Atmospheric observations-based tools to support climate mitigation actions

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IG³IS Integrated Global Greenhouse Gas Information System

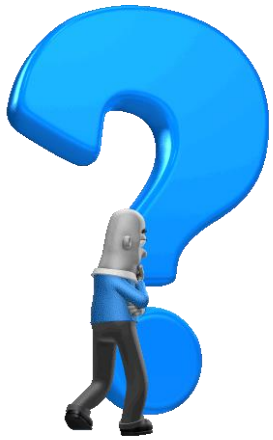
Motivation

- Paris Agreement's ambition to limit warming **to well below 2 °C above pre-industrial levels** while **pursuing efforts to limit the temperature increase to 1.5 °C above pre-industrial levels**
- Build upon initial **Nationally Determined Contributions** (NDCs) from Parties to the UNFCCC, a crucial step towards common objective
- Countries invited to update emission targets by 2020 and every five years
- **Transparency** and reporting on national progress
- Opportunity for **parties to cooperate** to implement their NDCs via **Article 6** allowing use of **market-based mechanisms**.

Players: Parties to convention (national governments), non-Party stakeholders (private sector, city and state governments)

The stakeholders need information **what** emissions to cut, **where, how much**, and was the **intended reduction achieved?**

Users need information for actions



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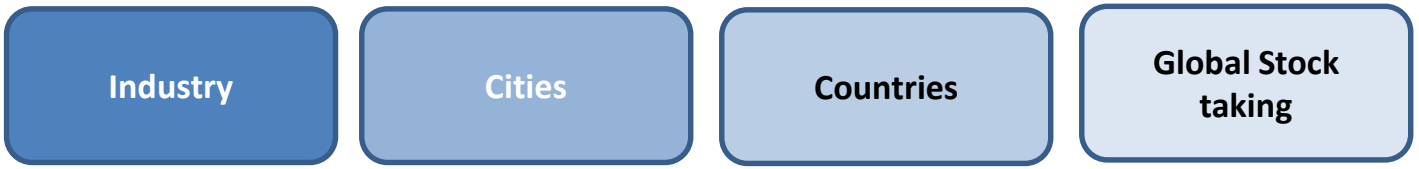
Integrated Global Greenhouse Gas Information System (IG³IS) will be

… a common framework for provision of the **systematic services to user community** who intend to reduce its greenhouse gas emissions

- Support the use of atmospheric concentration data to improve emission inventories (memorandum of understanding with UNFCCC, signed at COP23)
- Consensus on a coherent set of good-practice methods and guidelines
- Quality control (benchmarking)

Range of scales



Some of the IG³IS Principles

As any service IG³IS starts from the user in mind

Services are developed and delivered within a common internationally recognized framework rooted in the international organization (credibility)

Users include national, state and city governments and emissions compilers, the private sector and UNFCCC

