Trends & Applications in Geospatial & Earth Observation Technologies

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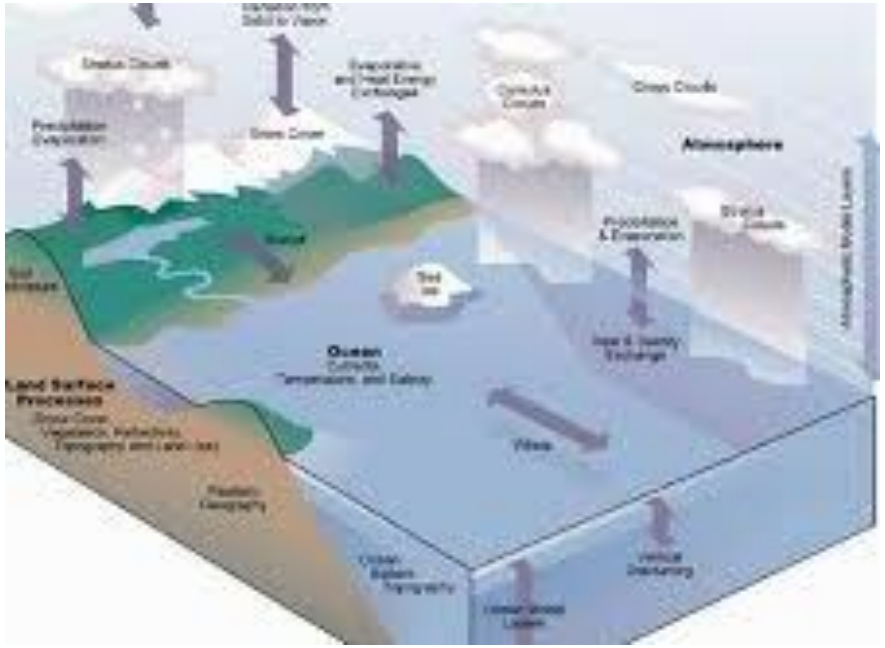
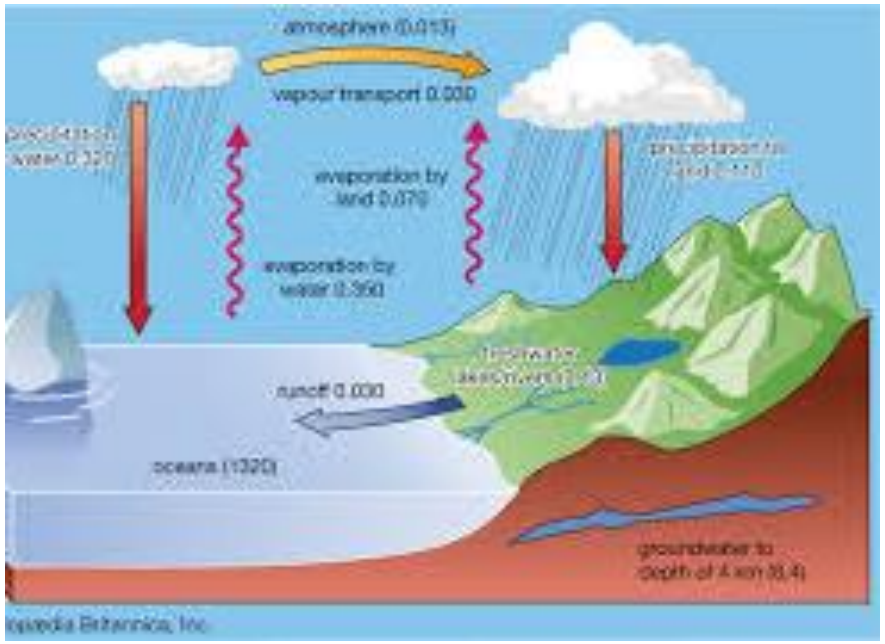
World Geospatial Industry Council

A Starting Point

"Realize that everything connects to everything else"

Leonardo de Vinci (1452-1519)





