Integrated Global GHG Information System (IG³IS): Evidence Based Policy Support and Evaluation

Phil DeCola
Sigma Space

Oksana Tarasova
WMO GAW

Riley Duren
NASA JPL

Kevin Gurney
Arizona State University

Jacqueline McGlade
Valentin Foltescu
UNEP

and the IG³IS Planning Team
International IG³IS Planning Team Members

Chair: Phil DeCola

Paris Agreement and GHG Monitoring: Evolving from Top-Down versus Bottom-Up Paradigm

**Then (2009)**

- Binding Multi-national Treaty Commitments
- "we will verify your reported emissions"
- A grand top-down GHG Information System
- Advocates: Science Community!!!

**Now (2016)**

- Nationally Determined Contributions
- "we will help you improve your data"
- Federation of focused monitoring systems
- Advocates: WMO (191 countries), UNEP, Cities (eg, C40), NGOs, Industry (eg, Oil Companies)
Paris Agreement – limit the temperature increase by 2°C by limiting emissions

**Fundamental problem** – it is what you **HAVE** in the atmosphere, not what you **PUT** in the atmosphere, that controls the temperature

Calculations are for year in 2011

Human (9GtC in) – ocean (2.3GtC out) – biosphere (2.6GtC out)
Conference of the Parties
Twenty-second session
Marrakech, 7–18 November 2016
Item X of the provisional agenda

Aggregate effect of the intended nationally determined contributions: an update
Comparison of global emission levels in 2025 and 2030 resulting from the implementation of the INDCs and under other scenarios

How to get emissions?

- “Bottom-up” measurements (SELF REPORTING)
  - Emissions reporting
  - Reported and “verified” offsets
  - Site-specific measurements

- “Top-down” measurements
  - Comprehensive atmospheric observation system
  - Ecosystem and ocean observations
  - Inverse modelling

- Combination of above

Assuming that we know ocean and biospheric uptake

NDCs are evaluated every 5 years -> are we on the right track?
Where can we cut more?
Are oceans and biosphere are working as expected?
The Integrated Global Greenhouse Gas Information System (IG3IS)

IG3IS Goals and Principles

**Goal:** Support the success of post-COP21 actions of nations, sub-national governments, and the private sector to reduce climate-disrupting GHG emissions through a sound-scientific, measurement-based approach that:

- reduces uncertainty of national emission inventory reporting,
- identifies large and additional emission reduction opportunities, and
- provides nations with timely and quantified guidance on progress towards their emission reduction strategies and pledges (e.g., NDCs)

**Principles**

- IG3IS will serve as an international coordinating mechanism and establish and propagate consistent methods and standards.
- Diverse measurement and analysis approaches will fit within a common framework.
- Stakeholders are entrained from the beginning to ensure that information products meet user priorities and deliver on the foreseen value proposition.
- Success-criteria are that the information guides additional and valuable emission-reduction actions.

IG3IS must mature in concert with evolution of technology and user-needs / policy.
IG³IS programmatic evolution within WMO

- CAS Mgt (May 2013)
- WMO/GAW GMT (Jun 2013)
- CAS (Nov 2013)
- Resolution Approved by WMO Congress (Jun 2015)
- WMO Exec Council (Jun 2014)

- IG³IS Planning Team Established and Concept Paper Drafted (July 2015 – May 2016)
- Concept Paper Endorsed by WMO Executive Council (Jun 2016)

- UNEP Collaboration MOU (Feb 2016)

- Resolution Approved by WMO Congress (Jun 2015)
WMO Role in GHG Information and IG³IS: Methods and standards for GHG Observations

The Role of the World Meteorological Organization (WMO)

- Ensure high quality, consistent, continuous GHG and other observations of atmospheric composition
- Develop high quality atmospheric transport and data inversion models
- Coordinate global atmospheric measurements; improve models and analysis
- Leverage capabilities across programs and nations
- Build capacity in developing nations
The patterns in observed surface concentrations are distinctly opposite to the daily variations of emissions fluxes from human activity.

Surface concentrations of CO$_2$ maximize at nighttime when the nocturnal PBL is shallow, but PBL height and rush hour emissions are increasing in the morning.

**Must understand atmospheric transport and dynamics to quantify emissions fluxes from atmospheric concentration measurements**
Near-term IG³IS Objectives
(3-5 year horizon)

Support of Paris Agreement:

• Timely and quantified trend assessment of NDCs in support of “Global Stocktaking”

• Improved national inventory reporting by making use of atmospheric measurements for all countries

Key sub-national efforts and new mitigation opportunities:

• GHG monitoring in large urban source areas (megacities)

• Detection and quantifying large unknown CH$_4$ emissions

HOW: Upscale good practices through pilot projects
Example from UK report to UNFCCC: Methane

- Early (1990s) mismatch with the inventory.
- Difficult to understand, most likely cause is landfill emissions but retrospectively challenging to investigate.
- Inspired DECC to expand the network from 1 to 4 stations.
Great match between national total ("bottom-up" and "top-down") but incorrect spatial distribution

Example from Switzerland: Methane (S. Henne et al., 2016)
GOSAT Observations Demonstrate
Space-based Detection of Megacity XCO2

Persistent, robust enhancement
= 3.2 ± 1.5 ppm
Example of additional emission reduction opportunities

Tier 1: Satellite detects hotspot region

Tier 2 (Blue boxes):
- Aircraft spectrometers estimate local fluxes & attributes source sectors

Tier 3: Plume Imaging
- Aircraft map point sources

Tier 4 (not shown):
- Surface observations
  - Enhanced Activity Data

Example of additional emission reduction opportunities

- Turner et al. 2015
- Taft dairies
- Kern River oil field
- Elk Hills oil field

Oil fields
- Dairies

500 km

Pixel size 1.5 m

Source 27A

500 m
“Nesting” – from the planet to a building

- Global consistency
- Consistency across scales
- Standardization
Contribution from satellite community

Supporting mid-term (and long-term) objectives:

- Improved national inventory reporting by making use of atmospheric measurements for all countries – *Satellite observations can help with “closing the budget” by measurement over ocean and over areas with poor data coverage* – requires reduced uncertainty

Key sub-national efforts and new mitigation opportunities:

- GHG monitoring in large urban source areas (megacities)
- Detection and quantifying large unknown CH$_4$ emissions
- *Satellites can identify and quantify “hot spots”* – requires 24/7 observations of very high spatial resolution over fixed area, multi-parameter observations are needed for attribution
Future IG$^3$IS with geostationary GHG sounders and low-Earth orbiting mapping systems
Thank you
Merci