Future of OCO-2 MIP and CEOS top-down budget

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Review of 2023 pilot dataset

- Created pilot dataset of National CO_2 budgets over 6 years (2015-2020)

- Estimates derived from atmospheric CO_2 data (in situ and OCO-2).

- Published data description in ESSD and had dataset hosted by CEOS as GST dataset.

Net Surface Emissions & Removals of Carbon Dioxide (2015-2020)
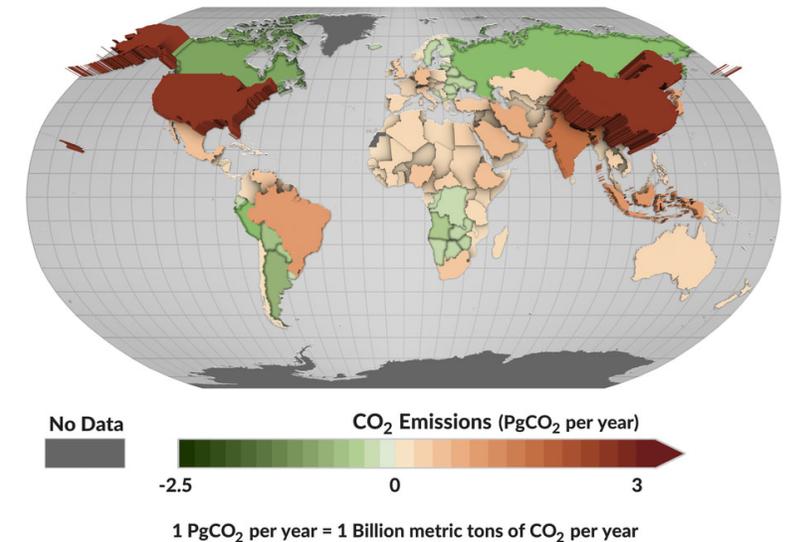
No Data CO_2 Emissions (PgCO$_2$ per year)
-2.5   0   3

1 PgCO$_2$ per year = 1 Billion metric tons of CO_2 per year

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Data description paper |

07 Mar 2023

National CO$_2$ budgets (2015–2020) inferred from atmospheric CO$_2$ observations in support of the global stocktake

Brendan Byrne ✉, David F. Baker, Sourish Basu, Michael Bertolacci, Kevin W. Bowman, Dustin Carroll, Abhishek Chatterjee, Frédéric Chevallier, Philippe Ciais, Noel Cressie, David Crisp, Sean Crowell, Feng Deng, Zhu Deng, Nicholas M. Deutscher, Manvendra K. Dubey, Sha Feng, Omaira E. García, David W. T. Griffith, Benedikt Herkommer, Lei Hu, Andrew R. Jacobson, Rajesh Janardanan, Sujong Jeong, Matthew S. Johnson, Dylan B. A. Jones, Rigel Kivi, Junjie Liu, Zhiqiang Liu, Shamil Maksyutov, John B. Miller, Scot M. Miller, Isamu Morino, Justus Notholt, Tomohiro Oda, Christopher W. O'Dell, Young-Suk Oh, Hirofumi Ohyama, Prabir K. Patra, Hélène Peiro, Christof Petri, Sajeev Philip, David F. Pollard, Benjamin Poulter, Marine Remaud, Andrew Schuh, Mahesh K. Sha, Kei Shiomi, Kimberly Strong, Colm Sweeney, Yao Té, Hanqin Tian, Voltaire A. Velazco, Mihalis Vrekoussis, Thorsten Warneke, John R. Worden, Debra Wunch, Yuanzhi Yao, Jeongmin Yun, Andrew Zammit-Mangion, and Ning Zeng

Altmetrics
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484
Preprint
6
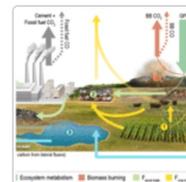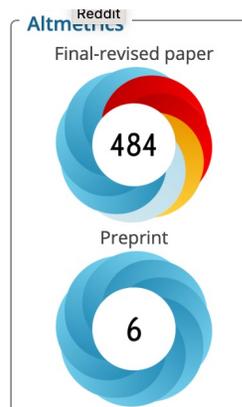
CE⊙S Committee on Earth Observation Satellites

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Carbon Dioxide

Pilot Top-down CO$_2$ emissions and removals associated with Terrestrial Carbon Stock Changes by nations

Updated October 2022

OCO-2 MIP experiments

- Dataset depends on OCO-2 MIP

- Three MIP datasets have been created (associated with ACOS retrieval version).