The Earth as an Interconnected System

Trends in Geospatial & Earth Observations

Open Data

Technological Advances

Better Integration & Coordination

Hyper Partnering

Linkages to Policy Mandates

PARIS2015
UN CLIMATE CHANGE CONFERENCE
COP21·CMP11

UN World Conference on Disaster Risk Reduction
2015 Sendai Japan

SUSTAINABLE DEVELOPMENT GOALS

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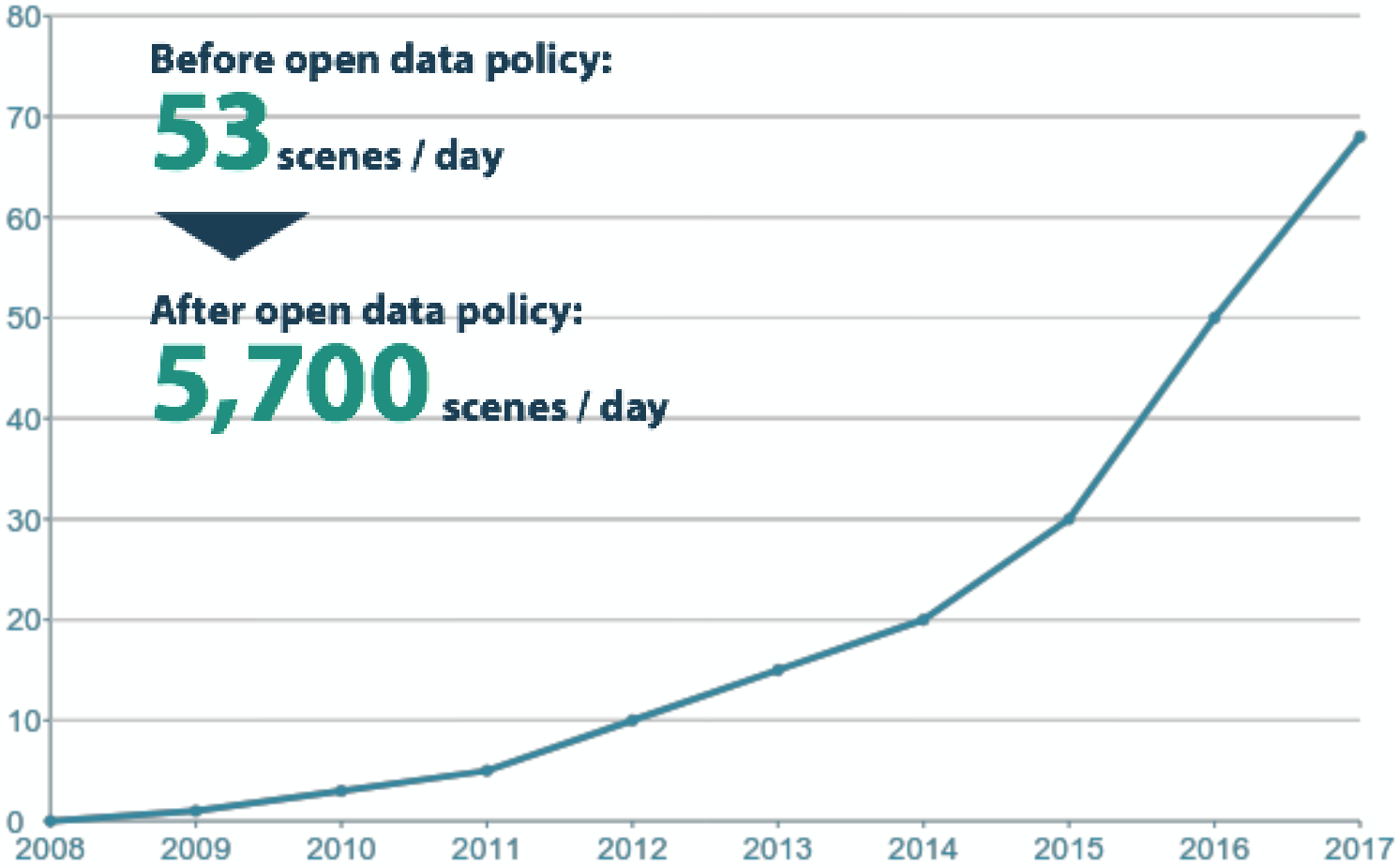
SUSTAINABLE DEVELOPMENT GOALS

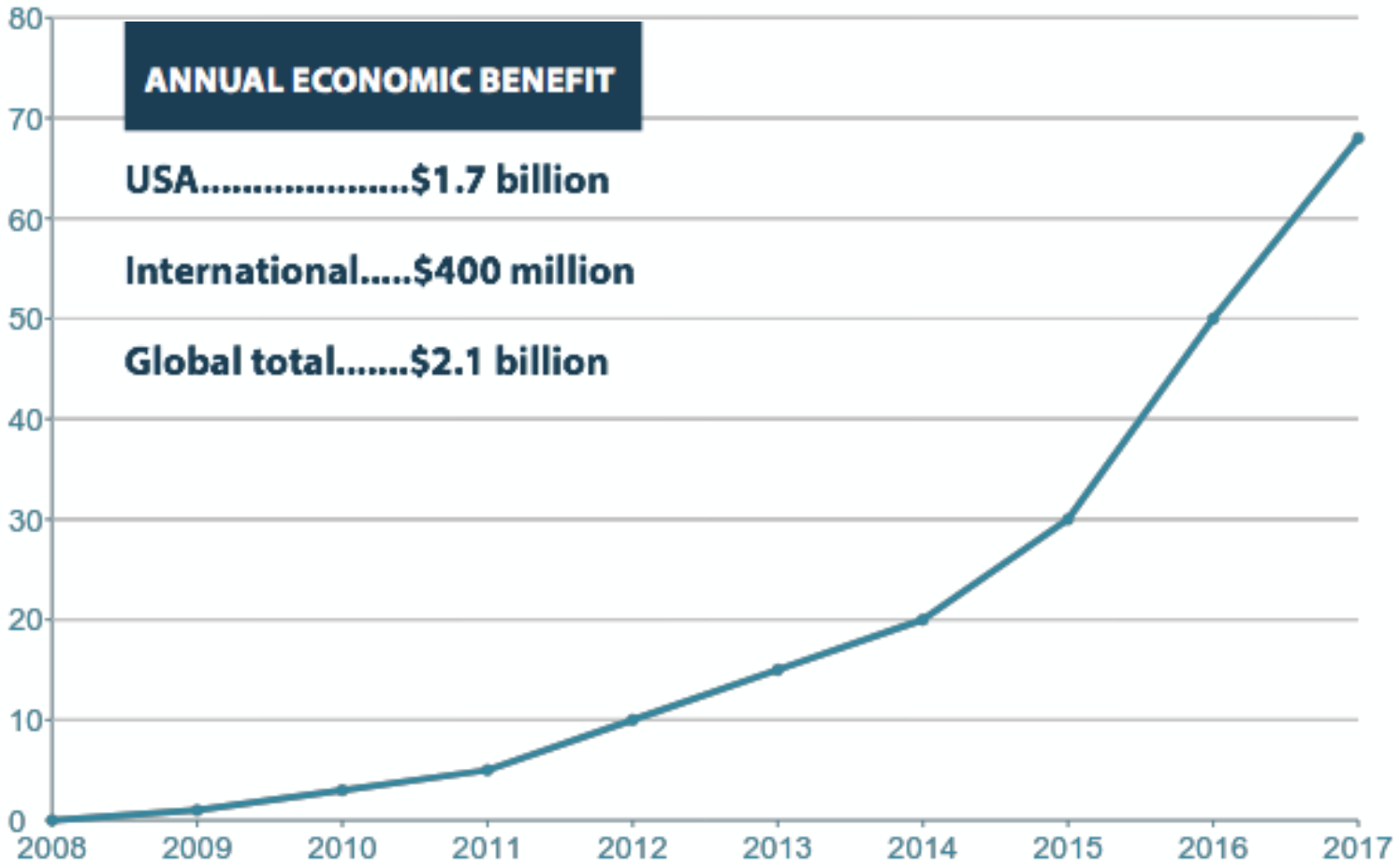
The Value of Open Data (1)

Millions of Landsat Scene Downloads



The Value of Open Data (2)

Billions in Economic Benefits (USD)



