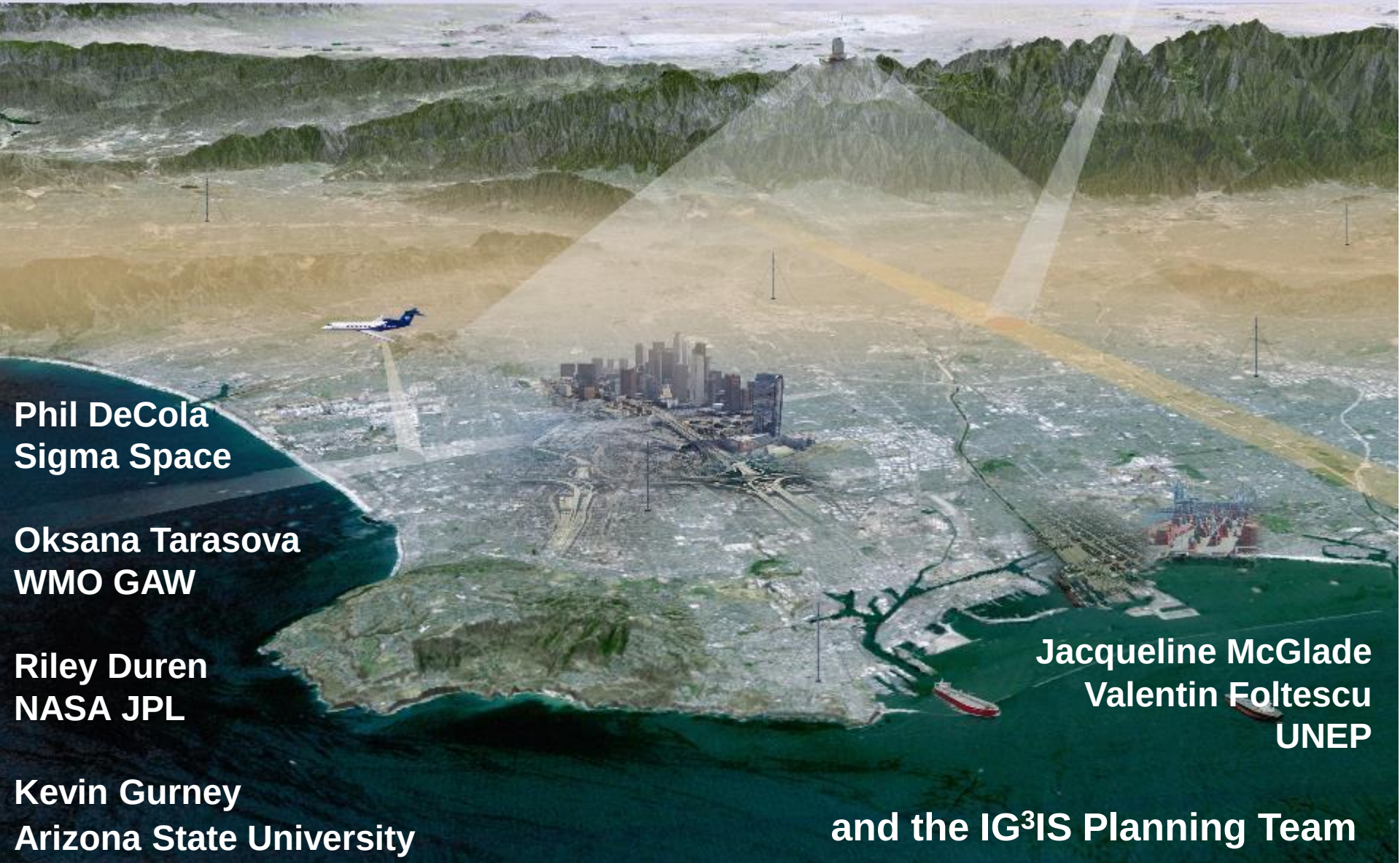
Integrated Global GHG Information System (IG^{3}IS): Evidence Based Policy Support and Evaluation



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and the IG^{3}IS Planning Team

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

Then (2009)

Binding Multi-national Treaty Commitments

"we will <u>verify</u> your reported emissions"

A grand top-down GHG Information System

Advocates: Science Community!!!

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Now (2016)

Nationally Determined Contributions

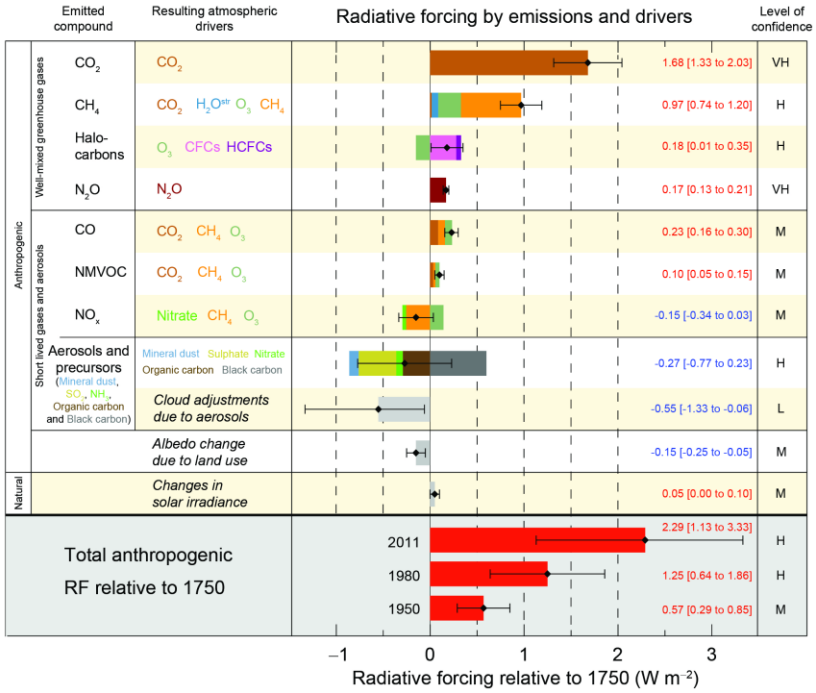
"we will <u>help</u> you <u>improve</u> your data"

