using Stratospheric Sulfate Aerosols, *Philosophical Transactions of the Royal Society A*, **366**

**2009:**

18. **S. Tilmes**, R. R. Garcia, D. E. Kinnison, A. Gettelman, P. J. Rasch (2009), Impact of Geo-engineered Aerosols on the Troposphere and Stratosphere, *J. Geophys. Res.*, **114**, doi:10.1029/2008JD011420

**2010:**

19. **S. Tilmes**, L. Pan, P. Hoor, G. W. Sachse, M. Loewenstein, J. Lopez, C. Webster,

- L. E. Cristensen, M. Proffitt, R.-S. Gao, G. S. Diskin, M. A. Avery, J. R. Podolske, R. L. Herman, N. Spelten, A. Weinheimer, T. Campus, E. J. Hints, E. M. Weinstock, J. Pittman, M. A. Zondl, M. E. Paige, E. Atlas, 2010: An Aircraft based Upper Troposphere Lower Stratosphere O<sub>3</sub>, CO and H<sub>2</sub>O Climatology for the Northern Hemisphere, *J. Geophys. Res.*, **115**, D14303, doi: 10.1029/2009JD012731
20. Hegglin, M., A. Gettelman, P. Hoor, R. Krichevsky, G. L. Manney, L. L. Pan, S.-W. Son, G. Stiller, **S. Tilmes**, K. A. Walker, V. Eyring, T. G. Shepherd, D. Waugh, H. Akiyoshi, J. Austin, A. Baumgaertner, S. Bekki, P. Braesicke, C. Bruhl, N. Butchart, M. Chipperfield, M. Dameris, S. Dhoms, S. Frith, H. Garn, S. C. Hardiman, P. Jockel, D. E. Kinnison, J. F. Lamarque, E. Mancini, M. Michou, O. Morgenstern, T. Nakamura, D. Oliviere, S. Pawson, G. Pitari, D. A. Plummer, E. Rozanov, J. F. Scinocca, K. Shibata, D. Smale, H. Teyssere, W. Tian, Y. Yamashita (2010), Multi-Model Assessment of the Upper Troposphere and Lower Stratosphere: Extra-tropics, *J. Geophys. Res.*, **115**, D00M09, doi: 10.1029/2010JD013884
21. R. J. Salawitch, T. Canty, T. Kurosu, K. Chance, Q. Liang, A. da Silva, S. Pawson, J.E. Nielsen, J.M. Rodriguez, P.K. Bhartia, X. Liu, L.G. Huey, J. Liao, R.E. Stickel, D.J. Tanner, J.E. Dibb, W.R. Simpson, D. Donohue, A. Weinheimer, F. Flocke, D. Knapp, D. Montzka, J.A. Neuman, J.B. Nowak, T.B. Ryerson, S. Oltmans, D.R. Blake, E.L. Atlas, D.E. Kinnison, **S. Tilmes**, L.L. Pan, F. Hendrick, M. Van Roozendaal, K. Kreher, P.V. Johnston, G. Chen, R.B. Pierce, J.H. Crawford, D.J. Jacob, (2010) New Interpretation of Total Column BrO during Arctic Spring *Geophys. Res. Lett.*, **37**, L21805, doi:10.1029/2010GL043798
- 2011:**
22. **S. Tilmes**, L. Emmons, H. Schlager, K. Law, et al., (2010) CO and Black Carbon contribution of anthropogenic and fire emissions to the pollution in high northern latitudes in spring and summer using 2008 POLARCAT aircraft observations and MOZART4 model results, *Atmos. Chem. Phys. Discuss.*, **11**, 26173-26243, doi:10.5194/acpd-11-26173-2011, 2011
23. A. Kunz, L. L. Pan, P. Konopka, D. E. Kinnison, and **S. Tilmes**, 2011: Chemical and dynamical discontinuity at the extratropical tropopause based on START08 and WACCM analyses, *J. Geophys. Res.*, **116**, D24302, doi:10.1029/2011JD016686, 2011
24. S. Choi, Y. Wang, R. J. Salawitch, T. Canty, J. Joiner, T. Zeng, T. P. Kurosu, K. Chance, A. Richter, L. G. Huey, J. Liao, J. A. Neuman, J. B. Nowak, J. E. Dibb, A. J. Weinheimer, G. Diskin, T. B. Ryerson, A. da Silva, J. Curry, D. Kinnison, **S. Tilmes**, and P. F. Levelt, Analysis of satellite-derived Arctic tropospheric BrO columns in conjunction with aircraft measurements during ARCTAS and ARCPAC, *Atmos. Chem. Phys.*, **12**, 1255-1285, 2011
- 2012:**
25. **S. Tilmes**, D. E. Kinnison, R. R. Garcia, R. Salawitch, T. Canty, J. Lee-Taylor, S. Madronich, K. Chance, 2012, Impact of very short-lived halogens on stratospheric ozone abundance and UV radiation in a geo-engineered atmosphere, *Atmos. Chem. Phys.*, **12**, 10945-10955, 2012