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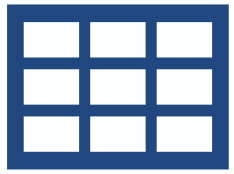
Open Data

Technological Advances



Better Integration & Coordination

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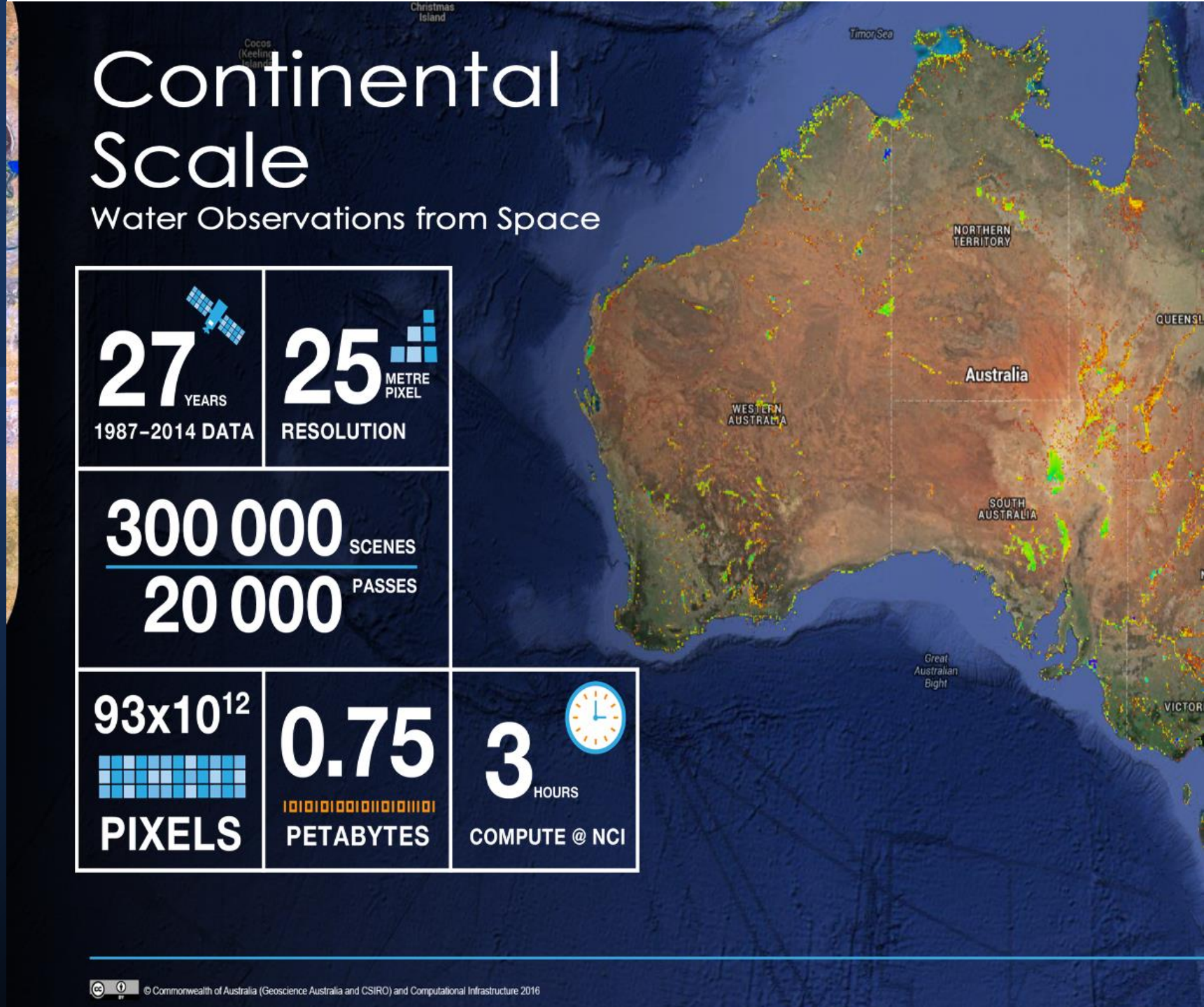
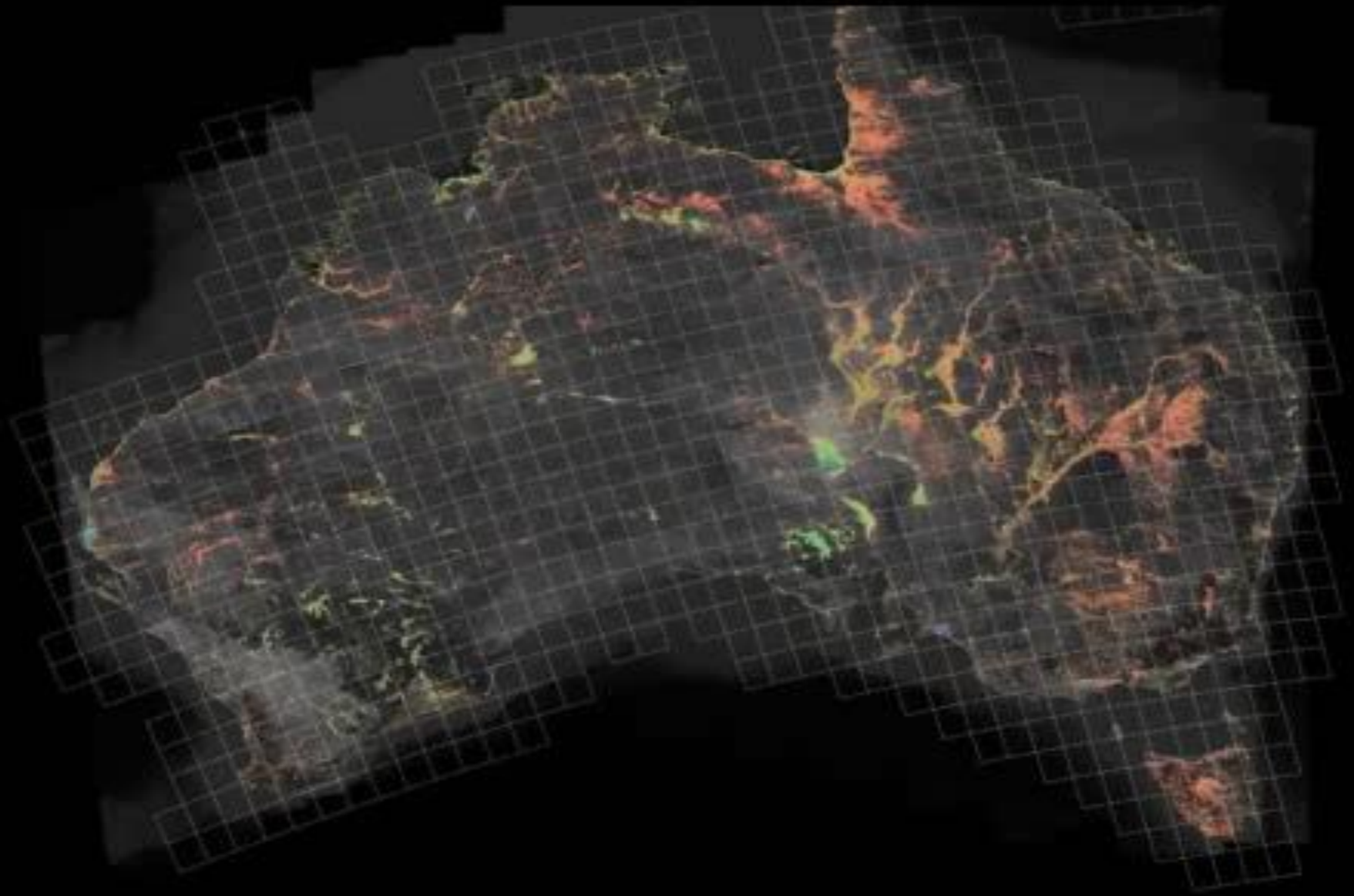
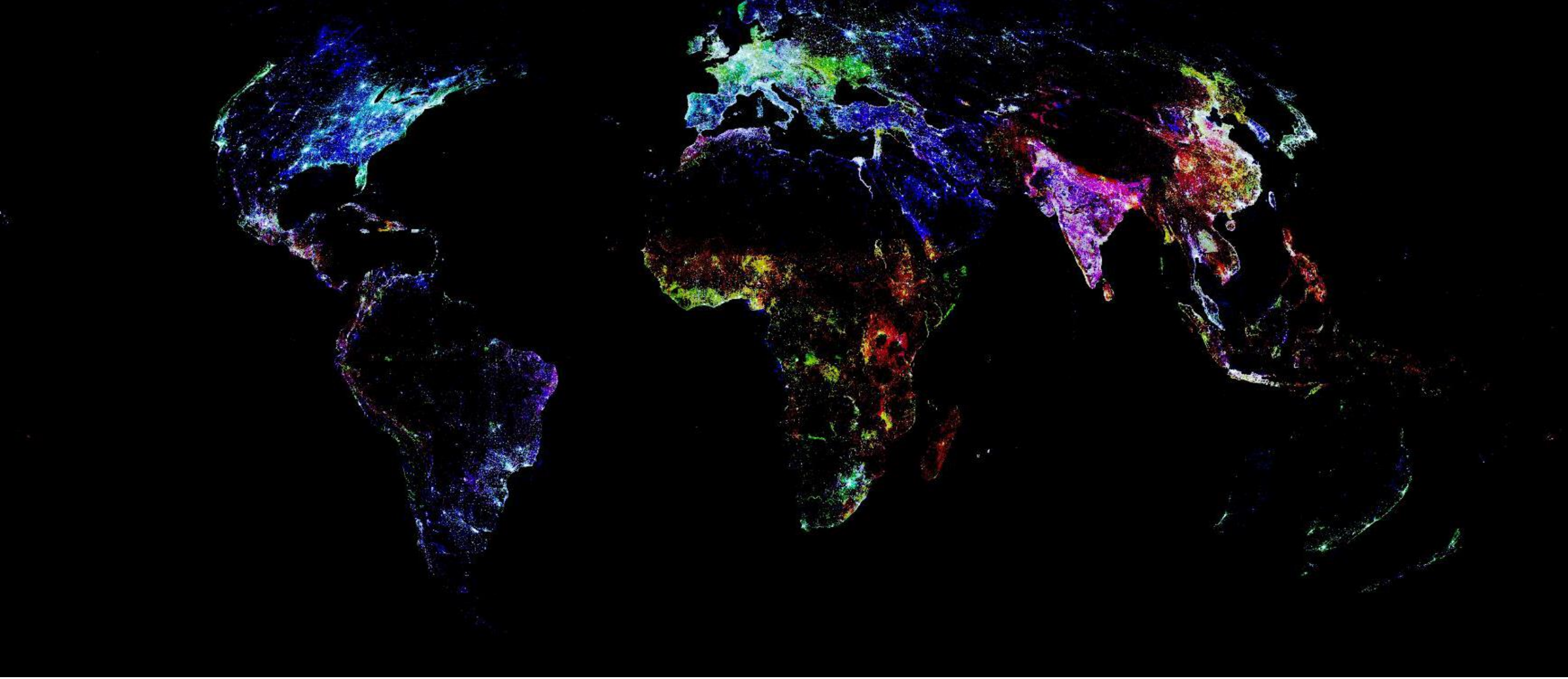
Large-Area Geographic Analyses







