
Curriculum Vitae: Bryan N. Duncan

NASA Research Physical Scientist
NASA Aura Mission Project Scientist

Contact Information

Atmospheric Chemistry and Dynamics Laboratory
NASA Goddard Space Flight Center (GSFC)

Education

Georgia Institute of Technology, Atlanta, GA
Ph.D. Earth and Atmospheric Sciences (1997)
Minor: Environmental Law
M.S. Earth and Atmospheric Sciences (1993)
B.S. Chemistry (1991)

Employment History

- *NASA Goddard Space Flight Center (GSFC)*
1/09-present Research Physical Scientist
 - *University of Maryland, Baltimore County – Goddard Earth Sciences & Technology Center*
7/08-12/08 Senior Research Scientist
11/04- 7/08 Associate Research Scientist
1/04-10/04 Visiting Assistant Research Scientist
 - *Swiss Institute of Technology – Atmospheric Chemistry Modeling Laboratory*
11/01-10/03 Research Associate
 - *Harvard University – Department of Earth and Planetary Sciences*
10/00-11/01 Research Associate
10/97- 9/00 Postdoctoral Fellow
 - *Georgia Institute of Technology – School of Earth and Atmospheric Sciences*
9/91- 9/97 Graduate Research Assistant
 - *Georgia Tech Research Institute* 3/90-12/93 Lab Technician
 - *Engineering Science, Inc.* 3/88- 3/90 Environmental Field Technician
 - *Federal Paper Board* 3/87-12/87 Chemistry Lab Technician
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Management Experience

NASA's *Aura Mission Project Science Office (2009-present)*

- Project Scientist (August 2017-present)
- Deputy Project Scientist (2009-2017)

The *Aura* Project Scientist is responsible for ensuring the satisfactory accomplishment of the *mission goal* to study the chemistry and dynamics of the Earth's atmosphere from the ground through the mesosphere and *mission scientific objective* to advance the understanding of changes in Earth's radiation balance, air quality, and the ozone layer that result from changes in atmospheric composition.

Duties include

- Promoting *Aura* data to researchers, operational users, stakeholders, general public, etc.
- Serving as primary liaison to NASA mission operations, [A-Train](#) satellite project scientists, headquarters, and data users.
- Serving as primary liaison to *Aura*'s multi-national instrument teams and their host institutions:
 - *Microwave Limb Sounder (MLS)*: NASA Jet Propulsion Laboratory (JPL)
 - *Ozone Monitoring Instrument (OMI)*: Dutch Meteorological Institute (KNMI), Netherlands Space Office (NSO), and Finnish Meteorological Institute (FMI)
 - *Tropospheric Emission Spectrometer (TES)*: NASA JPL
- Managing the *Aura Mission* multi-million dollar budget.
- Leading the biennial Senior Review proposal (justification for continued operations) and written/oral responses to external review panel questions/comments. Duncan led the 2017 Senior Review proposal and responses. He contributed heavily to proposals and responses in 2011, 2013, and 2015.
- Organizing *Aura* science team meetings (~120 participants each, ~every 1-2 y)

NASA's *Applied Remote Sensing Training (ARSET) Program*

- Responsible Civil Servant (November 2015-present)

ARSET builds the skills to acquire and use NASA satellite and model data for decision support. The program provides training via online webinars and in-person workshops. ARSET trainings are intended for policymakers, NGOs, and other applied science professionals seeking to incorporate NASA remote sensing into their daily activities.

Duties include

- Promoting ARSET to researchers, operational users, stakeholders, general public, etc.
- Serving as primary liaison to NASA headquarters.
- Managing the ARSET Program's budget.

Satellite Continental and Oceanic Atmospheric Pollution Experiment (SCOAPE)

- PI of inter-agency agreement between NASA and Department of Interior Bureau of Ocean Energy Management (BOEM).

The goal of SCOAPE is to assess the feasibility of monitoring offshore air quality with satellite observations. The project includes an assessment report and a ship-based research campaign in the Gulf of Mexico in May 2018.

