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Toward top-down, internationally coordinated monitoring of greenhouse gas fluxes in support of climate change mitigation action under the Paris Agreement

The Global Greenhouse Gas Watch

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WMO OMM

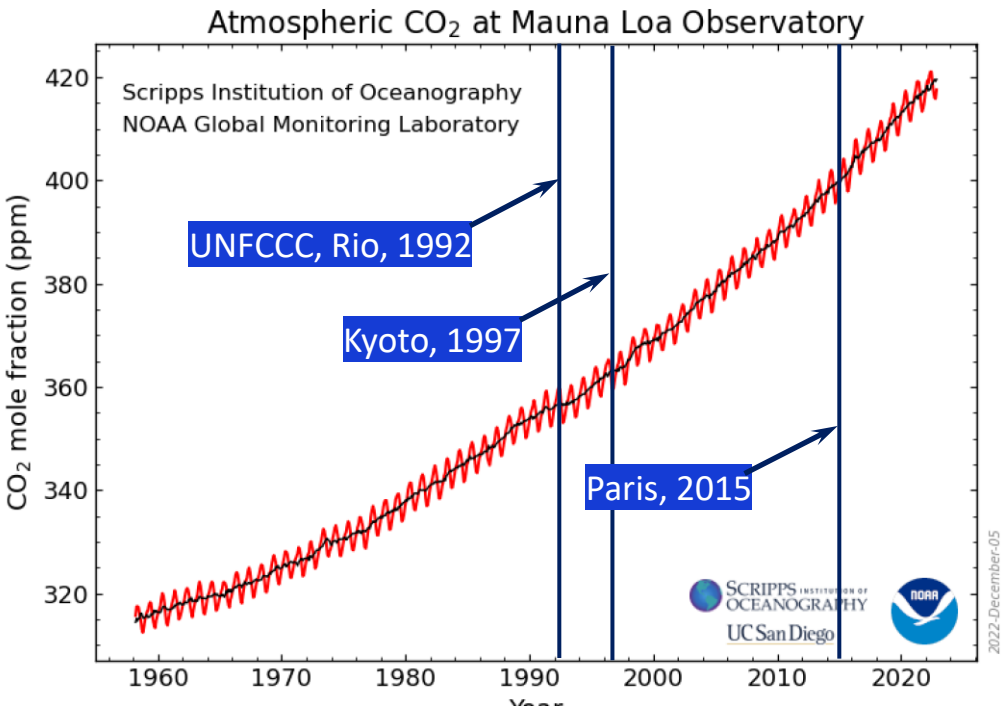
World Meteorological Organization
Organisation météorologique mondiale

Problem Statement

- The Paris Agreement has been adopted with the aim of limiting climate change via reducing net anthropogenic greenhouse gas (GHG) emissions;
- Focusing on anthropogenic GHG emissions alone will not be sufficient*;* GHG fluxes driven by natural processes are often much larger, and their response to anthropogenic emissions and climate change must be taken into account.