26. **S. Tilmes**, J.-F. Lamarque, L. K. Emmons, A. Conley, M. G. Schultz, M. Sauniois, V. Thouret, A. M. Thompson, S. J. Oltmans, B. Johnson, and D. Tarasick, 2011: Technical Note: Ozonesonde climatology between 1995 and 2011: description, evaluation and applications, *Atmos. Chem. Phys.*, **12**, 7475-7497, 2012
  27. **S. Tilmes**, A. Monaghan, J. Done, 2012: Addressing Climate Challenges in Developing Countries, *EOS Meeting Report*, **93**, No. 14, 3 April 2012
  28. A. M., Thompson, S. K. Miller, **S. Tilmes**, D. W. Kollonige, J. C. Witte, S. J. Oltmans, B. J. J. Johnson, M. Fujiwara, F. J. Schmidlin, G. Coetzee, N. Komala, M. Maata, M. Mohamad, J. Nguyo, C. C. Mutai, S.-Y. Ogino, F. R. DaSilva, N. M. Paes Leme, F. Posny, R. Scheele, H. B. Selkirk, M. Shiotani, R. Stuebi, G. Levrat gle, B. Calpini, V. Thouret, H. Tsuruta, J. Valverde-Canossa, H. Voemel, S. Yonemura, J. A. Diaz, N. T. T. Tranh, and H. T. T. Ha, 2012, SHADOZ (Southern Hemisphere Additional Ozonesondes) Ozone Climatology (2005-2009). 4. Tropospheric and Tropical Tropopause Layer (TTL) profiles with comparisons to OMI-Based ozone products, *J. Geophys. Res.*, doi:10.1029/2011JD016911, in press.
  29. L. L. Pan, A. Kunz, C. R. Homeyer, L. A. Munchak, D. E. Kinnison, and **S. Tilmes**, 2012: Commentary on using equivalent latitude in the upper troposphere and lower stratosphere, *Atmos. Chem. Phys.*, **12**, 9187-9199, 2012
  30. M. Sauniois, L. Emmons, J.-F. Lamarque, **S. Tilmes**, C. Wespes, V. Thouret, and M. Schultz, 2012: Impact of sampling frequency in the analysis of tropospheric ozone observations, *Atmos. Chem. Phys.*, **12**, 6757-6773, 2012.
  31. A. Saiz-Lopez, J.-F. Lamarque, D. E. Kinnison, **S. Tilmes**, C. Ordóñez, J. J. Orlando, A. J. Conley, J. M. C. Plane, A. S. Mahajan, G. Sousa Santos, E. L. Atlas, D. R. Blake, S. P. Sander, S. Schauffler, A. M. Thompson, and G. Brasseur, 2011: Estimating the climate significance of halogen-driven ozone loss in the tropical marine troposphere, *Atmos. Chem. Phys.*, **12**, 3939-3949, doi: 10.5194/acp-12-3939-2012.
  32. J.-F. Lamarque, Emmons, L. K., Hess, P. G., Kinnison, D. E., **Tilmes, S.**, Vitt, F., Heald, C. L., Holland, E. A., Lauritzen, P. H., Neu, J., Orlando, J. J., Rasch, P., and Tyndall, G., 2011: CAM-chem: description and evaluation of interactive atmospheric chemistry in CESM, *Geosci. Model Dev.*, **5**, 2, 369-411, doi: 10.5194/gmd-5-369-2012.
  33. C. Ordóñez, J.-F. Lamarque, **S. Tilmes**, D. E. Kinnison, E. L. Atlas, D. R. Blake, G. Sousa Santos, G. Brasseur, and A. Saiz-Lopez, 2011: Bromine and iodine chemistry in a global chemistry-climate model: description and evaluation of very short-lived oceanic sources, *Atmos. Chem. Phys.*, **12**, 1423-1447, doi: 10.5194/acp-12-1423-2012.
- 2013:**
34. P.-L. Ma, P.J. Rasch, H. Wang, K. Zhang, R. C. Easter, **S. Tilmes**, J. D. Fast, X. Liu, J.-H. Yoon, and J.-F. Lamarque, 2013, The Role of Circulation Features on Black Carbon Transport into the Arctic in the Community Atmosphere Model Version 5 (CAM5), *J. Geophys. Res.*, doi: 10.1002/jgrd.50411
  35. M. Brakebusch, C. Randall, D. Kinnison, **S. Tilmes**, M. Santee, G. Manney, Evaluation of Whole Atmosphere Community Climate Model simulations of