Changes in the Arctic and Boreal System (CABS)

- Co-lead of NASA GSFC's internal working group (~25 members) from 2014 to present.
CABS seeks to foster communication on Arctic boreal system processes across scientific disciplines within NASA and with the greater scientific community.
 - Currently leading an international scientific review article on satellite and in situ observing strategies for various components of the Arctic boreal system (e.g., sea ice, permafrost, clouds, wildfire aerosols). Due to *Review of Geophysics* in March 2018.

International IGAC/SPARC Chemistry Climate Model Initiative (CCMI)

- Co-chair since January 2016 & Science Steering Committee (SSC) member since 2013.
CCMI seeks to advance development of chemistry-climate modeling and the science of the interaction between chemistry and climate. It does this by providing a forum for model groups and the community to discuss and compare models and to facilitate comparisons and analysis with observations.
 - As co-chair, he works with the SSC (10-15 members) to develop the future directions of the CCMI effort, advocates for the CCMI effort at international conferences, handles day-to-day management, such as reporting to IGAC and SPARC organizations, organizes scientific workshops (~125 people), etc.
 - As SSC member, he promotes the use of satellite and suborbital data to constrain and evaluate atmospheric model simulations of trace gases.

NASA's Health & Air Quality Applied Sciences Team (HAQAST)

- Selected member since 2011.
HAQAST facilitates the use of NASA satellite data and atmospheric model output by health and air quality stakeholders.
 - Leading a project to develop and supply NASA global air quality forecasts to UNICEF so that they may alert parents of children with respiratory disease of impending poor air quality. Project is in conjunction with health professionals and NASA's [Global Modeling and Assimilation Office \(GMAO\)](#).
 - Leading an effort to provide air quality information to the Department of Defense Army Public Health Center (APHC) for deployed troops, particularly in South Asia.
 - Co-leading a HAQAST "tiger team" of 11 HAQAST members and 6 health & air quality stakeholders to demonstrate the efficacy of U.S. environmental laws and concomitant

health benefits over the past few decades, using a combination of satellite data and air quality model output.

Education and Outreach

Post-Doctoral Advisees

- *Yasuko Yoshida* (2006-2008); now a research scientist at NASA
- *Xiaohua Pan* (2009-2010); now a research scientist at NASA
- *Elena Yegorova* (2011-2013); now a research scientist at Nuclear Regulatory Commission
- *Yasin Elshorbany* (2014-2016); now a research scientist at National Snow & Ice Data Center

Student Advisees

- *Jordan Goodrich* (U. New Hampshire; undergraduate; summer 2008); now a postdoc at Scripps Institution of Oceanography; served on his Master's thesis committee (July 2010).
- *Kaitlyn Steele* (U. New Hampshire; undergraduate; summer 2010); now a graduate student in the Department of Geology, U. of Maryland College Park.
- *Kennedy Chioma* (Charles H. Flowers High School, MD; high school; spring semester 2016); now a sophomore at Howard Hughes Medical Institute, U. of Maryland Baltimore County.
- *Emerson Sirk* (Cornell U.; undergraduate; summer 2017); now a junior at Cornell U. – Environmental Sciences major

NASA's [Applied Remote Sensing Training \(ARSET\)](#) Program

- Led ARSET Webinar: Introduction to Satellite Remote Sensing for Air Quality Applications (July 27, 2016) – *Invited*
- Upcoming In-Person Trainer (March 20-23, 2018): “[NASA Remote Sensing for Air Quality Applications](#)”, Indonesian Agency for Meteorological, Climatological and Geophysics and U.S. State Department, Jakarta, Indonesia.

NASA Aura Communications

- “[Air Quality: Observations from Space](#)” website: Develops and maintains a website dedicated to bringing satellite-based air quality observations to health and air quality managers, policy makers, and general public.
- [Aura's website](#): Manages content, including for public outreach to scientists, policy makers, and general public.
- [Aura's "Ozone Garden"](#): Maintains, develops, and farms the Goddard Space Flight Center Visitor Center Ozone Garden, which contains unique bioindicator plants that are sensitive to ozone air pollution.
- Presents to educators (K-12), scientists, policy-makers, and general public several times a year on Earth observations, such as with NASA's [Hyperwall](#). See “Invited Presentations”.

