Atmospheric observations and analysis tools to support policy and quantify value

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Paris agreement

- 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**
- Builds on **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

Players: state stakeholders (national governments), non-state stakeholders (private sector, city governments)

The stakeholders need information **what** emissions to cut, **where**, **how much**, and if they did so was there any desirable **effect** achieved
Emissions and concentrations

Paris Agreement aims to achieve 2C by controlling emissions

National emissions are calculated following IPCC Guidelines

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<th>category</th>
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<tr>
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<td>Energy</td>
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<td>Total</td>
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Commitments (e.g. NDC): e.g. x% of YY Gt

IN

+3.5 GtCO2

OUT

+34.1 GtCO2

-9.7 GtCO2

16.4 GtCO2

Amount of gases (concentrations!!!)

temperature

radiation
Can science provide a solution?

Yes! Let’s add the atmosphere into the equation:

- observations
- transport modelling and attributions

Emission inventory

= ADDITIONAL information on emissions
The Integrated Global Greenhouse Gas Information System (IG$^3$IS)

**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 **user-driven approach** that:

- Improve knowledge of the national emissions, **WHAT?**
- Identifies large and additional emission reduction opportunities (industrial methane), **WHERE?**
- Provides timely and quantified guidance on progress towards their emission reduction strategies and pledges (e.g., NDCs), **EFFECT?**

**HOW?** IG$^3$IS Science Implementation Plan was approved by EC-70
National case for New Zealand

- Three sites with CO$_2$ and $^{14}$CO$_2$ measurements
- Larger uptake than prior model or bottom up accounting, particularly in forested regions
- Differences to bottom up accounting partly due to differences between LULUCF and what the atmosphere ‘sees’. These issues are still being resolved.

**Scenario:** carbon market trader (**benefits:** better knowledge of how much carbon credits is possible to sell during each year)
Mitigation opportunities: Super-emitters in oil and gas sector

Accurate emission estimates | Mitigation of emissions

5% of sites accounted for 50% of the emissions
Mitigation opportunities (methane leaks)

**Tier 1:** Satellite detects hotspot region

**Scenario:** investor (benefits: better knowledge if your investment in the new technologies at a certain facility did bring you expected/claimed reductions)

**Tier 2 (Blue boxes):** Aircraft spectrometers estimates local fluxes & attributes source sectors

**Tier 3:** Plume Imaging aircraft map point sources

**Tier 4 (not shown):** Surface observations

- Kern River oil field
- Elk Hills oil field
- Taft dairies

- Turner et al. 2015
- Taft dairies
- Oil fields
- Dairies

Pixel size 1.5m

500 km

50 km
The Megacity Project provides a strategy, methodology and roadmap for an international framework to assess directly the carbon emission trends of the world’s megacities.

http://megacities.jpl.nasa.gov

Scenario: city planner  
(benefits: better knowledge of emission distribution in the city/where to act)
Los Angeles inverse model of 12 tower measurements shows methane hot spots at known & a large unknown source
Airborne imaging spectrometer sees methane plume confirming large leak from distribution system
Increasing Mitigation Effectiveness

- IG3IS Science implementation plan
- Global coalition
- Financing Vehicle
- Delivery Mechanisms

CREDIBILITY
IMPLEMENTATION
COMMITMENT
POLITICAL
COMMITMENT
CASH
Thank you!
Merci!
1) Advancing atmospheric transport modelling and improved quantification and benchmarking of inverse modelling skill

2) Improved technical capacity to disentangle the relative contributions of fossil fuel CO₂ and biospheric CO₂ in atmospheric concentration measurements of CO₂, as well as source attribution of the other gases through improved measurement capability of isotopic composition and advancing inverse model analyses of co-emitted, co-varying atmospheric constituents.

The same sources inject into the atmosphere both climate forcers and pollutants that are detrimental for human health and the ecosystems
Near-term IG$^3$IS Objectives

1. Improve knowledge and reduce uncertainty of national emission inventory reporting to UNFCCC;
2. Locate and quantify previously unknown emission reduction opportunities such as fugitive methane emissions from industrial sources; and,
3. Provide subnational entities such as large urban source regions (megacities) with timely and quantified information on the amounts, trends and attribution by sector of their GHG emissions to evaluate and guide progress towards emission reduction goals.
4. Support of global stock taking