

# NOAA GML GLOBAL MONITORING ANNUAL CONFERENCE 2021

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Times are in Mountain Daylight Time

## Monday Afternoon, May 24, 2021 Agenda

(Only presenter's name is given; please refer to abstract for complete author listing.)

**11:30** *Conference Virtual Meeting Room Opens*

	Page No.
<b>Session 1</b> <i>Carbon Cycle and Greenhouse Gases Day 1 Presentations — Chaired by Aleya Kaushik</i>	
12:00 - 12:05 Welcome and Meeting Logistics <i>Aleya Kaushik (eGMAC Organizing Committee)</i>	-
12:05 - 12:20 The Revised CO <sub>2</sub> Calibration Scale at the World Calibration Centre WCC-Empa <i>Christoph Zellweger (Swiss Federal Laboratories for Materials Science and Technology (Empa), Dübendorf, Switzerland)</i>	1
12:20 - 12:35 Top-down Atmospheric Inventories of CO <sub>2</sub> and CH <sub>4</sub> to Support the Global Stocktakes <i>David Crisp (NASA Jet Propulsion Laboratory, California Institute of Technology)</i>	2
12:35 - 12:50 Global Land GPP from the Terrestrial Photosynthesis State Estimate <i>Andrew R Jacobson (Cooperative Institute for Research in Environmental Sciences (CIRES), University of Colorado)</i>	3
12:50 - 13:05 Midwest U.S. Croplands Determine Model Divergence in North American Carbon Fluxes <i>Wu Sun (Carnegie Institution for Science, Department of Global Ecology)</i>	4
13:05 - 13:20 Multi-Season Evaluation of CO <sub>2</sub> Weather in OCO-2 MIP Models <i>Li Zhang (The Pennsylvania State University, Department of Meteorology and Atmospheric Science)</i>	5
13:20 - 13:35 Latitudinal Distribution of Atmospheric $\Delta^{14}\text{CO}_2$ over the Southern Ocean <i>Jocelyn Turnbull (GNS Science, National Isotope Centre, Lower Hutt, New Zealand)</i>	6
<b>13:35 - 14:00</b> <i>Coffee Break and Open Discussion</i>	
<b>14:00 - 16:00</b> <i>Poster Session</i>	

# NOAA GML GLOBAL MONITORING ANNUAL CONFERENCE 2021

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## Tuesday Afternoon, May 25, 2021 Agenda

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**11:30**      **Conference Virtual Meeting Room Opens**

		Page No.
<b>Session 2</b>	<b>Halocarbons and Other Trace Species Presentations</b> — <i>Chaired by Isaac Vimont</i>	
12:00 - 12:05	Welcome and Meeting Logistics <i>Isaac Vimont (eGMAC Organizing Committee)</i>	-
12:05 - 12:20	On the Importance of Accurate, Observation-based Assessments Of Global Environmental Agreements <i>Steve Montzka (NOAA Global Monitoring Laboratory (GML))</i>	7
12:20 - 12:35	Improved Global Distributions of SF <sub>6</sub> and Mean Age of Stratospheric Air from MIPAS by Use of New Spectroscopic Data <i>Gabriele P. Stiller (Karlsruhe Institute of Technology, Institute for Meteorology and Climate Research, Karlsruhe, Germany)</i>	8
12:35 - 12:50	Atmosphere-based U.S. Emission Estimates of SF <sub>6</sub> for 2007 - 2018 <i>Lei Hu (Cooperative Institute for Research in Environmental Sciences (CIRES), University of Colorado)</i>	9
12:50 - 13:05	Atmospheric Carbonyl Sulfide for the Last 52.5 Thousand Years from a South Pole Ice Core <i>Murat Aydin (University of California at Irvine, Department of Earth System Science)</i>	10
13:05 - 13:20	Quantifying the Imprints of Stratospheric Contributions to Interhemispheric Differences in Tropospheric CFC-11, CFC-12, and N <sub>2</sub> O Concentrations <i>Megan Lickley (Massachusetts Institute of Technology, Department of Earth, Atmospheric, and Planetary Sciences)</i>	11
13:20 - 13:35	Australian Hydrofluorocarbon (HFC) Emissions: 2003-2020 <i>Paul Fraser (Commonwealth Scientific and Industrial Research Organisation (CSIRO), Oceans and Atmosphere, Aspendale, Australia)</i>	12
<b>13:35 - 14:00</b>	<b>Coffee Break and Open Discussion</b>	
<b>14:00 - 16:00</b>	<b>Poster Session</b>	
<b>16:00 - 17:00</b>	<b>eGMAC Virtual Happy Hour</b>	