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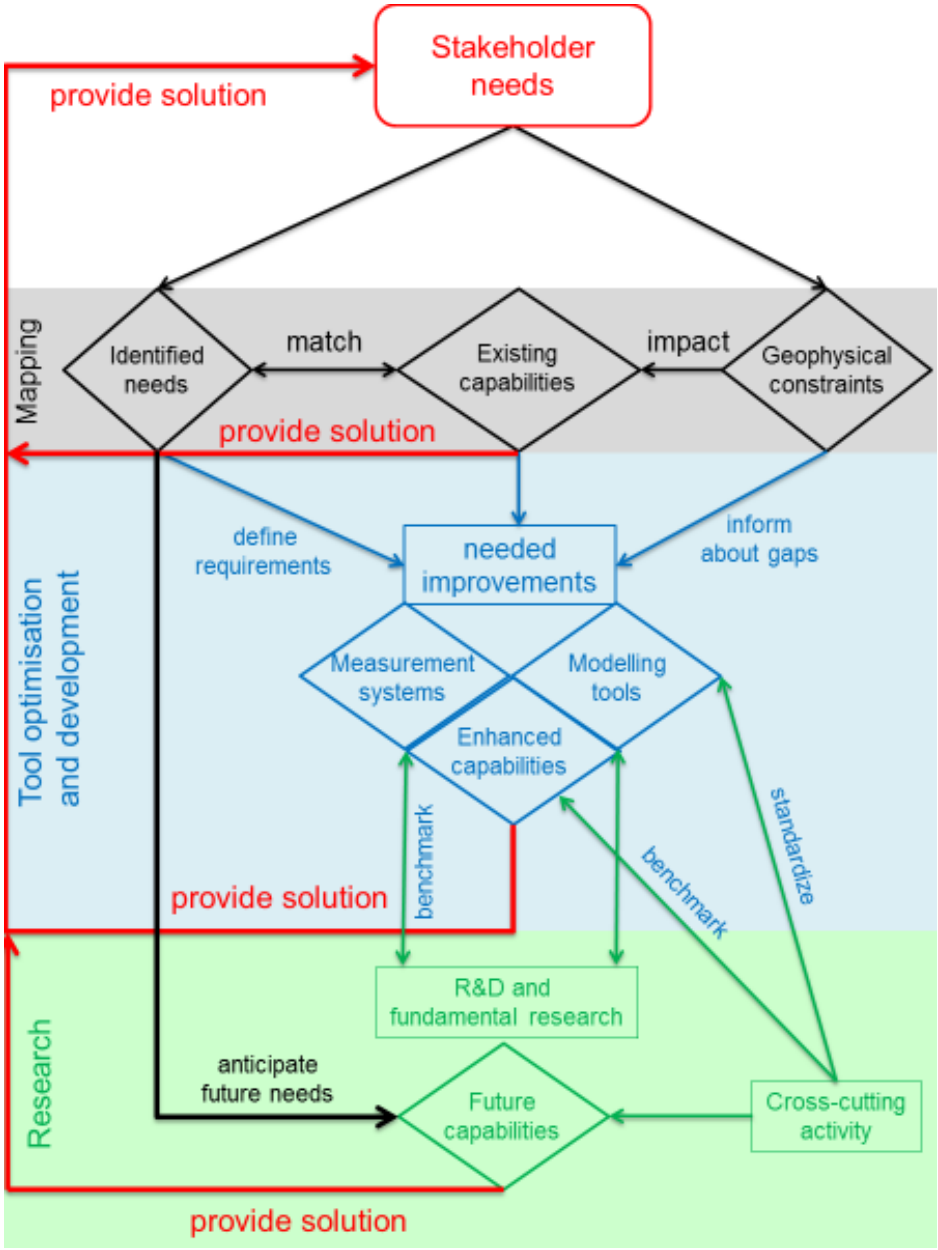
How does it work in practice?



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IG³IS Implementation: Products and Objectives

Products

- ***Pilot projects*** **to build user-base and improve skill,**
- ***Document good-practice*** **implementation guidelines**

Objectives

- ***Improved national inventory reporting*** by making use of atmospheric measurements for all countries
- Timely and quantified trend assessment in ***support of countries' NDC tracking and "Global Stocktaking"*** (TBD)

Key sub-national efforts and new mitigation opportunities:

- GHG monitoring in ***large urban source areas*** (cities/states- subnational)
- Detection and quantifying ***large unknown industrial CH_4 emissions***

Crosscutting Activities

- **Stimulate high-priority** ***Research and Development***
- **Inverse Modeling** ***benchmarking, testbed and intercomparison***

