Integrated Global Greenhouse Gas Information System (IG³IS)
Atmospheric measurements to manage mitigation

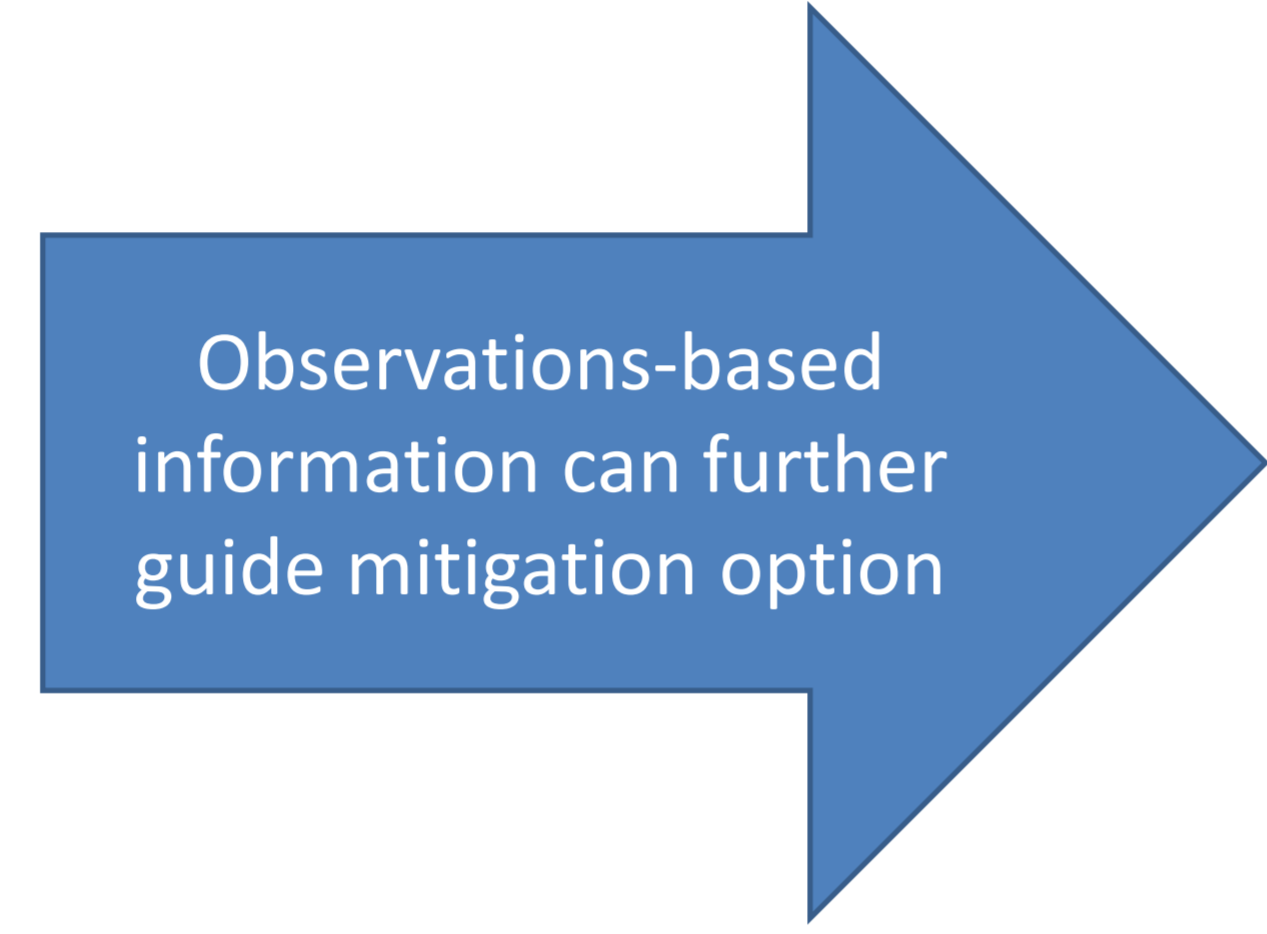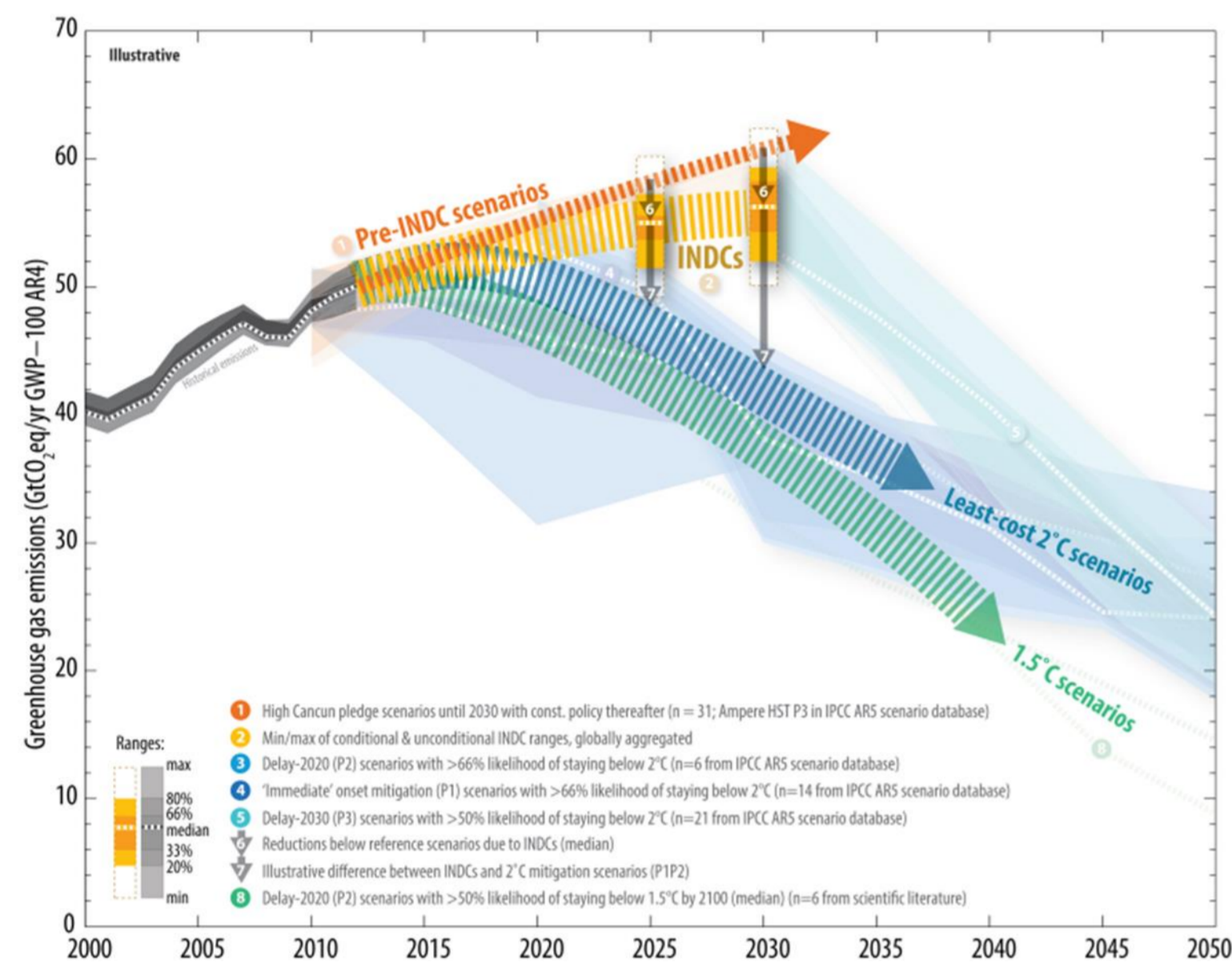### Phil DeCola and IG³IS planning team*

