Weekly Report – August 14, 2026

Cooperative Institute for Satellite Earth System Studies (CISESS)

NOAA/NESDIS/STAR

Submitted by: Maureen Cribb
Email: mcribb@umd.edu
Phone: 301-405-9344

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PUBLICATIONS

Updated: The Global Carbon Budget

Citation: Friedlingstein, Pierre, Michael O'Sullivan, Matthew W. Jones, Robbie M. Andrew, Dorothee C. E. Bakker, Judith Hauck, Peter Landschützer, Corinne Le Quéré, Hongmei Li, Ingrid T. Luijkx, Glen P. Peters, Wouter Peters, Julia Pongratz, Clemens Schwingshackl, Stephen Sitch, Josep G. Canadell, Philippe Ciais, Kjetil Aas, Simone R. Alin, Peter Anthoni, Leticia Barbero, Nicholas R. Bates, Nicolas Bellouin, Alice Benoit-Cattin, Carla F. Berghoff, Raffaele Bernardello, Laurent Bopp, Ida Bagus Mandhara Brasika, Matthew A. Chamberlain, Naveen Chandra, Frédéric Chevallier, Louise P. Chini, Nathan O. Collier, Thomas H. Colligan, Margot Cronin, Laique M. Djeutchouang, Xinyu Dou, Matt P. Enright, Kazutaka Enyo, Michael Erb, Wiley Evans, Richard A. Feely, Liang Feng, Daniel J. Ford, Adrianna Foster, Filippa Fransner, Thomas Gasser, Marion Gehlen, Thanos Gkritzalis, Jefferson Goncalves De Souza, Giacomo Grassi, Luke Gregor, Nicolas Gruber, Bertrand Guenet, Özgür Gürses, Kirsty Harrington, Ian Harris, Jens Heinke, George C. Hurtt, Yosuke Iida, Tatiana Ilyina, Akihiko Ito, Andrew R. Jacobson, Atul K. Jain, Tereza Jarníková, **Annika Jersild**, Fei Jiang, Steve D. Jones, Etsushi Kato, Ralph F. Keeling, Kees Klein Goldewijk, Jürgen Knauer, Yawen Kong, Jan Ivar Korsbakken, Charles Koven, Taro Kunimitsu, Xin Lan, Junjie Liu, Zhiqiang Liu, Zhu Liu, Claire Lo Monaco, Lei Ma, Gregg Marland, Patrick C. McGuire, Galen A. McKinley, Joe R. Melton, Natalie Monacci, Erwan Monier, Eric J. Morgan, David R. Munro, Jens D. Müller, Shin-Ichiro Nakaoka, Lorna R. Nayagam, Yosuke Niwa, Tobias Nutzel, Are Olsen, Abdirahman M. Omar, Naiqing Pan, Sudhanshu Pandey, Denis Pierrot, Zhangcai Qin, Pierre Regnier, Gregor Rehder, Laure Resplandy, Alizée Roobaert, Thais M. Rosan, Christian Rödenbeck, Jörg Schwinger, Ingunn Skjelvan, T. Luke Smallman, Victoria Spada, Mohanan G. Sreeush, Qing Sun, Adrienne J. Sutton, Colm Sweeney, Didier Swingedouw, Roland Séférian, Shintaro Takao, Hiroaki Tatebe, Hanqin Tian, Xiangjun Tian, Bronte Tilbrook, Hiroyuki Tsujino, Francesco Tubiello, Erik van Ooijen, Guido R. van der Werf, Sebastiaan J. van de Velde, Anthony P. Walker, Rik Wanninkhof, Xiaojuan Yang, Wenping Yuan, Xu Yue, and Jiye Zeng, 2026: Global Carbon Budget 2025. *Earth Syst. Sci. Data*, **18**, 3211–3288, https://doi.org/10.5194/essd-18-3211-2026.

Summary: CISESS Scientist Annika Jersild and other members of the international carbon cycle research community present a "living data" update on the global carbon budget, the 14th such update published in the journal *Earth System Science Data*. The authors provide a comprehensive description and synthesis of datasets and methodologies quantifying the five major components of the global carbon budget: fossil carbon dioxide (CO_2) emissions, land-use change, global atmospheric CO_2 growth rate, global net uptake of CO_2 by the ocean, and global net uptake of CO_2 by the land. Their analysis focuses on the industrial period (1750 to 2025) and the recent period since 1959. The overall picture shows that compared to 2024, global fossil CO_2 emissions in 2025 are projected to increase by 1%, with emissions from coal, oil, and gas all above their previous year levels. Over the 2014–2024 period, Brazil, Indonesia, and the Democratic Republic of Congo were responsible for more than half of global land-use CO_2 emissions, mainly via deforestation. Based on new process understanding, the global net uptake of CO_2 by the ocean has taken up 29% of the total emissions in the past decade. Also, the land sink (excluding land use) has taken up 21% of the total emissions during the same period. This kind of annual update is essential to meet the demand for the most current information on how anthropogenic activities are changing the climate system and the underlying mechanisms behind it all.

