2023年11月10日 IGES
COP28直前ウェビナーシリーズ 第1回「政治的局面を迎えるグローバルストックテイク
世界の軌道修正成るか」

IPCCに関与する科学者の立場から、第1回GSTへの期待と考察

TOGETHER FOR IMPLEMENTATION.
TOGETHER FOR IMPLEMENTATION.
DECARBONIZATION

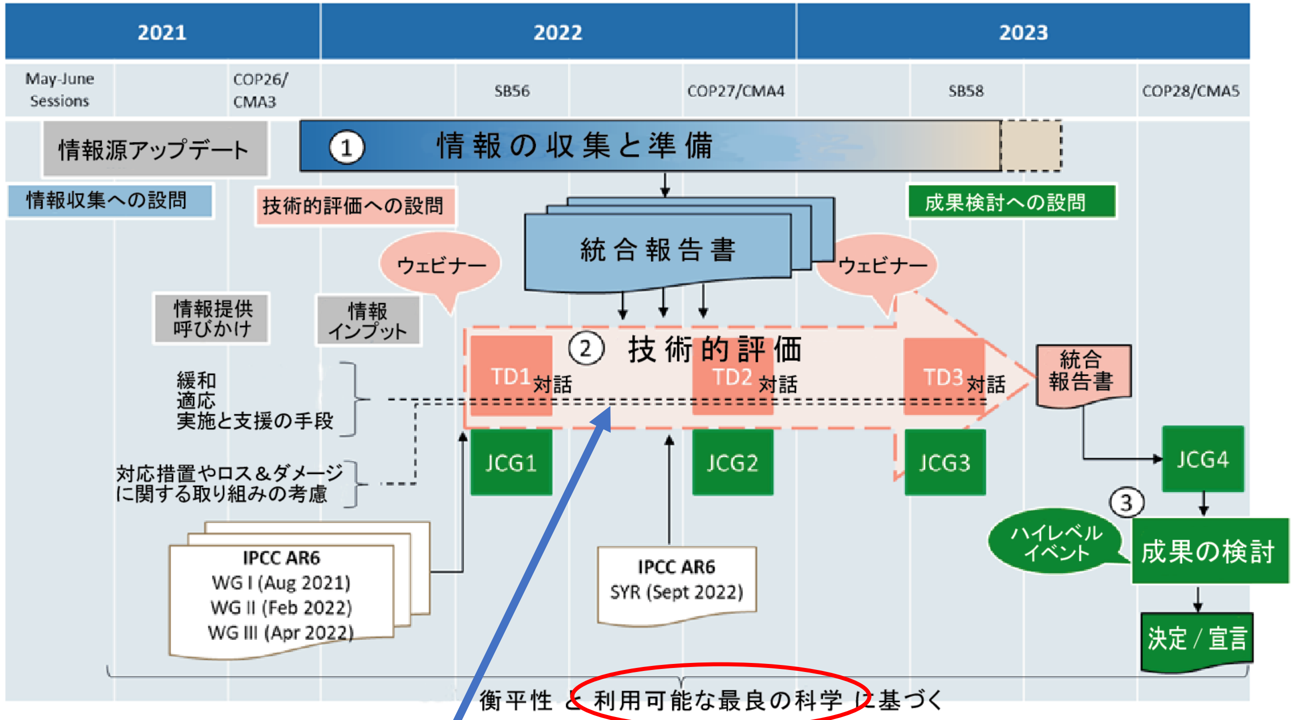
伊藤 昭彦
東京大学 大学院農学生命科学研究科
国立環境研究所 地球システム領域
海洋研究開発機構 北極環境変動総合研究センター

科学の役割

科学の必要性1
成果・知見のインプット
・論文、報告書
・データ　など

情報源
- 締約国からの提出物
- 最新IPCC報告書
- 補助機関報告書
- 関連機関報告書
- 国連機関報告書
- 締約国の自発的提出
- 地域グループ・機関
- 締約国以外の提出物

第1回グローバルストックテイクのスケジュール


2021
2022
2023
May-June Sessions
COP26/ CMA3
SB56
COP27/CMA4
SB58
COP28/CMA5
情報源アップデート
① 情報の収集と準備
情報収集への設問
技術的評価への設問
成果検討への設問
統合報告書
ウェビナー
ウェビナー
情報提供 呼びかけ
情報 インプット
② 技術的評価
TD1 対話
TD2 対話
TD3 対話
統合 報告書
緩和
適応
実施と支援の手段
対応措置やロス＆ダメージに関する取り組みの考慮
JCG1
JCG2
JCG3
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③
ハイレベル イベント
成果の検討
決定 / 宣言
IPCC AR6 WG I (Aug 2021) WG II (Feb 2022) WG III (Apr 2022)
IPCC AR6 SYR (Sept 2022)
衡平性 と 利用可能な最良の科学 に基づく

自然科学者が苦手な部分？

・客観性
・透明性
・中立性
・定量性
・普遍性
・迅速性

政策フェーズでも

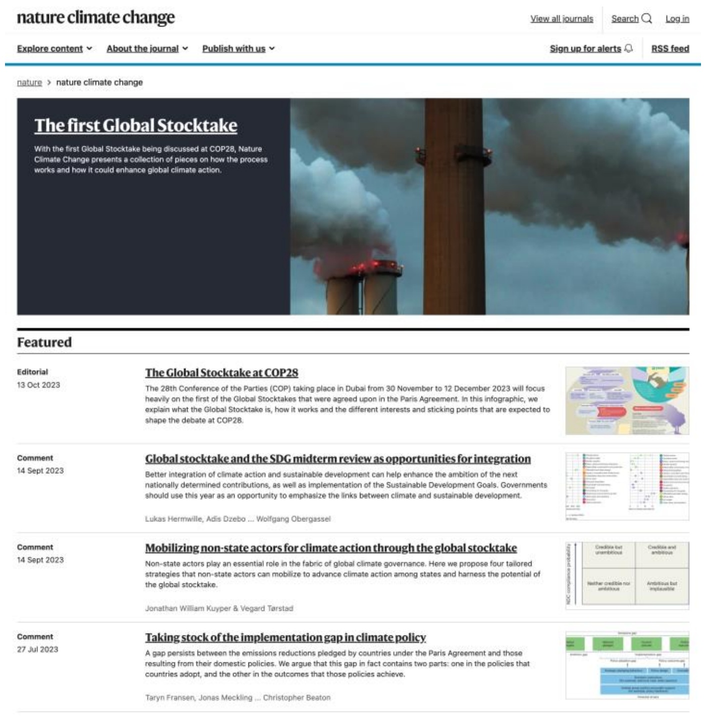
排出削減目標
（NDC）の更新

科学の必要性2
どこまで引き上げるべきか？
技術的に可能か？

提出物の概容（統合報告書より）
As of 2 October 2023, submissions were received from 24 Parties (日本含む) on behalf of Party groups or individual Parties, representing 180 Parties and from 44 non-Party stakeholders (IGES含む) expressing views on the elements for the consideration of outputs components of the first global stocktake totalling 787 pages (423 from Parties and 371 from non-Party stakeholders).

GSTに向き合う科学

気候変動のトップジャーナルが
1st Global Stocktakeを特集



nature climate change

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nature > nature climate change

The first Global Stocktake

With the first Global Stocktake being discussed at COP28, Nature Climate Change presents a collection of pieces on how the process works and how it could enhance global climate action.

Featured

Editorial
13 Oct 2023

The Global Stocktake at COP28

The 28th Conference of the Parties (COP) taking place in Dubai from 30 November to 12 December 2023 will focus heavily on the first of the Global Stocktakes that were agreed upon in the Paris Agreement. In this infographic, we explain what the Global Stocktake is, how it works and the different interests and sticking points that are expected to shape the debate at COP28.

Comment
14 Sept 2023

Global stocktake and the SDG midterm review as opportunities for integration

Better integration of climate action and sustainable development can help enhance the ambition of the next nationally determined contributions, as well as implementation of the Sustainable Development Goals. Governments should use this year as an opportunity to emphasize the links between climate and sustainable development.

Lukas Hermwille, Adis Dzebo ... Wolfgang Obergassel

Comment
14 Sept 2023

Mobilizing non-state actors for climate action through the global stocktake

Non-state actors play an essential role in the fabric of global climate governance. Here we propose four tailored strategies that non-state actors can mobilize to advance climate action among states and harness the potential of the global stocktake.

Jonathan William Kuyper & Vegard Tørstad

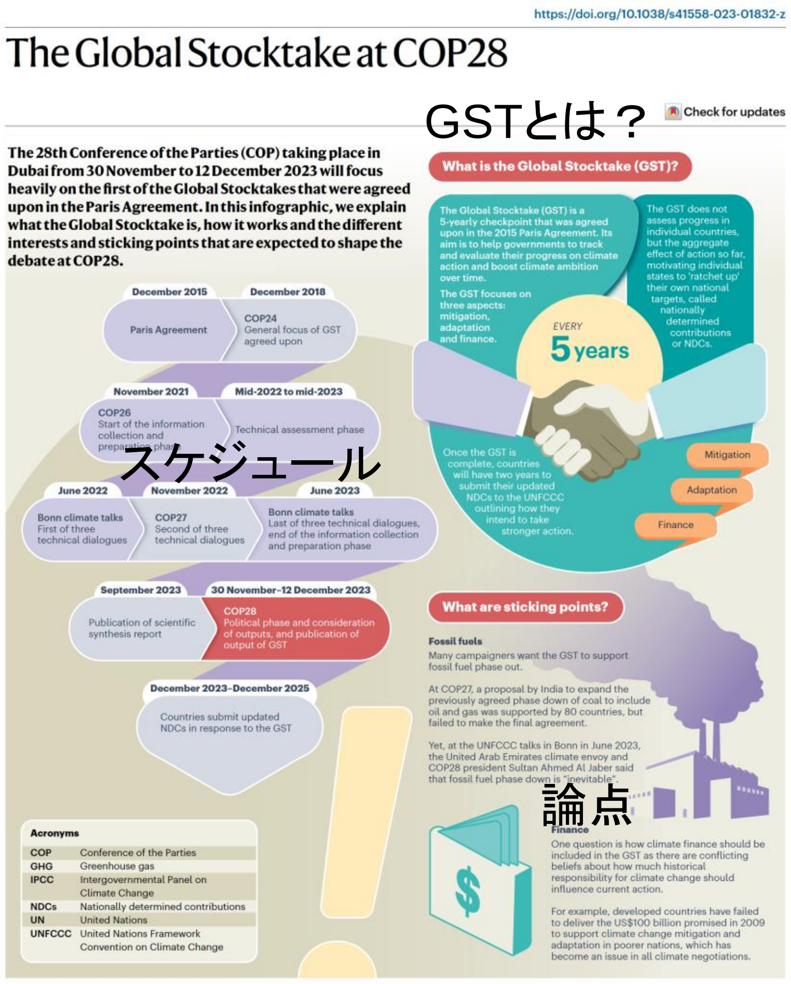
Comment
27 Jul 2023

Taking stock of the implementation gap in climate policy

A gap persists between the emissions reductions pledged by countries under the Paris Agreement and those resulting from their domestic policies. We argue that this gap in fact contains two parts: one in the policies that countries adopt, and the other in the outcomes that those policies achieve.