# NOAA GML GLOBAL MONITORING ANNUAL CONFERENCE 2021

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## Wednesday Afternoon, May 26, 2021 Agenda

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**10:30 - 11:30** *Early Career Scientist Panel*

**11:30** *Conference Virtual Meeting Room Opens*

	Page No.
<b>Session 3</b> <i>Ozone and Water Vapor Presentations — Chaired by Irina Petropavlovskikh</i>	
12:00 - 12:05 Welcome and Meeting Logistics <i>Irina Petropavlovskikh (eGMAC Organizing Committee)</i>	-
12:05 - 12:20 Negative Ozone Anomalies at a High Mountain Site in Northern Italy during 2020: a Possible Role of COVID-19 Lockdowns? <i>Paolo Cristofanelli (Institute of Atmospheric Sciences and Climate, National Research Council of Italy, Bologna, Italy)</i>	13
12:20 - 12:35 An Updated Examination of the Post-2013 Ozone Total Column Ozone “Dropoff” <i>Ryan M. Stauffer (NASA Goddard Space Flight Center (GSFC), Atmospheric Chemistry and Dynamics Laboratory)</i>	14
12:35 - 12:50 Regional and Seasonal Trends in Tropical Ozone from SHADOZ Profiles: Reference for Models and Satellite Products <i>Anne M. Thompson (NASA Goddard Space Flight Center (GSFC), Atmospheric Chemistry and Dynamics Laboratory)</i>	15
12:50 - 13:05 On the Use of Satellite Observations to Fill Gaps in the Halley Station Total Ozone Record <i>Lily N. Zhang (Massachusetts Institute of Technology, Department of Earth, Atmospheric, and Planetary Sciences)</i>	16
13:05 - 13:20 SAGE III/ISS Validation of Ozone and Water Vapor V5.2 Data Using Collocated Balloon-borne Measurements <i>Susan Kizer (Science Systems and Applications, Inc. (SSAI))</i>	17
13:20 - 13:35 Progress Towards a More Environmentally Friendly NOAA Frost Point Hygrometer <i>Dale Hurst (Cooperative Institute for Research in Environmental Sciences (CIRES), University of Colorado)</i>	18
<b>13:35 - 14:00</b> <i>Coffee Break and Open Discussion</i>	
<b>14:00 - 16:00</b> <i>Poster Session</i>	

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**11:30**      **Conference Virtual Meeting Room Opens**

	Page No.
<b>Session 4</b> <b>Global Radiation and Aerosols Presentations</b> — <i>Chaired by Patrick Sheridan</i>	
12:00 - 12:05      Welcome and Meeting Logistics <i>Patrick Sheridan (eGMAC Organizing Committee)</i>	-
12:05 - 12:20      Aviation Impact on Atmospheric Aerosol Observed from IAGOS-CARIBIC Flying Laboratory <i>Christoph Mahnke (Forschungszentrum Jülich GmbH, Institute of Energy and Climate Research, IEK-8                                  Troposphere, Jülich, Germany)</i>	19
12:20 - 12:35      Snow Extent and Depth Over Central North America:1966-2018 <i>Logan Soldo (Cooperative Institute for Research in Environmental Sciences (CIRES), University of Colorado)</i>	20
12:35 - 12:50      All-sky Aerosol Direct Radiative Effects at the ARM SGP Site <i>Kelly Balmes (Cooperative Institute for Research in Environmental Sciences (CIRES), University of Colorado)</i>	21
12:50 - 13:05      Baseline Balloon Stratospheric Aerosol Profiles (B <sup>2</sup> SAP): Long-term Stratospheric Aerosol Measurements <i>Michael A Todt (Cooperative Institute for Research in Environmental Sciences (CIRES), University of Colorado)</i>	22
13:05 - 13:20      Toward Understanding the Effect of Smoke Aerosols on Boundary Layer Properties and Regional Weather Due to Local-Generated and Transported Smoke <i>Marcela Loría-Salazar (University of Oklahoma)</i>	23
13:20 - 13:35      Marine Biogenic Emissions, African Dust and Smoke Impact Aerosol Composition and Cloud Condensation Nuclei in the North Atlantic Marine Boundary Layer: Observations during ATOMIC/EUREC <sup>4</sup> A and Insights from 50 Years of Aerosol Measurement in Barbados <i>Cassandra Gaston (University of Miami, Rosenstiel School of Marine and Atmospheric Sciences)</i>	24
<b>13:35 - 14:00</b> <b>Coffee Break and Open Discussion</b>	
<b>14:00 - 16:00</b> <b>Poster Session</b>	