- Develops [educational materials](#), such as articles, lenticulars, and lessons, with Aura Communications personnel, including educational videos:
 - [Science on a Sphere "Monsoons"](#)
 - ["Air pollution around the world"](#) (153K views)
 - ["Tale of Three Cities: Air Quality as Seen from Space"](#) (17K views)
 - ["Breathable – A Story about Air Quality"](#)
- Secured NASA non-reimbursable Space Act Agreement with private company, [littleBits](#), in 2014 for the development of educational materials:
 - Contributed to [Space Kit](#) lessons with Aura Communications personnel.
 - Awarded two PI-led NASA ROSES Internal Research and Development (IRAD) proposals (2012, 2013) for the lesson development.

NASA [Health and Air Quality Applied Sciences Team \(HAQAST\)](#) Communications

- Led two media campaigns/press releases:
 - Press release on [June 27, 2014](#) on U.S. trends of one satellite-observed air pollutant, nitrogen dioxide (NO₂), was picked up by numerous news organizations (e.g., Fox News, The Weather Channel), including [CNN](#), who interviewed Duncan.
 - Press release and conference on [December 14, 2015](#) on NO₂ global trends as presented in Duncan et al. [2015]. It was picked up by numerous international news organizations, including BBC World News, Michigan Public Radio and BBC World News Radio, who did live interviews of Duncan.
 - The press release materials were used in a [video by former President Obama](#) on the efficacy of air pollution controls in the U.S. and air pollution trends around the globe.
- Led review article on use of satellite data for air quality applications [[Duncan et al., 2014](#)].
- As part of a HAQAST tiger team, currently developing materials (e.g., 1 page information sheets) and augmenting the Air Quality website for health and air quality managers so that they may demonstrate to policy makers the efficacy of U.S. air pollution emission controls over the last few decades.

Publications (updated 12/28/2017)

<i>Total Articles in Publication List:</i>	76
<i>Sum of the Times Cited:</i>	4622
<i>Average Citations per Article:</i>	60.82
<i>h-index:</i>	36

Majid, A., M. Val Martin, L.N. Lamsal, B.N. **Duncan** (2017), A decade of changes in nitrogen oxides over regions of oil and natural gas activity in the United States, *Elementa: Science of the Anthropocene*, 5:76. doi:<https://doi.org/10.1525/elementa.259>. Nicely, J. M., et al. (2016), An Observationally Constrained Evaluation of the Oxidative Capacity in the Tropical Western Pacific Troposphere, *J. Geophys. Res. Atmos.*, 121, doi:10.1002/2016JD025067.

- Knowland, K. E., Ott, L. E., **Duncan**, B. N., & Wargan, K. (2017). Stratospheric intrusion-influenced ozone air quality exceedances investigated in the NASA MERRA-2 reanalysis. *Geophysical Research Letters*, *44*, 10, 69110,701. <https://doi.org/10.1002/2017GL074532>.
- Jin X., A.M. Fiore, L.T. Murray, L.C. Valin, L.N. Lamsal, B.N. **Duncan**, K.F. Boersma, I. De Smedt, G. Gonzalez Abad, K. Chance, and G.S. Tonnesen (2017). Evaluating a space-based indicator of surface ozone-NO_x-VOC sensitivity over mid-latitude source regions and application to decadal trends. *J. Geophys. Res.*, *122*. <https://doi.org/10.1002/2017JD026720>.
- Nielsen, J.E. et al. (2017), Chemical Mechanisms and their Applications in the Goddard Earth Observing System (GEOS) Earth System Model, *J. Advances Modeling Earth Systems*, doi:10.1002/2017MS001011.
- Choi, H.-D., H. Liu, J.H. Crawford, D.B. Considine, D.J. Allen, B.N. **Duncan**, L.W. Horowitz, J.M. Rodriguez, S.E. Strahan, L. Zhang, X. Liu, M.R. Damon, and S.D. Steenrod (2017), Global O₃-CO correlations in a chemistry and transport model during July-August: evaluation with TES satellite observations and sensitivity to input meteorological data and emissions, *Atmos. Chem. Phys.*, *17*, 8429-8452, <https://doi.org/10.5194/acp-17-8429-2017>.
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- Elshorbany, Y.F., B.N. **Duncan**, S.A. Strode, J.S. Wang, and J. Kouatchou, The description and validation of a computationally-efficient CH₄-CO-OH (ECCOHv1.01) chemistry module for 3-D model applications, *Geosci. Model Dev.*, *9*, 799-822, doi:10.5194/gmd-9-799-2016, 2016.
- Ott, L.E., B.N. **Duncan**, A.M. Thompson, G. Diskin, Z. Fasnacht, A.O. Langford, M. Lin, A.M. Molod, J.E. Nielsen, S.E. Pusede, A.J. Weinheimer, and Y. Yoshida, Frequency and Impact of Summertime Stratospheric Intrusions over Maryland during DISCOVER-AQ (2011): New Evidence from NASA's GEOS-5 Simulations, *J. Geophys. Res.*, doi:10.1002/2015JD024052, 2016.
- Duncan**, B.N., L.N. Lamsal, A.M. Thompson, Y. Yoshida, Z. Lu, D.G. Streets, M.M. Hurwitz, and K.E. Pickering, A space-based, high-resolution view of notable changes in urban NO_x pollution around the world (2005-2014), *J. Geophys. Res.*, doi:10.1002/2015JD024121, 2016.
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- Follette-Cook, M.B., K.E. Pickering, J.H. Crawford, B.N. **Duncan**, C.P. Loughner, G.S. Diskin, A. Fried, and A.J. Weinheimer, Spatial and temporal variability of trace gas columns derived from WRF/Chem regional model output: Planning for geostationary observations of atmospheric composition, *Atmos. Environ.*, *118*, 28-44, doi:10.1016/j.atmosenv.2015.07.024, 2015.