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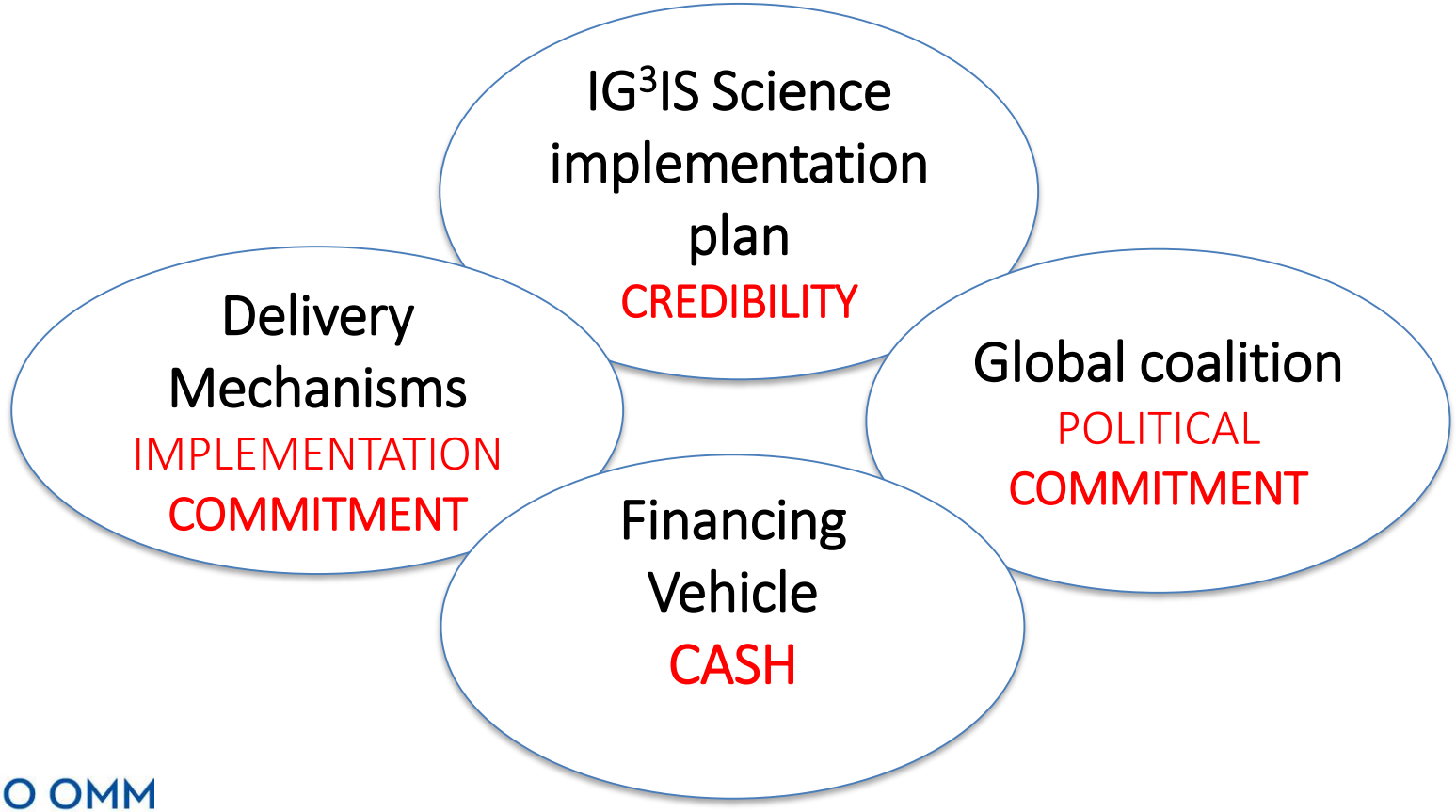
Where we are now

IG^{3}IS is going into implementation stage

- Implementation plan (guidelines) is approved by WMO Executive Council
- Office is established in WMO with support of Switzerland