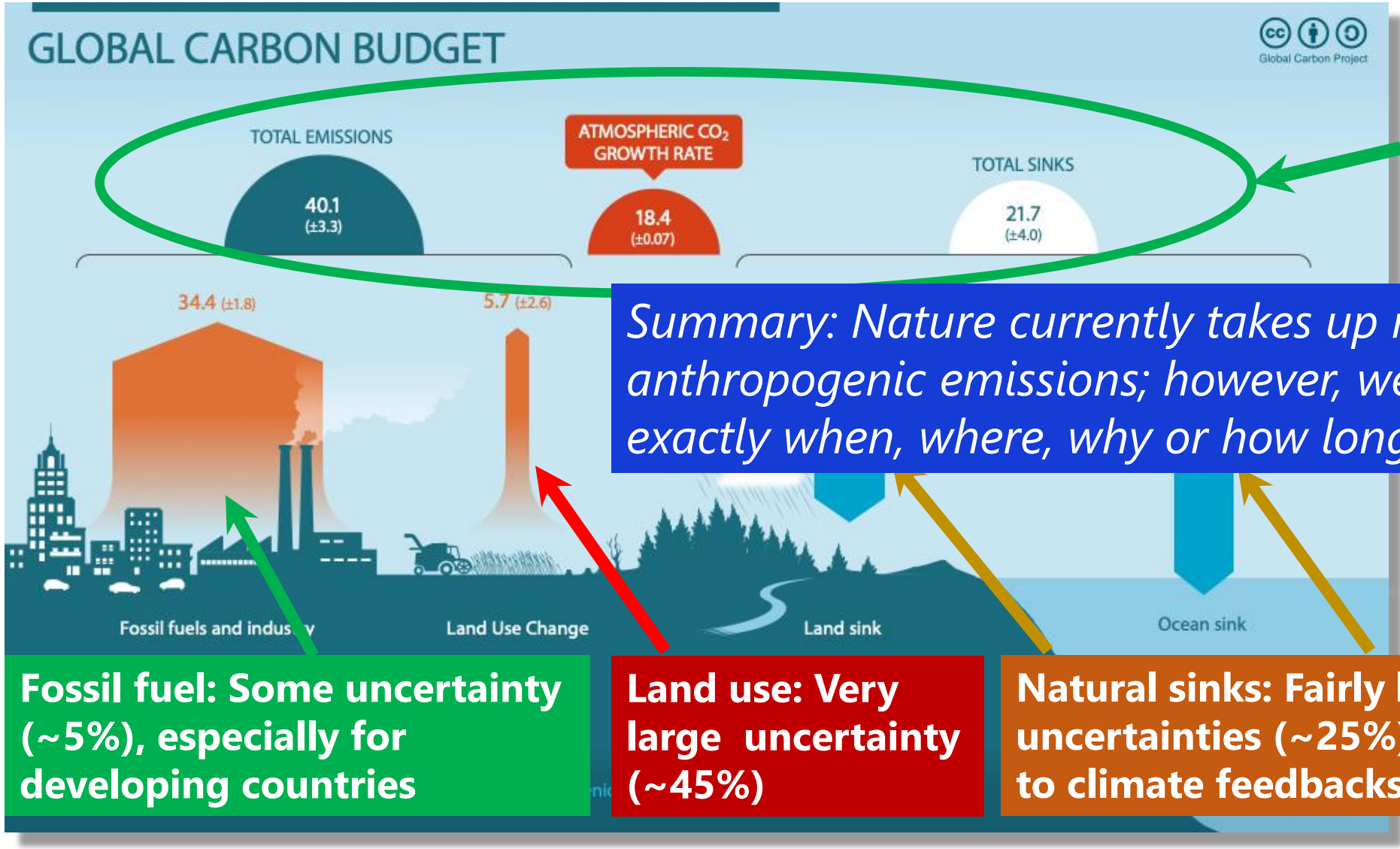
- The impact of mitigation activities based on *offsetting* e.g using carbon *credits*) continues to be ineffectively monitored and thus poorly documented;
- Monitoring tends to focus on indirect measures (carbon stored, or emissions avoided), not on the impact of the target quantity, namely atmospheric concentrations:

The climate responds to the atmospheric GHG concentrations, not to what we claim to be doing to reduce or offset our CO_2 emissions!



How well do we understand the CO_2 fluxes ?

(Graphic by the Global Carbon Project)



Top level global budget is well understood

Summary: Nature currently takes up roughly half of anthropogenic emissions; however, we do not know exactly when, where, why or how long this will continue.