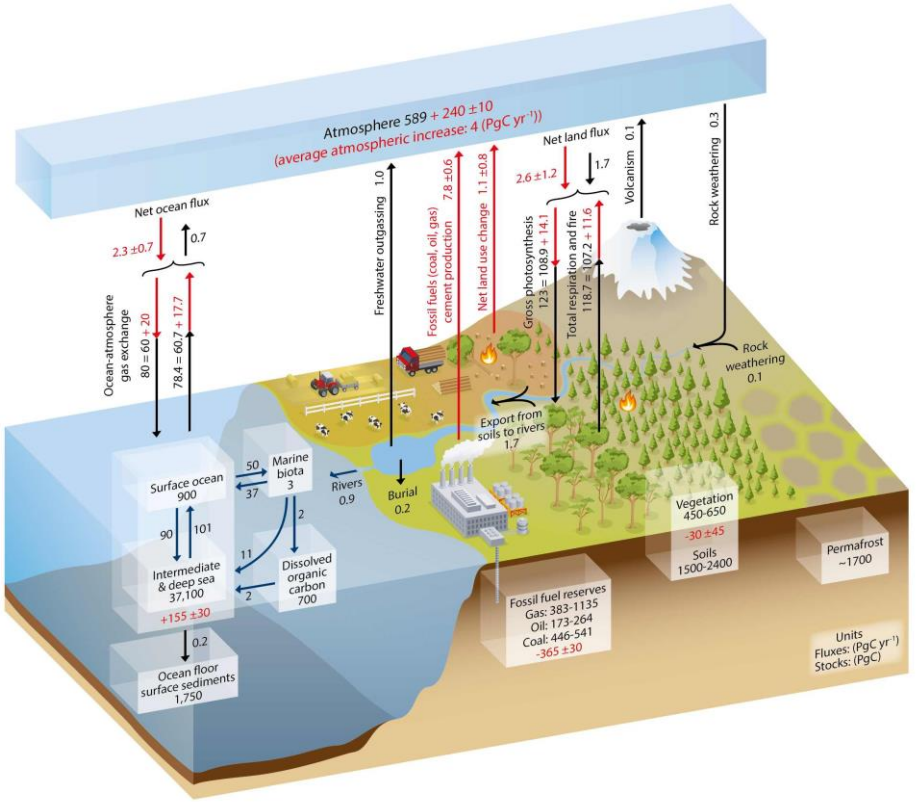
Federation of focused monitoring systems

Advocates: WMO (191 countries),UNEP, Cities (eg, C40), NGOs, Industry (eg, Oil Companies)

Paris Agreement – limit the temperature increase by 2C 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)

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United Nations

FCCC/CP/2016/2

Framework Convention on Climate Change

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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

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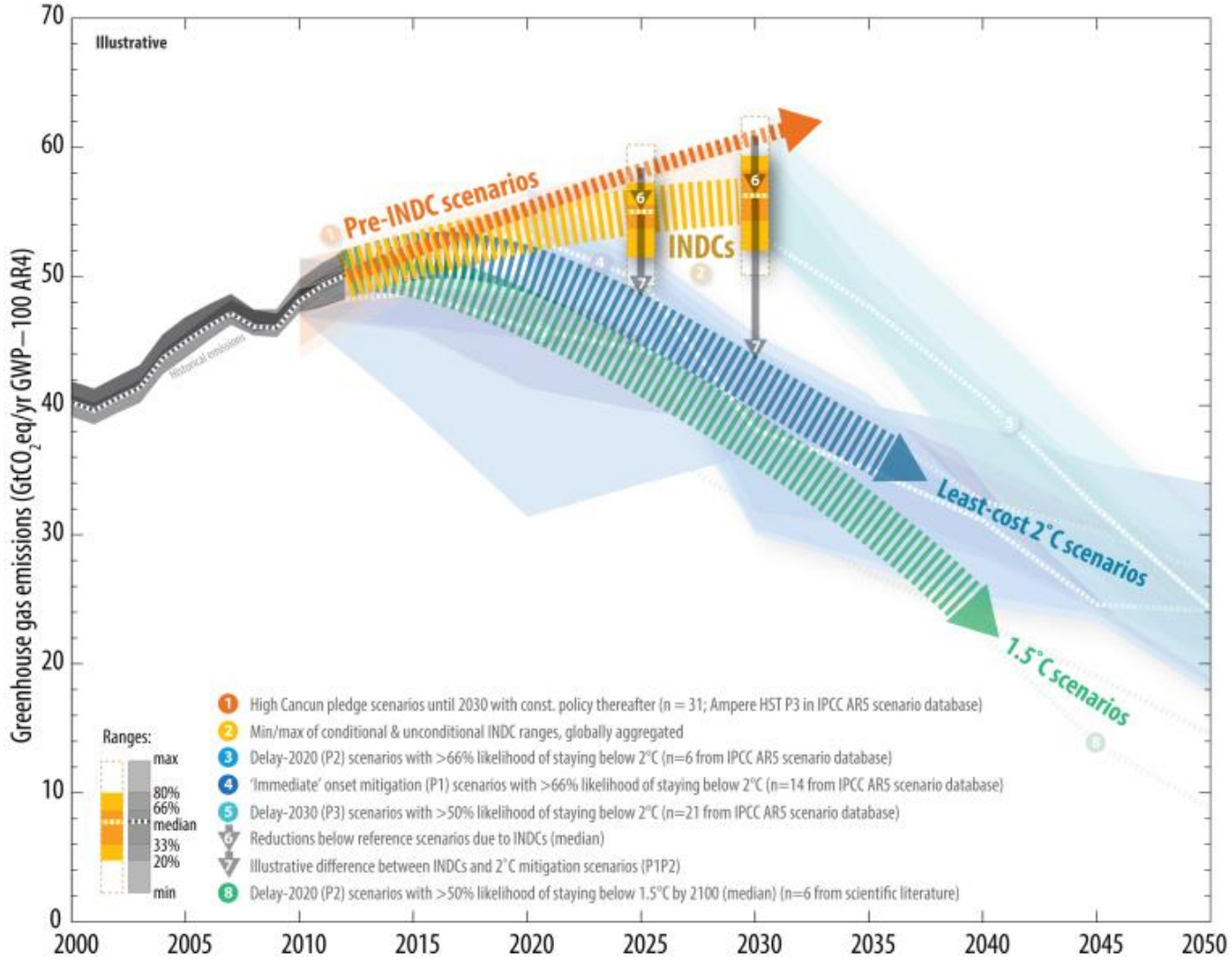
Comparison of global emission levels in 2025 and 2030 resulting from the implementation of the INDCs and under other scenarios



Source: IPCC Synthesis report on the aggregate effect of intended nationally determined contributions http://unfccc.int/focus/indc_portal/items/9240.php

How to get emissions?