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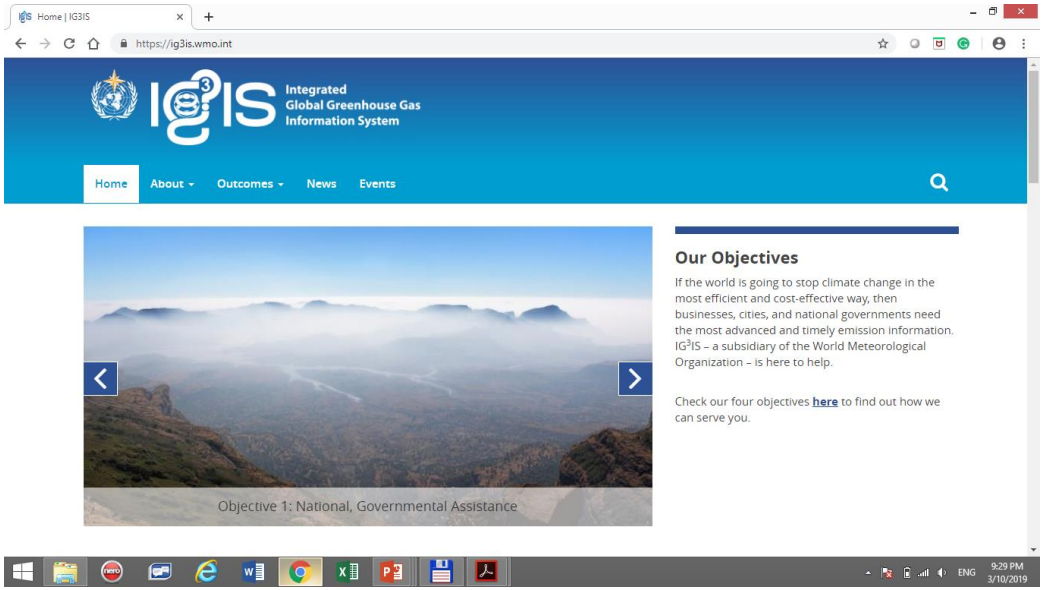
IG³IS Office

- Developed branding and website, that includes:
  - Interactive world map
  - Publications database with 250+ publications
  - Guidelines for proposing an IG³IS project



[ig3is.wmo.int](ig3is.wmo.int)

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Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

IG^{3}IS in the UNFCCC process

- **COP 22**

  First Earth Information Day

  IG^{3}IS was presented to Parties (plenary and poster) and the summary report on the Earth Information Day referred to IG^{3}IS (paragraphs 30, 31 and 73–86) <https://unfccc.int/sites/default/files/earthinformationday.2016.1.summaryreport.pdf>

- **SBSTA 47**

  The SBSTA conclusions (FCCC/SBSTA/2017/7) noted the increasing capability to systematically monitor greenhouse gas concentrations and emissions, through in situ as well as satellite observations, and its relevance in support of the Paris Agreement.[53]

  [53] See the section titled "Decision 51 - IG^{3}IS Implementation Plan" in the WMO submission, referred to in paragraph 51(a) above, and the summary report on the Earth Information Day, paragraphs 30, 31 and 73–86.

- **SBSTA 48**

  Side event: Towards a global network for monitoring the implementation of the Paris Agreement

IG^{3}IS in the UNFCCC process

- **UNFCCC and WMO memorandum of understanding**
  One collaborative project on promoting the use of IG^{3}IS in developing countries