- ozone during Arctic winter 2004-2005, *J. Geophys. Res Atmos.*, **118**, 2673-2688, DOI: 10.1002/jgrd.50226
36. A. R. Berg, C. L. Heald, K. E. Huff Hartz, A. G. Hallar, A. J. H. Meddens, J. A. Hicke, J.-F. Lamarque, and **S. Tilmes**, 2012, The impact of bark beetle infestation on monoterpene emissions and secondary organic aerosol formation in Western North America, *Atmos. Chem. Phys.*, 13, 3149-3161, 2013
  37. P. J. Young, A. T. Archibald, K. W. Bowman, J.-F. Lamarque, V. Naik, D. S. Stevenson, **S. Tilmes**, A. Voulgarakis, O. Wild, D. Bergmann, P. Cameron-Smith, I. Cionni, W. J. Collins, S. B. Dalsøren, R. M. Doherty, V. Eyring, G. Faluvegi, L. W. Horowitz, B. Josse, Y. H. Lee, I. A. MacKenzie, T. Nagashima, D. A. Plummer, M. Righi, S. T. Rumbold, R. B. Skeie, D. T. Shindell, S. A. Strode, K. Sudo, S. Szopa, and G. Zeng, 2012, Pre-industrial to end 21st century projections of tropospheric ozone from the Atmospheric Chemistry and Climate Model Intercomparison Project (ACCMIP), *Atmos. Chem. Phys.*, 13, 2063-2090, 2013
  38. A. Jones, J. M. Haywood, K. Alterskjær, O. Boucher, J. N. S. Cole, C. L. Curry, P. J. Irvine, D. Ji, B. Kravitz, J. E. Kristjánsson, J. C. Moore, U. Niemeier, A. Robock, H. Schmidt, B. Singh, **S. Tilmes**, S. Watanabe, and J.-H. Yoon, The impact of abrupt suspension of solar radiation management (termination effect) in experiment G2 of the Geoengineering Model Intercomparison Project (GeoMIP), *J. Geophys. Res. Atmos.*, 118, doi:10.1002/jgrd.50762.
  39. B. Kravitz, K. Caldeira, O. Boucher, A. Robock, P. J. Rasch, K. Alterskjær, D. Bou Karam, J. N. S. Cole, C. L. Curry, J. M. Haywood, P. J. Irvine, D. Ji, A. Jones, J. E. Kristjánsson, D. J. Lunt, J. Moore, U. Niemeier, H. Schmidt, M. Schulz, B. Singh, **S. Tilmes**, S. Watanabe, S. Yang, and J.-H. Yoon (2013), Climate model response from the Geoengineering Model Intercomparison Project (GeoMIP), *Journal of Geophysical Research*, 118, doi:10.1002/jgrd.50646.
  40. **S. Tilmes**, J. Fasullo, J.-F. Lamarque, D. R. Marsch, M. Mills, K. Alterskjær, O. Boucher, J. N. S. Cole, C. L. Curry, J. M. Haywood, P. J. Irvine, D. Ji, A. Jones, D. B. Karam, B. Kravitz, J. E. Kristjánsson, J. C. Moore, H. O. Muri, U. Niemeier, P. J. Rasch, A. Robock, H. Schmidt, M. Schulz, B. Singh, S. Watanabe, S. Yang, and J.-H. Yoon, The hydrological impact of geoengineering in the Geoengineering Model Intercomparison Project (GeoMIP), *Journal of Geophysical Research*, accepted, doi: 10.1002/jgrd.50868

#### **Diplomarbeit:**

S. Kanera (1998), Die Bestimmung der trockenen Deposition in einem mesoskaligen Chemie-Transport-Model (EURAD), *Diplomarbeit*, Universität Köln

#### **Dissertations and Books:**

- S. Tilmes (2004), Chemical ozone loss in the Arctic polar stratosphere derived from satellite observations, *Ph.D. thesis* Johann Wolfgang Goethe Universität, Frankfurt, Germany, Tilmes2003-Dissertation.pdf, 172pp.
- S. Tilmes (2004), Chemical ozone loss in the Arctic polar stratosphere: an analysis of twelve years of satellite observations, Jülich, Forschungszentrum,