Detecting spatial pattern of inequalities from remote sensing by the Joint Research Centre (JRC), European Commission

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SUSTAINABLE DEVELOPMENT GOALS

Better Integration & Coordination

Internally -- within our respective organizations

Nationally -- between and among our respective national entities

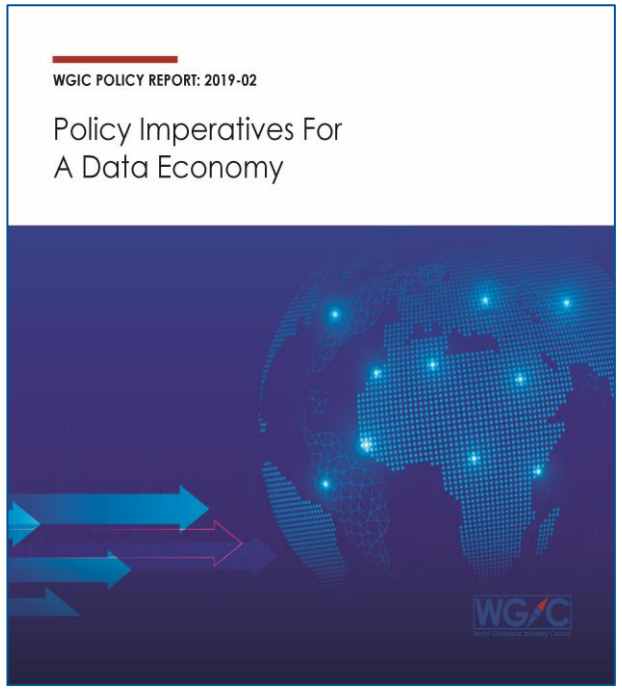
Regionally – e.g., continent-wide efforts, associations

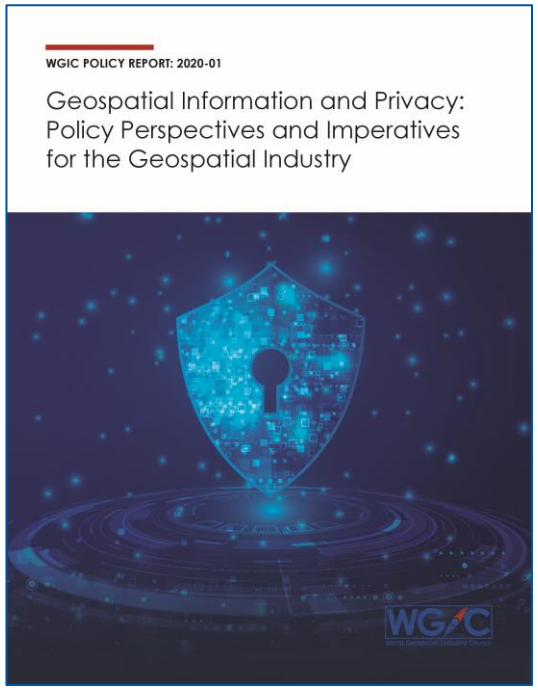
Globally – International organizations

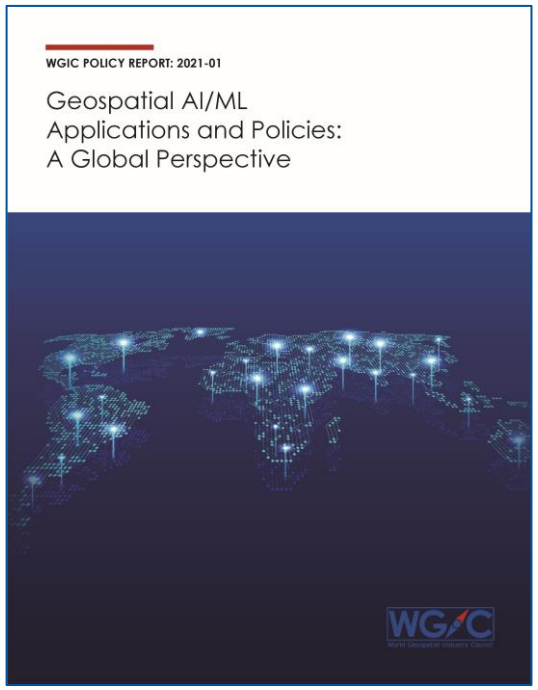
Hyper Partnering

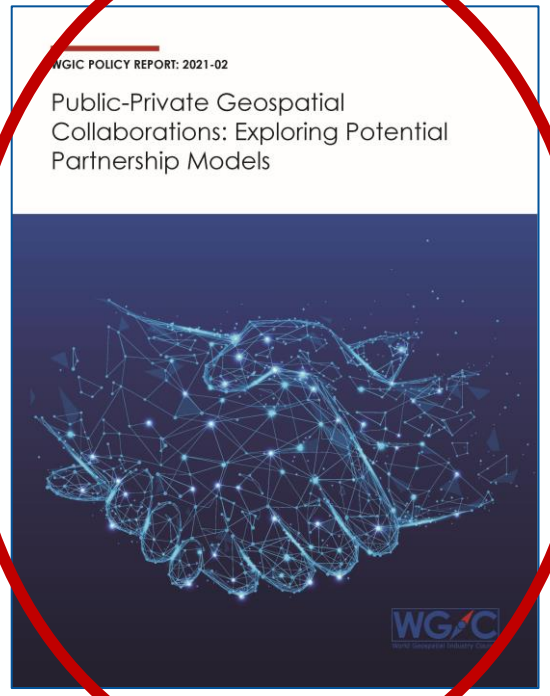
- Academia
- Commercial Sector
- Not-for-Profits
- Public Sector