Taryn Fransen, Jonas Meckling ... Christopher Beaton

https://www.nature.com/collections/dajifcgcej



https://doi.org/10.1038/s41558-023-01832-z

The Global Stocktake at COP28

Check for updates

The 28th Conference of the Parties (COP) taking place in Dubai from 30 November to 12 December 2023 will focus heavily on the first of the Global Stocktakes that were agreed upon in the Paris Agreement. In this infographic, we explain what the Global Stocktake is, how it works and the different interests and sticking points that are expected to shape the debate at COP28.

スケジュール

December 2015 Paris Agreement
December 2018 COP24 General focus of GST agreed upon
November 2021 COP26 Start of the information collection and preparation phase
Mid-2022 to mid-2023 Technical assessment phase
June 2022 Bonn climate talks First of three technical dialogues
November 2022 COP27 Second of three technical dialogues
June 2023 Bonn climate talks Last of three technical dialogues, end of the information collection and preparation phase
September 2023 Publication of scientific synthesis report
30 November–12 December 2023 COP28 Political phase and consideration of outputs, and publication of output of GST
December 2023–December 2025 Countries submit updated NDCs in response to the GST

GSTとは？

What is the Global Stocktake (GST)?

The Global Stocktake (GST) is a 5-yearly checkpoint that was agreed upon in the 2015 Paris Agreement. Its aim is to help governments to track and evaluate their progress on climate action and boost climate ambition over time.

The GST focuses on three aspects: mitigation, adaptation and finance.

The GST does not assess progress in individual countries, but the aggregate effect of action so far, motivating individual states to 'ratchet up' their own national targets, called nationally determined contributions or NDCs.

EVERY 5 years

Once the GST is complete, countries will have two years to submit their updated NDCs to the UNFCCC outlining how they intend to take stronger action.

What are sticking points?

Fossil fuels

Many campaigners want the GST to support fossil fuel phase out.

At COP27, a proposal by India to expand the previously agreed phase down of coal to include oil and gas was supported by 80 countries, but failed to make the final agreement.

Yet, at the UNFCCC talks in Bonn in June 2023, the United Arab Emirates climate envoy and COP28 president Sultan Ahmed Al Jaber said that fossil fuel phase down is "inevitable".

論点

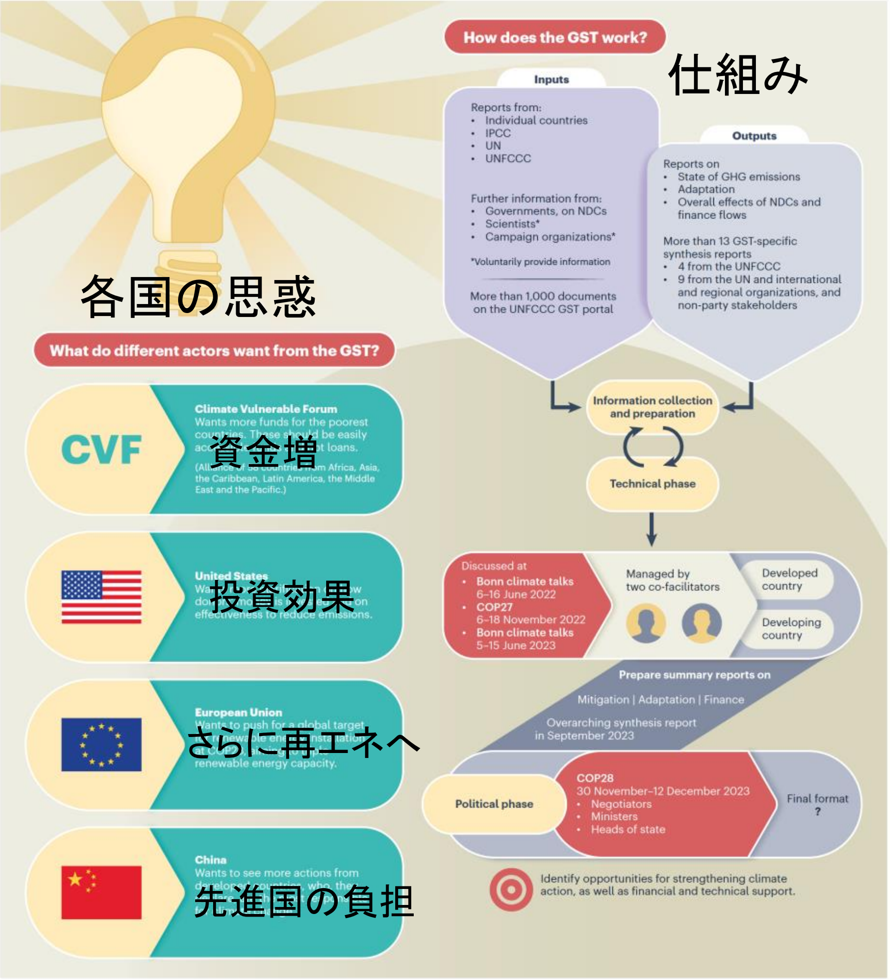
Finance

One question is how climate finance should be included in the GST as there are conflicting beliefs about how much historical responsibility for climate change should influence current action.

For example, developed countries have failed to deliver the US$100 billion promised in 2009 to support climate change mitigation and adaptation in poorer nations, which has become an issue in all climate negotiations.

Acronyms

COP	Conference of the Parties
GHG	Greenhouse gas
IPCC	Intergovernmental Panel on Climate Change
NDCs	Nationally determined contributions
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change



各国の思惑

What do different actors want from the GST?

Climate Vulnerable Forum
Wants more funds for the poorest countries. These should be easily ac[illegible]t loans.
(All[illegible] countries from Africa, Asia, the Caribbean, Latin America, the Middle East and the Pacific.)

資金増

United States
Wa[illegible] do[illegible] on effectiveness to reduce emissions.

投資効果

European Union
Wants to push for a global target [illegible] renewable energy installation at COP2[illegible] renewable energy capacity.

さらに再エネへ

China
Wants to see more actions from developed countries, who the[illegible]

先進国の負担

How does the GST work?

仕組み

Inputs

Reports from:
- Individual countries
- IPCC
- UN
- UNFCCC

Further information from:
- Governments, on NDCs
- Scientists*
- Campaign organizations*

*Voluntarily provide information

More than 1,000 documents on the UNFCCC GST portal

Outputs

Reports on
- State of GHG emissions
- Adaptation
- Overall effects of NDCs and finance flows

More than 13 GST-specific synthesis reports
- 4 from the UNFCCC
- 9 from the UN and international and regional organizations, and non-party stakeholders

Information collection and preparation

Technical phase

Discussed at
- **Bonn climate talks** 6–16 June 2022
- **COP27** 6–18 November 2022
- **Bonn climate talks** 5–15 June 2023

Managed by two co-facilitators

Prepare summary reports on

Mitigation | Adaptation | Finance

Overarching synthesis report in September 2023

Political phase

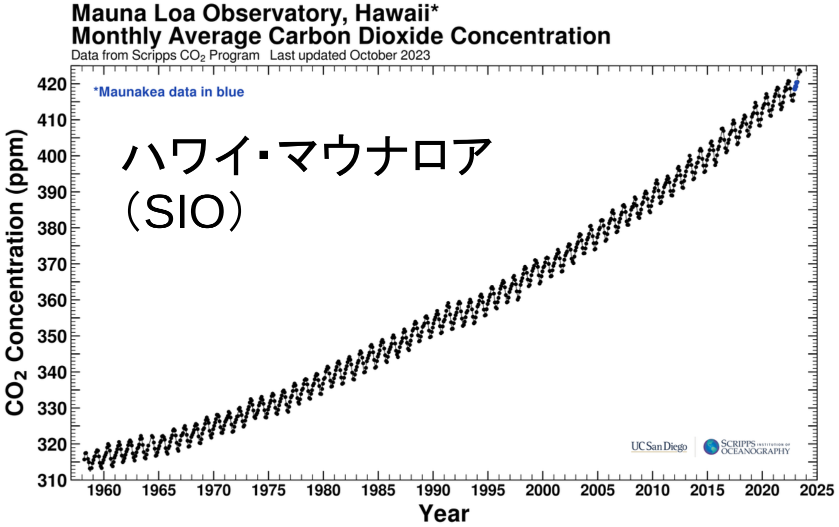
COP28
30 November–12 December 2023
- Negotiators
- Ministers
- Heads of state

Final format ?

Identify opportunities for strengthening climate action, as well as financial and technical support.