- **SBSTA 48**

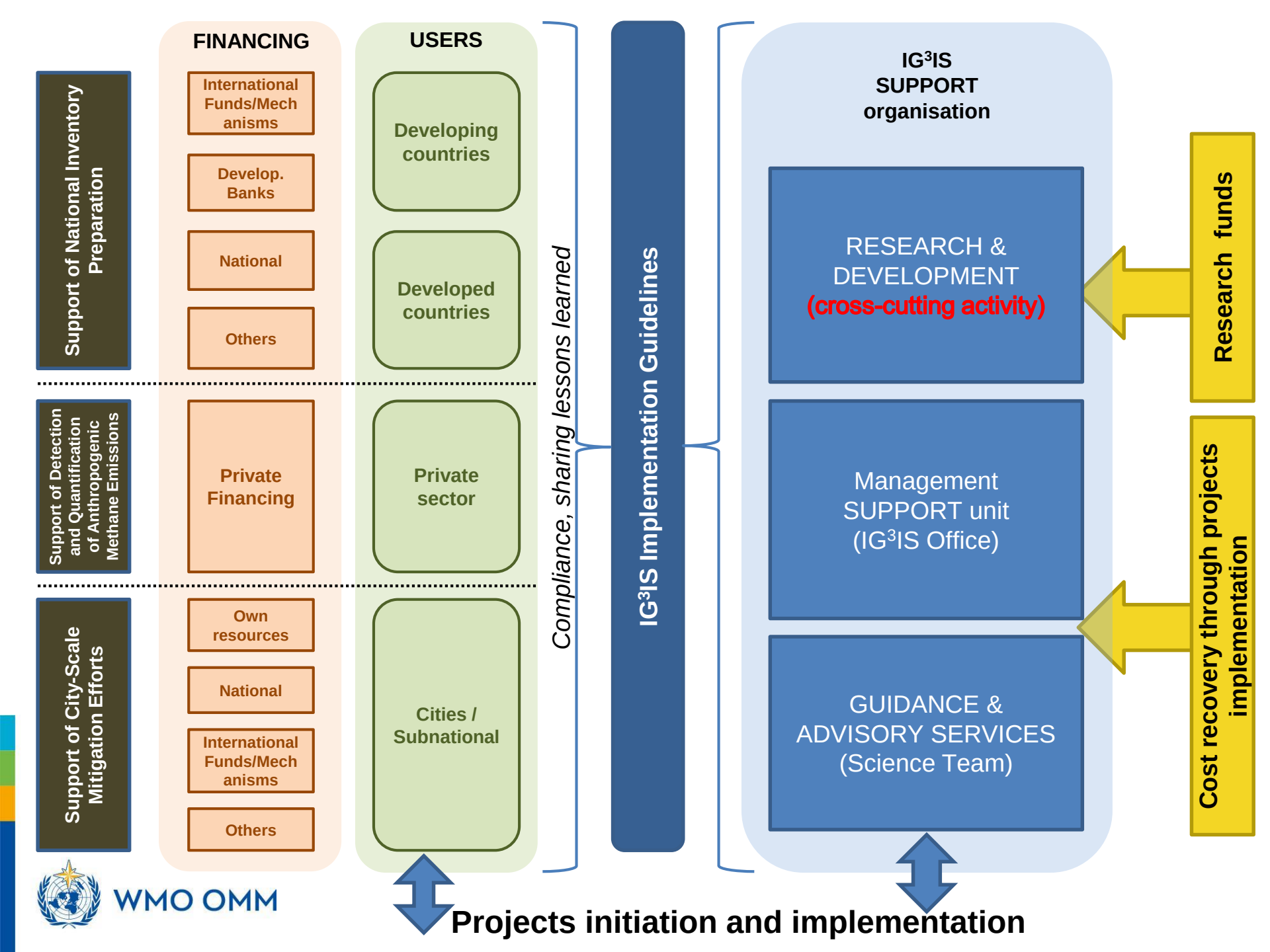
  Tenth Research Dialogue

  Poster on: Support of the implementation of the Paris agreement: Role of the Integrated Global Greenhouse Gas Information System (IG^{3}IS). The poster presented the IG^{3}IS principles and a number of national and city-scale examples.

- **SBSTA 49**

  Possible elements for SBSTA conclusions under systematic observation, include:

  - Recognition of the importance of atmospheric observations and analysis to track progress towards achieving the purpose and long-term goal of the Paris Agreement and identify opportunities to improve information on current greenhouse gas emissions levels and distribution, and to increase effectiveness of global and national greenhouse gas emission reduction efforts.


FINANCING
USERS
Support of National Inventory Preparation
International Funds/Mechanisms
Develop. Banks
National
Others
Developing countries
Developed countries
Support of Detection and Quantification of Anthropogenic Methane Emissions
Private Financing
Private sector
Support of City-Scale Mitigation Efforts
Own resources
National
International Funds/Mechanisms
Others
Cities / Subnational
Compliance, sharing lessons learned
IG³IS Implementation Guidelines
IG³IS SUPPORT organisation
RESEARCH & DEVELOPMENT (cross-cutting activity)
Management SUPPORT unit (IG³IS Office)
GUIDANCE & ADVISORY SERVICES (Science Team)
Research funds
Cost recovery through projects implementation
Projects initiation and implementation
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IG³IS cross cutting activity (CCA)

Leads: Sander Houweling and Thomas Lauvaux

***Goal** is to establish benchmarks of inversion performance and the quality of derived emission estimates*

The activity builds on the experience of TRANSCOM community. The 1th joint IG³IS – TRANSCOM Workshop took place in Lund, Sweden on Sept. 17-20, 2018 (supported by WMO and ICOS)

After the meeting the survey was perform to initiate the comparison activities. Responses were collected from 31 scientists across 27 different research laboratories.