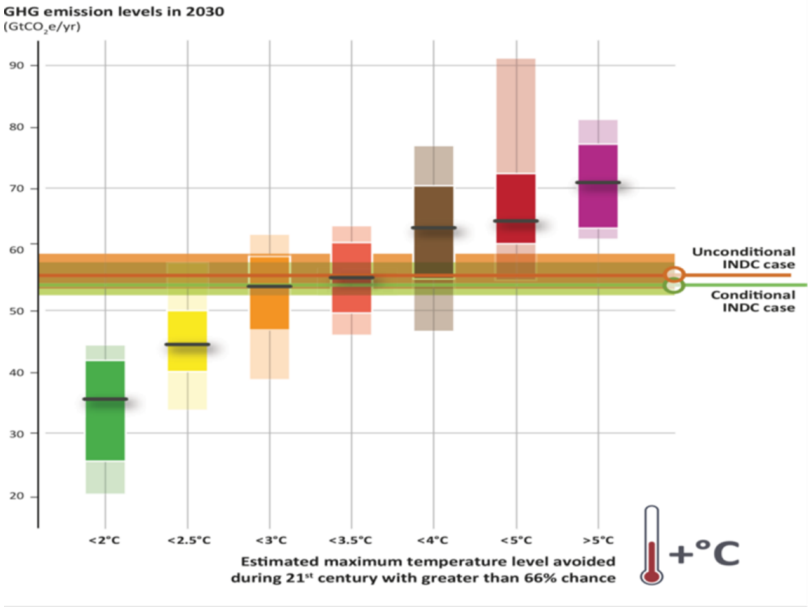
- "Bottom-up" measurements (SELF REPORTING)
  - Emissions reporting
  - Reported and "verified" offsets
  - Site-specific measurements

NDCs

Assuming that we know ocean and biospheric uptake

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

- Combination of above



NDC are evaluated every 5 years -> are we on the right track?
Where can we cut more?
Are oceans and biosphere are working as expected?

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The Integrated Global Greenhouse Gas Information System (IG³IS)
IG³IS Goals and Principles

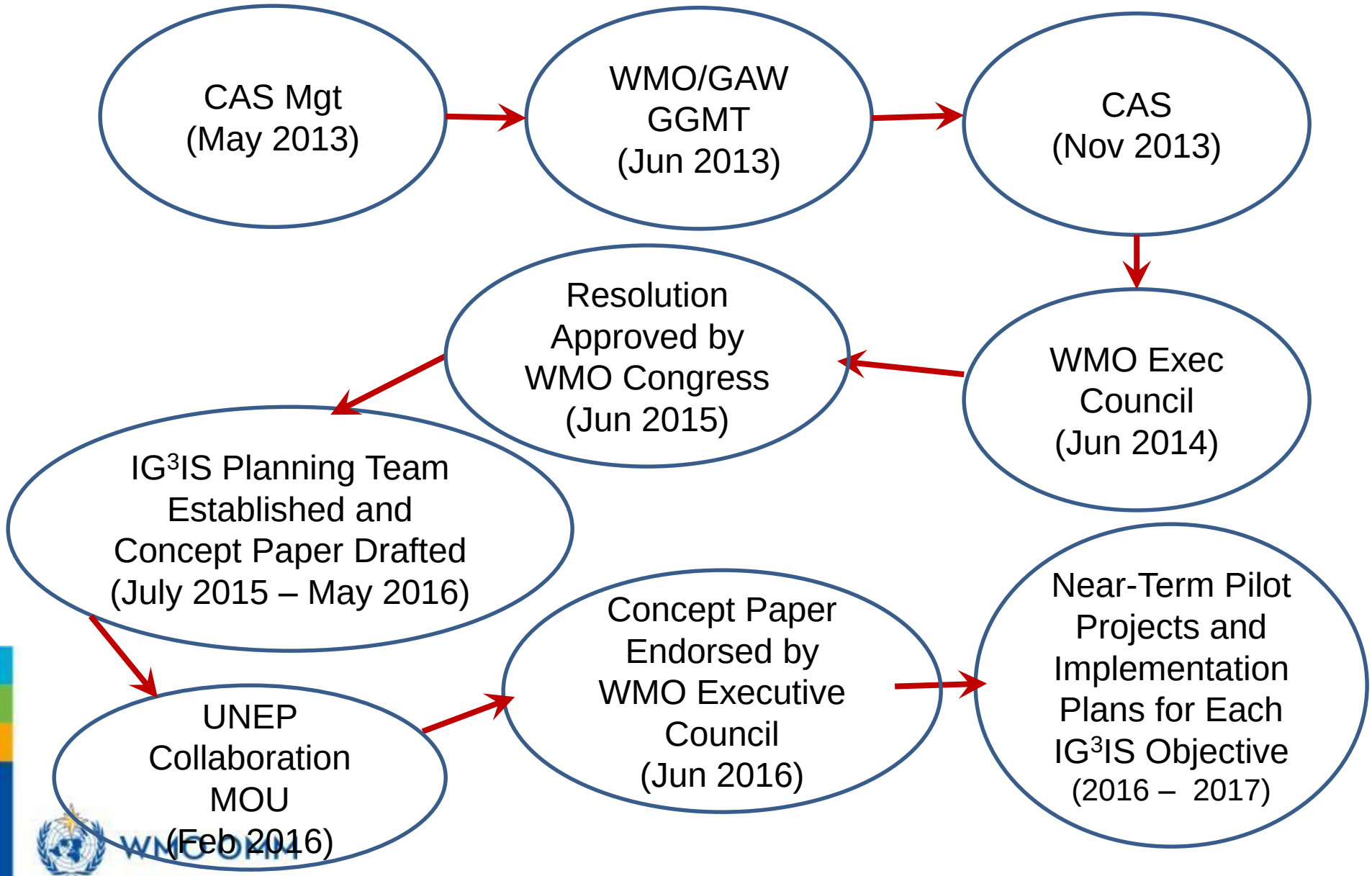
Goal: Support the success of post-COP21 actions of nations, sub-national governments, and the private sector to reduce climate-disrupting GHG emissions through a sound-scientific, measurement-based approach that:

- **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.

