



GEOSS Asia-Pacific Symposium

Earth Observations Supporting the Implementation of the SDGs in the Asia Pacific Region

Date

11th-13th January 2017

Venue

Tokyo International Exchange Center, Plaza Heisei, Japan



The GEO Carbon and GHG Initiative



Toward policy-relevant global C & GHG observations and analysis

A. Bombelli *et al.*



cmcc Euro-Mediterranean Center on Climate Change, Italy





GEOSS Asia-Pacific Symposium

*Earth Observations Supporting the Implementation
of the SDGs in the Asia Pacific Region*

Tokyo
11-13 January 2017



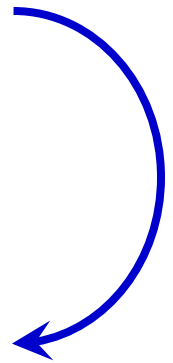
GEO
CARBON AND
GHG INITIATIVE

GEO-C The GEO Carbon and GHG Initiative

PPT outline:

- 1- why a GEO C & GHG (GEO-C) initiative?**
- 2- GEO-C objectives and work plan
- 3- AO contribution to GEO-C

From science, policy and users perspective!





GEOSS Asia-Pacific Symposium

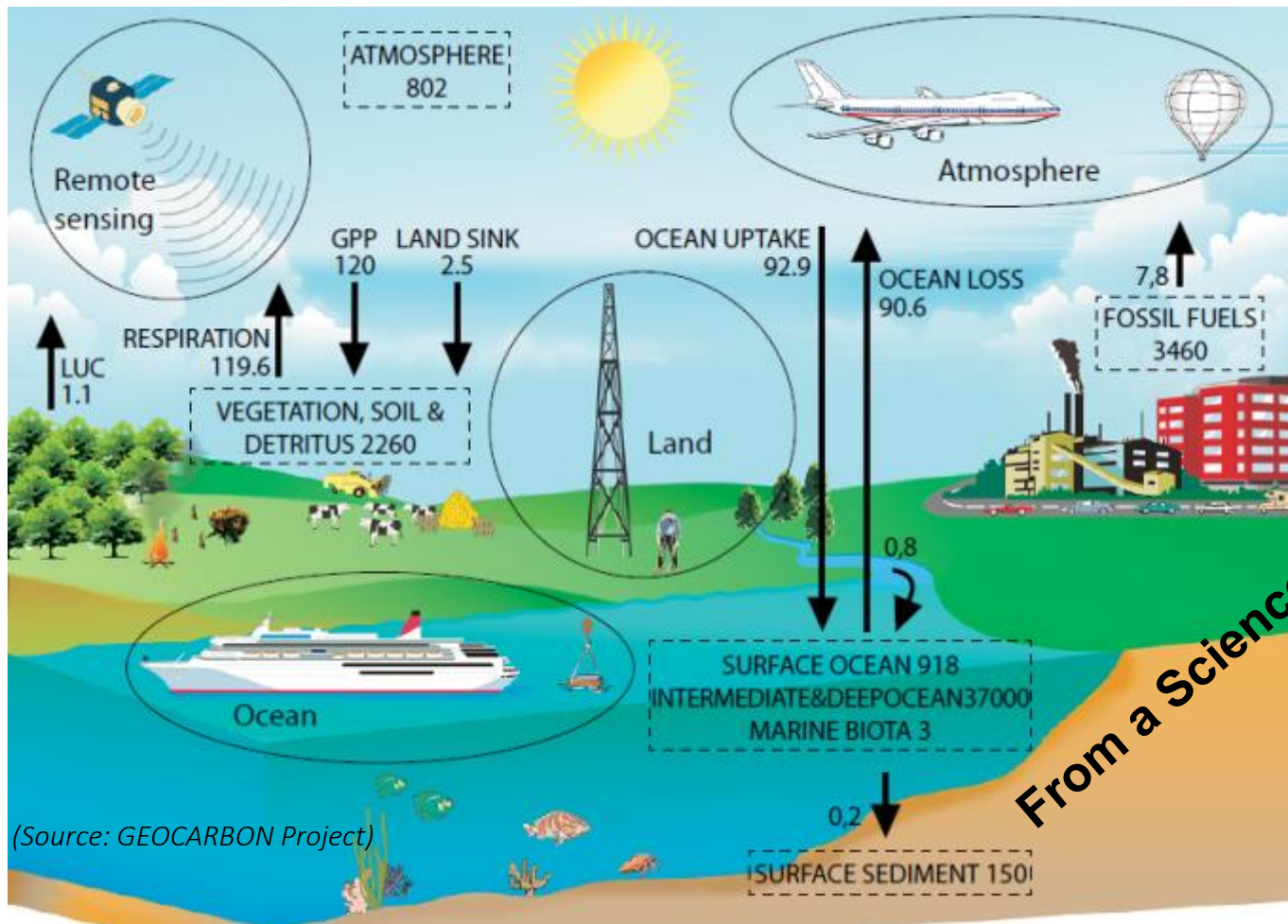
Earth Observations Supporting the Implementation of the SDGs in the Asia Pacific Region