Country	# particip.
Germany	3
USA	11
Netherlands	2
Sweden	2
England	3
France	2
New Zealand	1
Korea	1
Japan	4
Australia	1
Finland	1
Total	31

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Project selection

Urban experiment	Votes
Indianapolis (INFLUX)	17
Los Angeles (LA Megacity)	9
Paris (MegaParis and follow-up)	12
Others	12

Conclusion: We start with Indianapolis, IN and we add other projects in the following year depending on data/goals/PI's.

National experiment	Votes
Western EU-ICOS	13
US NACP	11
Other (sub)regions	9
CH4 / CO2	About even

Conclusion:

- First focus: CH_4 trend over Western Europe
- Spin off / application of VERIFY products => to be discussed further this meeting

Next IG³IS – Transcom meeting: Paris Oct. 7-11 (2019)

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IG³IS Symposium and User Summit, 13-15 November, Geneva

- This Symposium for the first time brought together key users from a number of different sectors to engage in dialogue with technical developers of IG3IS information.
- Stakeholders and users attending the Symposium:

National emission compilers: Germany, Switzerland, UK, Chile, Australia

Cities representatives: Mexico, Salt Lake City, Recife, Paris, Auckland, International Council for Local Environmental Initiatives (ICLEI)

Private-sector/Markets/NGOs: International Emissions Trading Association (IETA), Environmental Defense Fund (EDF), World Business Council for Sustainable Development (WBCSD), Initiative for Climate Action Transparency (ICAT), Oil and Gas Climate Initiative (OGCI)

More than 60 attendees from 24 countries, including scientists, national stakeholders and private sector representatives.

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National Objective

Stakeholder Needs		Technical Expert Services	
Uncertainties Faced & Uses for Emissions Data	• *Refrigeration* • *LULUCF* • *Soil emissions* • *Wastewater treatment* • *Biogas facilities* • *Waste incineration* • *Industrial leakages*	**Capabilities**	• *Targeted surveys, source allocation from surrounding sites* • *Targeted campaigns/observation networks* • *Rapid/automated data processing* • *Inverse modelling system* • *CO2 and CH4 fluxes*
Needs	***Standard methodology** for use at facility/local/regional scale and permits international comparisons*	**Examples**	• *CH4 & N2O uncertainties investigated in Switzerland* • *Forest carbon sink found to absorb 30-60% more carbon than thought in New Zealand*
	*Tools to understand **how mitigation actions are performing** and how will **potentially reduce emissions***	**Lessons Learned from Past Projects**	• *Sources with similar distributions are difficult to separate;* • *Top-down estimation needs spatially explicit prior emissions* • *Robust high-quality instruments essential for long-term monitoring;* • *Atmospheric information can improve fidelity of reporting, effectiveness of action* • *Tackles unknown unknowns*
	***Global stocktake can be used as an opportunity** to get a global overview on the share of total **GHG emissions**, track **emission reductions** and **local actions**, to provide **observation-based evidence** on the emission trades.*		