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## Friday Afternoon, May 28, 2021 Agenda

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**11:30**      **Conference Virtual Meeting Room Opens**

		Page No.
<b>Session 5</b>	<b>Carbon Cycle and Greenhouse Gases Day 2 Presentations — Chaired by Lei Hu</b>	
12:00 - 12:05	Welcome and Meeting Logistics <i>Lei Hu (eGMAC Organizing Committee)</i>	-
12:05 - 12:20	Quantifying Fossil Fuel Methane Emissions using Co-emitted Tracers and Uncertain Emission Ratios <i>Alice E. Ramsden (University of Bristol, Bristol, United Kingdom)</i>	25
12:20 - 12:35	Using Measurements of $^{13}\text{CH}_4$ and $\text{CH}_4$ in a Dual Tracer Atmospheric Inversion for Methane Source Attribution <i>Sourish Basu (NASA Goddard Space Flight Center (GSFC), Global Monitoring and Assimilation Office)</i>	26
12:35 - 12:50	Nature or Humans? Scenarios for Constraining Why Atmospheric Methane Continues to Rise <i>Zhen Zhang (University of Maryland)</i>	27
12:50 - 13:05	Continuous Methane Emissions Monitoring at Permian Natural Gas Production Sites <i>Caroline Alden (Cooperative Institute for Research in Environmental Sciences (CIRES), University of Colorado)</i>	28
13:05 - 13:20	MOPITT Validation with <i>in Situ</i> Carbon Monoxide Profiles from Aircraft and AirCore <i>Sara Martinez-Alonso (National Center for Atmospheric Research (NCAR), Atmospheric Chemistry Observations and Modeling Laboratory)</i>	29
13:20 - 13:35	An Atmospheric Constraint on the Seasonal Air-sea Exchange of Oxygen and Heat in the Extratropics <i>Eric Morgan (Scripps Institution of Oceanography, University of California at San Diego)</i>	30
<b>13:35 - 14:00</b>	<b>Coffee Break and Open Discussion</b>	
<b>14:00 - 16:00</b>	<b>Poster Session</b>	

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## Monday, May 24, 2021 Poster Session Agenda

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**14:00 - 14:05** *Poster Session Welcome and Logistics*

**14:05 - 14:30** *Lightning Talks (90-seconds for each presenter)*

**14:30 - 15:15** *Poster Session - Block 1*

**15:15 - 16:00** *Poster Session - Block 2*

### **Carbon Cycle and Greenhouse Gases Poster Block 1: 14:30 - 15:15**

- P-1 Errors and Uncertainties Associated with the Use of Unconventional Non-fuel Activity Data for Estimating CO<sub>2</sub> Emissions  
*Tomohiro Oda (The Earth from Space Institute (EfsI), Universities Space Research Association (USRA))*
- P-2 Evaluating Consistency between Total Column CO<sub>2</sub> Retrievals from OCO-2 and the *in situ* Network over North America: Implications for Carbon Flux Estimation  
*Bharat Rastogi (Cooperative Institute for Research in Environmental Sciences (CIRES), University of Colorado)*
- P-3 Top-down North American CO<sub>2</sub> fluxes with a Nested Version of CMSF-Flux  
*Brendan Byrne (University of Toronto, Toronto, Canada)*
- P-4 Evaluation of Inverse Model Estimates of Terrestrial Biological CO<sub>2</sub> fluxes from the OCO-2 V9 MIP in Temperate North America using ACT-America Airborne Observations  
*Yuyan Cui (The Pennsylvania State University, Department of Meteorology and Atmospheric Science)*
- P-5 Testing a Flux Estimation Method That Accounts for Transport Error  
*Vikram Khade (University of Toronto, Department of Physics, Toronto, Canada)*
- P-6 Summary of Advancements in the GGG2020 TCCON Retrieval  
*Coleen Roehl (California Institute of Technology)*