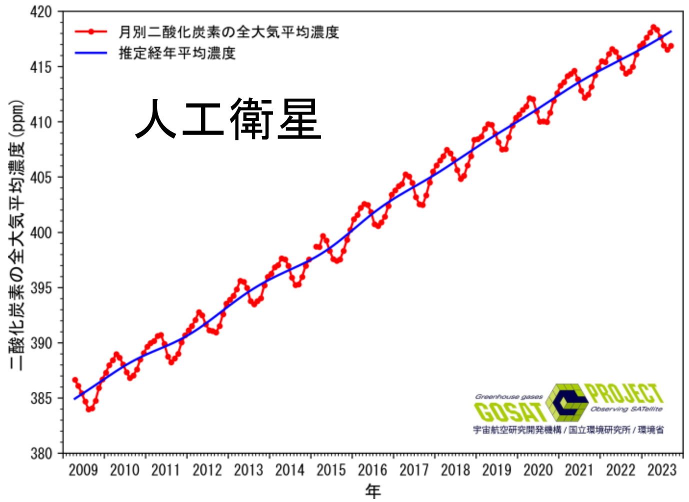
大気の温室効果ガスは減っていない

※新型コロナによる排出減少は2020年に7%程度だけ (国際プロジェクトの分析)

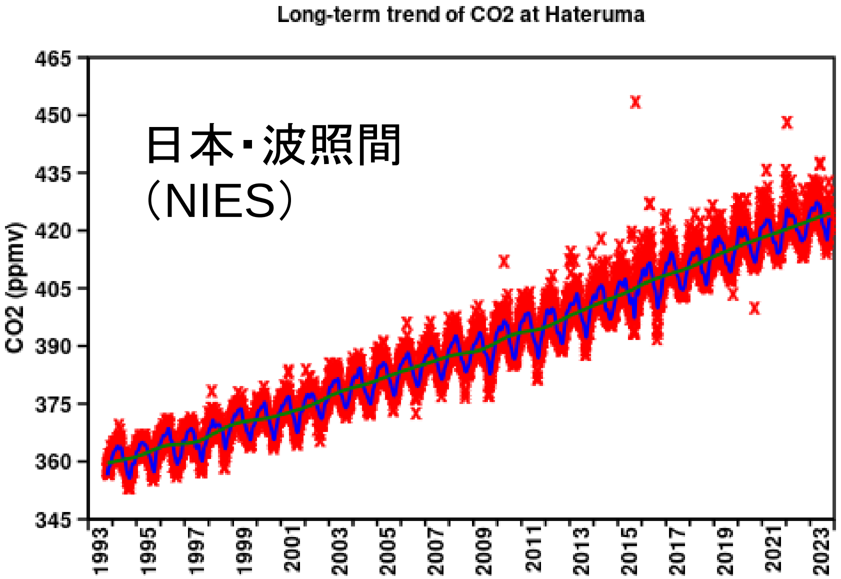


Mauna Loa Observatory, Hawaii*
Monthly Average Carbon Dioxide Concentration
Data from Scripps CO_2 Program   Last updated October 2023

ハワイ・マウナロア
（SIO）

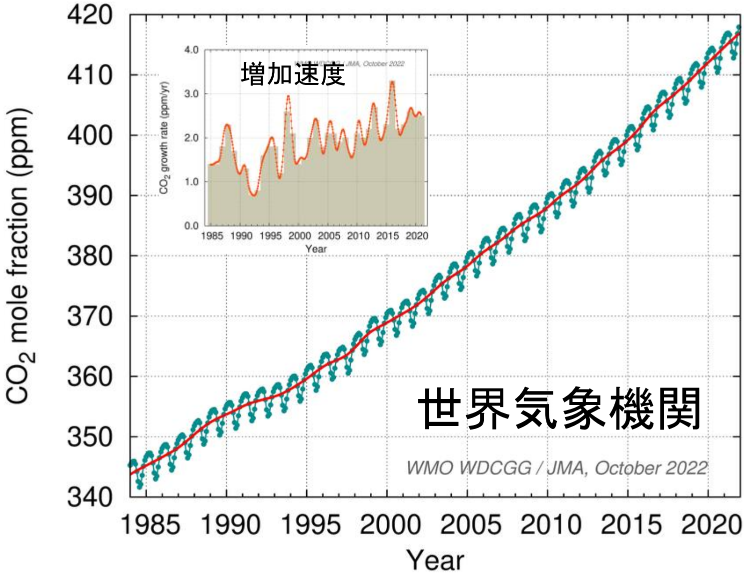


人工衛星



Long-term trend of CO2 at Hateruma

日本・波照間
（NIES）

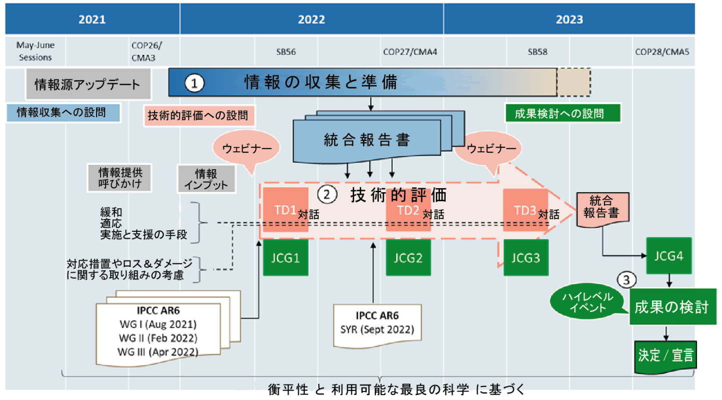


世界気象機関

WMO WDCGG / JMA, October 2022

科学的な課題

第1回グローバルストックテイク


2021
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May-June Sessions
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IPCC AR6 SYR (Sept 2022)
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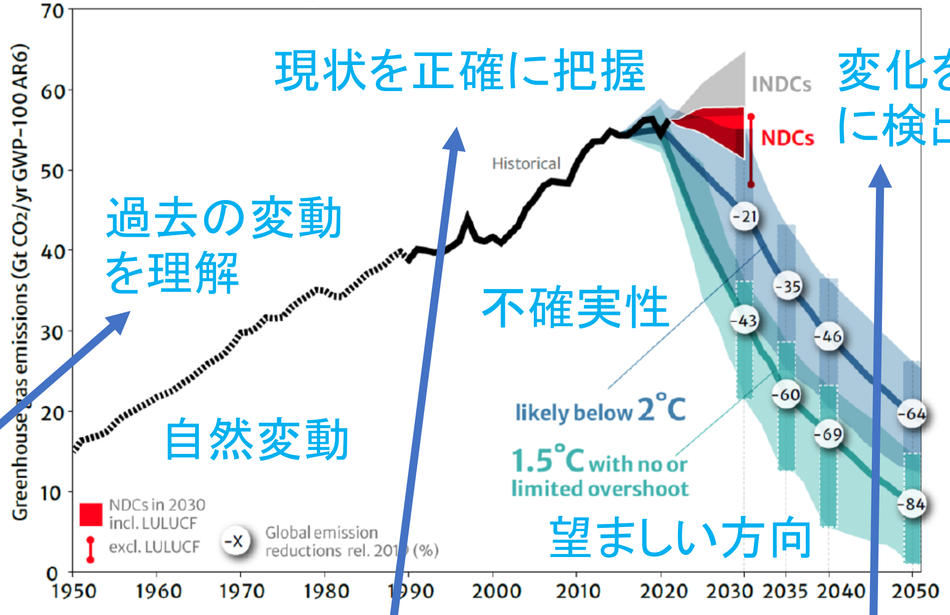


現状を正確に把握

変化を迅速に検出

過去の変動を理解

不確実性

自然変動

望ましい方向

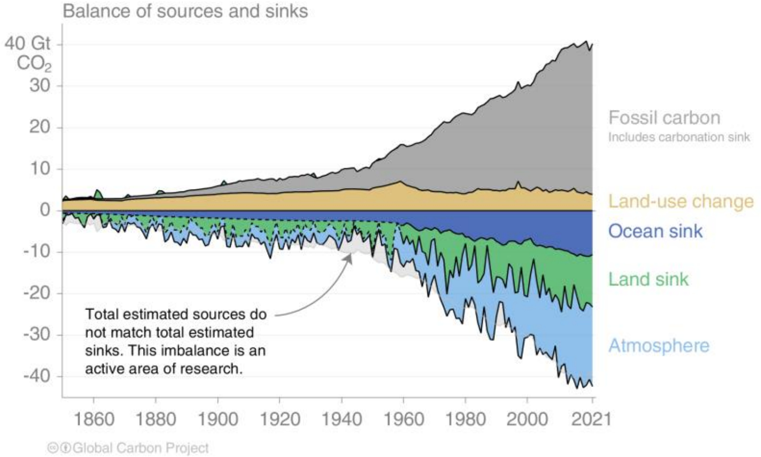
緩和技術

将来の排出削減と温暖化抑制の関係

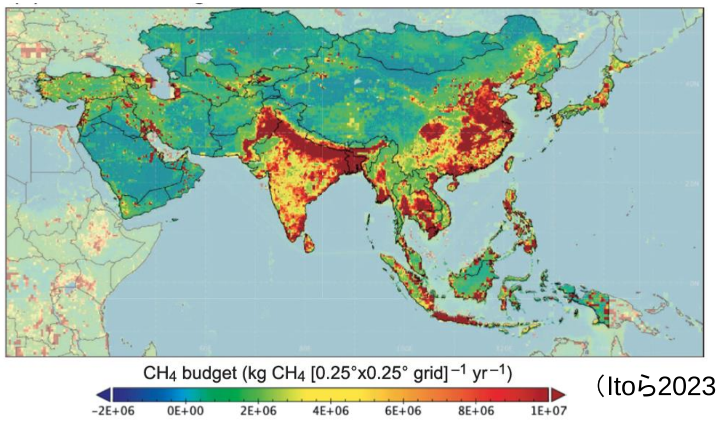
残された影響
→適応

科学的研究の成果

統合解析（国際炭素プロ）

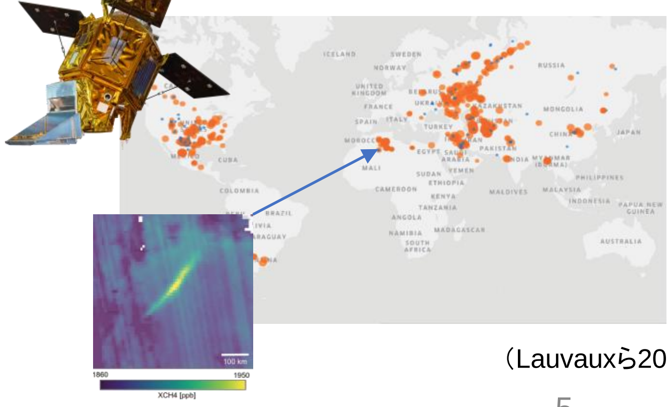


排出・吸収の積上げ


CH₄ budget (kg CH₄ [0.25°x0.25° grid]⁻¹ yr⁻¹)
-2E+06
0E+00
2E+06
4E+06
6E+06
8E+06
1E+07