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- de Foy, B., Z. Lu, D. Streets, L. Lamsal, and B. **Duncan**, Estimates of power plant NO_x emissions and lifetimes from OMI NO₂ satellite retrievals, *Atmos. Environ.*, *116*, 1-11, doi: 10.1016/j.atmosenv.2015.05.056, 2015.
- Ziemke, J., A. Douglass, L. Oman, S. Strahan, and B. **Duncan**, Tropospheric ozone variability in the tropics from ENSO to MJO and shorter timescales, *Atmos. Chem. Phys.*, *15*(5), 8037-8049, doi: 10.5194/acp-15-8037-2015, 2015.
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Invited Research Presentations (2017)

- 2017 John C. and Susan S.G. Wierman Distinguished Lecture at Johns Hopkins University (Baltimore, MD; December 7)
- Group on Earth Observations (GEO): Air Quality Side Event (Washington, DC; October 23)
- International Society of Exposure Science: Annual Meeting in session: Integrating Diverse Environmental Exposure Datasets to Study Human Health – from Satellite Sensing and Ground Monitoring to Personal Exposure (Research Triangle Park, NC; October 17)
- Finnish Meteorological Institute Arctic Science Networking Workshop (Helsinki, Finland; August 30, 2017)
- World Bank/EPA: Filling the Gaps Workshop (Washington, DC; July 25-26)
- Department of Defense Army Public Health Center: Environmental Impacts on Health Readiness Working Group meeting (Arlington, VA; June 20)
- American Thoracic Society Annual Meeting: Satellites And Their Use In Studying Health And Air Quality: Highlights From the NASA Health And Air Quality Applied Sciences Team (Washington, DC; May 24)

- *Study of Environmental Arctic Change (SEARCH) Methane Workshop* (Seattle, WA; March 7, 2017 – didn't attend)
- *SatSummit: Lightning talk, entitled, "Satellite Data for Health & Air Quality Applications"* (Washington, DC; January 31)

Earlier Invited Research Presentations (Partial List)