Tokyo
11-13 January 2017



GEO
CARBON AND
GHG INITIATIVE

The Global Carbon Cycle: a complex interaction of different systems in different domains – directly linked to climate change



(Source: GEOCARBON Project)

From a Science Perspective





GEOSS Asia-Pacific Symposium

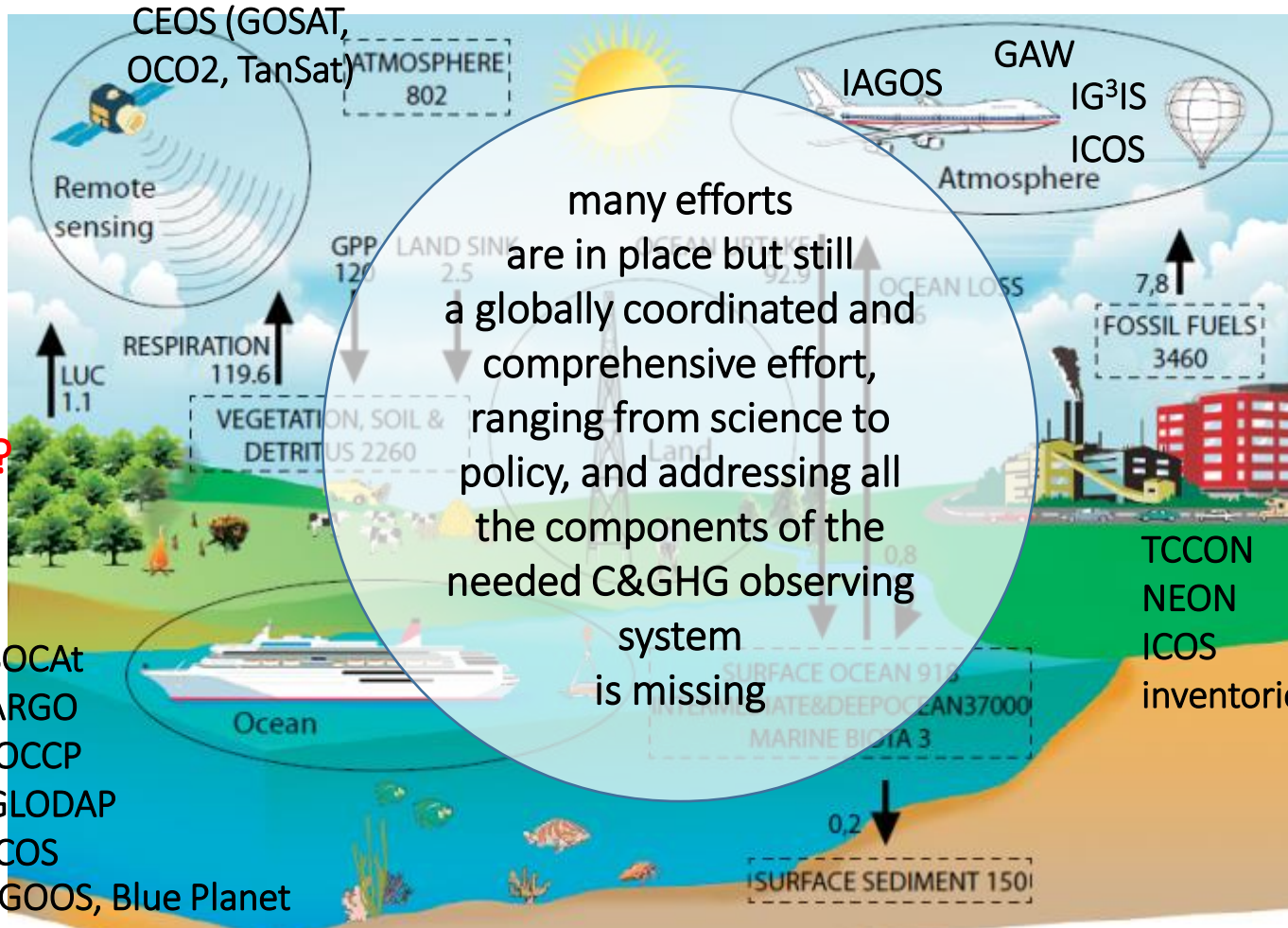
Earth Observations Supporting the Implementation of the SDGs in the Asia Pacific Region

Tokyo 11-13 January 2017



GEO
CARBON AND GHG INITIATIVE

Monitoring the Global C-Cycle: a complex ensemble of different players, countries, systems, networks, datasets, methodologies, rules, standards...



What about AP region?

GCOS
GCP

... and many OTHERS!