WGIC – Policy Reports









SPACE & GEOSPATIAL

VIRTUAL PAVILION FOR COP 26

Greenhouse Gas (GHG) Monitoring from Space

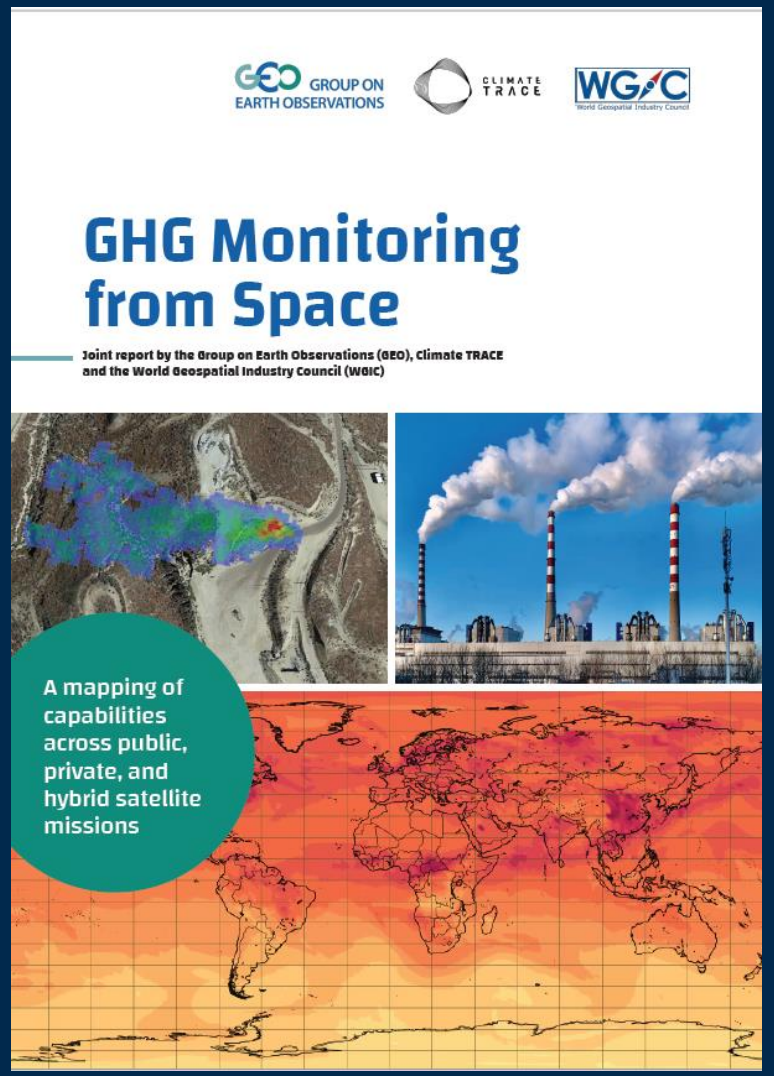
2 November, 14:00 -15:30 GMT

Joint report launch mapping the capabilities aross public, private and hybrid missions.

GROUP ON EARTH OBSERVATIONS

CLIMATE TRACE

World Geospatial Industry Council



Download it at:

www.WGICouncil.org

A mapping of capabilities across public, private and hybrid satellite missions

Development of the first systematic database - public, private & hybrid missions for GHG monitoring from Space

Database of the GHG Monitoring capabilities from space across Public, Private and Hybrid missions

COUNTRY/REGION, ORGANIZATION, MISSION AND INSTRUMENT					GHG MONITORED DIRECTLY			POTENTIAL POLICY-RELEVANT APPLICATION			DATA ACCESS
Country/ Region	Organization	Mission (Instrument)	Status	Mission Goal and Application	CO_2	CH_4	N_2O	Point-Source level	National level	Global level	Open access / Limited access / Paid subscription
PUBLIC MISSIONS: 21											
Canada	CSA ESA NASA	SciSat-1 (ACE)	In orbit	Mission Goal: To monitor and analyze the chemical processes that control the distribution of ozone in the upper troposphere and stratosphere. Application: SciSat-1 can measure the vertical resolutions of all major GHGs identified for monitoring under the Paris Agreement.	✓	✓	✓			✓	Open access
China	NRSCC NSMC-CMA	FengYun-3D (GAS)	In orbit	Mission Goal: Operational meteorology with substantial contribution to ocean and ice monitoring, climate monitoring, atmospheric chemistry and space weather. Application: Retrieve GHGs in the atmosphere.	✓	✓	✓		✓	✓	Limited access
China	CNSA	Gaofen-5 (GMI)	In Orbit	Mission Goal: Hyperspectral observations of Earth's environments to track environmental impacts, water quality, and atmospheric change. Application: To measure carbon dioxide and methane in the troposphere and understand the source and sink processes that affect these GHGs.	✓	✓		✓			Limited access
China	NRSCC NSMC-CMA	TanSat (ACGS)	In orbit	Mission Goal: To retrieve the atmosphere column-averaged CO_2 dry air mole fraction (XCO_2) with precisions of 1% on national and global scales. Application: To improve the understanding on the global CO_2 distribution and its contribution to the climate change. Additionally, to monitor the CO_2 variation on seasonal time scales.	✓	✓		✓	✓	✓	Limited access
Europe	EC ECMWF ESA EUMETSAT	Copernicus Carbon Dioxide Monitoring/ CO_2M	In develop-ment	Mission Goal: The CO_2M will focus on measuring carbon dioxide and methane emissions, which are released into the atmosphere specifically through human activity. Application: Reduce current uncertainties in estimates of emissions of CO_2 from the combustion of fossil fuel at national and regional scales. Produce an independent source of information to assess the effectiveness of policy measures, track their impact towards decarbonising Europe and meeting national emission reduction targets. Note- this mission will deploy a constellation of satellites.	✓	✓		✓	✓	✓	Open access

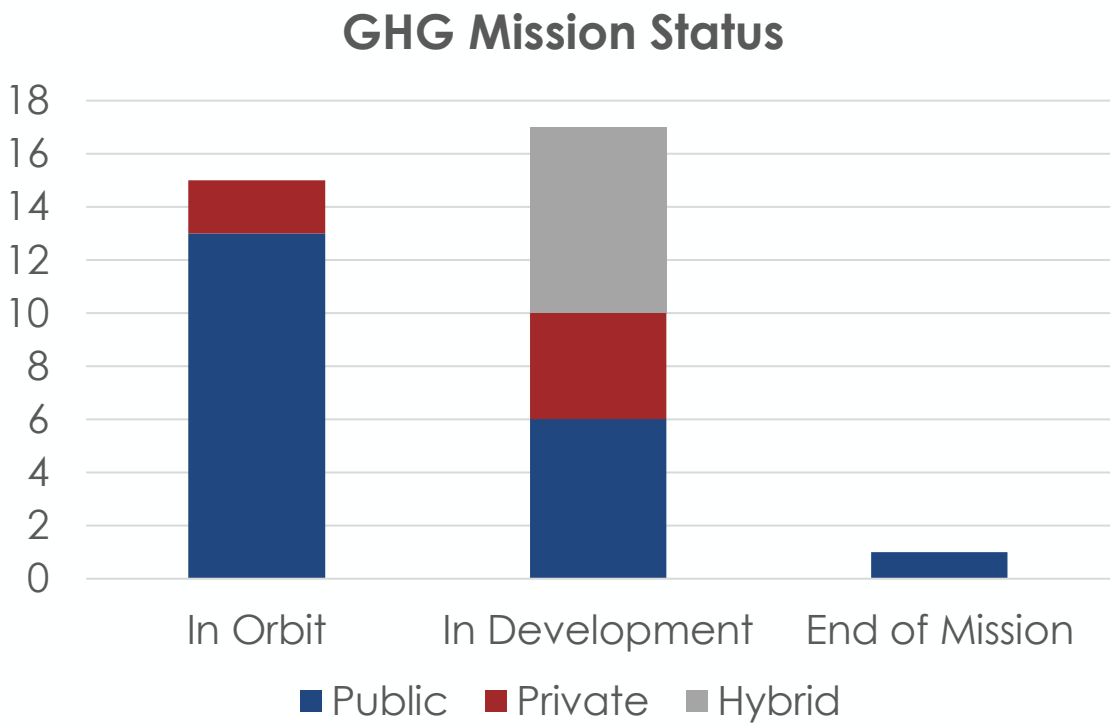
Three GHGs are generally recognized as the critical drivers of climate change: **carbon dioxide (CO2), methane (CH4) and nitrous oxide (N2O).**