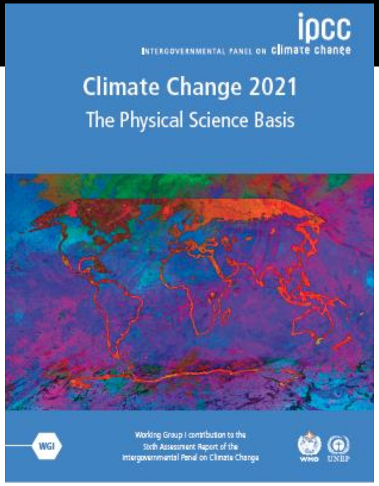
（Itoら2023）

衛星による監視



（Lauvauxら2022）

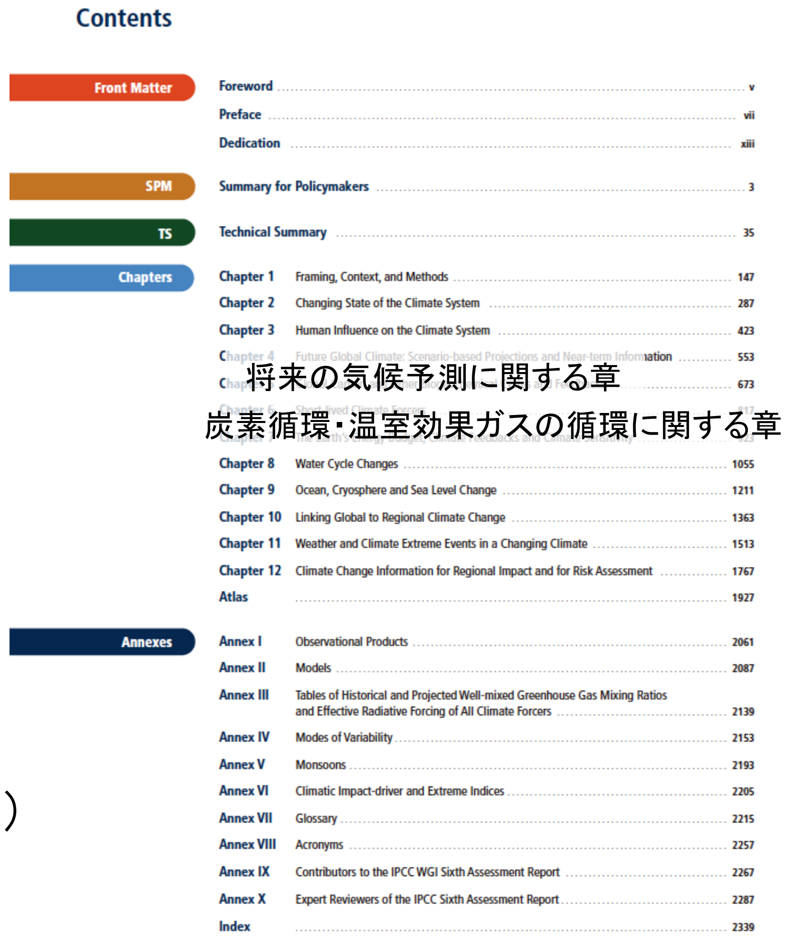
IPCCへの貢献


ipcc
INTERGOVERNMENTAL PANEL ON climate change
Climate Change 2021
The Physical Science Basis
WGI
Working Group I contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change
WMO
UNEP

第１作業部会
　科学

第2作業部会
　影響・適応
第3作業部会
　緩和
1.5℃特別報告書
陸域特別報告書
（都市特別報告書）

IPCC（気候変動に関する政府間パネル）
国連による気候変動科学の統括機関



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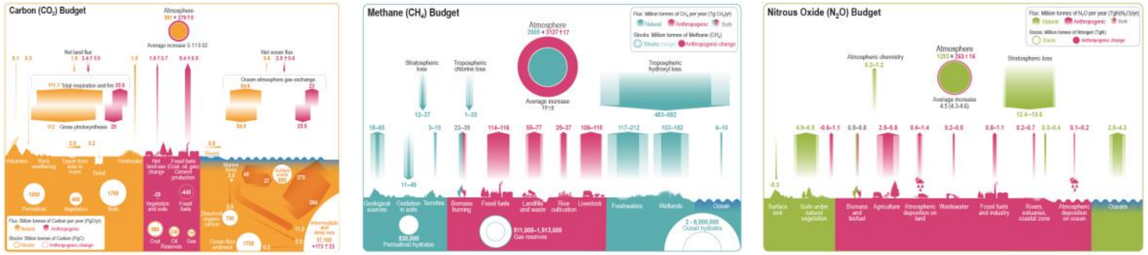
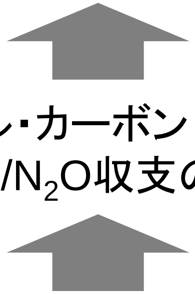
将来の気候予測に関する章
炭素循環・温室効果ガスの循環に関する章

世界から多数の科学者が参加し最新の知見をまとめた、
最も信頼できる科学的根拠
（ただし発表間隔は5年以上：　2013 -> 2021）

日本の研究者も貢献
LA　（気象研・石井、JAMSTEC・Prabir Patra）
専門家査読者、論文引用


Carbon (CO_2) Budget
Methane (CH_4) Budget
Nitrous Oxide (N_2O) Budget
Atmosphere



グローバル・カーボン・プロジェクト
・CO_2/CH_4/N_2O収支の統合解析

各研究機関・グループによる観測・モデル・解析

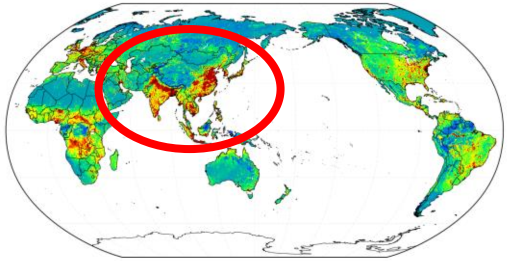
世界の動向

パリ協定グローバルストックテイク（GST）

（第1回: 2023、第2回: 2028、、、）

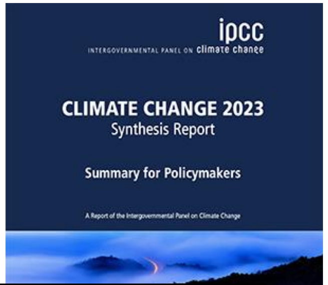
Global Stocktake governance and facilitation.

ただし
- 資金的な裏付けは弱い
- 活動間の整合性は未調整
- 地域的な粗密
  →欧米で密、アジアは手薄



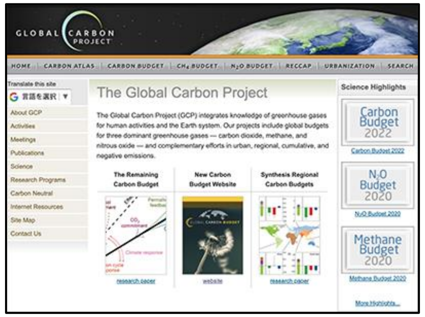
世界の観測・研究コミュニティ

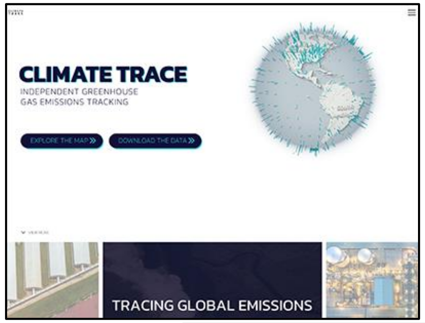
次期IPCC報告書（AR7）に向けた検討開始


ipcc
INTERGOVERNMENTAL PANEL ON climate change
CLIMATE CHANGE 2023
Synthesis Report
Summary for Policymakers
A Report of the Intergovernmental Panel on Climate Change

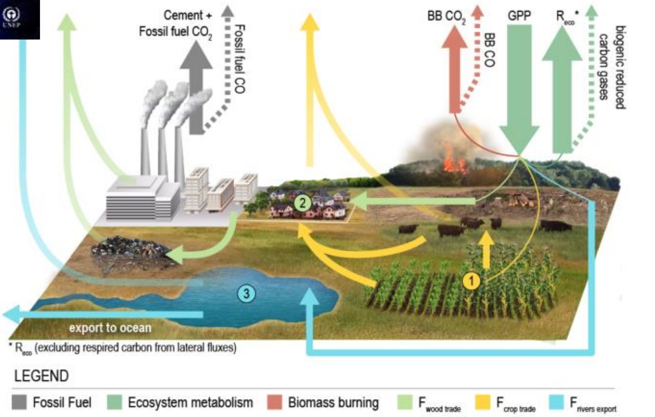
Global Greenhouse Gas Watch (GGGW)

WMO Global Greenhouse Gas Watch（GGGW）総会で採択


The Global Carbon Project

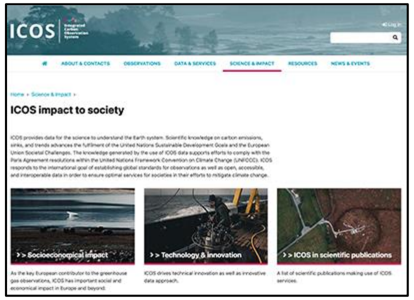

CLIMATE TRACE
INDEPENDENT GREENHOUSE GAS EMISSIONS TRACKING
TRACING GLOBAL EMISSIONS

MONITORING THE HUMAN IMPACT ON CO2


Cement + Fossil fuel CO_2
Fossil fuel CO
BB CO_2
BB CO
GPP
R_{eco}*
biogenic reduced carbon gases
1
2
3
export to ocean
*R_{eco} (excluding respired carbon from lateral fluxes)
LEGEND
Fossil Fuel
Ecosystem metabolism
Biomass burning
$F_{wood\ trade}$
$F_{crop\ trade}$
$F_{rivers\ export}$

CEOS and the UNFCCC Global Stocktake

Carbon Monitor


ICOS impact to society

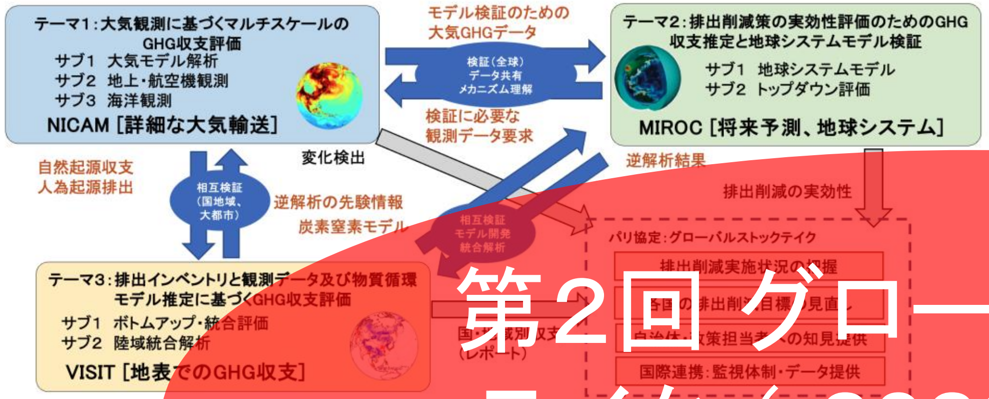
We develop the capabilities for Monitoring, Reporting, and Verification of carbon stocks and fluxes.