### Contributions to Reports and Books:

- J. Zimmermann and S. Tilmes (1999), Investigation of trace gas variability for use in model evaluation, *GLOREAM Annual Report 1999*, page 142
- *SPARC CCMVal Report on the Evaluation of Chemistry-Climate Models* (2010), V. Eyring, T. G. Shepherd, D. W. Waugh (Eds.), SPARC Report No. 5, WCRP-X, WMO/TD-No. X, <http://www.atmosp.physics.utoronto.ca/SPARC>, Co-author of Chapter 6: Stratospheric Chemistry and Chapter 7: Upper Troposphere Lower Stratosphere
- *WMO ozone assessment 2010*: Co-author in Chapter 5: Information and Options for Policymakers, Contributor of Chapter 2: Stratospheric
- Book on *Geo-Engineering Climate Change. Environmental Necessity or Pandora's Box?* Edited by Brian Lauder and J. Michael T. Thompson, published 2010
- Book on *Stratospheric Ozone Depletion and Climate Change*, Chapter Author: Impact of Geo-engineering on Stratospheric Ozone and Climate, Edited by Rolf Müller, published 2012
- Eyring, V., J.-F. Lamarque, P. Hess, F. Arfeuille, K. Bowman, M. P. Chipperfield, B. Duncan, A. Fiore, A. Gettelman, M. A. Giorgetta, C. Granier, M. Hegglin, D. Kinnison, M. Kunze, U. Langematz, B. Luo, R. Martin, K. Matthes, P. A. Newman, T. Peter, A. Robock, T. Ryerson, A. Saiz-Lopez, R. Salawitch, M. Schultz, T. G. Shepherd, D. Shindell, J. Stählerin, S. Tegtmeier, L. Thomason, **S. Tilmes**, J.-P. Vernier, D. W. Waugh, and P. J. Young, Overview of IGAC/SPARC Chemistry-Climate Model Initiative (CCMI) Community Simulations in Support of Upcoming Ozone and Climate Assessments, *SPARC Newsletter No. 40*, p. 48-66, 2013

### Non-refereed Publications:

- **S. Tilmes**, Short Comment in *Atmos. Chem. Phys. Discussion* o, 1977-2020, 2009, to the Paper: Evaluation of CLaMS, KASIMA and ECHAM5/MESy1 simulations in the lower stratosphere using observations of Odin/SMR and ILAS/ILAS-I, F. Khosrawi, R. Müller, M. H. Proffitt, R. Ruhnke, O. Kirner, P. Jöckel, J.-U. Groöf, J. Urban, D. Murtagh, and H. Nakajima (March 2009)
- R. Müller and **S. Tilmes** (2008), Comment on “Middle atmosphere CO, N<sub>2</sub>O, HNO<sub>3</sub>, and temperature profiles during the warm Arctic winter 2001–2002” by G. Muscari et al., *J. Geophys. Res.*, **113**,doi:10.1029/2007/JD009709

### Invited Scientific Presentations (first author only):

1. **S. Tilmes**, R. Müller, J.-U. Groöf, R. Spang, T. Sugita, H. Nakajima and Y. Sasano, Overview of chemical ozone loss in polar regions over the last 12 years

- based on satellite observations: HALOE, ILAS, and ILAS-II, *The International Association of Geomagnetism and Aeronomy* Toulouse: July 2005, Invited Oral Presentation
2. **S. Tilmes**, Relevance of simulations of chemical responses to climate change for atmospheric chemistry, *Managing Solar Radiation Workshop*, San Francisco, USA: Nov. 2006, Invited Oral Presentation
  3. **S. Tilmes**, R. R. Garcia, D. E. Kinnison, A. Gettelman, P. J. Rasch, R. Müller, R. Salawitch, Impact of Proposed Geo-engineering schemes on Troposphere and Stratosphere, *AMS/AGU Head and Chair Meeting* Boulder: 16. October, 2008, Invited Oral Presentation
  4. **S. Tilmes**, R. R. Garcia, D. E. Kinnison, A. Gettelman, P. J. Rasch, R. Müller, R. Salawitch, Impact of Geo-engineered Aerosols on Stratospheric Ozone, *94th ESA Annual Meeting* Albuquerque: August, 2009, Invited Oral Presentation
  5. **S. Tilmes**, The impact of geo-engineered aerosols on Troposphere and Stratosphere, *Environmental Defense Found Science Day on Geo-engineering*, San Francisco, USA: February 2010, Invited Oral Presentation
  6. **S. Tilmes**, The impact of geo-engineered aerosols on Troposphere and Stratosphere, *Asilomar Conference on Climate Interventions*, Monterey, CO: March 22-25, 2010, Poster Presentation
  7. **S. Tilmes**, D. E. Kinnison, R. R. Garcia, J. Lee-Taylor, R. Salawitch, Tim Canty, Impact of Geo-engineering on the Ozone Abundance in the Stratosphere, Monitoring of Geoengineering Effects and their Natural and Anthropogenic Analogues - Part II: California Institute of Technology Pasadena, November 15-18, 2011, Invited Oral Presentation
  8. **S. Tilmes**, D. E. Kinnison, R. R. Garcia, J. Lee-Taylor, R. Salawitch, T. Canty, S. Madronich, K. Chance, Impact of Very Short-lived Halogens on Stratospheric Ozone Abundance and UV radiation in a Geo-engineered Atmosphere, *AGU Fall Meeting 2012*, San Francisco, CA, December 07, 2012, Invited Oral Presentation
  9. **S. Tilmes**, D. E. Kinnison, R. R. Garcia, J. Lee-Taylor, R. Salawitch, T. Canty, S. Madronich, K. Chance, The Impact of Solar Radiation Management on Stratospheric Chemistry, *Atmospheric Chemical Mechanisms - Atmospheric Chemistry into the Future*, UC Davis Conference Center, December 10-12 2012, Invited Oral Presentation