GEOSS Asia-Pacific Symposium

Earth Observations Supporting the Implementation of the SDGs in the Asia Pacific Region

Tokyo
11-13 January 2018



GEO
CARBON AND
GHG INITIATIVE

State of the art of GHG and carbon cycle knowledge:
despite significant progresses still many issues are in place!



- Uncertainties
- Non CO2 GHG (CH4, N2O, etc.)
- Tipping points
- Critical hotspots
- Sustainability of networks
- Low global coverage
- Lack of interoperability
- Lack of communication
- ... others!

... probably another (different) effort is needed!





GEOSS Asia-Pacific Symposium

Earth Observations Supporting the Implementation of the SDGs in the Asia Pacific Region

Tokyo
11-13 January 2017



GEO
CARBON AND
GHG INITIATIVE

GEO-C: policy relevance

Article 7 Adaptation

7.7 Strengthening cooperation

Strengthening scientific knowledge on climate, including research, systematic observation of the climate system to support decision-making

Article 14 Global stocktaking

14.1 ...in a comprehensive and facilitative manner, considering mitigation, adaptation and the means of implementation and support, and in the light of equity and the best available science.

Reporting

- to be transparent
- based on global stocktake
- shift from verification to support for countries to improve reporting

From a Policy Perspective



PARIS2015
UN CLIMATE CHANGE CONFERENCE
COP21-CMP11

Policy needs reliable GHG-related information





GEOSS Asia-Pacific Symposium

Earth Observations Supporting the Implementation of the SDGs in the Asia Pacific Region

Tokyo
11-13 January 2017



GEO
CARBON AND
GHG INITIATIVE

Progress in 2016: link with UNFCCC has significantly improved!



United Nations
Framework Convention on
Climate Change

- Poster presented at UNFCCC SBSTA-44, Research Dialogue, 19 May 2016, Bonn



A. Bombelli¹, J.H. Butler², J.G. Canadell³, P. Ciais⁴, P. DeCola⁵, A.J. Dolman⁶, R.M. Duren⁷, D.-G. Kim⁸, W.L. Kutsch⁹, S. Houwing¹⁰, J.V. Lavric¹¹, H. Loeschner¹², H. Murooka¹³, A. Obregon¹⁴, B. Pfeil¹⁵, S.E. Plummer¹⁶, N. Saigusa¹⁷, R.J. Scholes¹⁸, T. Tanhua¹⁹, M. Teitelzweig²⁰, A.T. Vermeulen²¹, L. Yi²²

Contact: antonio.bombelli@unfccc.int

¹CMCC, Italy; ²NOAA, US; ³CSIRO, Australia; ⁴CECE, France; ⁵ESMA, US; ⁶RU University Amsterdam, Netherlands; ⁷JPL-NASA, US; ⁸Meteo France Centre, France; ⁹CECE, France; ¹⁰INRA, France; ¹¹INRA, France; ¹²INRA, France; ¹³INRA, France; ¹⁴INRA, France; ¹⁵INRA, France; ¹⁶INRA, France; ¹⁷INRA, France; ¹⁸INRA, France; ¹⁹INRA, France; ²⁰INRA, France; ²¹INRA, France; ²²INRA, France

Introduction

The budgets of carbon and other greenhouse gases (GHGs) still carry many uncertainties that make it difficult to evaluate the success of climate change mitigation strategies. Improvements in long-term, high quality observing systems within and across the atmospheric, oceanic, terrestrial and human domains are required to quantify GHG sources and sinks, to understand changes in the carbon cycle and hence the climate system, and to address society's efforts to mitigate and adapt to climate change. Many observing efforts and initiatives are currently in place at regional and global levels, but what is needed further is a global coordinating mechanism to provide useful, comprehensive and comparable information to resource managers and policy makers.

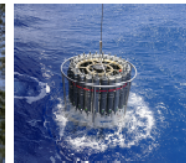


Objective

The main aim of the GEO Carbon and GHG Initiative is to develop an independent system for monitoring and evaluating natural and anthropogenic changes in the carbon cycle and GHG emissions and to provide decision makers with timely and reliable policy-relevant information, recommendations and data-products.

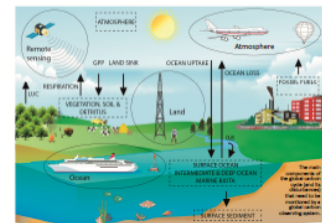
Mission

The GEO Carbon and GHG Initiative is a global effort proposed in the framework of GEO to promote interoperability and provide integration across the different components of a global carbon monitoring system, particularly at the interfaces of the different domains (atmosphere, ocean and terrestrial) and approaches (space-based, in-situ and in-lab). The intention is neither to rewrite nor duplicate existing efforts, but instead to build on existing initiatives and networks, ensure their continuity and coherence, and fill in the missing pieces to obtain a comprehensive, globally coordinated, carbon and GHG observation and analysis system. The initiative shall address policy agencies and will operate as a common and open platform to plan and implement strategies and joint activities at the global level from science to policy.