WMO

UNEP

❑ In recognition of the progress that has been made in atmospheric research, measurement and modelling, WMO has initiated the development of an Integrated Global Greenhouse Gas Information System (IG³IS). WMO GAW provides the standards for atmospheric measurements, and IG³IS will establish, propagate and, over time, improve the methodological standards for how atmospheric transport inverse model analyses of atmospheric GHG concentration measurements ("top-down") can be combined with spatially and temporally explicit socioeconomic emission inventory data ("bottom-up") to better inform and manage emission reduction policies and measures.

The average increase in atmospheric CO_2 during the last decade corresponds to ~44% of the CO_2 emitted by human activity with the remaining ~56% removed by the oceans and terrestrial biosphere. Ocean uptake of CO_2 leads to ocean acidification.
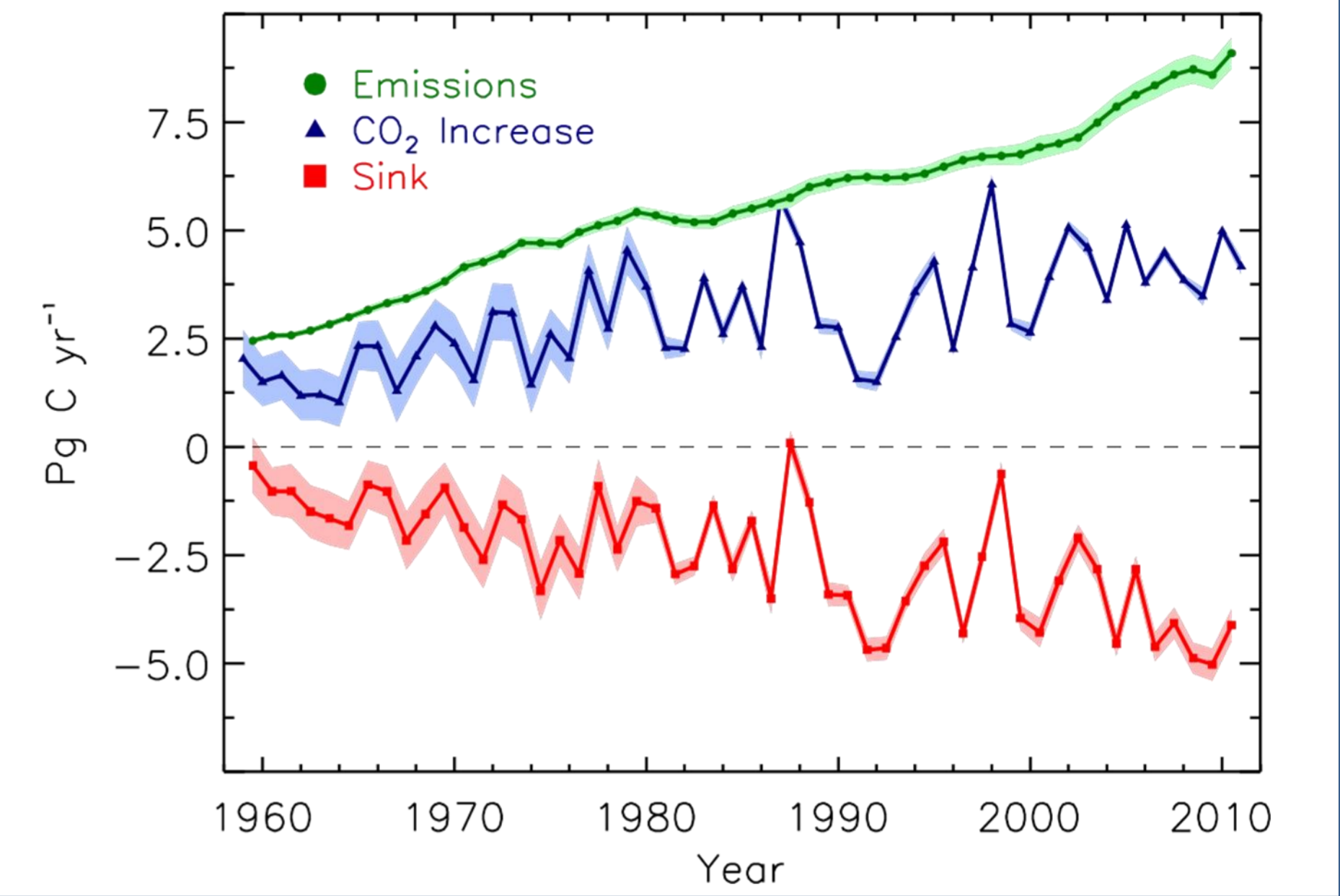

❑ Support the success of post-COP21 actions of nations, sub-national governments, and the private sector to reduce climate-disrupting GHG emissions through a measurement-based approach that:

➤ Reduces uncertainty of national emission inventory reporting;
➤ Detects large and additional emission reduction opportunities;
➤ Helps to inform the "stock take" (trends) of emission reduction strategies over time.

❑ **IG³IS 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.

—Objectives must be practical and focused.

—Success-criteria are that the information guides additional and valuable emission-reduction actions.

—IG³IS must mature in concert with evolution of user-needs, policy, and technology.

Observations-based information can further guide mitigation option

IPCC *Source:* IPCC Synthesis report on the aggregate effect of intended nationally determined contributions

National level examples

United Kingdom Measurement Network

Use the NAME transport model driven by 3-D meteorology to understand the recent (3-4 weeks) history of the air arriving at measurement stations

Emission inventories and inverse modelling results for UK

Emission inventory results substantially improved in 2016 in comparison with 2015 through addressing the issues with inventory compilation detected through atmospheric observations and inverse modelling

Emission inventories and inverse modelling results for Switzerland

The spatial distribution of the prior emission inventory for Switzerland is shown in (a), posterior emissions are shown in (b), and their absolute and relative difference (posterior minus the prior) are shown in (c) and (d), respectively. Spatial differences are up to 40%.

Urban level example

Los Angeles GHG observing system

The Hestia Project: Quantifies all fossil fuel CO_2 emissions at building and street scale

A number of research projects around the world have developed and tested methods for independent estimation of greenhouse gas emissions (e.g. the Los Angeles / Paris Megacity Project, and Recife, Brazil). This work has established urban greenhouse gas information methods that combine atmospheric monitoring, advanced inventory data-mining and model analyses. IG³IS will design individual observation systems suitable for a given city's requirements and applications to be deployed in different parts of the world, particularly in the developing countries where GHG information needs are greatest and capacity is limited.

IG³IS planning team

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Oil and Gas industry example

This IG³IS objective intends to extend to the world the significant successes in detecting methane super-emitters in North American oil and gas supply chain. By informing oil and gas system operators of large leaks, significant methane emissions reductions are achievable. Exploring these solutions and applying them to new types of sites and emissions profiles, for example offshore platforms or coal bed methane, can potentially provide further reductions.