### **Carbon Cycle and Greenhouse Gases Poster Block 2: 15:15 - 16:00**

- P-7 Effects of Drought, Fire, and Stand Age on Carbon Dioxide Flux in Semi-arid Chaparral Ecosystems  
*Andrea Fenner (San Diego State University, Global Change Research Group)*
- P-8 Seasonal Soil Respiration Responses to Semiarid Shrublands  
*Jessica Montes (San Diego State University, Global Change Research Group)*
- P-9 The Interactive Effects of Elevated Carbon Dioxide Concentrations and Water Stress on Grapevine (*Vitis Vinifera* L.) Gas Exchange and Water Use Efficiency  
*Alessandra Zuniga (San Diego State University, Global Change Research Group)*
- P-10 Surface Ocean PCO<sub>2</sub> from the Surface Carbon State Estimate (SCSE)  
*David Munro (Cooperative Institute for Research in Environmental Sciences (CIRES), University of Colorado)*
- P-11 Gaining Insights Into the Seawater Carbonate System using Discrete  $f$ CO<sub>2</sub> Measurements  
*Maribel I. García-Ibáñez (Centre for Ocean and Atmospheric Sciences, School of Environmental Sciences, University of East Anglia, Norwich, United Kingdom)*
- P-12 Coral Reef Community Metabolism and Air-sea CO<sub>2</sub> fluxes in American Samoa: Does Land-based Pollution Drive Spatial Variability in Ecosystem Functions?  
*Candace Alagata (San Diego State University, Global Change Research Group)*
- P-13 Mapping Atmospheric CO<sub>2</sub> and O<sub>2</sub> from Airborne Observations using a Mass-weighted Isentropic Coordinate  
*Yuming Jin (Scripps Institution of Oceanography, University of California at San Diego)*

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**14:00 - 14:05** *Poster Session Welcome and Logistics*

**14:05 - 14:30** *Lightning Talks (90-seconds for each presenter)*

**14:30 - 15:15** *Poster Session - Block 1*

**15:15 - 16:00** *Poster Session - Block 2*

### ***Halocarbons and Other Trace Species Poster Block 1: 14:30 - 15:15***

P-14 Quality Assurance in the WMO-Global Atmosphere Watch (GAW) Program: A New Expert Team on Measurement Quality for More Standardization and Evaluation

*Herman G.J. Smit (Institute for Energy and Climate Research, Troposphere IEK-8, Research Center Juelich, Juelich, Germany)*

P-15 Characterization of a New Marine Source of Atmospheric BTEX

*Erin Dunne (Commonwealth Scientific and Industrial Research Organisation (CSIRO), Oceans and Atmosphere, Aspendale, Australia)*

P-16 Initial Testing of an Aeris Technologies Ultra N<sub>2</sub>O/CO Spectrometer

*Brad Hall (NOAA Global Monitoring Laboratory (GML))*

P-17 Global N<sub>2</sub>O Emissions on the Rise: Results from a 3-D Model Budget Estimate of Atmospheric N<sub>2</sub>O and its Isotopologues for 1980-2020

*Qing Liang (NASA Goddard Space Flight Center (GSFC), Atmospheric Chemistry and Dynamics Laboratory)*

P-18 Adoption of the WMO Scale for H<sub>2</sub> Measurements in Ambient Air Samples by the Global Greenhouse Gas Reference Network

*Andrew Croxwell (Cooperative Institute for Research in Environmental Sciences (CIRES), University of Colorado)*

### ***Halocarbons and Other Trace Species Poster Block 2: 15:15 - 16:00***

P-19 Effects of Heatwaves and Drought Stress on Isoprene in a UK Temperate Forest: Results from the 2018-2020 WISDOM Campaigns

*Valerio Ferracci (Cranfield University, Cranfield, United Kingdom)*

P-20 Evaluating and Quantifying the Emission Sources to Address the Rising Air Quality Catastrophe In Indian Megacity: Bengaluru

*Poonam Mangaraj (Post-Graduate Environment Sciences, Utkal University, Bhubaneswar, India)*

P-21 Characterizing Typical Atmospheric Concentrations of Shorter-lived Br-containing Species over North America, between 2000-2020

*Katie Smith (University of Miami, Rosenstiel School of Marine and Atmospheric Sciences)*

P-22 Urban Emissions Load from Passenger Transportation and its Mitigation

*Arti Choudhary (Utkal University, Bhubaneswar-751004, India)*

P-23 Increasing Atmospheric Helium from Fossil Fuel Exploitation

*Benjamin Birner (Scripps Institution of Oceanography, University of California at San Diego)*