Policy relevance

After the recent agreement reached in Paris (UNFCCC COP 21, 2015) the need for a coordinated initiative to establish a long-term global observation system for carbon cycle and GHGs that provides, on an operational mode, reliable data, information, recommendations and products with sufficient accuracy, coverage and timeliness to verify climate policies, is needed more than ever. This is exactly the purpose of the GEO Carbon and GHG Initiative. The intention is to closely interact with UNFCCC and its bodies and Parties for the monitoring, reporting and verification (MRV) process. National reports contain inputs that are essential to any global assessment, and the GEO Carbon and GHG Initiative may in turn provide the countries with useful and independent information, ranging from data to methodologies. The services provided will include not only biophysical data, but also cost-estimates and evaluations of social impacts associated with emissions reduction, land-use change, ocean management and other policy relevant strategies.



Planned Activities

These are the activities already planned, divided into four different tasks. Further tasks can be carried out depending on the requirements.

Task 1 - User needs and policy interface: to engage with users and policy makers and ensure the consistency with their needs and address the policy agenda.
Task 2 - Data access and availability: to provide long-term, high quality and open access near-real-time data and data products, complying with the GEOSS principles, from a domain-overarching carbon cycle and GHG monitoring system.

Task 3 - Optimization of observational networks: to develop and implement an ongoing task a procedure for achieving observations of identified essential carbon cycle variables within user-defined specifications and at minimum total cost.

Task 4 - Budget calculations and breakdown across scales to support policy implementation: to develop consistent budgets of CO₂, CH₄ and N₂O from local to global scales using a combination of observations, inventories, models and data assimilation techniques.



- Participation at EarthInfo Day, 10 Nov 2016, Marrakesh
- Talk „The GEO Carbon and GHG Initiative – Integration across domains“
- Poster: „GEO’s efforts in support of the Paris Agreement“



MARRAKECH COP22 | CMP12 | CMA1
UN CLIMATE CHANGE CONFERENCE 2016
مؤتمر الأمم المتحدة لتغيير المناخ



GEOSS Asia-Pacific Symposium

Earth Observations Supporting the Implementation
of the SDGs in the Asia Pacific Region

Tokyo
11-13 January 2017



GEO
CARBON AND
GHG INITIATIVE

Users' needs

Users are mainly: scientific community and policy makers, as well as data managers, operational agencies (for example for MRV), etc – **let's discuss!**

The users need to:

- be more connected with the scientific community (in case of non-scientific users, of course!)
- have a common platform to plan joint strategies and implement coordinated activities
- ensure the consistency of GEO-C with their needs
- identified key essential carbon cycle variables within user-defined specifications and at minimum cost
- open access repositories with long-term, high quality and near-real-time data and products
- somebody that advocates for the need of data, networks, infrastructures, new platforms, etc.
- somebody that communicate carbon-related information to mass media
- policy (in case of decision makers) relevant data, information and products, of sufficient accuracy, coverage and timeliness to support them in addressing climate policies and anthropogenic climate change

⇒ **GEO-C can address (possibly) all the above needs**

From a Users Perspective





GEOSS Asia-Pacific Symposium

*Earth Observations Supporting the Implementation
of the SDGs in the Asia Pacific Region*

Tokyo
11-13 January 2017



GEO
CARBON AND
GHG INITIATIVE

PPT outline:

- 1- why a GEO C & GHG (GEO-C) initiative?
- 2- GEO-C objectives and work plan**
- 3- AO contribution to GEO-C





GEOSS Asia-Pacific Symposium

*Earth Observations Supporting the Implementation
of the SDGs in the Asia Pacific Region*

Tokyo
11-13 January 2017



GEO
CARBON AND
GHG INITIATIVE

GEO-C: toward policy-relevant global carbon cycle observation and analysis

The main aim of the GEO Carbon and GHG Initiative is to facilitate cooperation to i) develop a coordinated system of domain overarching observations (atmosphere, land, oceans) from different platforms (space-based, air- and ship-borne and in-situ monitoring systems) for ii) monitoring and evaluating changes in the carbon and other cycles, and GHG emissions as they relate to human activities and climate change, and to iii) provide decision makers with timely and reliable policy-relevant information.