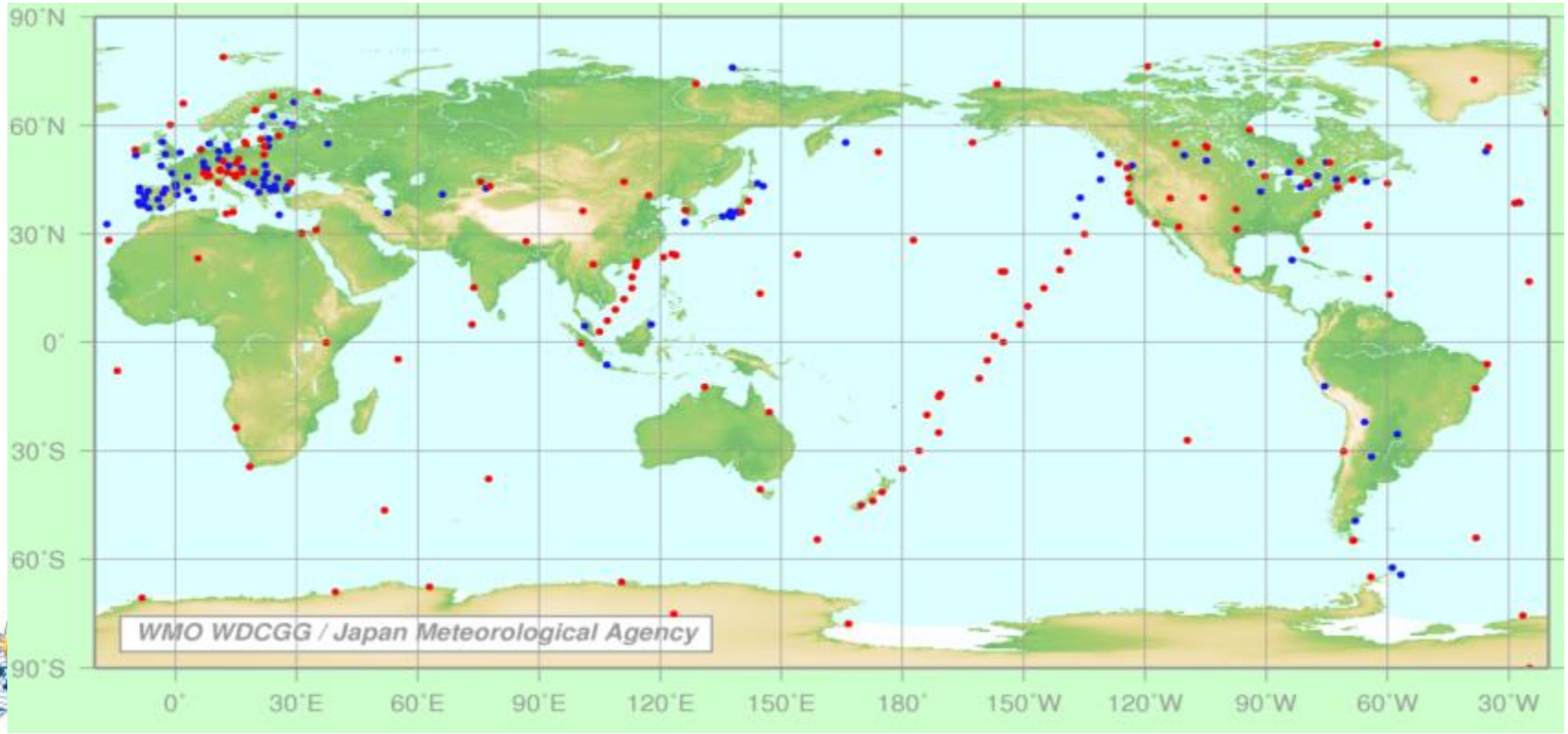
IG³IS programmatic evolution within WMO



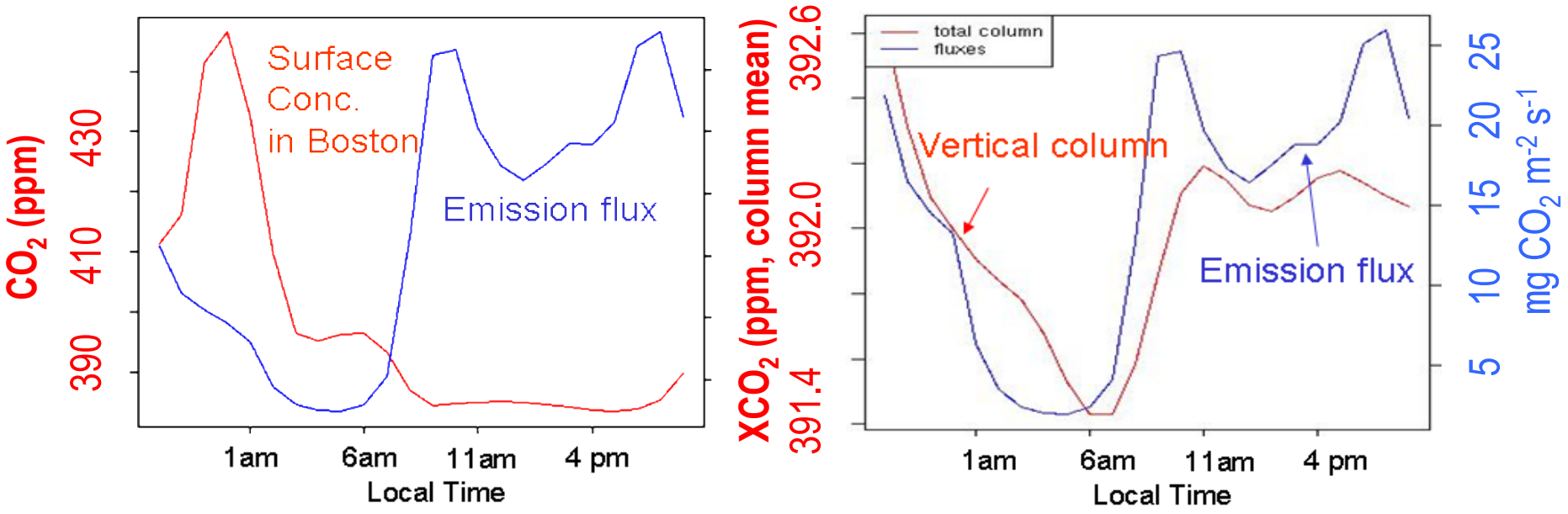
WMO Role in GHG Information and IG^{3}IS: Methods and standards for GHG Observations

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



WMO Role in GHG Information: Atmospheric Transport



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

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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

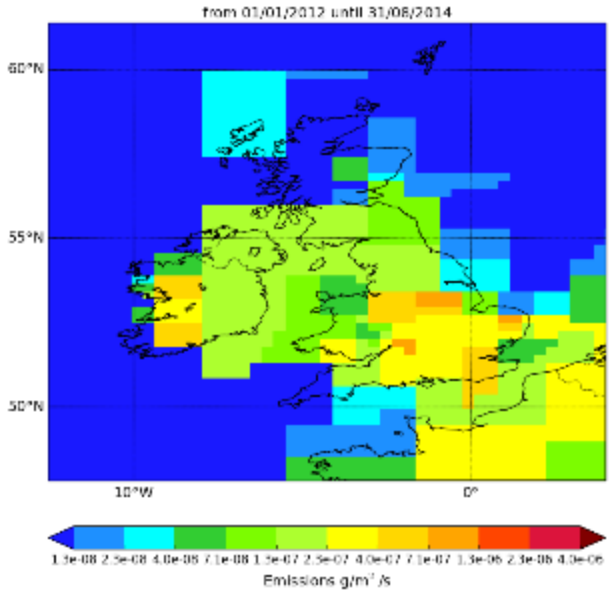
Key sub-national efforts and new mitigation opportunities:

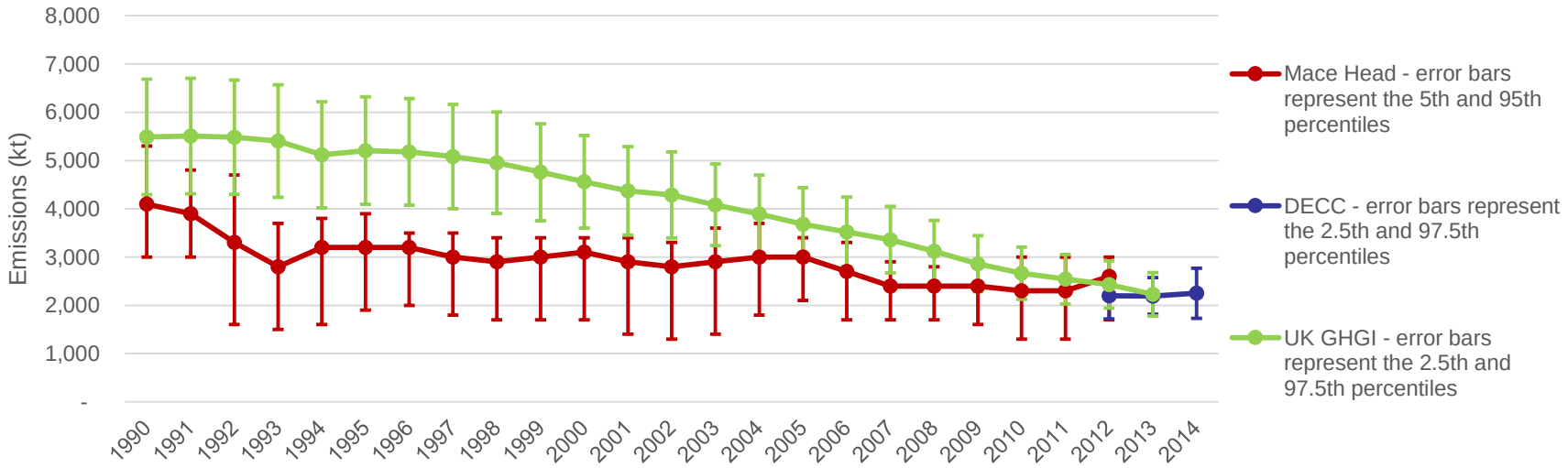
- GHG monitoring in large urban source areas (megacities)
- Detection and quantifying large unknown CH_4 emissions

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.





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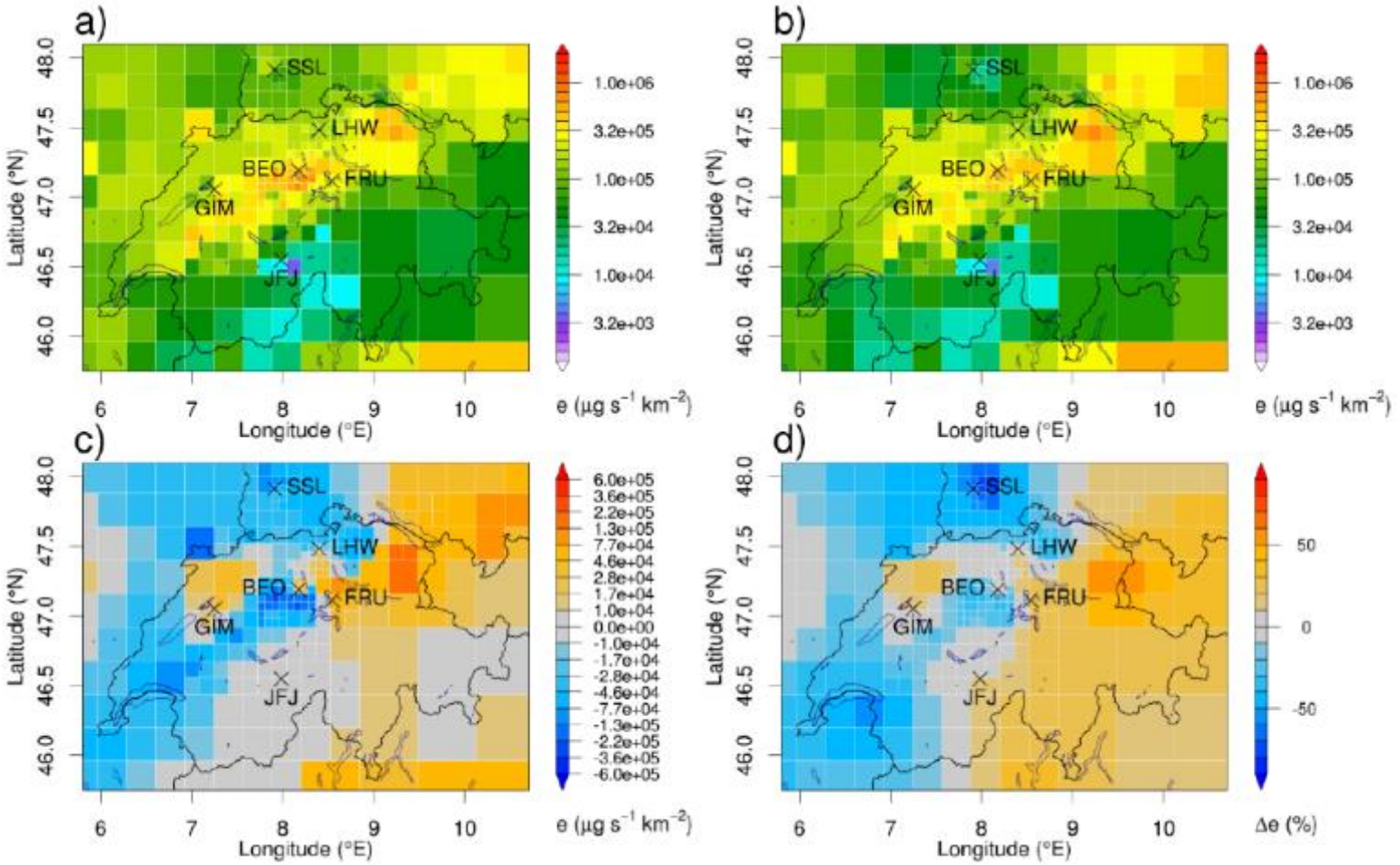
Example from Switzerland: Methane

- Great match between national total (“bottom-up” and “top-down”) but incorrect spatial distribution