(Byrne et al., 2023, ESSD)

日本の動向

緩和（GHG収支）関係の情報をグローバルストックテイク（①情報収集）に提供

環境研究総合推進費（SII-8 → S-22）


テーマ1：大気観測に基づくマルチスケールのGHG収支評価
サブ1　大気モデル解析
サブ2　地上・航空機観測
サブ3　海洋観測
NICAM［詳細な大気輸送］
モデル検証のための大気GHGデータ
検証（全球）
データ共有
メカニズム理解
検証に必要な観測データ要求
テーマ2：排出削減策の実効性評価のためのGHG収支推定と地球システムモデル検証
サブ1　地球システムモデル
サブ2　トップダウン評価
MIROC［将来予測、地球システム］
変化検出
逆解析結果
自然起源収支
人為起源排出
相互検証
（国地域、
大都市）
逆解析の先験情報
炭素窒素モデル
相互検証
モデル開発
統合解析
排出削減の実効性
パリ協定：グローバルストックテイク
排出削減実施状況の把握
各国の排出削減目標の見直し
自治体・政策担当者への知見提供
国際連携：監視体制・データ提供
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（レポート）
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サブ1　ボトムアップ・統合評価
サブ2　陸域統合解析
VISIT［地表でのGHG収支］

第2回 グローバルストック
テイク（-2028）に向けた
分析・戦略・研究開発

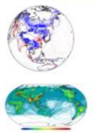
データベース［公開］
報告書
UNFCCC
ポータル

トップダウン推定（テーマ1、2）

グローバル
- ・CO_2, CH_4 収支マップ：1 x 1deg, NICAM, 1[illegible]
- ・CO_2, CH_4, N_2O収支マップ：地域分割, MIRO[illegible]-ACTM, [illegible]–202[illegible]
- ・CO_2, CH_4、N_2O 10年毎の集計表

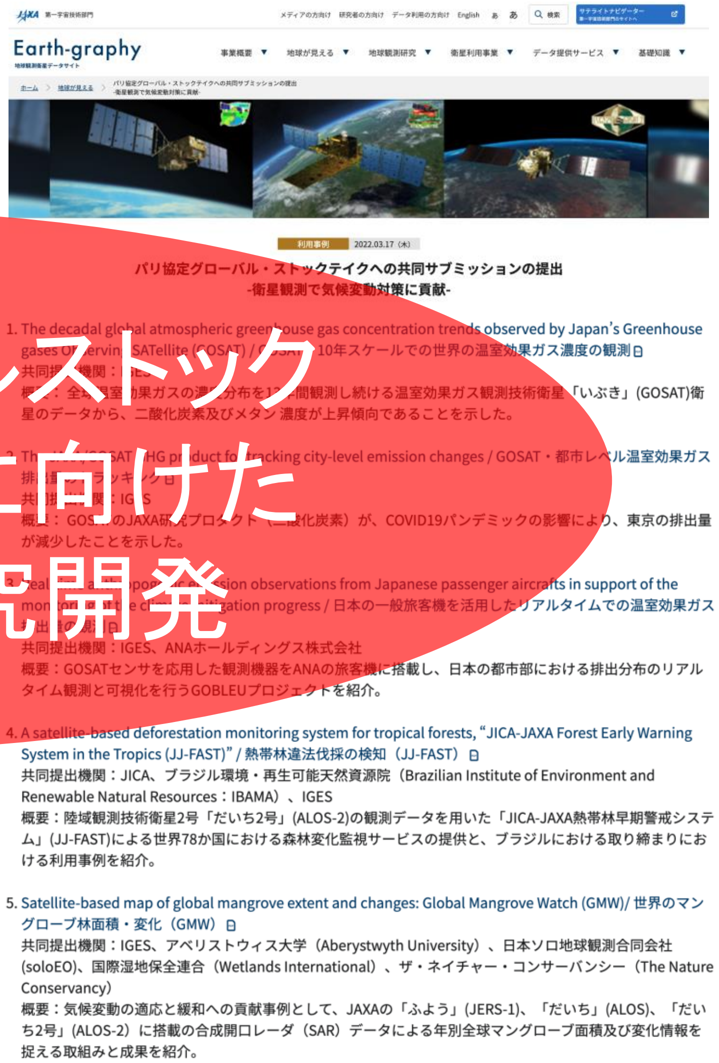
国 / 地域
- ・CO_2、CH_4収支：地域別、NICAM, 1990–2020
- ・CO_2、CH_4, N_2O 収支：11–15 地域 / top 20 放出源, 2000–2019
- ・大気中 CO_2, CH_4 濃度：地表, 船舶, 航空機, 1994–2021

ボトムアップ推定（テーマ3）



グローバル
- ・自然起源 CO_2, CH_4, N_2O収支マップ：0.5 x 0.5deg, VISIT, 1990–2020
- ・人為排出インベントリ：0.25 x 0.25deg, 1990–2018
- ・CO_2, CH_4, N_2O 10年毎の集計表

国 / 地域
- ・CO_2, CH_4, N_2O 収支：地域別（RECCAP2 地域）, 1990–2018
- ・陸域 CO_2 収支（GPP, NEE）：アジア、0.25×0.25deg, 2000–2020

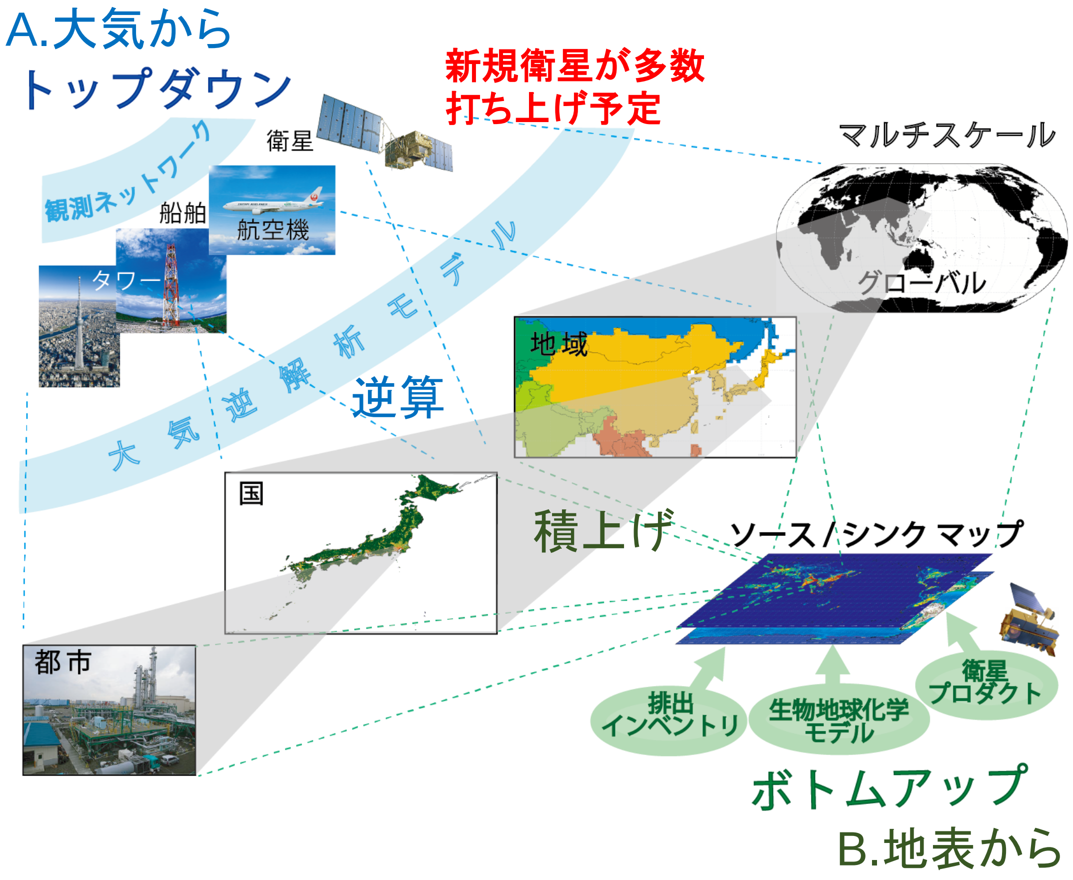

JAXA 第一宇宙技術部門
メディアの方向け　研究者の方向け　データ利用の方向け　English　あ　あ　検索
サテライトナビゲーター 第一宇宙技術部門のサイトへ
Earth-graphy
地球観測衛星データサイト
事業概要　地球が見える　地球観測研究　衛星利用事業　データ提供サービス　基礎知識
ホーム ＞ 地球が見える ＞ パリ協定グローバル・ストックテイクへの共同サブミッションの提出 -衛星観測で気候変動対策に貢献-
利用事例
2022.03.17（木）