- *IEEE IGARSS Conference* (Beijing, China; July 10, 2016 – didn't attend)
- *American Thoracic Society Environmental Health Policy Committee Webinar* (June 15, 2016)
- *Energy Summit - U. Wisconsin* (Madison, WI; October 13, 2015)
- *Atmospheric and Oceanic Sciences Seminar, U. Wisconsin* (Madison, WI; October 12, 2015)
- *Ozone Monitoring Instrument (OMI) Science Team Meeting* (de Bilt, Netherlands; September 1, 2015)
- *EPA International Emission Inventory Conference* (San Diego, CA; April 15, 2015)
- *Electric Power Research Institute (EPRI) ENV-VISION: Environmental Vision - An International Electricity Sector Conference* (Crystal City, VA; May 14, 2015)
- *NASA Obs4MIPs Workshop* (Washington, DC; May 30, 2014)
- *University of Edinburgh School of GeoSciences Seminar*, (Edinburgh, UK; May 19, 2014)
- *IGAC/SPARC Chemistry Climate Modeling Initiative Workshop* (Davos, Switzerland; October, 2012)
- *National Institute of Standards and Technology (NIST) Global Learning and Observations to Benefit the Environment (GLOBE) Teacher Workshop* (Bethesda, MD; July 25, 2011)
- *U. California – Davis Atmospheric Chemical Mechanisms Conference* (Davis, CA; December 8, 2010)
- *NOAA Geophysical Fluid Dynamics Laboratory Seminar* (Princeton, NJ; July 8, 2009)
- *NASA Langley Seminar* (Hampton, VA; August 8, 2008)
- *Joint IGAC/CACGP/SOLAS/WMO Symposium: Atmospheric Chemistry at the Interfaces* (Capetown, South Africa; September 19, 2006)

Funding (Competed)

Inter-Agency Agreement

- Duncan (PI), \$500K, awarded in September 2017
 Dept. of Interior Bureau of Ocean Energy Management (BOEM)
Title: "Use of Satellite Data for Offshore Air Quality Applications"
Project Name: Satellite Continental & Oceanic Atmospheric Pollution Experiment (SCOAPE)

Duncan as PI

- \$120K/y for 3 y duration, awarded in 2016
Solicitation: NASA ROSES 2015 Health and Air Quality Applied Sciences Team
Title: “A Satellite-Based Global Health Air Quality Index (HAQI): Development and Assessment”
- \$10.5K/y for 1 y duration, awarded in 2013
Solicitation: NASA ROSES 2013 Internal Research and Development (IRAD)
Title: “Sensors, Circuits, and Satellites Work Plan”
- \$260K/y for 4 y duration, awarded in 2013
Solicitation: NASA ROSES 2012 Modeling, Analysis, and Prediction (MAP)
Title: “Model analysis of the factors regulating the trends and variability of methane, carbon monoxide and OH”
- \$95K/y for 1 y duration, awarded in 2012
Solicitation: NASA ROSES 2012 Internal Research and Development (IRAD)
Title: “Exploring the Electromagnetic Spectrum”
- \$150K/y for 5 y duration, awarded in 2011
Solicitation: NASA ROSES 2009 Air Quality Applied Sciences Team (AQAST)
Title: “Application of OMI Observations to a Space-Based Indicator of NO_x and VOC Controls on Surface Ozone Formation: A U.S. and Global Perspective”
- \$160K/y for 4 y duration, awarded in 2009.
Solicitation: NASA ROSES 2008 Modeling, Analysis and Prediction (MAP)
Title: “Constraining Uncertainty in Simulations of Tropospheric Composition: Implications for Predictions of Future Air Quality”
- \$160K/y for 3 y duration, awarded in 2007.
Solicitation: NASA ROSES 2006 Earth System Science Research using Data and Products from the Terra, Aqua, and ACRIMSAT Satellites Solicitation
Title: “A Global Modeling Initiative (GMI) Study of the Long-Range Transport of Pollution using Fused Carbon Monoxide Measurements from EOS”
- \$220K/y for 3 y duration, awarded in 2005.
Solicitation: NASA ROSES 2004 Modeling, Analysis and Prediction Climate Variability and Change
Title: “A Global Modeling Initiative (GMI) Study of the Sensitivity of Transport to Meteorological Fields”

Duncan as Co-I

- M. Follette-Cook (PI; Morgan State U.), 4 y duration, awarded in 2017
Solicitation: NASA ROSES 2016 Modeling, Analysis, and Prediction (MAP)
Title: “Coupled Predictive Fire Emissions and Interactive Aerosol and Greenhouse Gas Chemistry (“Quick Chemistry”) in the GEOS-5 Earth System Model”
- A. Fiore (PI; Columbia U.), \$255K/y for 3 y duration, awarded in 2017
Solicitation: NASA ROSES 2016 Atmospheric Composition: Aura Science Team and Atmospheric Composition Modeling and Analysis Program