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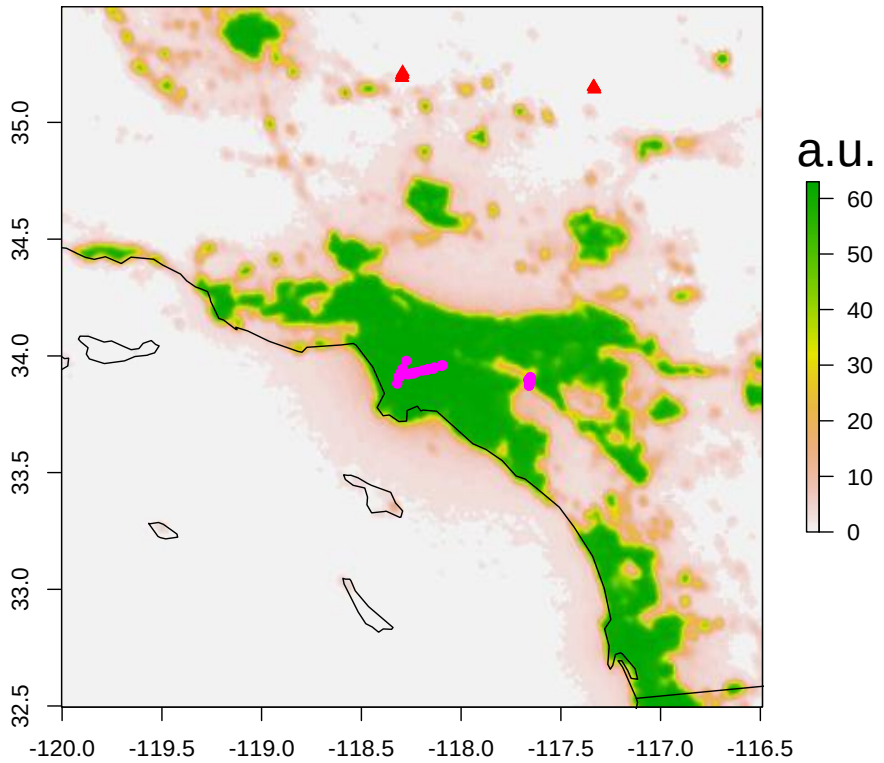
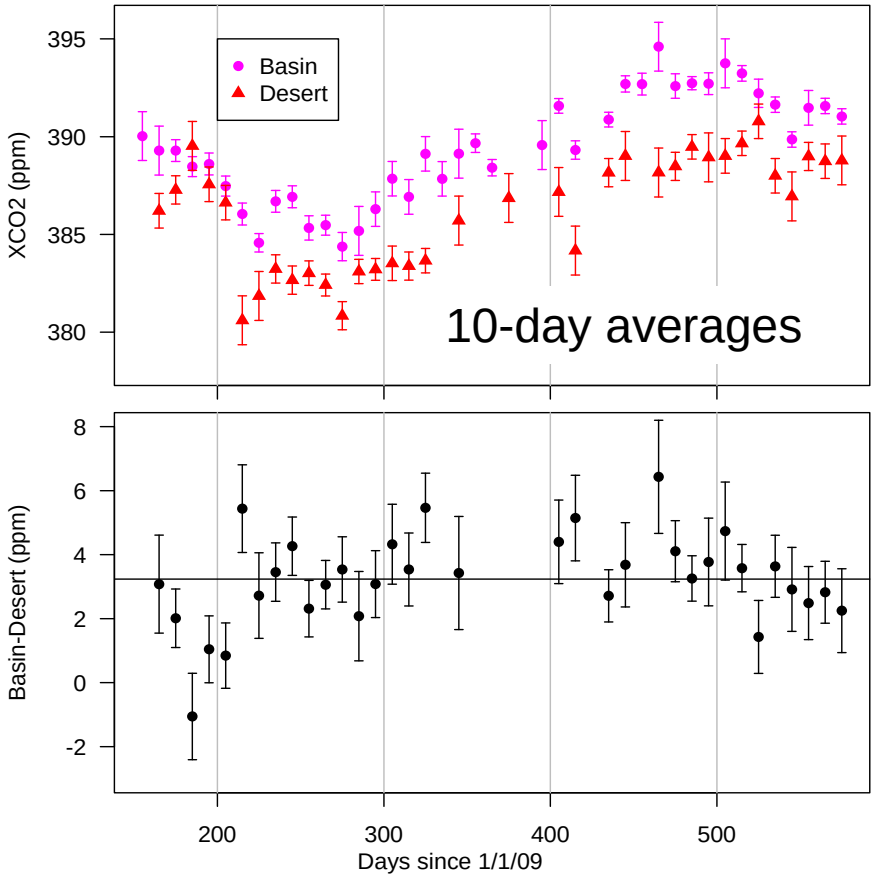
(S. Henne et al., 2016)

GOSAT Observations Demonstrate Space-based Detection of Megacity XCO2

Selecting observations over LA & 'Background' Location



Selected GOSAT footprint locations over LA nightlights



Kort et al., GRL (2012)

Persistent, robust enhancement = 3.2 ± 1.5 ppm

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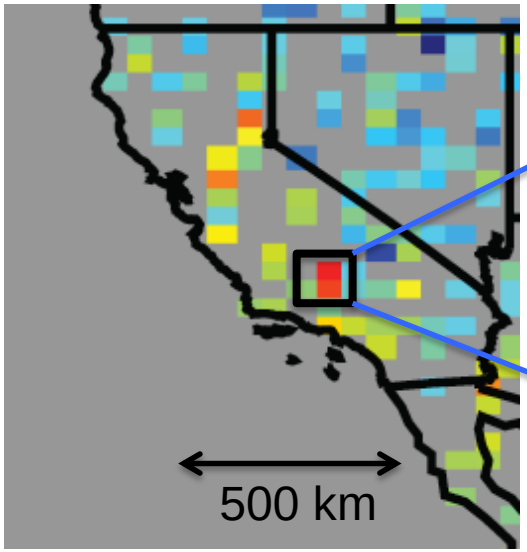
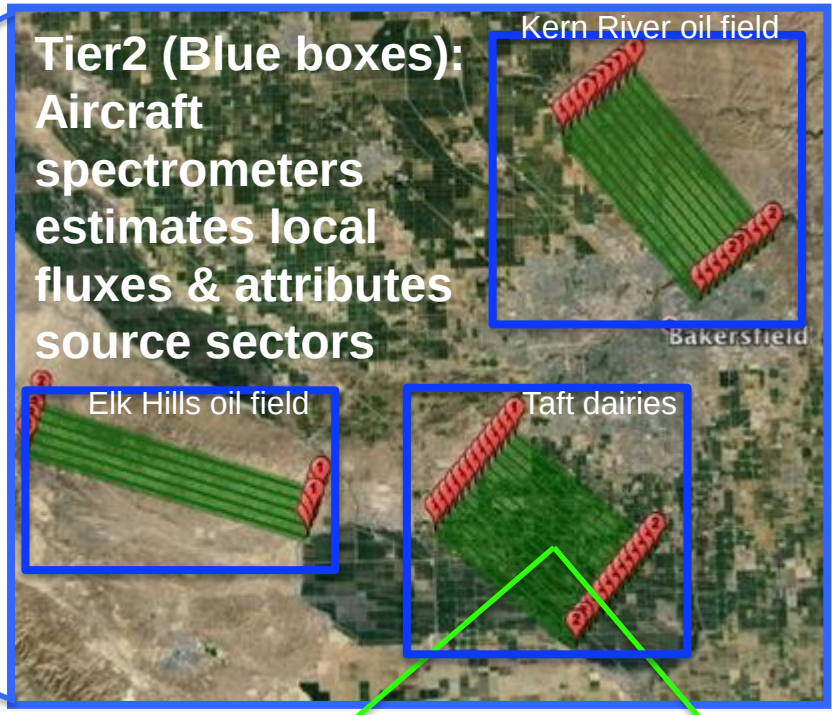
Example of additional emission reduction opportunities