パリ協定グローバル・ストックテイクへの共同サブミッションの提出
-衛星観測で気候変動対策に貢献-

1. The decadal global atmospheric greenhouse gas concentration trends observed by Japan's Greenhouse gases Observing SATellite (GOSAT) / GOSAT：10年スケールでの世界の温室効果ガス濃度の観測
   共同提出機関：IGES
   概要：全球温室効果ガスの濃度分布を12年間観測し続ける温室効果ガス観測技術衛星「いぶき」(GOSAT)衛星のデータから、二酸化炭素及びメタン 濃度が上昇傾向であることを示した。
2. The [illegible]/GOSAT GHG product for tracking city-level emission changes / GOSAT・都市レベル温室効果ガス排出量のトラッキング
   共同提出機関：IGES
   概要：GOSATのJAXA研究プロダクト（二酸化炭素）が、COVID19パンデミックの影響により、東京の排出量が減少したことを示した。
3. Real-time anthropogenic emission observations from Japanese passenger aircrafts in support of the monitoring of the climate mitigation progress / 日本の一般旅客機を活用したリアルタイムでの温室効果ガス排出量の観測
   共同提出機関：IGES、ANAホールディングス株式会社
   概要：GOSATセンサを応用した観測機器をANAの旅客機に搭載し、日本の都市部における排出分布のリアルタイム観測と可視化を行うGOBLEUプロジェクトを紹介。
4. A satellite-based deforestation monitoring system for tropical forests, "JICA-JAXA Forest Early Warning System in the Tropics (JJ-FAST)" / 熱帯林違法伐採の検知（JJ-FAST）
   共同提出機関：JICA、ブラジル環境・再生可能天然資源院（Brazilian Institute of Environment and Renewable Natural Resources：IBAMA）、IGES
   概要：陸域観測技術衛星2号「だいち2号」(ALOS-2)の観測データを用いた「JICA-JAXA熱帯林早期警戒システム」(JJ-FAST)による世界78か国における森林変化監視サービスの提供と、ブラジルにおける取り締まりにおける利用事例を紹介。
5. Satellite-based map of global mangrove extent and changes: Global Mangrove Watch (GMW)/ 世界のマングローブ林面積・変化（GMW）
   共同提出機関：IGES、アベリストウィス大学（Aberystwyth University）、日本ソロ地球観測合同会社(soloEO)、国際湿地保全連合（Wetlands International）、ザ・ネイチャー・コンサーバンシー（The Nature Conservancy）
   概要：気候変動の適応と緩和への貢献事例として、JAXAの「ふよう」(JERS-1)、「だいち」(ALOS)、「だいち2号」(ALOS-2）に搭載の合成開口レーダ（SAR）データによる年別全球マングローブ面積及び変化情報を捉える取組みと成果を紹介。

排出削減を検出できるか？

- 測定・推定の精度（±）は、実は研究者もよく分かっていない
  センサーの精度は反復計測の“ばらつき”から評価できる。
  国・地域スケールのGHG収支の精度は？


A.大気から
トップダウン
新規衛星が多数
打ち上げ予定
衛星
観測ネットワーク
船舶
航空機
タワー
マルチスケール
グローバル
地域
大気逆解析モデル
逆算
国
積上げ
ソース/シンクマップ
都市
排出
インベントリ
生物地球化学
モデル
衛星
プロダクト
ボトムアップ
B.地表から

考え方 （個人的な意見）

- 異なる手法（A.大気から逆算 と B.地表から積上げ）の差よりも小さい変化は検出困難
- 同じ手法の中で使うモデル・データ間の差よりも小さい変化は検出困難

例：　日本・韓国のメタン収支[2008–2017]

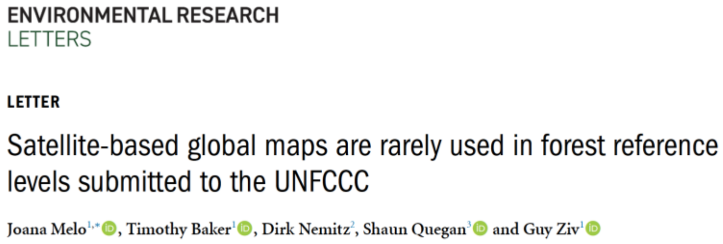
A. 大気から:　4.42 ± 0.73 Tg CH_4 yr^{-1}　（±16.5%）

B. 地表から:　4.02 ± 0.68 Tg CH_4 yr^{-1}　（±16.9%）

A vs B:　0.4 Tg CH_4 yr^{-1}　（9.9%）

地域・時期・ガスによって異なる（データの質・量、放出源が異なるため）

科学と政策の距離



ENVIRONMENTAL RESEARCH
LETTERS

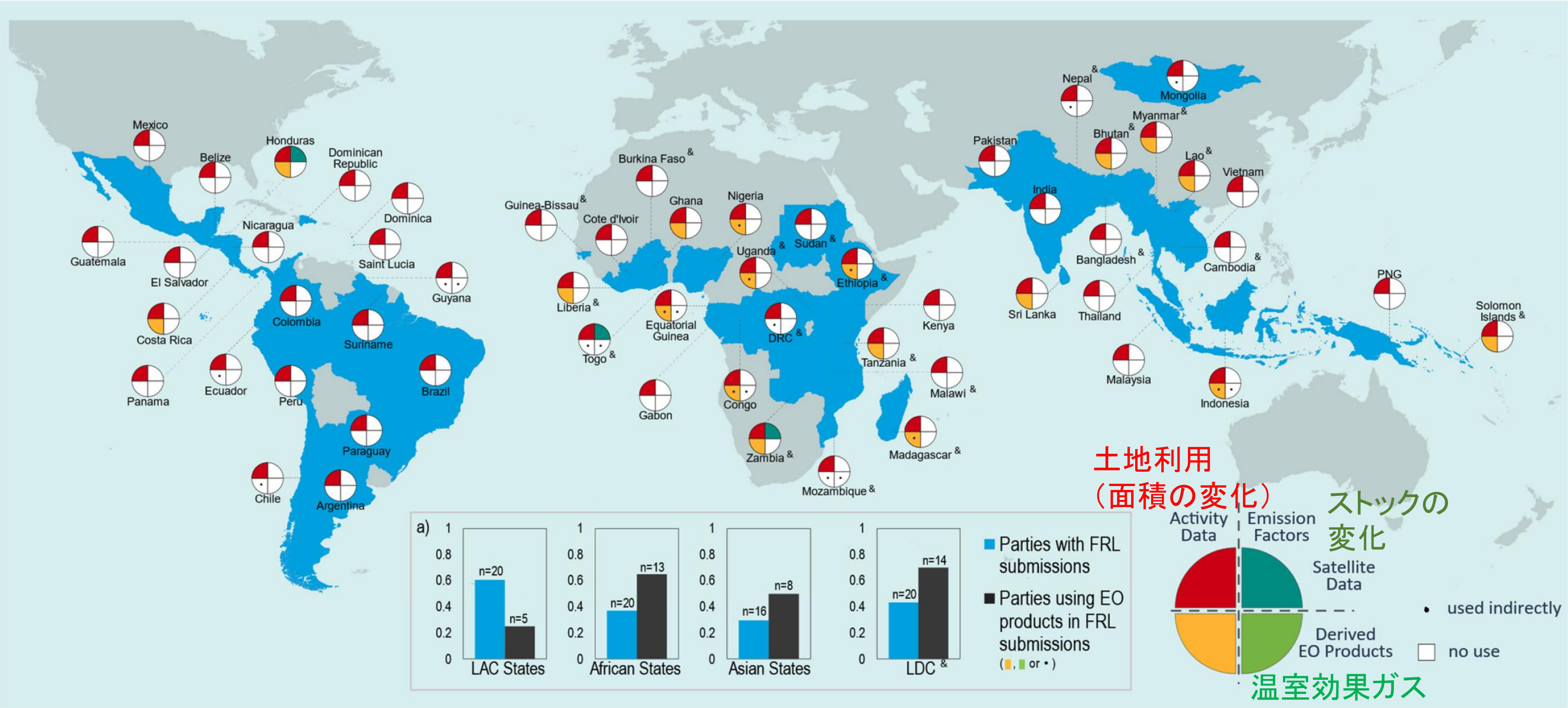
LETTER

Satellite-based global maps are rarely used in forest reference levels submitted to the UNFCCC

Joana Melo[1,*], Timothy Baker[1], Dirk Nemitz[2], Shaun Quegan[3] and Guy Ziv[1]

UNFCCCに提出された森林の現状データにおいて
科学的（衛星）データは **あまり使われていない**

→ 科学と政策の対話、キャパビル、データ利用ガイドラインなどの必要性


Mexico
Belize
Honduras
Dominican Republic
Dominica
Nicaragua
Guatemala
El Salvador
Saint Lucia
Guyana
Colombia
Suriname
Costa Rica
Panama
Ecuador
Peru
Brazil
Paraguay
Chile
Argentina
Burkina Faso &
Guinea-Bissau &
Cote d'Ivoir
Ghana
Nigeria
Liberia &
Togo &
Equatorial Guinea
Uganda &
Sudan &
Ethiopia &
DRC &
Kenya
Tanzania &
Malawi &
Gabon
Congo
Zambia &
Madagascar &
Mozambique &
Pakistan
Nepal &
Mongolia
Myanmar &
Bhutan &
Lao &
Vietnam
India
Bangladesh &
Cambodia &
Sri Lanka
Thailand
PNG
Solomon Islands &
Malaysia
Indonesia
a)
1
0.8
0.6
0.4
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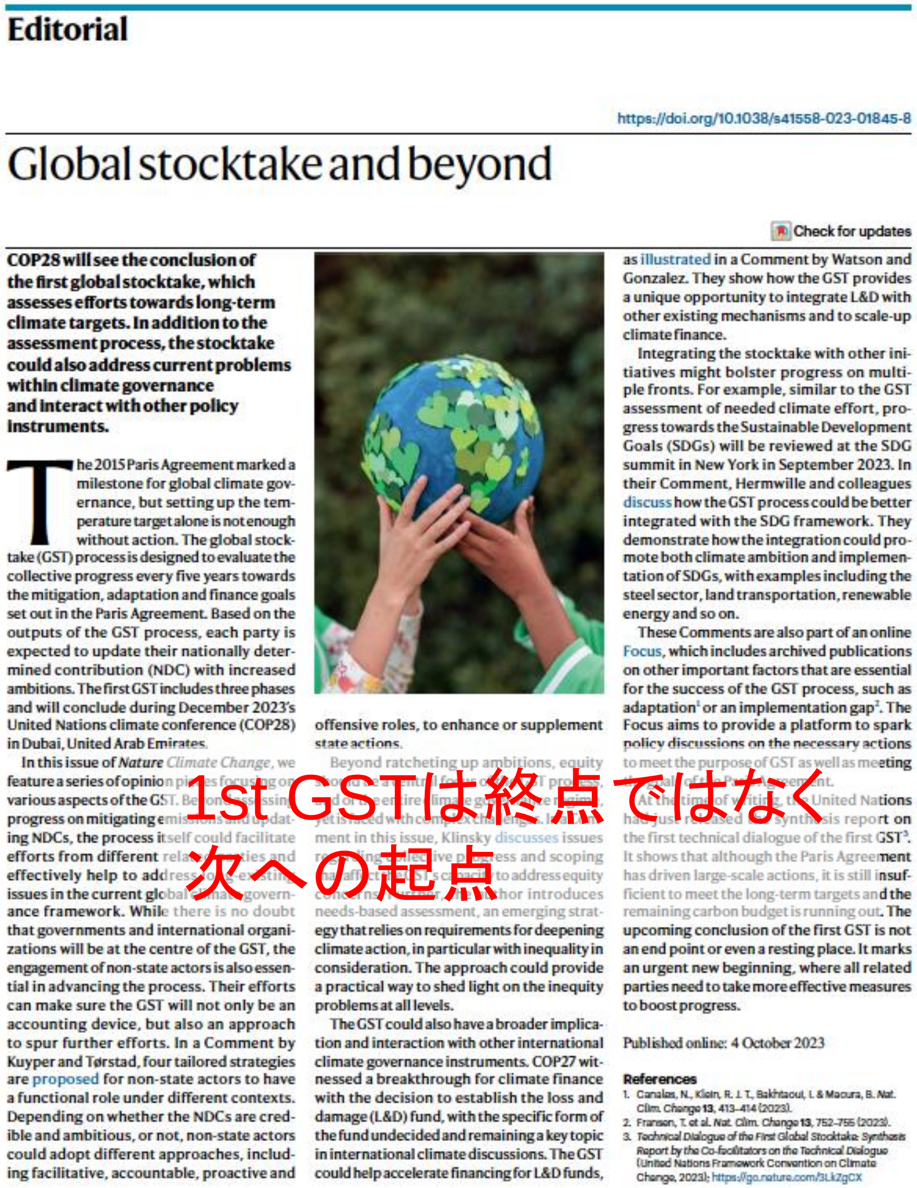
0
n=20
n=5
LAC States
n=20
n=13
African States
n=16
n=8
Asian States
n=20
n=14
LDC &
🟦 Parties with FRL submissions
■ Parties using EO products in FRL submissions (▮, ▮ or •)
Activity Data
Emission Factors
Satellite Data
Derived EO Products
• used indirectly
☐ no use