**16:00 - 17:00** *eGMAC Virtual Happy Hour*

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## Wednesday, May 26, 2021 Poster Session Agenda

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**14:00 - 14:05** *Poster Session Welcome and Logistics*

**14:05 - 14:30** *Lightning Talks (90-seconds for each presenter)*

**14:30 - 15:15** *Poster Session - Block 1*

**15:15 - 16:00** *Poster Session - Block 2*

### ***Ozone and Water Vapor Poster Block 1: 14:30 - 15:15***

P-24 New ECC Ozonesonde Pump Flow Efficiency Measurements

*Bryan Johnson (NOAA Global Monitoring Laboratory (GML))*

P-25 The Importance of the Time Response of Electrochemical Concentration Cell (ECC) Ozonesondes for Measurements of Tropospheric and Stratospheric Ozone

*Holger Vömel (National Center for Atmospheric Research (NCAR), Earth Observing Laboratory)*

P-26 ASOPOS (Assessment of Standard Operating Procedures (SOPs) for OzoneSondes) 2.0: Ozonesonde Measurement Principles and Best Operational Practices

*Debra E. Kollonige (NASA Goddard Space Flight Center (GSFC), Atmospheric Chemistry and Dynamics Laboratory)*

P-27 Provision of IAGOS Water Vapour Data in Near Real Time (NRT) for the Validation of the Chemical Transport Models of Copernicus Atmosphere Monitoring Service (CAMS)

*Susanne Rohs (Forschungszentrum Jülich GmbH, Institute of Energy and Climate Research, IEK-8 Troposphere, Jülich, Germany)*

P-28 Consistency of Total Column Ozone Measurements between the Brewer and Dobson Spectroradiometers of the LKO Arosa and PMOD/WRC Davos

*Julian Gröbner (Physikalisch-Meteorologisches Observatorium Davos, World Radiation Center (PMOD/WRC), Davos, Switzerland)*

### ***Ozone and Water Vapor Poster Block 2: 15:15 - 16:00***

P-29 Sources of Elevated Ozone in the Northern Colorado Front Range

*Detlev Helmig (Boulder A.I.R. LLC)*

P-30 Four Years of CU MAX-DOAS Observations of Stratospheric NO<sub>2</sub> and O<sub>3</sub> at Mauna Loa Observatory, Hawaii

*Christopher F. Lee (University of Colorado, Department of Chemistry)*

P-31 Changes in the Seasonality and the Magnitude of the Diurnal Cycle at NOAA Surface Ozone Monitoring Sites

*Peter Effertz (Cooperative Institute for Research in Environmental Sciences (CIRES), University of Colorado)*

P-32 Comparison of Ozone Profiles between Umkehr, Ozonesonde and M2GMI Model Against the Troposphere and Lower Stratosphere

*Koji Miyagawa (Guest Scientist at NOAA Global Monitoring Division (GML))*

P-33 Payload Design for Global Continuous Atmospheric Mapping (GCAM)

*Narayanan M. Komerath (Taksha Institute)*



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**14:30 - 15:15** *Poster Session - Block 1*

**15:15 - 16:00** *Poster Session - Block 2*

### ***Global Radiation and Aerosols Poster Block 1: 14:30 - 15:15***

P-34 New Measurements of the Lunar Spectral Irradiance for Satellite Calibration

*Stephen Maxwell (National Institute of Standards and Technology (NIST))*

P-35 Radionuclide Emission from Coal Based Thermal Power And industries in India (2018)

*Madhusmita Mishra (Post-Graduate Environment Sciences, Utkal University, Bhubaneswar, India)*

P-36 Atmospheric Data Community Toolkit (ACT): A Python Library for Working with Atmospheric Data

*Ken Kehoe (University of Oklahoma)*

P-37 Investigating Drift Estimates and Corrections for NEON Data

*Janae Csavina (National Ecological Observatory Network (NEON))*

P-38 Air Quality Patterns Associated with Changes in Energy Use during the COVID-19 Pandemic in Kenya

*Cohen Ang'u (University of Nairobi, Wangari Maathai Institute, Kapenguria, Kenya)*

### ***Global Radiation and Aerosols Poster Block 2: 15:15 - 16:00***

P-39 Extreme Ice Crystal Events Linked to Biomass and Fossil Fuel Combustion

*Darrel Baumgardner (Droplet Measurement Technologies)*

P-40 A Spatially Dense Aerosol Instrument Network in the Southern Great Plains: POPSnet-SGP