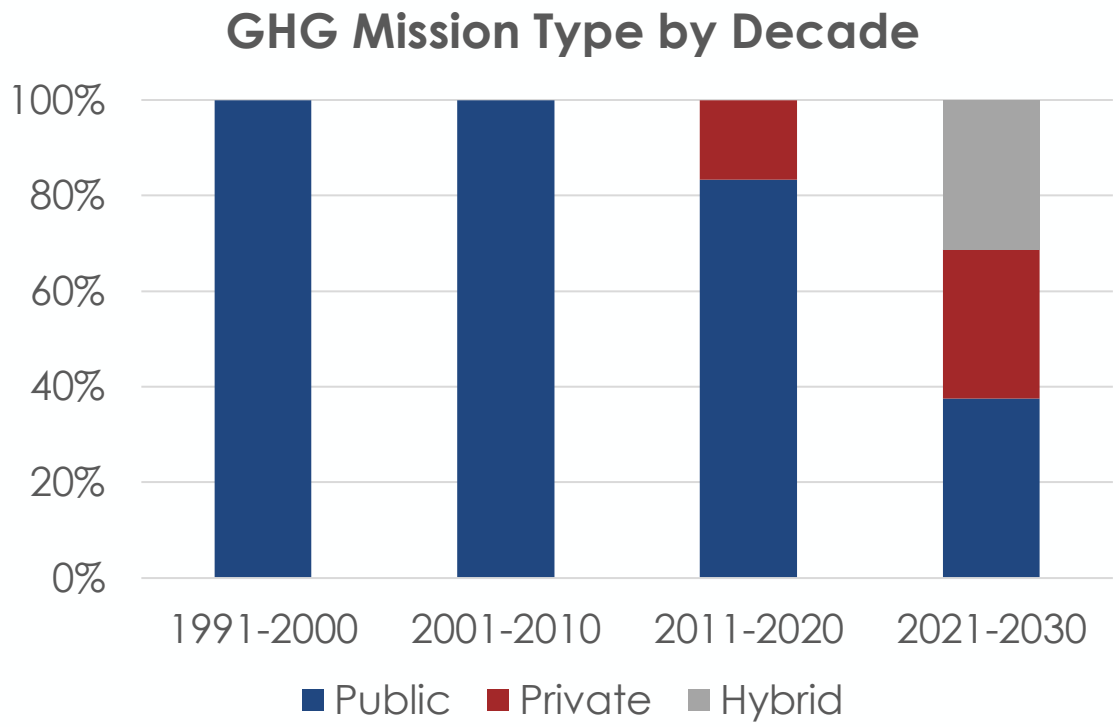
Relevant missions:

33 identified missions, most are driven by public entities

- **Public missions:** 21 in total, 13 in orbit and 7 in development, 1 end of life;
- **Private missions:** 7 commercial missions, 1 in orbit and operational, and 1 in its final trial period before being fully operational;
- **Hybrid:** 5 missions (all in development) with proposed launch dates until the 2040s.

Insights from the Report on GHG Monitoring from Space





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SUSTAINABLE DEVELOPMENT GOALS

Key Policy Messages from the Report

1. **Satellite observations reduce uncertainty in GHG emission monitoring** by providing data across a range of spatial, temporal, and spectral resolutions or scales;

2. **Government space agencies have the capability to collect national and global baseline data** for all relevant GHGs in a sustained manner with measurement availability ranging into the 2040s;

3. **Private sector companies are speedily entering the market** and bringing additional point-source emissions monitoring capabilities for specific GHGs;

4. **Hybrid models are increasingly emerging** and leveraging respective strengths;

5. **Collaboration, innovation, and financing are key levers** for GHG monitoring from space;

6. **Open data, open science and open knowledge are essential** to drive on-the-ground solutions

7. **New opportunities are arising for analysing secondary remote sensing measurements** with frontier IT technologies which call for transparency and capacity development.

