Brad Weir, Ph.D.
NASA Goddard Space Flight Center
8800 Greenbelt Road (Code 610.1)
Greenbelt, MD 20771

+1 (520) 248-8214
brad.weir@nasa.gov
https://science.gsfc.nasa.gov/sed/bio/brad.weir

Brief bio

Dr. Brad Weir is the lead developer of NASA's Goddard Earth Observing System (GEOS) Constituent Data Assimilation System (CoDAS) — a state-of-the-art statistical method for estimating atmospheric trace gas abundances based on satellite observations. He has over 10 years of experience developing and applying mathematical and statistical methods to address questions about the physics, chemistry, and biology of the Earth's atmosphere, ocean, and land surface. His work has appeared in Science, the New York Times, the Washington Post, the websites of National Geographic and the BBC, and the NASA/ESA/JAXA trilateral Earth Observing Dashboard.

Employment

2013 – present **Scientist (Senior Scientist, 2021–present)**
Global Modeling and Assimilation Office (GMAO)
NASA Goddard Space Flight Center
- Goddard Earth Sciences Technology and Research II, Morgan State University (2021–Present)
- Goddard Earth Sciences Technology and Research I, Universities Space Research Association (2013–2021)

2010 – 2013 **Post-doctoral Research Associate**
College of Earth, Ocean, and Atmospheric Sciences (CEOAS)
Oregon State University

Education

2003 – 2010 Ph.D., Mathematics, University of Arizona
1999 – 2003 B.A., *Cum Laude*, Mathematics, New York University

Professional Service

2024 – 2028 American Geophysical Union (AGU) *Eos* Science Adviser, Nonlinear Geophysics
2023 – 2026 AGU Secretary, Nonlinear Geophysics
2024 – present World Meteorological Organization (WMO) Global Greenhouse Gase Watch (G3W) Modeling Team

Publications

Duncan et al. (2024). "Opinion: Beyond global means – novel space-based approaches to indirectly constrain the concentrations of and trends and variations in the tropospheric hydroxyl radical (OH)." *Atmos. Chem. Phys.* **24**, 13001–13023. https://doi.org/10.5194/acp-24-13001-2024

Pandey et al. (2024). "Toward Low-Latency Estimation of Atmospheric CO2 Growth Rates Using Satellite Observations: Evaluating Sampling Errors of Satellite and In Situ Observing Approaches." *AGU Adv.* **5**, e2023AV001145. https://doi.org/10.1029/2023av001145

Souri et al. (2024). "Enhancing long-term trend simulation of the global tropospheric hydroxyl (TOH) and its drivers from 2005 to 2019: a synergistic integration of model simulations and satellite observations." *Atmos. Chem. Phys.* **24**, 8677–8701. https://doi.org/10.5194/acp-24-8677-2024

Gaubert et al. (2023). "Neutral tropical African CO2 exchange estimated from aircraft and satellite observations." *Glob. Biogeochem. Cy.* **37**, e2023GB007804. https://doi.org/10.1029/2023gb007804

Balashov et al. (2023). "Flood impacts on net ecosystem exchange in the Midwestern and Southern United States in 2019." *J. Geophys. Res.: Atmos.* **128**, e2022JD037697. https://doi.org/10.1029/2022jd037697

Taylor et al. (2023). "Evaluating the consistency between OCO-2 and OCO-3 XCO2 estimates derived from the NASA ACOS version 10 retrieval algorithm." *Atmos. Meas. Tech.* **16**, 3173–3209. https://doi.org/10.5194/amt-16-3173-2023

Wargan et al. (2023). "M2-SCREAM: A stratospheric composition reanalysis of Aura MLS data with MERRA-2 transport." *Earth Space Sci.* **10**, e2022EA002632. https://doi.org/10.1029/2022ea002632

Weir et al. (2022). "Assessing progress toward the Paris Climate Agreement from space." *Environ. Res. Lett.* **11**, 111002. https://doi.org/10.1088/1748-9326/ac998c

Walley et al. (2022). "Airborne lidar measurements of XCO2 in synoptically active environment and associated comparisons with numerical simulations." *J. Geophys. Res.: Atmos.* **127**, e2021JD035664. https://doi.org/10.1029/2021jd035664

Sweeney et al. (2022). "Using atmospheric trace gas vertical profiles to evaluate model fluxes: a case study of Arctic-CAP observations and GEOS simulations for the ABoVE domain." *Atmos. Chem. Phys.* **22**, 6347–6364. https://doi.org/10.5194/acp-22-6347-2022

Schuh et al. (2022). "On the role of atmospheric model transport uncertainty in estimating the Chinese land carbon sink." *Nature* **603**, E13–E14. https://doi.org/10.1038/s41586-021-04258-9

Peiro et al. (2022). "Four years of global carbon cycle observed from the Orbiting Carbon Observatory 2 (OCO-2) version 9 and in situ data and comparison to OCO-2 version 7." *Atmos. Chem. Phys.* **22**, 1097–1130. https://doi.org/10.5194/acp-22-1097-2022

Zhang et al. (2022). "Multi-Season Evaluation of CO2 Weather in OCO-2 MIP Models." *J. Geophys. Res.: Atmos.* **127**, e2021JD035457. https://doi.org/10.1029/2021jd035457

Weir et al. (2021b). "Regional impacts of COVID-19 on carbon dioxide detected worldwide from space." *Science Adv.* **7**, eabf9415. https://doi.org/10.1126/sciadv.abf9415