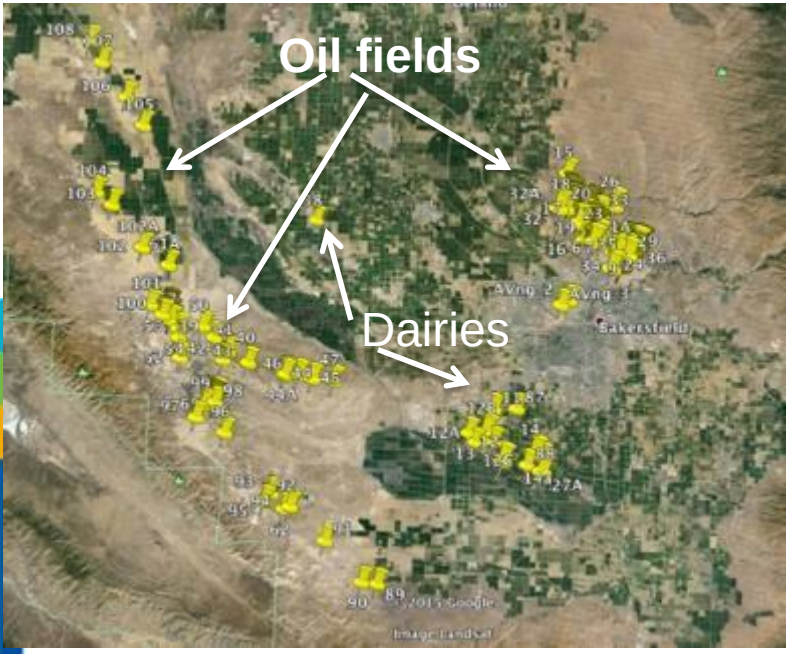
Tier 1: Satelite detects hotspot region



Turner et al 2015

Tier2 (Blue boxes): Aircraft spectrometers estimates local fluxes & attributes source sectors