#### **Other Scientific Presentations (first author only):**

10. **S. Tilmes**, R. Müller, J.-U. GroöB and D. S. McKenna (2001), Calculation of chemical ozone loss in the arctic winter 1996-1997 using ozone-tracer correlations : comparison of ILAS and HALOE results, *26th General Assembly of the European Geophysical Society* Nice: 25.03.2001 -30.03.2001, Oral Presentation
11. **S. Tilmes**, R. Müller, J.-U. GroöB, D. S. McKenna, J. M. Russell III, U. Schmidt, Y. Sasano, A. Engel (2002), Overview of ozone loss in several Arctic winters from 1991/92 to 2001/02 based on HALOE observations, *27<sup>th</sup> General Assembly of the European Geophysical Society* Nice, France, 26.04.2002, Oral Presentation
12. **S. Tilmes**, R. Müller, J.-U. GroöB, U. Schmidt, Y. Sasano, J. M. Russell III and

- D. S. McKenna (2003), Chemical ozone loss and tracer evolution in the eleven Arctic winters between 1991/92 and 2001/02 derived from HALOE observations, *EGS-AGU-EUG Joint Assembly* Nice, France, 06.04.2003 -11.04.2003, Poster
13. **S. Tilmes**, R. Müller, J.-U. Groöß, U. Schmidt, Y. Sasano, J. M. Russell III, D. S. McKenna and G. C. Toon (2003), Chemical ozone loss and tracer evolution in twelve Arctic winters between 1991/92 and 2002/03 derived from satellite observations, *XXIII General Assembly of the International Union of Geodesy and Geophysics*, Sapporo, Japan: 30.06.2003 - 11.07.2003, Oral Presentation
  14. **S. Tilmes**, R. Müller, J.-U. Groöß, M. Hoepfner, G. C. Toon and J. M. Russell III (2003), Very early chlorine activation and ozone loss in the Arctic winter 2002-2003, *SOLVE II / WINTERSOL Joint Science Team Meeting* Orlando, Fla.: 21.10.2003 - 24.10.2003, Poster
  15. **S. Tilmes**, R. Müller, J.-U. Groöß, F. Khosrawi and M. Riese (2004), Ozone loss and related processes diagnosed using the tracer correlation technique (TRAC), *7th ILASII Science Team meeting* Tokyo: 01.03.2004 - 03.03.2004, Oral Presentation
  16. **S. Tilmes**, R. Müller, J.-U. Groöß and J. M. Russell III (2004), Ozone loss and chlorine activation in the Arctic winter 1991/92 to 2002/03 derived from HALOE observations, *Quadrennial Ozone Symposium 2004*, Kos, Greece: 01.06.2004 - 08.06.2004, Poster
  17. **S. Tilmes**, R. Müller, J.-U. Groöß (2004), Development of chemical ozone loss during the setup phase of the polar vortex, *8th ILASII Science Team meeting* Seoul: 03. - 04.11.2004, Oral Presentation
  18. **S. Tilmes**, R. Müller, J.-U. Groöß (2004), Chemical ozone loss and related processes in the Antarctic winter 2003 using tracer-tracer correlations, *8<sup>th</sup> ILASII Science Team meeting* Seoul: 03. - 04.11.2004, Oral Presentation
  19. **S. Tilmes**, R. Müller, J.-U. Groöß, R. Spang, T. Sugita, H. Nakajima and Y. Sasano (2005), Overview of chemical ozone loss in polar regions over the last 12 years based on satellite observations: HALOE, ILAS, and ILAS-II, *NCAR/ACD Seminar* Boulder: 27.06.2005, Oral Presentation
  20. **S. Tilmes**, D. E. Kinnison, R. R. Garcia, R. Müller, A. Engel, H. Nakajima Y. Sasano and J. Russell III (2005), Evaluation of Heterogeneous Processes in the Polar Lower Stratosphere in WACCM, *CCMVal 2005* Boulder: 17.-19.10.2005, Poster
  21. **S. Tilmes**, D. E. Kinnison, R. R. Garcia, R. Müller, A. Engel, H. Nakajima Y. Sasano and J. Russell III (2005), Evaluation of Heterogeneous Processes in the Polar Lower Stratosphere in WACCM, *AGU 2005* San Francisco: Oral Presentation
  22. **S. Tilmes**, R. Müller, J.-U. Groöß and Y. Sasano H. Nakajima (2006), Development of chemical ozone loss during the setup phase of the polar vortex, *EGU General Assembly 2006* Vienna: 2.-7.04.2006: Oral Presentation
  23. **S. Tilmes**, D. E. Kinnison, R. R. Garcia, R. Müller (2006), Evaluation of Heterogeneous Processes in the Polar Lower Stratosphere in WACCM, *CMOS 2006* Toronto: 29.05.-01.06.2006: Poster
  24. **S. Tilmes** (2007), Evaluierung von UTLS Prozessen in Modellen mit Hilfe von Tracer-Tracer Korrelationen, *ICG Seminar* Fortschungszentrum Jülich, Germany:

22. Juni 2007

25. **S. Tilmes**, P. Pan, D. Kinnison, S. Schauffler, R. Garcia (2007), Evaluation of NCAR MOZART-3 and WACCM models in the UTLS region using tracers with different lifetimes, *CCMVal Meeting Leeds*, UK: 27. June 2007: Poster
26. **S. Tilmes**, R. Garcia, D. Kinnison, R. Müller, R. Salawitch, M. Rex (2007), Evaluation of Chemical Polar Ozone Loss in the Lower Stratosphere within CCM Model, *CCMVal Meeting Leeds*, UK: 27. June 2007: Oral Presentation
27. **S. Tilmes**, P. Pan, D. Kinnison, S. Schauffler (2007), Transport Characteristics of the UTLS region based on tracers with different lifetimes, *Middle Atmosphere Conference Portland*, USA: 20.-24. August 2007: Oral Presentation
28. **S. Tilmes**, R. Müller, R. Salawitch (2007), The sensitivity of polar ozone depletion to proposed Geo-engineering schemes and volcanic eruptions, *Middle Atmosphere Conference Portland*, USA: 20.-24. August 2007: Poster
29. **S. Tilmes**, R. Garcia, D. Kinnison, A. Gettelman, P. J. Rasch (2007), Impact of geo-engineered aerosols on stratospheric composition and dynamics, *AGU 2007 San Francisco*, USA: 6. December 2007: Oral Presentation
30. **S. Tilmes**, (2008), Impact of geo-engineered aerosols on stratospheric composition and dynamics, *Seminar*, MPI Mainz, Germany: 8. January 2008
31. **S. Tilmes**, (2008), Impact of geo-engineered aerosols on stratospheric composition and dynamics, *Seminar*, MPI Hamburg, Germany: 9. January 2008
32. **S. Tilmes**, L. Pan, D. Kinnison, S. Schauffler (2008), Transport Characteristics of the UTLS region based on tracers with different lifetimes using the MOZART3 model, *START08 workshop*, Boulder: 9. January 2008 (Presented Remotely).
33. **S. Tilmes**, L. Pan, D. Kinnison, WACCM3 team (2008), HIRDLS use with WACCM3 and MOZART, *HIRDLS Science team meeting*, Boulder: 30 January 2008, Oral Presentation
34. **S. Tilmes**, R. R. Garcia, D. E. Kinnison, A. Gettelman, P. J. Rasch, R. Müller, R. Salawitch, (2008), Impact of Geo-engineered Aerosols on Stratosphere composition and dynamics, *EGU General Assembly 2008 Vienna*: 14.-18.04.2008: Poster
35. **S. Tilmes**, L. Pan, D. Kinnison, (2008), Method of model evaluation for the extra-tropical tropopause region and its application to NCAR WACCM models, *EGU General Assembly 2008 Vienna*: 14.-18.04.2008: Oral Presentation
36. **S. Tilmes**, R. R. Garcia, D. E. Kinnison, A. Gettelman, P. J. Rasch, R. Müller, R. Salawitch, (2008), Impact of Geo-engineered Aerosols on Troposphere and Stratosphere, *NCAR/ACD Seminar Boulder*: 29.09.2008, Oral Presentation
37. **S. Tilmes**, R. R. Garcia, D. E. Kinnison, A. Gettelman, P. J. Rasch, R. Müller, R. Salawitch, (2008), Impact of Geo-engineered Aerosols on Troposphere and Stratosphere, *LASP Seminar CU Boulder*: 23. October 2008, Oral Presentation
38. **S. Tilmes**, L. Emmons, ARCTAS team, (2009), ARCTAS Aircraft Observations and NCAR MOZART4 Model Results: 3 Cases, *ARCTAS Workshop Virginia Beach*: 26.-29 January, 2009, Poster
39. **S. Tilmes**, D. E. Kinnison, L. L. Pan, START08 team, (2009), Initial Comparison between START08 and WACCM, *START08 Workshop and CAM/WACCM Workshop Boulder*: March 04-06, 2009, Oral Presentation
40. **S. Tilmes**, et al., (2009), Model Evaluation of Tracer Behavior in the Upper