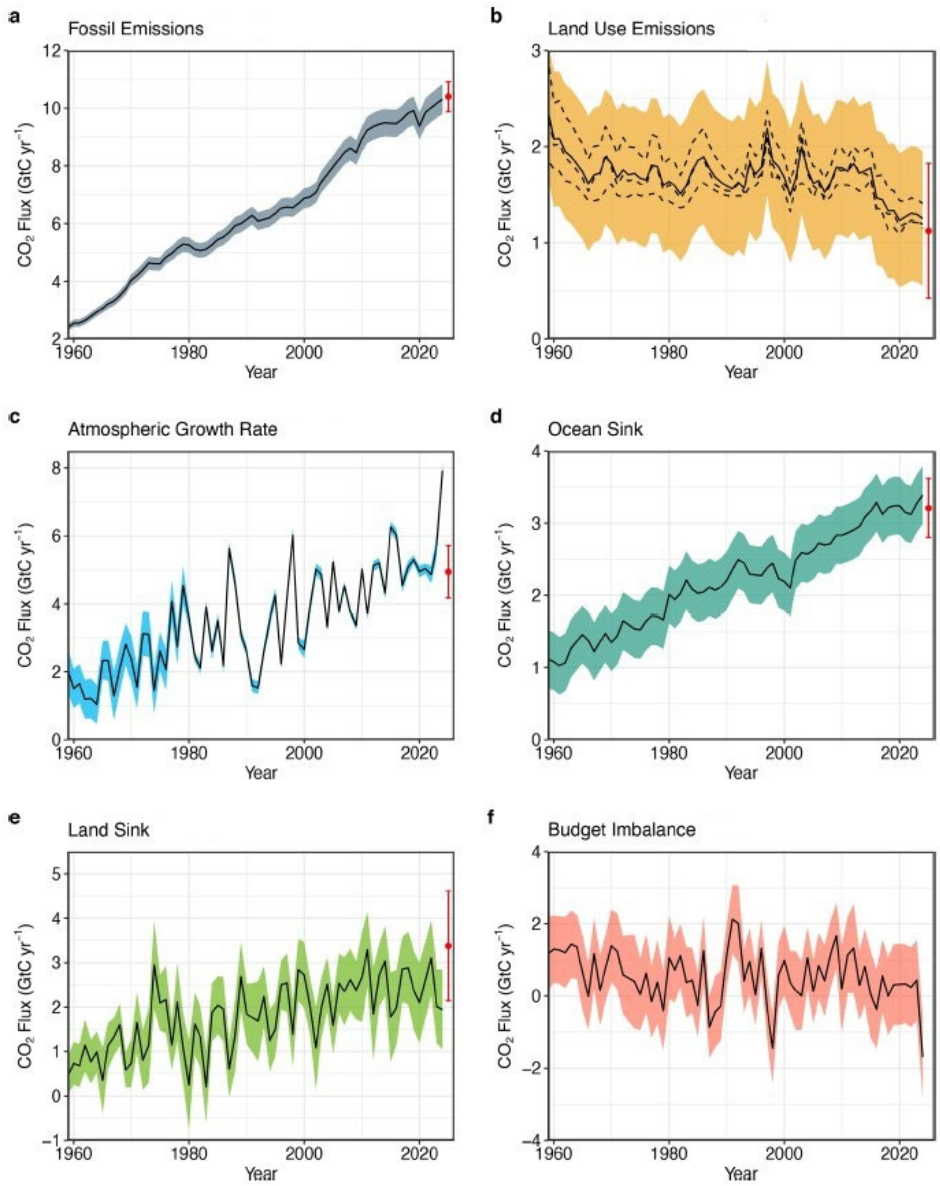

Figure: Components of the global carbon budget and their uncertainties as a function of time for (a) fossil CO_2, (b) emissions from land-use change, (c) growth rate in atmospheric CO_2 concentration, (d) the ocean CO_2 sink, (e) the land CO_2 sink, and (f) the budget imbalance, defined as the sum of all sources and sinks and a measure of the mismatch between the estimated total emissions and the estimated changes in the atmosphere, land, and ocean reservoirs. All data are in GtC yr^{-1} with the uncertainty bounds representing ±1 standard deviation (colored shaded areas). The red dots indicate the authors' projections for the year 2025, and the red error bars show uncertainties in the 2025 projections.