*Elizabeth Asher (Cooperative Institute for Research in Environmental Sciences (CIRES), University of Colorado)*

P-41 A Dual-wavelength Photo-thermal Interferometer for the Determination of Aerosol Optical Absorption Coefficient and the Absorption Ångström Exponent

*Grisa Mocnik (University of Nova Gorica, Nova Gorica, Slovenia)*

P-42 The Relationship between Aerosol Optical Properties and Gases at the Table Mountain Monitoring Station during the 2020 Colorado Wildfire Season

*Lauren Schmeisser (Cooperative Institute for Research in Environmental Sciences (CIRES), University of Colorado)*

P-43 How Well Do Satellites Measure Aerosol Optical Depth over Mountainous U.S. Sites Co-located with Sunphotometers?

*James Patrick Sherman (Appalachian State University, Department of Physics and Astronomy)*

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**14:05 - 14:30** *Lightning Talks (90-seconds for each presenter)*

**14:30 - 15:15** *Poster Session - Block 1*

**15:15 - 16:00** *Poster Session - Block 2*

### **Carbon Cycle and Greenhouse Gases Poster Block 1: 14:30 - 15:15**

- P-44 Investigating Temporal Relationships between Vegetation (NDVI) and Soil Moisture (SMAP) in Tamil Nadu, India  
*Venkadesh Samykanu (Tamil Nadu Agricultural University, Agro Climate Research Centre,, Coimbatore, India)*
- P-45 Innovations in Inverse Modeling of the Global CO<sub>2</sub> and δ<sup>13</sup>C Budgets  
*Gerbrand Koren (Wageningen University, Department of Meteorology and Air Quality, Wageningen, The Netherlands)*
- P-46 Updated Climatological Maps of Surface Ocean δ<sup>13</sup>C of DIC  
*David Munro (Cooperative Institute for Research in Environmental Sciences (CIRES), University of Colorado)*
- P-47 Understanding Vegetation Responses to Climate Change Through Carbon Isotopic Discrimination in the Simple Biosphere Model  
*Aleya Kaushik (Cooperative Institute for Research in Environmental Sciences (CIRES), University of Colorado)*
- P-48 Evaluation of Carbon and Oxygen Isotope Fractionation of Pressurized CO<sub>2</sub> as a Function of Temperature  
*Tracey Jacksier (Air Liquide, Delaware Research & Technology Center)*
- P-49 Absolute <sup>13</sup>C/<sup>12</sup>C Isotope Amount Ratios for Carbon Dioxide (CO<sub>2</sub>) in Air as Measured by Dual-wavelength Cavity Ring-down Spectroscopy  
*Adam J. Fleisher (National Institute of Standards and Technology (NIST))*

### **Carbon Cycle and Greenhouse Gases Poster Block 2: 15:15 - 16:00**

- P-50 Progress Towards Diagnosis of North American CO<sub>2</sub> and CH<sub>4</sub> Fluxes with the Expanded In-situ Measurement Network  
*Natasha Miles (The Pennsylvania State University, Department of Meteorology and Atmospheric Science)*
- P-51 Analysis of Oil and Gas Ethane and Methane Emissions in the Southcentral and Eastern United States Using Four Seasons of Continuous Aircraft Ethane Measurements  
*Zachary Barkley (The Pennsylvania State University, Department of Meteorology and Atmospheric Science)*
- P-52 Collaboration Cultivates Confidence: Round Robin and Site Comparisons Support Negative Excursions in δ<sup>13</sup>C-CH<sub>4</sub> Measurements  
*Peter Sperlich (National Institute of Water and Atmospheric Research (NIWA), Wellington, New Zealand)*
- P-53 Airborne Methane Lidar for Source Identification and Quantification  
*Betsy Farris (Ball Aerospace)*
- P-54 Recent Measurements Indicate an Increase in Methane Emissions from Alaska's North Slope  
*Rebecca H. Ward (University of Bristol, Bristol, United Kingdom)*
- P-55 Drone-based Measurements of Biogenic and Thermogenic Methane Fluxes at High Spatial Resolution  
*Jonathan F Dooley (New Mexico Tech)*
- P-56 Hydrogen in Antarctic Firm Air: Atmospheric Reconstructions and Implications for the Budget  
*John Patterson (University of California at Irvine, Department of Earth System Science)*

Notes:

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