- Troposphere Lower Stratosphere (UTLS), Oral Presentation; CCMVal2 Model Evaluation of Heterogeneous Processes in the Polar Lower Stratosphere, *CCMVal 2009* Toronto: June 2009, Poster
41. **S. Tilmes**, R. R. Garcia, D. E. Kinnison, A. Gettelman, P. J. Rasch, R. Müller, R. Salawitch, (2009), Impact of Geo-engineered Aerosols on Stratospheric Ozone, *CCSM Workshop* Breckenridge: June 18, 2009, Oral Presentation
  42. **S. Tilmes**, L. L. Pan, L. Emmons, H. Schlager, START08 ARCTAS and GRACE teams, (2009), Seasonal Differences of UTLS Exchange Processes between Spring and Summer in the Subtropics and Polar Region, *UTLS Workshop* Boulder: October 19-22, 2009, Oral Presentation
  43. **S. Tilmes**, L. Emmons, G. Lacressonniere, H. Schlager, (2009), CO and Black Carbon contribution of anthropogenic and fire emissions to the pollution in high northern latitudes in spring and summer using 2008 POLARCAT aircraft observations and MOZART4 model results, *AGU 2009* San Francisco: December 14-18, 2009, oral presentation
  44. **S. Tilmes**, et al., (2010), Polar Chemistry and Dynamics in CAM3.5, *CCSM Chemistry Climate Working Group Meeting*: 11 – 12 February 2010, Oral Presentation
  45. **S. Tilmes**, et al., (2010), Representation of Tracer Gradients across the Extratropical Tropopause in WACCM, *WACCM Working Group Meeting*: 22. February 2010, Oral Presentation
  46. **S. Tilmes**, D. Kinnison, R. Garcia, R. Salawitch, T. Canty, and J. Lee-Taylor, (2010) Impact of very short-lived halogens on stratospheric ozone abundance (and UV radiation) in a geo-engineered atmosphere, European Geosciences Union, General Assembly 2010, Vienna, Austria, 02-07
  47. **S. Tilmes** et al., (2010), Diagnostics and new Ozone Climatology, Breckenridge June 28-July 1<sup>st</sup>, 2010.
  48. **S. Tilmes** et al., (2010), Updated Ozone Climatology for Model Evaluations, Breckenridge June 28-July 1<sup>st</sup>, 2010.
  49. **S. Tilmes**, J.-F. Lamarque, M. Mills, D. Marsh, (2011), GeoMIP using CESM1-CAM4, *CAMChem Working Group* Feb 28-29, 2011
  50. **S. Tilmes**, Jean Francois Lamarque, Louisa Emmons, Francis Vitt, (2011), New Datasets: GEOS5, MERRA HIPPO/ Ozone, Chemistry-Climate Working Group Meeting, 16. March 2011
  51. **S. Tilmes**, Jean Francois Lamarque, Louisa Emmons, Francis Vitt, (2011), Running CAMChem, Chemistry-Climate Working Group Meeting, 16. March 2011
  52. **S. Tilmes**, Jean-Francois Lamarque, Dan Marsh, Mike Mills, GEOMIP using CESM1-CAM4, (2011), GeoMIP Stratospheric Aerosol Geoengineering Workshop, February 10-12, 2011, Rutgers University, New Brunswick, New Jersey, and European Geosciences Union, General Assembly 2011, Vienna, Austria, April 4-8, 2011
  53. **S. Tilmes**, J.-F. Lamarque, L. K. Emmons, M. Schultz, M. D. Parrish, A. M. Thompson, D. Tarasick, S. J. Oltmans, M. Saunois, B. Johnson, V. Thouret, H.-E. Scheel, S. Gilge, A. Volz-Thomas, (2011), Ozonesonde Climatology for Model Evaluation of the Troposphere and Lower Stratosphere, European Geosciences