Subnational Industrial and Private Sector Objective

Stakeholder Needs		Technical Expert Services	
Uncertainties Faced & Uses for Emissions Data	• *Accurate baseline and emissions data needed (carbon credits issuance)* • *Carbon market regulators also need data* • *Actions to quantify and reduce methane emissions (oil&gas)* • *Transport efficiency* • *(CCUS): actions that could enable the rapid scale-up commercially viable,* • *Energy efficiency in the industry*	**Capabilities**	• *Temporal/spatial resolution* • *Assessment of co-benefits (air quality benefits of reducing CH4 emissions)* • *Detection & Quantification* • *Attribution* • *Airplane gathered data* • *Flux towers*
Needs	*Companies need data and projections to help their **short and long term decision-making***	**Examples**	• *Study of U.S. Environmental Protection Agency (EPA) inventory of CH4 emissions from the U.S. oil and gas supply chain* • *CARB Inverse Modelling Program*
	***Companies want to stay ahead of risks, opportunities,** and policy and the competition*	**Lessons Learned from Past Projects**	• *Oil and gas methane: opportunity to link atmospheric measurements to mitigation actions* • *Global oil and gas system is not homogeneous* • *Propagate consistent methodologies* • *Importance of tracking progress in mitigation actions → multi-scale approach* • *Combined aerial - ground measurements help understand emission causes needed for mitigation* • *Super Emitters [of methane] weren't just in oil and gas*
	*Accurate GHG emissions **monitoring and reporting** is vital for international cooperation*		

Subnational Urban Objective

Stakeholder Needs		Technical Expert Services	
Uncertainties Faced & Uses for Emissions Data	• *Totals from summing emissions from individual municipalities not necessarily consistent with estimate over larger area* • *Better knowledge about the CH4 emissions* • *Identify with a better resolution the main emission sources* • *A spatially scalable system.*	**Capabilities**	• *Investigate future GHG emission scenarios and how they would impact local* • *Design appropriate monitoring systems to track mitigation success* • *Identifying CH4* • *Measure: CO2 index for citizens and decision-makers* • *Trigger: CO2 mapping service to target carbon reduction projects*
Specific Uncertainties	• *Improving emissions estimates from on-road vehicles* • *Power consumption* • *Importance of working with utility companies to decarbonize power generation* • *Quantifying carbon sinks of tree planting initiatives* • *Public awareness should be taken into greater account*	**Examples**	• *Canadian Cities: CH4 measurements* • *Mexico City: High precision measurements at two sites- Lower-cost medium precision measurements at ten sites*
Policy	• *Develop and apply a public policy to reduce the GHG emissions* • *Measure a reliable dimension of the public policy impact applied* • *Simulate scenarios of projections based on the results of the policy applied* • *Public policies should further integrate air pollution*	**Lessons Learned from Past Projects**	• *14C is the gold standard for partitioning CO2 into fossil components correlate tracers Challenges: Project in Mexico City* • *Find a 'low-cost' modus operandi keeping on track the performances of the low-cost sensors* • *High resolution modelling of the atmospheric dispersion in Mexico-City* • *Separate local/regional and anthropogenic/ biospheric contributions to the observed signals* • *Verification is NOT the primary need*
Air Quality Crossover	• *Integrate GHG and the air quality monitoring* • *Interaction of Air Quality and GHG emission between urban and biodiversity areas*		

The path forward

A number of actions were identified as a pathway forward for IG^{3}IS in the coming years:

- **IG^{3}IS will continue to cultivate active and intimate partnerships between its science team and the user communities**.

- IG^{3}IS **will have a focus on promoting new projects with stakeholders in nations, cities, and businesses in the developing world**, while continuing its successes in the developed world.

- The IG^{3}IS science team will continue to **promote technological abilities for creating projects on a wider range of GHG emission information**.

- IG^{3}IS **will broaden its portfolio within market mechanisms and the private sector** by offering services in the agricultural, forestry, waste management, and other land use and land use change sectors.

- Further efforts will be made on the establishment of the business model, **financial vehicle and delivery mechanisms**

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Thank you!
Merci!

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GLOBAL ATMOSPHERE WATCH

Why do we need IG³IS?

Observations

Analysis tools

- Trend analysis
- Mass balance
- Correlation analysis
- Eulerian inverse modeling
- Lagrangian Inverse modelling
- FFDAS
- Etc…

Information consistency across scales

IG³IS provides a common framework for the consistent methods and tools through quality assurance, benchmarking and documentation of the good practices

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