GEOSS Asia-Pacific Symposium

Earth Observations Supporting the Implementation of the SDGs in the Asia Pacific Region

Tokyo
11-13 January 2017

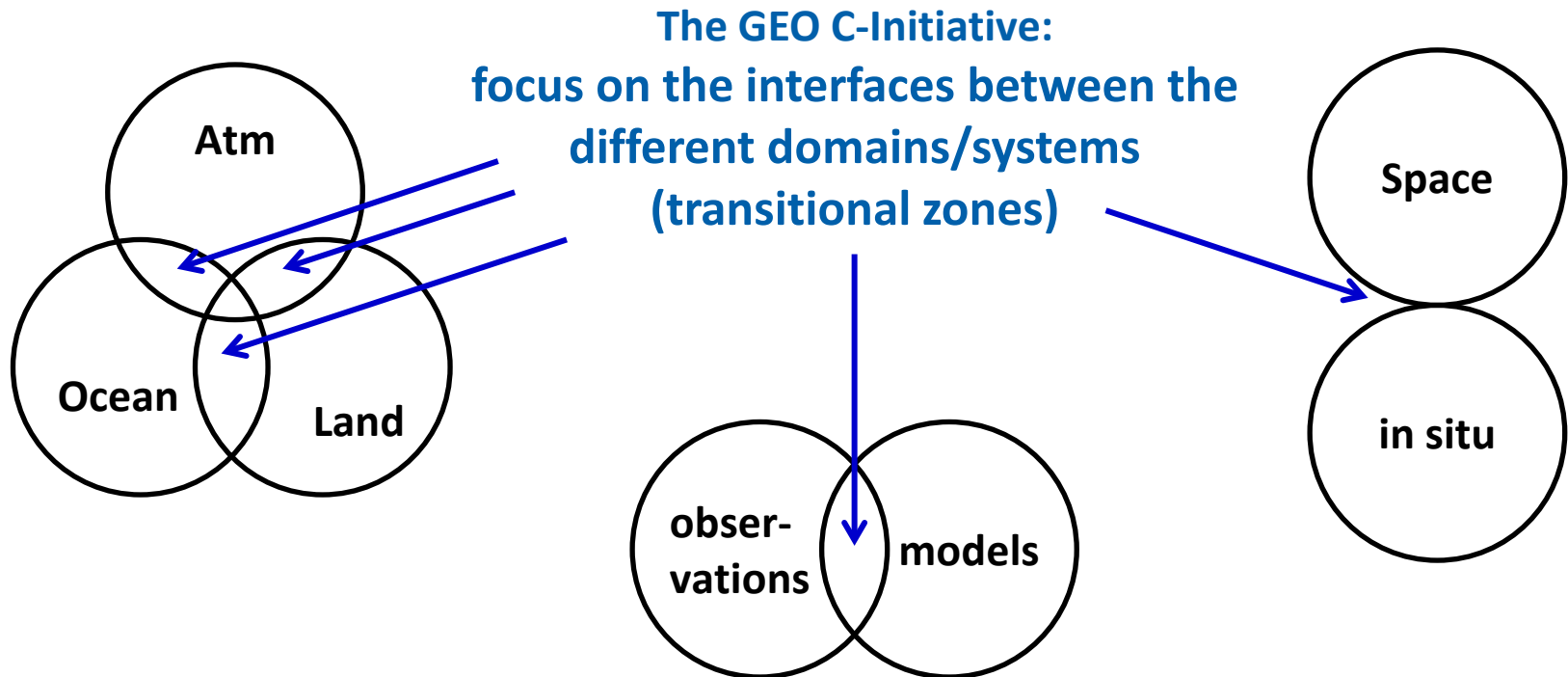


GEO
CARBON AND
GHG INITIATIVE

Cross cutting challenge – focusing on the interfaces

Insufficient communication/coordination between:

- atmosphere, land and ocean communities
- in situ and satellite observations
- modelers and observers





GEOSS Asia-Pacific Symposium

Earth Observations Supporting the Implementation of the SDGs in the Asia Pacific Region