- Title:* “Variability and Trends in Tropospheric Oxidation, and Relevance for Regional Air Quality, Global Atmospheric Composition, and Climate”
- J. Liu (PI), \$200K/y for 3 y duration, awarded in 2017
Solicitation: NASA ROSES 2016 Atmospheric Composition: Aura Science Team and Atmospheric Composition Modeling and Analysis Program
Title: “Quantifying the effects of stratosphere-troposphere exchange on tropospheric ozone interannual variability and trends, radiative forcing, and air quality”
 - L. Ott (PI), \$250K/y for 3 y duration, awarded in 2014
Solicitation: NASA ROSES 2013 Atmospheric Composition Campaign Data Analysis and Modeling
Title: “Statistics for stratospheric influence on surface GHGs during NASA's North American field campaigns: A study with aircraft & satellite data and high-resolution global models”
 - E. Wilson (PI), \$325K/y for 3 y duration, awarded in 2014
Solicitation: NASA ROSES 2013 Interdisciplinary Research in Earth Science (IDS)
Title: “Characterizing Thawing Permafrost Carbon Emissions: An Integrated Pilot Study in Support of Satellite Evaluation/Design and Earth System Modeling Capabilities”
 - X. Liu (PI) for 3 y duration, awarded in 2010.
Solicitation: NASA ROSES 2009 Atmospheric Composition: Modeling and Analysis (ACMA)
Title: “Investigate the Global Distribution of Tropospheric Ozone Measured by the OMI and GOME-2 Instruments with the GMI Chemistry Transport Model”
 - P. Colarco (PI) for 4 y duration, awarded in 2009.
Solicitation: NASA ROSES 2008 Modeling, Analysis and Prediction (MAP)
Title: “Improvements in Aerosol Microphysics, Radiation, and Chemical Interaction in the GEOS Chemistry-Climate Model: Applications to Atmospheric Brown Clouds”
 - J. Rodriguez (PI) for 4 y duration, awarded in 2009.
Solicitation: NASA ROSES 2008 Modeling, Analysis and Prediction (MAP)
Title: “Continued Studies of Chemistry-Climate Interactions: Reduction of Uncertainties through Model Sensitivity Experiments and Physically Based Model Evaluation”
 - J. Rodriguez (PI) for 3 y duration, awarded in 2007.
Solicitation: NASA ROSES 2007 Tropospheric Chemistry: Arctic Research of the Composition of the Troposphere from Aircraft and Satellites Solicitation (ARCTAS)
Title: “Analysis of ARCTAS and Related Satellite Measurements Utilizing A Hierarchy of Models”
 - K. Pickering (PI) for 3 y duration, awarded in 2007.
Solicitation: NASA ROSES 2007 Atmospheric Composition: Aura Science Team Solicitation
Title: “Tropospheric Transport Processes for Trace Gases and Aerosols: Regional-to-Global Chemical and Climate Consequences”

Service

- Member of the Weather and Air Quality subpanel of the 2017 National Academies of Sciences, Engineering, and Medicine [Decadal Survey for Earth Science and Applications from Space](#).

- Conferences, Workshops & Conference Sessions
 - Co-organizer for the IGAC/SPARC Chemistry Climate Model Initiative Workshop (~120 participants), held June 13-15, 2017 at Météo-France, Toulouse France.
 - Co-lead of a 1-day workshop (30 invited participants) in May 2017, entitled “Air Pollution Monitoring for Health Research and Patient Care”, held in conjunction with American Thoracic Society annual meeting in Washington, DC.
 - Session Co-convenor
 - American Meteorological Society 19th Conference on Atmospheric Chemistry, Seattle, Washington, January 2017.
 - American Geophysical Society: Ft. Lauderdale (May 2008); San Francisco (December 2012)
- Co-editor for the scientific journal, [Atmospheric Chemistry and Physics](#) (ACP; 2008-present).
- Reviewer of 20+ journal articles each year and numerous NASA proposals.