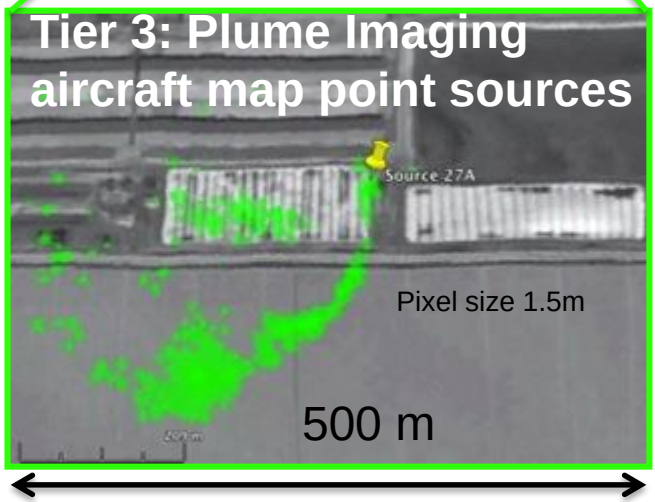




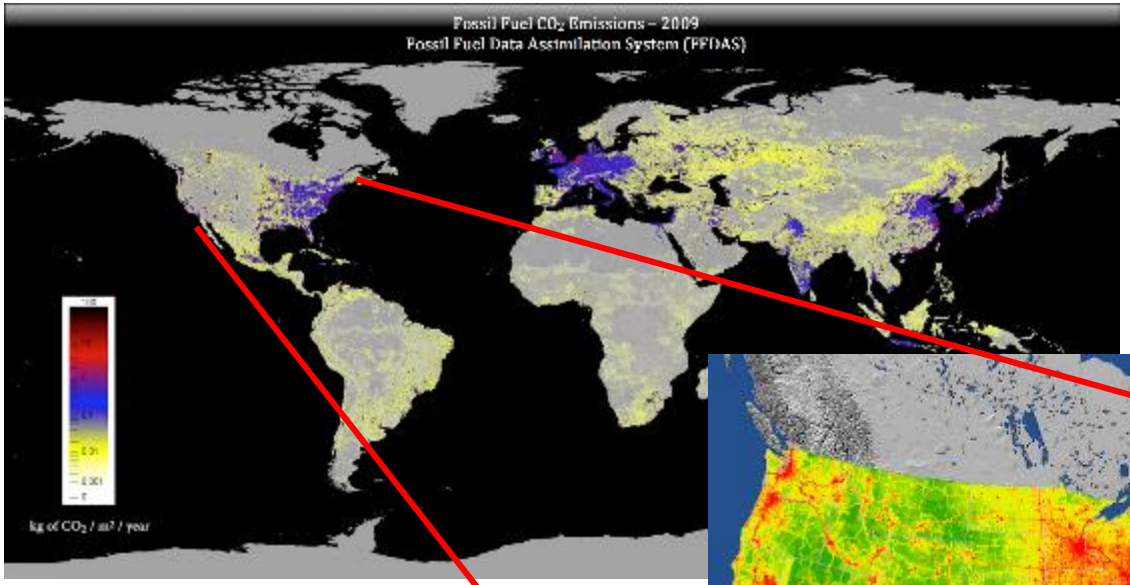
Enhanced Activity Data

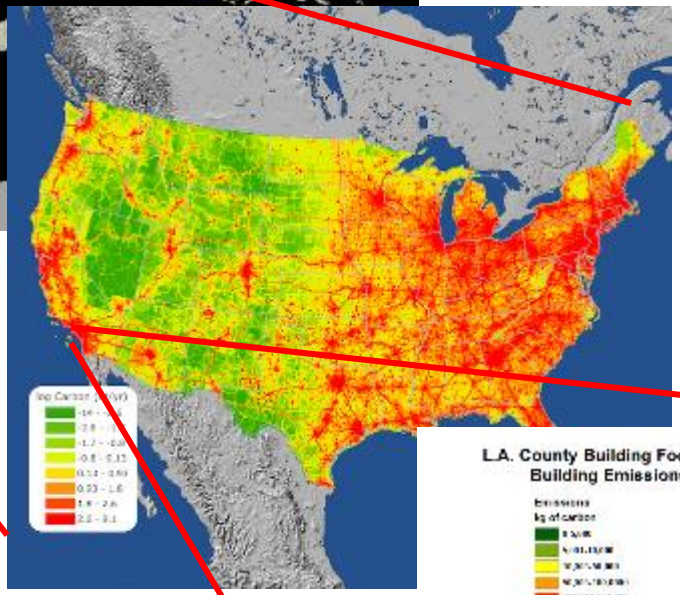
Tier 4 (not shown): Surface observations

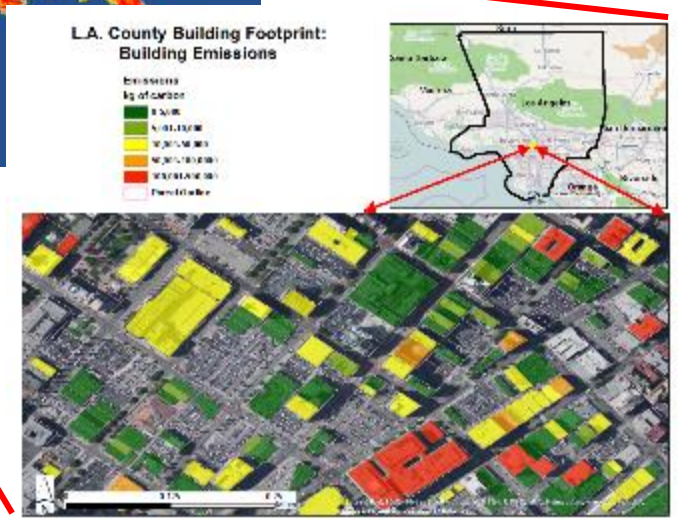
Tier 3: Plume Imaging aircraft map point sources



“Nesting” – from the planet to a building







- Global consistency
- Consistency across scales
- standardization

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Contribution from satellite community

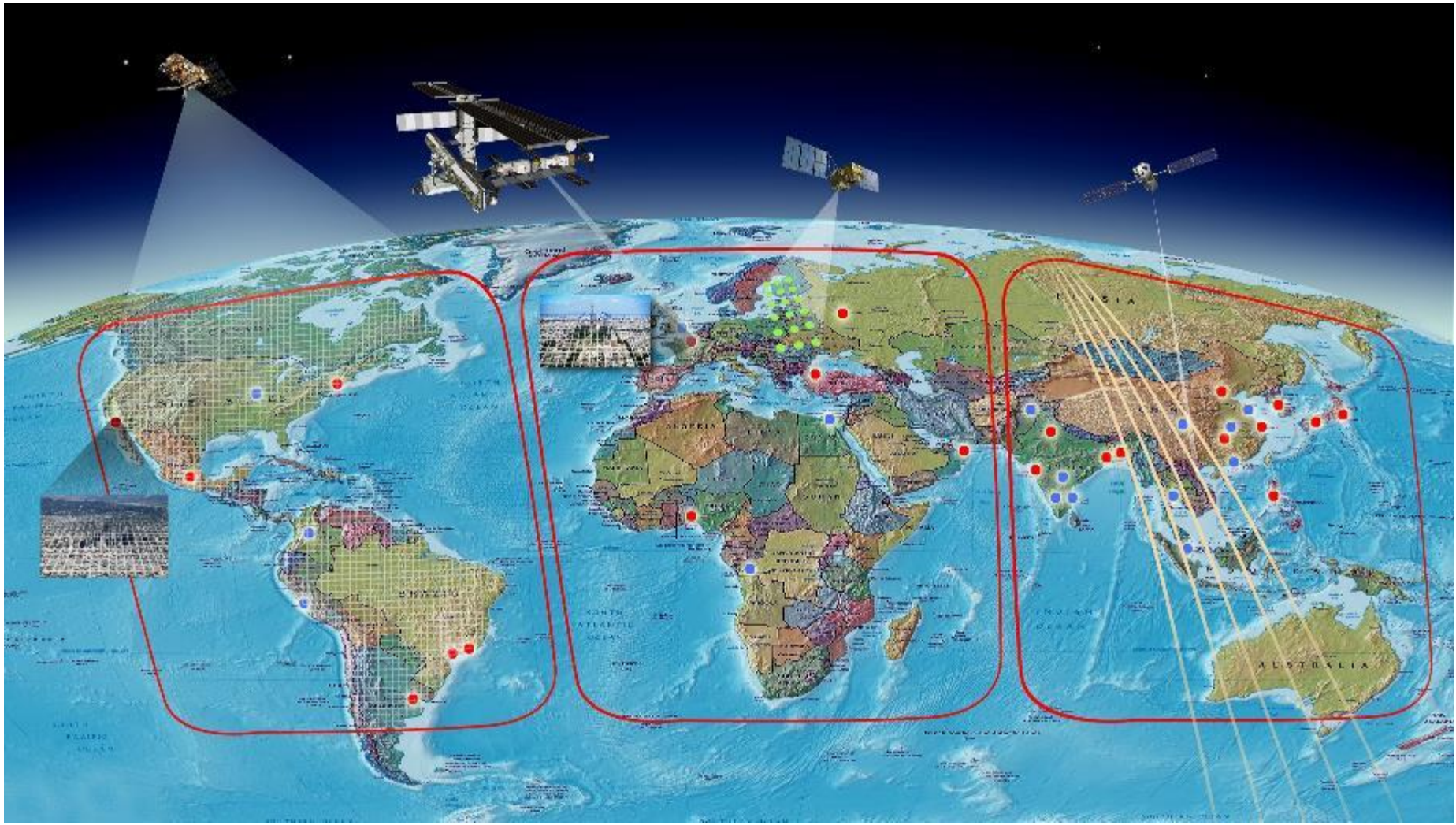
Supporting mid-term (and long-term) objectives:

- 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



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WEATHER CLIMATE WATER
TEMPS CLIMAT EAU

Thank you
Merci

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World Meteorological Organization
Organisation météorologique mondiale