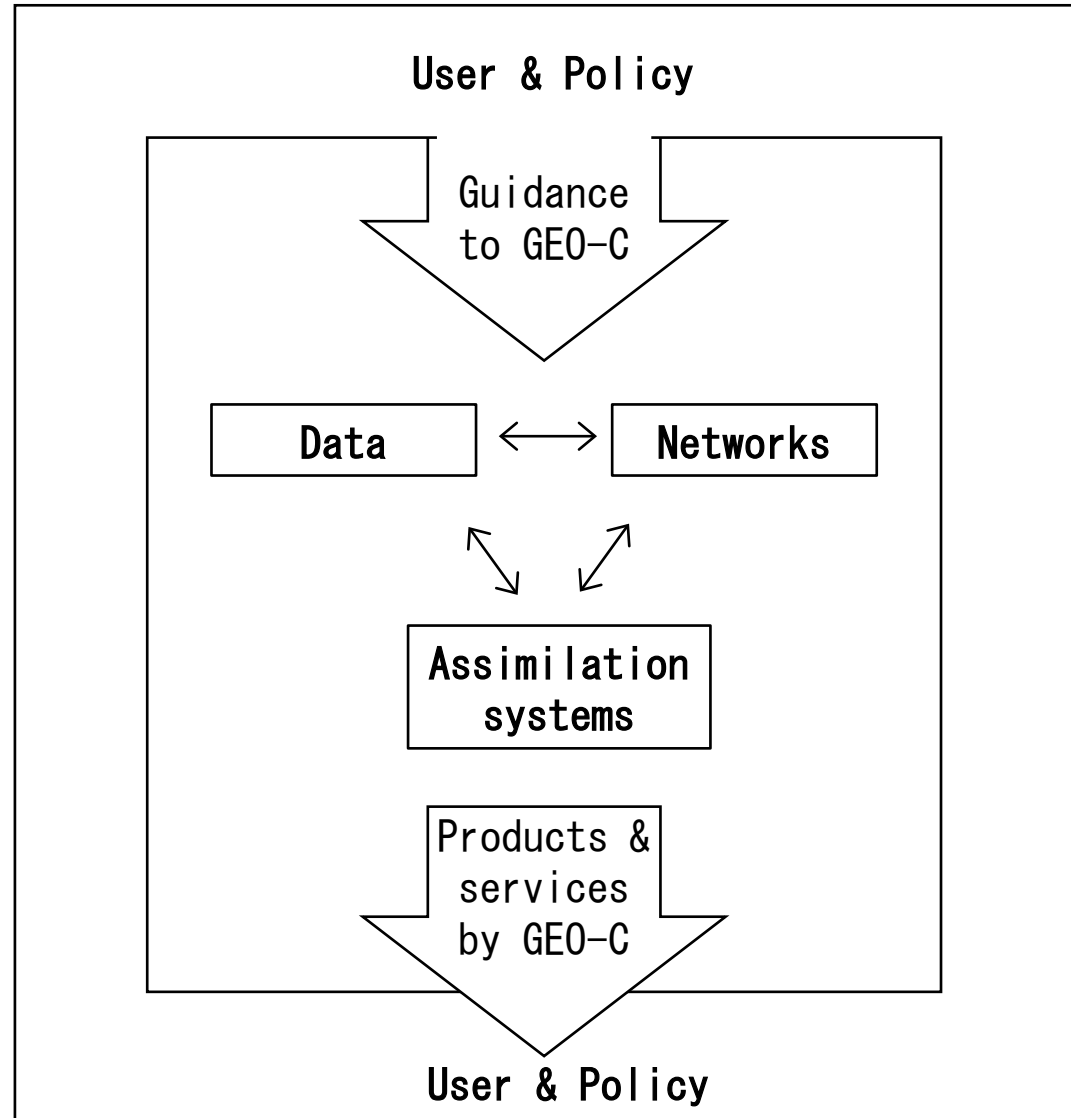
Tokyo
11-13 January 2017



GEO
CARBON AND
GHG INITIATIVE

Tasks (2017-2019)

- Task 1: User needs and policy interface
- Task 2: Data access and availability
- Task 3: Optimization of observational networks
- Task 4: Carbon and GHG budget calculations



Task 1 User needs and policy interface

Task Objectives

- Strengthen linkages with policy makers and relevant organizations (e.g. UNFCCC)
- Involve end-users and stakeholders in the activities of the proposed GEO Carbon and GHG Initiative
- Ensure consistency with user needs to drive the activities and address the policy agenda.

Activity 1.1 – User identification

Activity 1.2 – User needs assessment

Activity 1.3 – Address the policy agenda





GEOSS Asia-Pacific Symposium

*Earth Observations Supporting the Implementation
of the SDGs in the Asia Pacific Region*

Tokyo
11-13 January 2017



GEO
CARBON AND
GHG INITIATIVE

Task 2 Data access and availability

Task Objectives

- Provide long-term, open access to data and products
- Assure that data type, search, attribution, citation, distribution, and storage mode are state-of-the-art, sustainable and compatible with GEOSS principles
- Establish the data platform (database)

Activity 2.1 – Identification and description of key parameters and datasets to be provided

Activity 2.2 – Identification and description of requirements for interoperability with other data-providing systems

Activity 2.3 – Data management and data policy

Activity 2.4 – Data access web portal





GEOSS Asia-Pacific Symposium

*Earth Observations Supporting the Implementation
of the SDGs in the Asia Pacific Region*

Tokyo
11-13 January 2017



GEO
CARBON AND
GHG INITIATIVE

Task 3 Optimization of observational networks

Task Objectives

- Develop and implement a procedure for achieving observations of identified essential carbon cycle variables within user-defined specifications and at minimum total cost

Activity 3.1 – Design of an observing system for essential carbon cycle variables: This task will create the

Activity 3.2 – Generating and testing optimized design options: This activity will use Bayesian inversion

Activity 3.3 – Periodic adequacy reports





GEOSS Asia-Pacific Symposium

*Earth Observations Supporting the Implementation
of the SDGs in the Asia Pacific Region*

Tokyo
11-13 January 2017



GEO
CARBON AND
GHG INITIATIVE

Task 4 Budget calculations

Task Objectives

- Develop consistent budgets of GHGs from local/urban to global scales using a combination of observations, inventories, models and data assimilation techniques.
- Produce information (including C-budgets) to support the needs of policy makers at all scales from urban (e.g. large cities) to national, regional and the globe as well as a mechanism for verification.