Davis et al. (2021). "The Atmospheric Carbon and Transport (ACT)-America Mission." *Bull. Amer. Meteor. Soc.* **102**, E1714–E1734. https://doi.org/10.1175/bams-d-20-0300.1

Weir et al. (2021a). "Bias-correcting carbon fluxes derived from land-surface satellite data for retrospective and near-real-time assimilation systems." *Atmos. Chem. Phys.* **21**, 9609–9628. https://doi.org/10.5194/acp-21-9609-2021

Campbell et al. (2020). "Field Evaluation of Column CO2 Retrievals from Intensity-Modulated Continuous-Wave Differential Absorption Lidar Measurements during the ACT-America Campaign." *Earth Space Sci* **7**, e2019EA000847. https://doi.org/10.1029/2019ea000847

Wargan et al. (2020). "The anomalously small 2019 Antarctic ozone hole in an assimilation of MLS observations with the GEOS Constituent Data Assimilation System." *J. Geophys. Res.: Atmos.* **125**, e2020JD033335. https://doi.org/10.1029/2020JD033335
Lee et al. (2020). "Impact of a Regional US Drought on Land and Atmospheric Carbon." *J. Geophys. Res.: Biogeosci.* **125**, e2019JG00559. https://doi.org/10.1029/2019jg005599
Bell et al. (2020). "Evaluation of OCO-2 XCO2 Variability at Local and Synoptic Scales using Lidar and In Situ Observations from the ACT-America Campaigns." *J. Geophys. Res.: Atmos.* **125**, e2019JD031400. https://doi.org/10.1029/2019jd031400
Wargan et al. (2020). "Toward a Reanalysis of Stratospheric Ozone for Trend Studies: Assimilation of the Aura Microwave Limb Sounder and Ozone Mapping and Profiler Suite Limb Profiler Data." *J. Geophys. Res.: Atmos.* **125**, e2019JD031892. ttps://doi.org/10.1029/2019jd031892
Schuh et al. (2019). "Quantifying the impact of atmospheric transport uncertainty on CO2 surface flux estimates." *Global Biogeochem. Cycles* **33**, 484–500. https://doi.org/10.1029/2018GB006086
Lee et al. (2018). "The impact of spatiotemporal variability in atmospheric CO2 concentration on global terrestrial carbon fluxes." *Biogeosci.* **15**, 5635–5652. https://doi.org/10.5194/bg-15-5635-2018
Eldering et al. (2017). "The Orbiting Carbon Observatory-2 early science investigations of regional carbon dioxide fluxes." *Science* **358**, eaam5745. https://doi.org/10.1126/science.aam5745
Weir et al. (2013b). "A potential implicit particle smoother for high-dimensional systems." *Nonlin. Processes Geophys.* **20**, 1047–1060. https://doi.org/10.5194/npg-20-1047-2013
Weir et al. (2013a). "Implicit estimation of ecological model parameters." *Bull. Math. Biol.* **75**, 223–257. https://doi.org/10.1007/s11538-012-9801-6
Weir et al. (2011). "A vortex force analysis of the interaction of rip currents and surface gravity waves." *J. Geophys. Res.: Oceans* **116**, C05001. https://doi.org/10.1029/2010JC006232

Invited Presentations

"Constituent data assimilation plans of the GMAO at NASA Goddard." *Mathematical Approaches of Atmospheric Constituents Data Assimilation and Inverse Modeling*, Banff International Research Station, Banff, Alberta, Canada, 20 April 2023.
"Data assimilation for carbon monitoring." *WMO GHG/Carbon Monitoring Workshop*, World Meteorological Organization, Geneva, Switzerland, 11 June 2022.
"The Orbiting Carbon Observatory-2 project: Monitoring atmospheric carbon dioxide." *2022 Carbon Tracking and Reporting*, Energy Conference Network, Houston, Texas, USA, 22 April 2022.
"The GEOS-Carb reanalysis of atmospheric carbon dioxide." GMAO Seminar Series on Earth System Sceince, Global Modeling and Assimilation Office, Greenbelt, Maryland, USA, 5 April 2017.
"Implicit assimilation of satellite-based observations of ocean color." New Pathways to Understanding and Managing Marine Ecosystems: Quantifying Uncertainty and Risk Using Biophysical-Statistical Models of the Marine Environment, CSIRO Marine and Atmospheric Research, Hobart, Tasmania, Australia, 27-30 May 2013.

"Implicit parameter estimation." Probabilistic Approaches to Data Assimilation for Earth Systems, Banff International Research Station, Banff, Alberta, Canada, 17-22 February 2013.

"Implicit sampling: theory and implementation." International Workshop on Particle Filters for Data Assimilation, Institute for Statistical Mathematics, Tachikawa, Tokyo, Japan, 7 February 2013.

"Implicit assimilation for marine ecological models (Abstract NG41D-02)." 2012 Fall Meeting, AGU, San Francisco, Calif., USA, 3-7 December 2012.

Awards & Fellowships

2021, 2018, 2015	Scientific Achievement Award. GMAO, NASA.
2013	Early Career Travel Award. CSIRO Marine and Atmospheric Research.
2003	Graduate VIGRE Fellowship. Department of Mathematics, University of Arizona.
2003	Perley Lenwood Thorne Medal. Department of Mathematics, New York University.