(Annika Jersild, CISESS, ajersild@umd.edu; Funding: GOMO)

Tracking Chemical Emissions
Citation: Cahuich-López, Miguel, Christopher P. Loughner, **Fong Ngan**, Anna Karion, Lei Hu, Israel Lopez-Coto, Kimberly Mueller, Julia K. Marrs, Arlyn Andrews, John Miller, Brian C. McDonald, Colin Harkins, Congmeng Lyu, Meng Li, Kevin R. Gurney, Mark Cohen, Howard Diamond, Ariel Stein, and James Whetstone, 2026: Development and evaluation of an urban atmospheric inverse modeling framework for the Washington, DC and Baltimore, MD metropolitan area: initial results from an inert tracer case study. *J. Geophys. Res. Atmos.*, **131**(16), e2025JD045557, https://doi.org/10.1029/2025JD045557.
Summary: If a hazardous substance is released somewhere in a city, how much was released, where did it come from, and where is it going? These are questions posed in a proof-of-concept study carried out by CISESS Scientists Miguel Cahuich-López and Fong Ngan and colleagues in their recent paper published in the *Journal of Geophysical Research: Atmospheres*. The authors introduce and evaluate a high-resolution (1-km, 1-hr) urban-scale atmospheric inverse modeling system that infers emission characteristics from downwind atmospheric observations, using the Washington, DC, and Baltimore, MD, metropolitan area (DCBA) as the study domain and January 2019 as the study period. The system combines Weather Research and Forecasting weather model simulations to capture local winds and conditions, HYSPLIT to simulate how pollutants move and disperse through the atmosphere, and measurements from National Institute of Standards and Technology's Northeast Corridor Urban Test Bed. Both simulations and ground-based observations show that their model could substantially improve estimates of how much material was released and the total mass released across the DCBA. The system also captures hour-by-hour changes reasonably well when emissions come from a broad, city-sized area. The authors suggest that the proposed framework could help emergency managers rapidly estimate hazardous emissions, identify affected areas, and make better decisions to reduce exposure, illness, and deaths in the population after an urban chemical release.

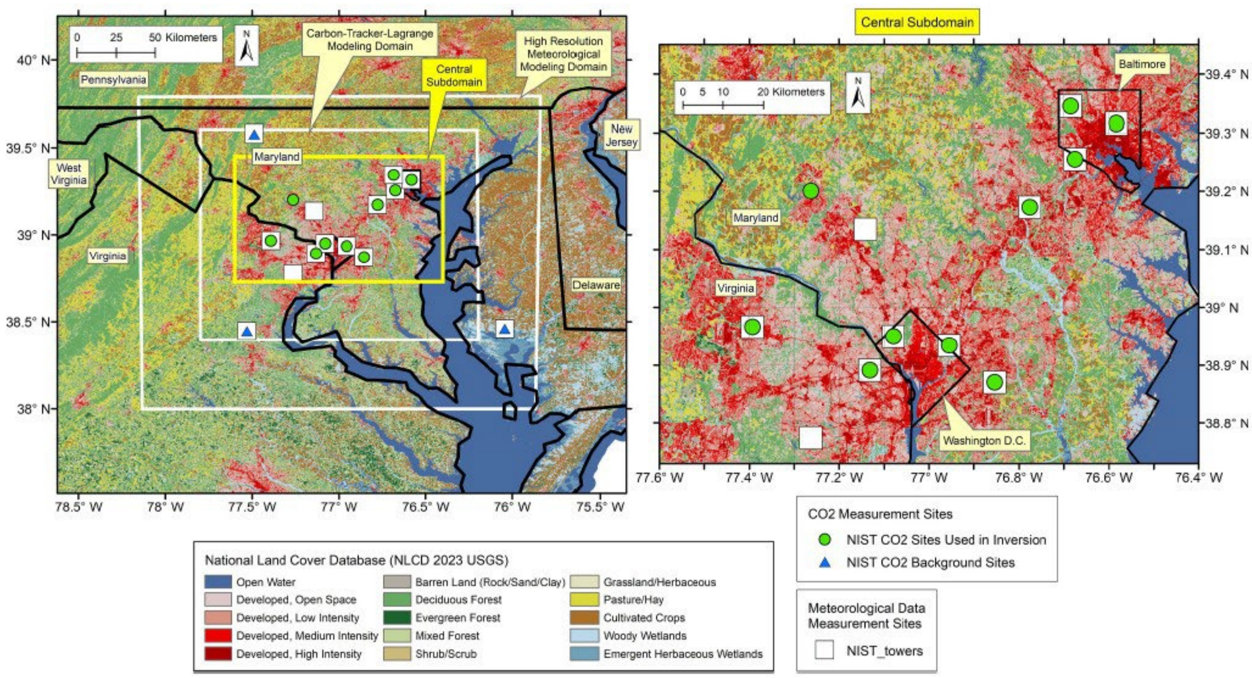

Figure: Map of the DCBA model domain. Green circle markers indicate the locations of the National Institute of Standards and Technology (NIST) towers used in the inversions, blue triangles denote NIST sites used to provide background concentrations, and white square markers represent the meteorological data network incorporated into the high-resolution meteorological modeling.

(Miguel Cahuich-López, CISESS, mcahuich@umd.edu, Funding: ARL; Fong Ngan, CISESS, fngan@umd.edu, Funding: ARL)

(Maureen Cribb, CISESS, mcribb@umd.edu, Funding: CISESS Task I)