Activity 4.4.3.1: Identification of test cases at different scales

Activity 4.4.3.2: Design of budget calculation approaches at each scale

Activity 4.4.3.3: Implementation of methodology

Activity 4.4.3.4: Scale consistency cross-comparison and interpretation

Activity 4.4.3.5: Development of resources for policy makers





GEOSS Asia-Pacific Symposium

*Earth Observations Supporting the Implementation
of the SDGs in the Asia Pacific Region*

Tokyo
11-13 January 2017



GEO
**CARBON AND
GHG INITIATIVE**

List of Deliverables (1/2)

- 1.1 A list of user groups identified and committed to interact with this initiative.
- 1.2 A user needs assessment report.
- 2.1 Identification and description of key parameters and datasets to be provided by GEO Carbon (Report and published paper)
- 2.2 Identification and description of requirements for interoperability of GEO Carbon with other data-providing systems (Report)
- 2.3 GEO Carbon data management and data policy (Report)
- 2.4 An operational single-location data access web portal for GEO Carbon data
- 2.5 A report describing the GEO Carbon data portal (includes outcomes from all Task activities)
- 3.1 Essential Carbon Variables: global assessment, including inputs from C-cycle researchers and information users, of which variables must be observed, where, how, how accurately and frequently, and how the observation system (including its various parts, and the processing chain all the way to end user) can be configured [Report and published paper].
- 3.2 Costs and attributes of options for a global carbon observing system [Report and published paper]
- 3.3 Spatial and temporal information reliability for essential carbon cycle variables in the year 2020 [Report, periodically updated]





GEOSS Asia-Pacific Symposium

Earth Observations Supporting the Implementation of the SDGs in the Asia Pacific Region

Tokyo
11-13 January 2017



GO
CARBON AND
GHG INITIATIVE

List of Deliverables (2/2)

- 4.1 Test case identification: global assessment, including inputs from C-cycle researchers and information users, of which variables must be observed, where, how, how accurately and frequently, and how the observation system (including its various parts, and the processing chain all the way to end user) can be configured. [Report and published paper]
- 4.2 Development of consistent cross-scale methodologies in a traceable manner, identifying assumptions, scale generalizations, observation requirements and gaps [Report and paper]
- 4.3 Calculations for all scales based on existing knowledge and methodological approaches [First Report]
- 4.4 Calculations for all scales based on experience from the first exercise (deliverables 3 and 6) and improvements in methodology [Second Report]
- 4.5 Calculations for all scales based on experience from the second exercise (deliverables 4 and 7) and improvements in methodology [Third Report and Paper]
- 4.6 and 4.7 Inter-comparison of results and methods in a traceable manner across scales [1st and 2nd Report]
- 4.8 Initial policy resource development (resource web site, summary for policy makers at each scale)
- 4.9 Policy resource development (tailoring to specifics of each scale and target audience)
- 4.10 Policy resource development (generation of quasi-operational resource products at each scale)
- 4.11 Improved and yearly updated global budgets for CO₂ and CH₄ (jointly with GCP)
- 4.12 Improved regional carbon budgets at higher spatial resolution (jointly with GCP)
- 4.13 Preliminary carbon budgets of selected cities (jointly with GCP).





GEOSS Asia-Pacific Symposium

*Earth Observations Supporting the Implementation
of the SDGs in the Asia Pacific Region*

Tokyo
11-13 January 2017



GEO
CARBON AND
GHG INITIATIVE

Next Steps (short term)

- Check and align with the new GCOS-IP that is now looking across carbon cycle.
- Fix dates for a face to face meeting. One option is to join it with the next 10th International Carbon Dioxide Conference, 21-25 August 2017 Interlaken, Switzerland. **Suggestions?**
- Fix working groups (at task and sub-tasks level) and start working at WG level before the meeting.
- Nominate the advisory board members.





GEOSS Asia-Pacific Symposium

Earth Observations Supporting the Implementation of the SDGs in the Asia Pacific Region

Tokyo
11-13 January 2017



GEO
CARBON AND
GHG INITIATIVE

Needed resources



The preparatory phase (2016) and associated activities have been sustained mainly by in-kind resources from the institutions willing to participate.

The implementation phase (2017-2025) need to be sustained by specific resources to be raised.



NO financial support ⇒ NO Flagship!