- Future of OCO-2 MIP impacts GST dataset

The 2015–2016 carbon cycle as seen from OCO-2 and the global in situ network

Sean Crowell[1], David Baker[2], Andrew Schuh[2], Sourish Basu[3,4], Andrew R. Jacobson[3,4], Frederic Chevallier[5], Junjie Liu[6], Feng Deng[7], Liang Feng[8,9], Kathryn McKain[3,4], Abhishek Chatterjee[10,11], John B. Miller[4], Britton B. Stephens[13], Annmarie Eldering[6], David Crisp[6], David Schimel[6], Ray Nassar[12], Christopher W. O'Dell[2], Tomohiro Oda[10,11], Colm Sweeney[4], Paul I. Palmer[8,9], and Dylan B. A. Jones[7]

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

Hélène Peiro[1], Sean Crowell[1], Andrew Schuh[2], David F. Baker[2], Chris O'Dell[2], Andrew R. Jacobson[3,4], Frédéric Chevallier[5], Junjie Liu[6], Annmarie Eldering[6], David Crisp[6], Feng Deng[7], Brad Weir[8,9], Sourish Basu[10,11], Matthew S. Johnson[12], Sajeev Philip[13,a], and Ian Baker[14]

MIP extension

2015   2016   2017   2018   2019   2020   2021   2022
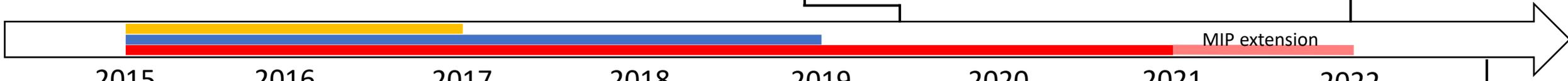
Model/Group	Transport	Assimilation	Resolution	Unc
NASA Ames	GEOS Chem	Variational	4°×5°	✗
CMS Flux	GEOS Chem	Variational	4°×5°	✗
U. Toronto	GEOS Chem	Variational	4°×5°	✗
COLA	GEOS Chem	EnKF	4°×5°	✗
CSU	GEOS Chem	Synthesis	4°×5°	✓
JHU	GEOS Chem	Variational	4°×5°	✗
WOMBAT	GEOS Chem	Synthesis/MCMC	2°×2.5°	✓
CIRA	PCTM	Variational	6.7°×6.7°	✗
NIES	NIES-TM/FLEXPART	Variational	3.75°×3.75°/0.1°×0.1°	✗
CAMS	LMDz	Variational	1.9°×3.75°	✓
Oklahoma U.	TM5	Variational	6°×4°	✗
NASA GSFC	TM5	Variational	3°×2°	✓
NOAA GML	TM5	EnKF	3°×2°/1°×1°	✗

National CO$_2$ budgets (2015–2020) inferred from atmospheric CO$_2$ observations in support of the global stocktake

Brendan Byrne[1], David F. Baker[2], Sourish Basu[3,4], Michael Bertolacci[5], Kevin W. Bowman[1,6], Dustin Carroll[7,1], Abhishek Chatterjee[1], Frédéric Chevallier[8], Philippe Ciais[8], Noel Cressie[5,1], David Crisp[1], Sean Crowell[9], Feng Deng[10], Zhu Deng[11], Nicholas M. Deutscher[12], Manvendra K. Dubey[13], Sha Feng[14], Omaira E. García[15], David W. T. Griffith[12], Benedikt Herkommer[16], Lei Hu[17], Andrew R. Jacobson[17,18], Rajesh Janardanan[19], Sujong Jeong[20], Matthew S. Johnson[21], Dylan B. A. Jones[10], Rigel Kivi[22], Junjie Liu[1,23], Zhiqiang Liu[24], Shamil Maksyutov[19], John B. Miller[17], Scot M. Miller[25], Isamu Morino[19], Justus Notholt[26], Tomohiro Oda[27,28], Christopher W. O'Dell[2], Young-Suk Oh[29], Hirofumi Ohyama[19], Prabir K. Patra[30], Hélène Peiro[9], Christof Petri[26], Sajeev Philip[31], David F. Pollard[32], Benjamin Poulter[1], Marine Remaud[8], Andrew Schuh[2], Mahesh K. Sha[33], Kei Shiomi[34], Kimberly Strong[10], Colm Sweeney[17], Yao Té[35], Hanqin Tian[36,37], Voltaire A. Velazco[12,38], Mihalis Vrekoussis[39,26], Thorsten Warneke[26], John R. Worden[1], Debra Wunch[10], Yuanzhi Yao[36], Jeongmin Yun[20], Andrew Zammit-Mangion[5], and Ning Zeng[28,4]

Future plans

- Not waiting for next GST – planning on more frequent updates.

- OCO-2 mission will continue with new ACOS 11.1 retrieval algorithm for foreseeable future.

- OCO-2 MIP is planning to perform reanalysis with ACOS 11.1 starting early in 2024:
    - In 2024, OCO-2 MIP will produce 8 or 9 year reanalysis (2015-2022 or 2015-2023).
    - Will be followed up annual updates extending MIP by one year
        - Annual updates will occur until new ACOS algorithm (not expected for several years)

- What about CH_4 dataset?
    - generate emissions for 2009 to 2022 using GOSAT.
    - Work with CAMS and NOAA plus other interested parties to see if we can combine results.

Questions/Discussion

- What is relationship between new datasets and CEOS?

- What are CEOS plans for CO_2 & CH_4 Fluxes?