土地利用
（面積の変化）

ストックの
変化

温室効果ガス
放出/吸収

1st GSTへの期待



Editorial

https://doi.org/10.1038/s41558-023-01845-8

Global stocktake and beyond

Check for updates

COP28 will see the conclusion of the first global stocktake, which assesses efforts towards long-term climate targets. In addition to the assessment process, the stocktake could also address current problems within climate governance and interact with other policy instruments.

The 2015 Paris Agreement marked a milestone for global climate governance, but setting up the temperature target alone is not enough without action. The global stocktake (GST) process is designed to evaluate the collective progress every five years towards the mitigation, adaptation and finance goals set out in the Paris Agreement. Based on the outputs of the GST process, each party is expected to update their nationally determined contribution (NDC) with increased ambitions. The first GST includes three phases and will conclude during December 2023's United Nations climate conference (COP28) in Dubai, United Arab Emirates.

In this issue of *Nature Climate Change*, we feature a series of opinion pieces focusing on various aspects of the GST. Beyond assessing progress on mitigating emissions and updating NDCs, the process itself could facilitate efforts from different related parties and effectively help to address long-existing issues in the current global climate governance framework. While there is no doubt that governments and international organizations will be at the centre of the GST, the engagement of non-state actors is also essential in advancing the process. Their efforts can make sure the GST will not only be an accounting device, but also an approach to spur further efforts. In a Comment by Kuyper and Tørstad, four tailored strategies are proposed for non-state actors to have a functional role under different contexts. Depending on whether the NDCs are credible and ambitious, or not, non-state actors could adopt different approaches, including facilitative, accountable, proactive and offensive roles, to enhance or supplement state actions.

Beyond ratcheting up ambitions, equity should be a central focus of the GST process, and of the entire climate governance regime, yet is faced with complex challenges. In a Comment in this issue, Klinsky discusses issues regarding collective progress and scoping that affect the GST's capacity to address equity concerns. Further, the author introduces needs-based assessment, an emerging strategy that relies on requirements for deepening climate action, in particular with inequality in consideration. The approach could provide a practical way to shed light on the inequity problems at all levels.

The GST could also have a broader implication and interaction with other international climate governance instruments. COP27 witnessed a breakthrough for climate finance with the decision to establish the loss and damage (L&D) fund, with the specific form of the fund undecided and remaining a key topic in international climate discussions. The GST could help accelerate financing for L&D funds, as illustrated in a Comment by Watson and Gonzalez. They show how the GST provides a unique opportunity to integrate L&D with other existing mechanisms and to scale-up climate finance.

Integrating the stocktake with other initiatives might bolster progress on multiple fronts. For example, similar to the GST assessment of needed climate effort, progress towards the Sustainable Development Goals (SDGs) will be reviewed at the SDG summit in New York in September 2023. In their Comment, Hermwille and colleagues discuss how the GST process could be better integrated with the SDG framework. They demonstrate how the integration could promote both climate ambition and implementation of SDGs, with examples including the steel sector, land transportation, renewable energy and so on.

These Comments are also part of an online Focus, which includes archived publications on other important factors that are essential for the success of the GST process, such as adaptation[1] or an implementation gap[2]. The Focus aims to provide a platform to spark policy discussions on the necessary actions to meet the purpose of GST as well as meeting the goals of the Paris Agreement.

At the time of writing, the United Nations had just released the synthesis report on the first technical dialogue of the first GST[3]. It shows that although the Paris Agreement has driven large-scale actions, it is still insufficient to meet the long-term targets and the remaining carbon budget is running out. The upcoming conclusion of the first GST is not an end point or even a resting place. It marks an urgent new beginning, where all related parties need to take more effective measures to boost progress.

Published online: 4 October 2023

References

1. Canales, N., Klein, R. J. T., Bakhtaoui, I. & Macura, B. *Nat. Clim. Change* **13**, 413–414 (2023).
2. Fransen, T. et al. *Nat. Clim. Change* **13**, 752–755 (2023).
3. *Technical Dialogue of the First Global Stocktake: Synthesis Report by the Co-facilitators on the Technical Dialogue* (United Nations Framework Convention on Climate Change, 2023); https://go.nature.com/3LkZgCX

1st GSTは終点ではなく
次への起点

各国の進捗状況（統合報告書では不十分と指摘）を踏まえ、NDCのより野心的方向への引き上げへ

→ 科学的な知見・データの重要性が再認識

→ さらなる開発研究への動機付け

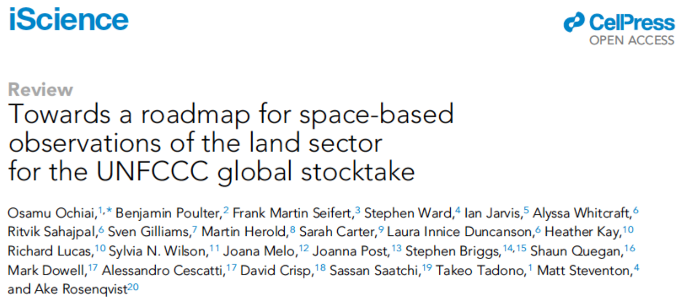
- 大気・海洋・陸域・都市の観測ネットワーク
- 最新のデータ・計算科学を活用したモデル
- より信頼性の高い情報に基づく排出インベントリ

→ 環境政策の科学的基盤となる大気・気候の監視へ

ご清聴ありがとうございました

補足

宇宙機関による貢献



iScience

CellPress OPEN ACCESS

Review

Towards a roadmap for space-based observations of the land sector for the UNFCCC global stocktake

Osamu Ochiai,[1,*] Benjamin Poulter,[2] Frank Martin Seifert,[3] Stephen Ward,[4] Ian Jarvis,[5] Alyssa Whitcraft,[6] Ritvik Sahajpal,[6] Sven Gilliams,[7] Martin Herold,[8] Sarah Carter,[9] Laura Innice Duncanson,[6] Heather Kay,[10] Richard Lucas,[10] Sylvia N. Wilson,[11] Joana Melo,[12] Joanna Post,[13] Stephen Briggs,[14,15] Shaun Quegan,[16] Mark Dowell,[17] Alessandro Cescatti,[17] David Crisp,[18] Sassan Saatchi,[19] Takeo Tadono,[1] Matt Steventon,[4] and Ake Rosenqvist[20]

CEOS and the UNFCCC Global Stocktake

This page provides an entry point for access to the datasets and guidance being developed by CEOS space agencies and partners in support of the goals of the Global Stocktake process of the Paris Climate Agreement.

CEOS
CO₂ & CH₄ Fluxes
Above Ground Biomass
Forests
Mangroves
Agriculture
Land Cover