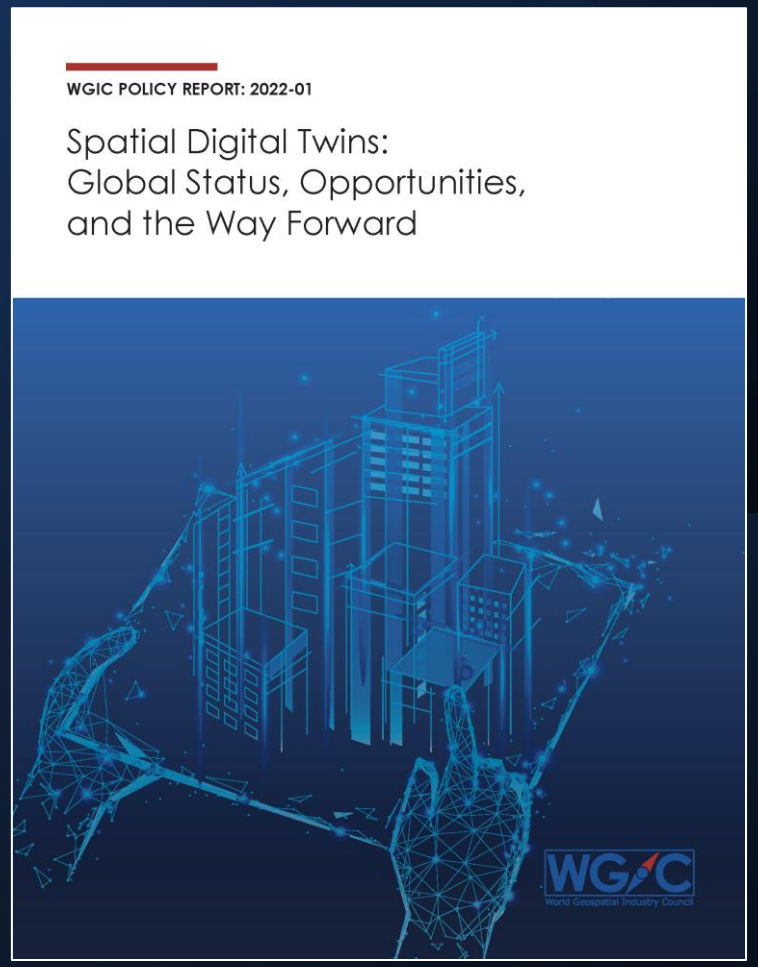
GEO GROUP ON EARTH OBSERVATIONS

CLIMATE TRACE

WGIC World Geospatial Industry Council

Based on these findings, we call for continued cooperation between public and private sector entities to fully maximize complementary capacities and synergies to **support policy makers in the race to net zero emissions going forward.**

Most Recent Report



From the Factory to the Street:

Once the domain of the Manufacturing Environment:

Advances in technology, and reduction in costs have created interest, applications and breadth of use-cases.

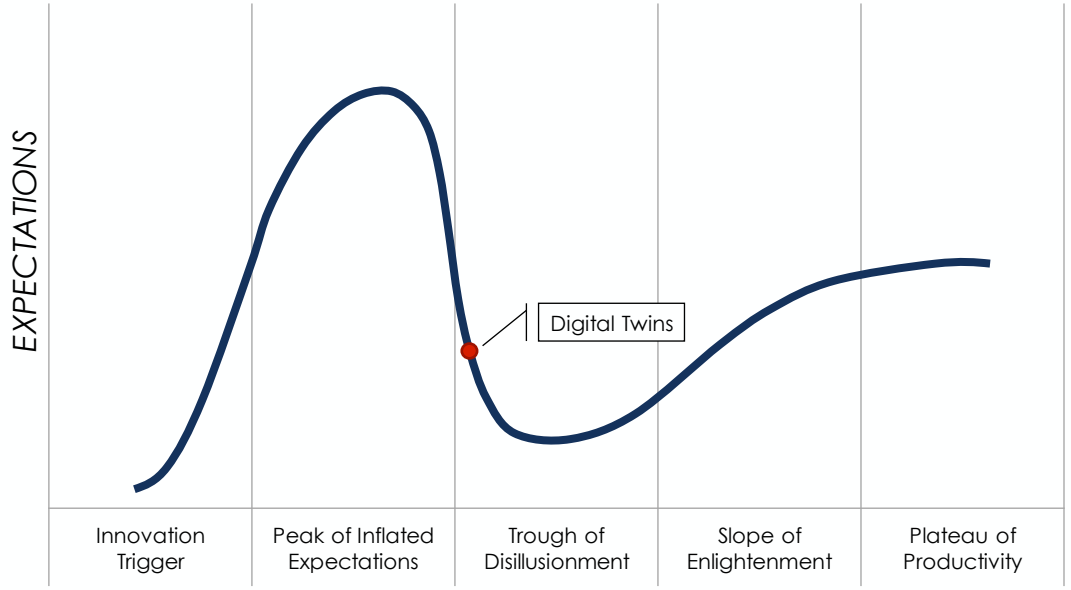
2021 **USD$12.7B revenue** associated with Digital Twins, with an ~$8B for the Geospatial Industry.

Projected to rise to $45B by 2026, with ~$25B projected for the Geospatial Industry.

Gartner's Hype Cycle

- The ‘technological push’ of Digital Twins is over
- Geospatial data will create an ‘applications pull’ to unlock re applications and use cases
- More value will be derived from Digital Twins than the original inception use-cases

Gartner Hype Cycle (August 2021)



Source: Gartner

Spatial Digital Twins – The Opportunities

Permits modelling and visualization of the real world and its processes.

Holistic, dimensionally accurate and location-based representation of assets, infrastructure and systems.

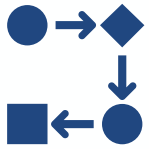
More spatial digital information is needed to truly align the digital and physical worlds.

Spatial Digital Twins – The Uncertainties

Over-use of synonymous terminology – metaverse, mirrored world, digital twin etc.

Calling 3D and 4D models Digital Twins

Hacking existing models or using simplified meshes for visualisations



Export and Import data instead of integrating systems

Report Findings

All advanced Digital Twin use-cases rely on spatial data (Spatial Digital Twins)

Geospatial data is fundamental to unlocking more applications from existing or individual Digital Twin ecosystems

Spatial data capture services by the geospatial industry enables improved visualization with low-cost alternatives

Future Vision

Future Vision

Every Digital Twin across the globe is updated in real-time, with information flows from sensors/inputs underpinned by spatial data.

Benefits, impacts & opportunities available to humanity can be identified by aggregating every Digital Twin based on their position, size & level of detail.

Voxel Size (or Scale)

Micro-level Digital Twins have a wealth of detail for Site- or Product-Specific decision-making

Hybrid-level Digital Twins aggregate selected data from micro-level or municipality/gov't datasets

Macro-level Digital Twins aggregate public (and/or Hybrid-Level) data from all available data sources.

World Geospatial Industry Council

A global Trade Association of private sector companies working in the Geospatial Sector

info@WGICouncil.org

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TOPCON
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voxelmaps

WGIC STRATEGIC GOALS

Strengthen contributions of the geospatial industry to society, and the global economy

Advance global policy matters relevant to the geospatial sector

Create business opportunities for the geospatial industry

Thank you

barbara.ryan@wgicouncil.org