- Union, General Assembly 2011, Vienna, Austria, April 4-8, 2011 (oral presentation) and Second “tropospheric ozone”, 11-14 April, 2011 in Toulouse, France (Poster)
54. **S. Tilmes**, J.-F. Lamarque, L. K. Emmons, A. Conley, M. G. Schultz, M. Saunois, V. Thouret, A. M. Thompson, S. J. Oltmans, B. Johnson, and D. Tarasick, (2011): Ozonesonde climatology between 1995 and 2009: Description, evaluation and applications, *Sat-Dat Meeting*, ACD, NCAR, August 17, 2011
  55. **S. Tilmes**, J.-F. Lamarque, L. K. Emmons, A. Conley, M. G. Schultz, M. Saunois, V. Thouret, A. M. Thompson, S. J. Oltmans, B. Johnson, and D. Tarasick, 2011: Ozonesonde climatology between 1995 and 2009: Description, evaluation and applications, *WCRP*, Denver, October 24-27, 2011, Poster
  56. **S. Tilmes**, J.-F. Lamarque, P. Hess, A. Fiore: (2011) CESM Chemistry Climate Working Group, *WCRP*, Denver, October 24-27, 2011, Poster
  57. **S. Tilmes**, J. Fasullo, J.-F. Lamarque, M. Mills, D. Marsh, (2012), The impact of climate engineering on temperatures and precipitation using an idealized solar dimming experiment, *Atmospheric working group meeting (AWGM)*, February 29., 2012
  58. **S. Tilmes**, J.-F. Lamarque, M. Mills, D. Marsh, J.Fasullo, (2012), GeoMIP using CESM1-CAM4, *CAMChem Working Group* Mar 1<sup>st</sup>, 2012
  59. **S. Tilmes**, J.-F. Lamarque, (2012), CAM4/CAM5 comparison, , *CAMChem Working Group* Mar 1<sup>st</sup>, 2012
  60. **S. Tilmes**, J.-F. Lamarque, M. Mills, D. Marsh, J.Fasullo, (2012), GeoMIP using CESM1-CAM4, *GeoMIP workshop*, Exeter, UK, March 30, 2012, Oral Presentation
  61. **S. Tilmes**, J.-F. Lamarque, L. K. Emmons, F. Fierly, E. Atlas, D. Blake, (2012), Evaluation of Chemistry-Climate Models using In-Situ Aircraft Observations, *CCMI workshop*, Davos, Switzerland, 14-16 May, 2012, Poster
  62. **S. Tilmes**, CAM4-CAM5 Comparison, (2012), *CESM Workshop, Breckenridge CAMChem Working Group*, June 18-21, 2012
  63. **S. Tilmes**: Presentation of Paper by G. Anderson et al., August 2012 in Science, *ACD Satdat Meeting*, 22. August, 2012
  64. **S. Tilmes**: (2013), CAM4/CAM5 update, identification of problems in CAM5 tropospheric surface area density, *CAMChem Working Group*, Feb 11-13, 2013
  65. **S. Tilmes**, J.-F. Lamaque, L. K. Emmons, D. E. Kinnison, T. Ryerson, K. Aikin, Science team PI’s, (2013) Evaluation of Chemistry-Climate Models using in-situ aircraft observations and ozonesonde observations, *CCMI Workshop*, NCAR Boulder, CO, May 14-16, 2013
  66. **S. Tilmes**, CAMChem: Updates on available compsets and their performance, (2013), *CESM Workshop, Breckenridge CAMChem Working Group*, June19, 2013
  67. **S. Tilmes**, Geoengineering Challenges and Impacts of SRM, Seminar, Institute for Advanced Sustainability Studies e.V., Postdam, Germany, 5. June, 2013
  68. **S. Tilmes**, GeoMIP overview presentation, Planning meeting for the Coupled Model Intercomparison Project phase 5 (CMIP6), August 5-9, Apsen, 2013
  69. **S. Tilmes**, Climate and Human Systems Project Discussion Meeting on Geoengineering, August 27, 2013