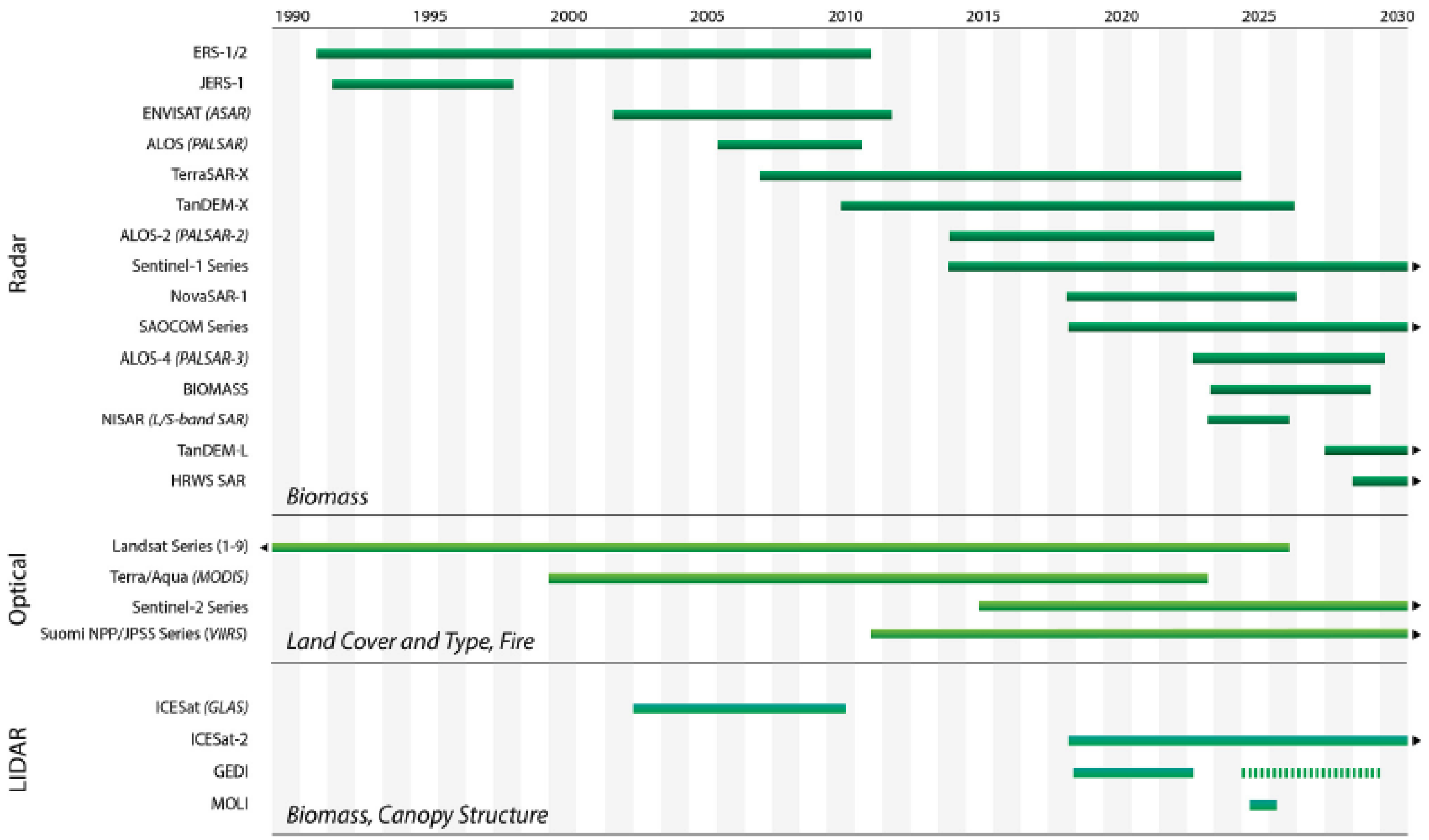
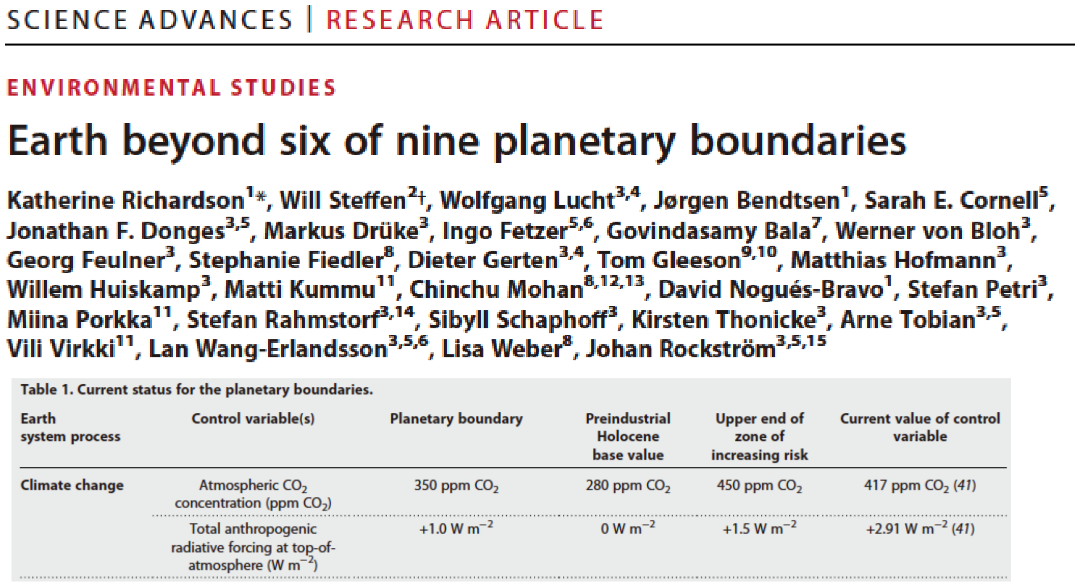


Figure 1. Earth observation satellite sensor types (CEOS member space agencies) supporting AFOLU information needs, and their (estimated) lifespans

補足

プラネタリーバウンダリー（地球の持続可能性限界）



SCIENCE ADVANCES | RESEARCH ARTICLE

ENVIRONMENTAL STUDIES

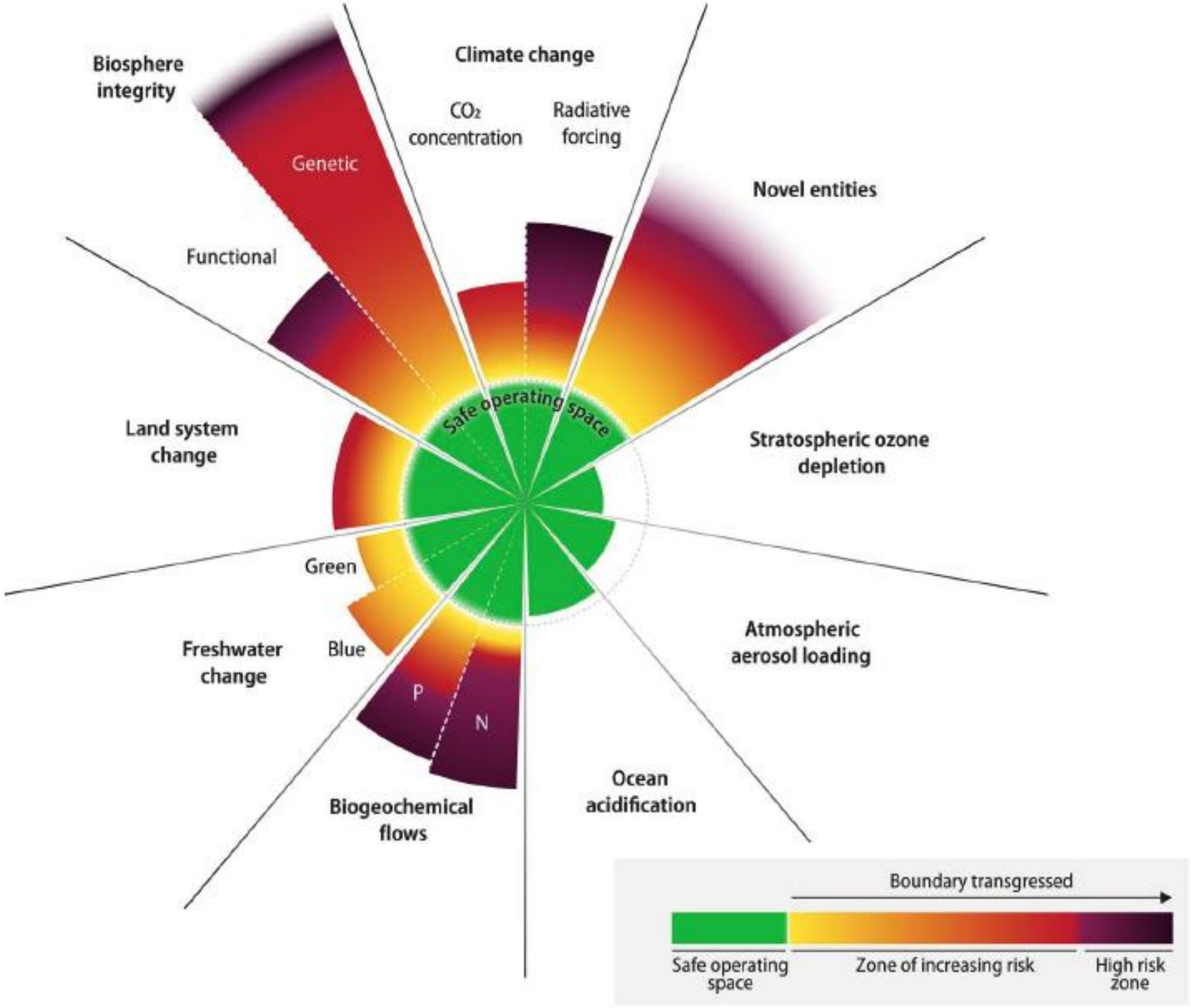
Earth beyond six of nine planetary boundaries

Katherine Richardson[1]*, Will Steffen[2]†, Wolfgang Lucht[3,4], Jørgen Bendtsen[1], Sarah E. Cornell[5], Jonathan F. Donges[3,5], Markus Drüke[3], Ingo Fetzer[5,6], Govindasamy Bala[7], Werner von Bloh[3], Georg Feulner[3], Stephanie Fiedler[8], Dieter Gerten[3,4], Tom Gleeson[9,10], Matthias Hofmann[3], Willem Huiskamp[3], Matti Kummu[11], Chinchu Mohan[8,12,13], David Nogués-Bravo[1], Stefan Petri[3], Miina Porkka[11], Stefan Rahmstorf[3,14], Sibyll Schaphoff[3], Kirsten Thonicke[3], Arne Tobian[3,5], Vili Virkki[11], Lan Wang-Erlandsson[3,5,6], Lisa Weber[8], Johan Rockström[3,5,15]

Table 1. Current status for the planetary boundaries.

Earth system process	Control variable(s)	Planetary boundary	Preindustrial Holocene base value	Upper end of zone of increasing risk	Current value of control variable
Climate change	Atmospheric CO_2 concentration (ppm CO_2)	350 ppm CO_2	280 ppm CO_2	450 ppm CO_2	417 ppm CO_2 (*41*)
	Total anthropogenic radiative forcing at top-of-atmosphere (W m^{-2})	+1.0 W m^{-2}	0 W m^{-2}	+1.5 W m^{-2}	+2.91 W m^{-2} (*41*)

気候変動


Biosphere integrity
Genetic
Functional
Climate change
CO_2 concentration
Radiative forcing
Novel entities
Safe operating space
Land system change
Stratospheric ozone depletion
Green
Blue
Freshwater change
P
N
Atmospheric aerosol loading
Biogeochemical flows
Ocean acidification
Boundary transgressed
Safe operating space
Zone of increasing risk
High risk zone

COP28成功のベンチマーク

https://www.wri.org/insights/cop28-benchmarks-success

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Benchmarks for Success for COP28

1. グローバルストックテイク[GST]を変革的行動に
    - NDCをより早期に（＜2035年）、より野心的に
2. 地球規模システムの変革
    - 代替燃料、食料・土地利用システム、都市
3. 気候変動へのレジリエンス
    - ロス＆ダメージ基金、適応枠組み
4. 脆弱な国々への資金提供
    - 気候関連資金フローを４兆３０００億ドル[-2030] へ