GEOSS Asia-Pacific Symposium

*Earth Observations Supporting the Implementation
of the SDGs in the Asia Pacific Region*

Tokyo
11-13 January 2017



GEO
CARBON AND
GHG INITIATIVE

PPT outline:

- 1- why a GEO C & GHG (GEO-C) initiative?
- 2- GEO-C objectives and work plan
- 3- AO contribution to GEO-C**





GEOSS Asia-Pacific Symposium

Earth Observations Supporting the Implementation of the SDGs in the Asia Pacific Region

Tokyo
11-13 January 2017



GEO
CARBON AND
GHG INITIATIVE

GEO-C and the AP Region

- AP region plays an important role in the global C-cycle and for what concerns GHG emissions and sinks
- In the AP Region there are many research institutions, agencies, organizations, etc., that play a key role in C & GHG observations and analysis

**see
next
PPTs**

Expectations from WG3 discussion

- Assess the status of C & GHG related observations in the AP region, including data availability
- Highlight gaps and weakness in the AP region and understand what may be need from GEO-C
- Further refine and increase the AP contribution to GEO-C
- Others?





GEOSS Asia-Pacific Symposium

*Earth Observations Supporting the Implementation
of the SDGs in the Asia Pacific Region*

Tokyo
11-13 January 2017



GEO
CARBON AND
GHG INITIATIVE

Global challenges – also relevant to AP region

- Need for coordination of the existing efforts which are scattered worldwide
- Further improvement and expansion to regional/global scale
- Commitments at country level to invest the needed resources to establish and sustain a long term operational global observing system for carbon cycle and greenhouse gases





GEOSS Asia-Pacific Symposium

Earth Observations Supporting the Implementation of the SDGs in the Asia Pacific Region

Tokyo
11-13 January 2017



GEO
CARBON AND
GHG INITIATIVE

Partnership

The ideal candidate to join the GEO-C partnership is any entity:

- With a mandate on GHG observations and/or analysis
- With international relevance and geographical focus from regional to global level
- With a role in GEO
- Having responsibilities on relevant monitoring site(s) network(s) and/or satellite mission(s)
- Managing (or contributing to) relevant datasets
- Developing relevant models and other products
- With expertise on science-policy interface
- Willing to commit resources (in kind, human, financial) for the 2017-2025 period





GEOSS Asia-Pacific Symposium

*Earth Observations Supporting the Implementation
of the SDGs in the Asia Pacific Region*

Tokyo
11-13 January 2017



GEO
CARBON AND
GHG INITIATIVE

Current Partnership (AP countries in bold)

- **CAS, China**
- CEOS, International
- CMCC, Italy
- ESA, EU
- GCP, International
- **Gifu University, Japan**
- Hawassa University, Ethiopia
- ICOS, Europe
- IIASA, International
- **JAMSTEC, Japan**
- **JAXA, Japan**
- **JMA, Japan**
- LSCE (CEA CNRS UVSQ), France
- NASA, USA
- **NIES, Japan**
- NOAA, USA
- Princeton University, USA
- Sigma Space Corp., USA
- SRON, Netherlands
- Stanford University, USA
- U.S. Carbon Cycle Science Program Office, USA
- UiB, Norway
- UKZN, South Africa
- University of the Witwatersrand, South Africa

**Contributions from other AP relevant partners
are welcomed!**





GEOSS Asia-Pacific Symposium

*Earth Observations Supporting the Implementation
of the SDGs in the Asia Pacific Region*

Date

11th-13th January 2017

Venue

Tokyo International Exchange Center, Plaza Heisei, Japan



THANKS!



List of contributors (non exhaustive)

A. Bombelli¹, J.H. Butler², J.G. Canadell³, P. Ciais⁴, P. DeCola⁵, A.J. Dolman⁶, R.M. Duren⁷, D.-G. Kim⁸, W.L. Kutsch⁹, S. Houweling¹⁰, J.V. Lavric⁹, H. Loescher¹¹, H. Muraoka¹², A. Obregón¹³, B. Pfeil¹⁴, S.E. Plummer¹⁵, N. Saigusa¹⁶, R.J. Scholes¹⁷, T. Tanhua¹⁸, M. Telszewski¹⁹, A.T. Vermeulen²⁰, L. Yi²¹

¹CMCC, Italy, ²NOAA, US, ³CSIRO, Australia, ⁴LSCE, France, ⁵SIGMA, US, ⁶VU University Amsterdam, Netherlands, ⁷JPL-NASA, US, ⁸Wondo Genet College, Ethiopia, ⁹ICOS, Finland, ¹⁰SRON, Netherlands, ¹¹NEON, US, ¹²Gifu Univ., Japan, ¹³GEO-Sec, int., ¹⁴UIB, Norway, ¹⁵ESA Climate Office, UK, ¹⁶NIES, Japan, ¹⁷Witwatersrand Univ., South Africa, ¹⁸GEOMAR, Germany, ¹⁹IOCCP, int., ²⁰ICOS, Lund Univ., Sweden, ²¹IAP/CAS, China