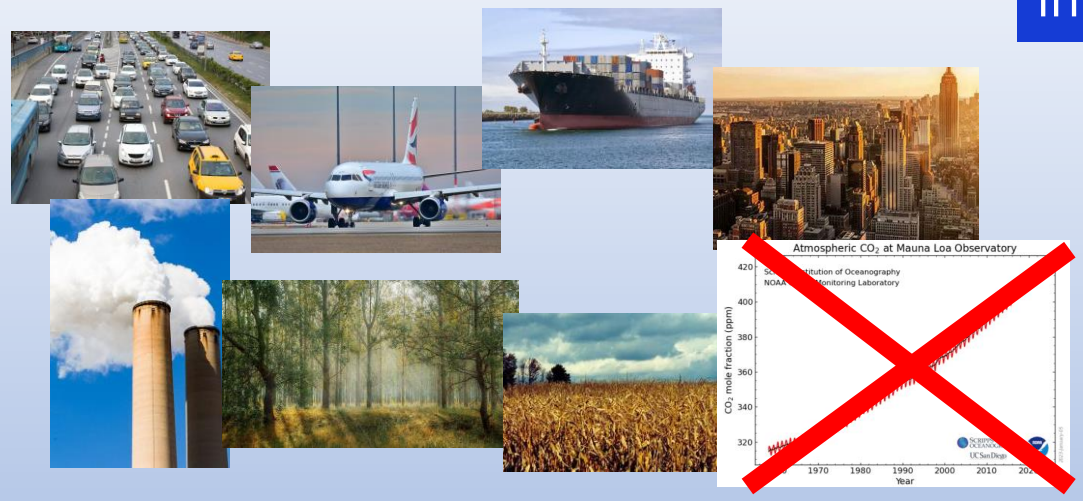
Fossil fuel: Some uncertainty (~5%), especially for developing countries

Land use: Very large uncertainty (~45%)

Natural sinks: Fairly large uncertainties (~25%); subject to climate feedbacks

Greenhouse gas concentration changes; top-down or bottom-up?
(both will be needed!)

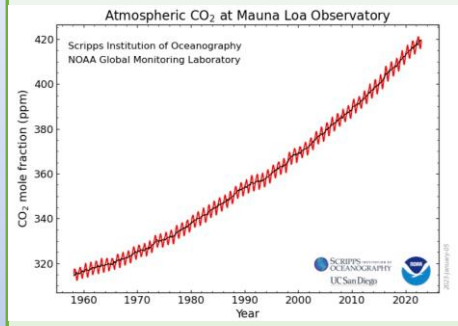
Bottom up: *Add up individual sources and sinks carbon and calculate overall contributions;*

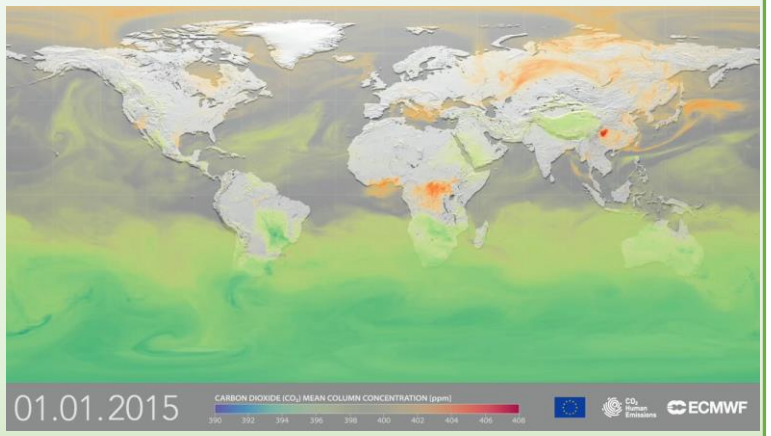


- Can provide very accurate estimation of anthropogenic ***emissions***;
- Bulk data national only, 1-2 years delayed;
- Does not work well in developing countries;
- Not applicable to most natural sources/sinks;

Almost all activities under IPCC and the Paris Agreement are based on bottom up

Global infrastrucure required for top-down GHG monitoring is very similar to WMO-coordinated infrastructure for weather prediction and climate analysis;





- Direct link to "centralized accounting";
- Global coverage, spatially disaggregated;
- Estimates of *net* ***fluxes*** rather than of emissions;
- Can be made available in near-real time;

Top-down technology mature, used by Parties individually, not yet in context of Paris Agreement

In response, 19th World Meteorological Congress (May 2023) endorsed the

Global Greenhouse Gas Watch;

Internationally coordinated, sustained, top-down GHG flux estimation

Key elements

- Integrated global greenhouse gas observing system (surface- and space-based);
- 24/7 operational GHG modeling/assimilation (multiple systems), providing top-down flux estimates;
- Routine internationally coordinated intercomparison and verification of model output;

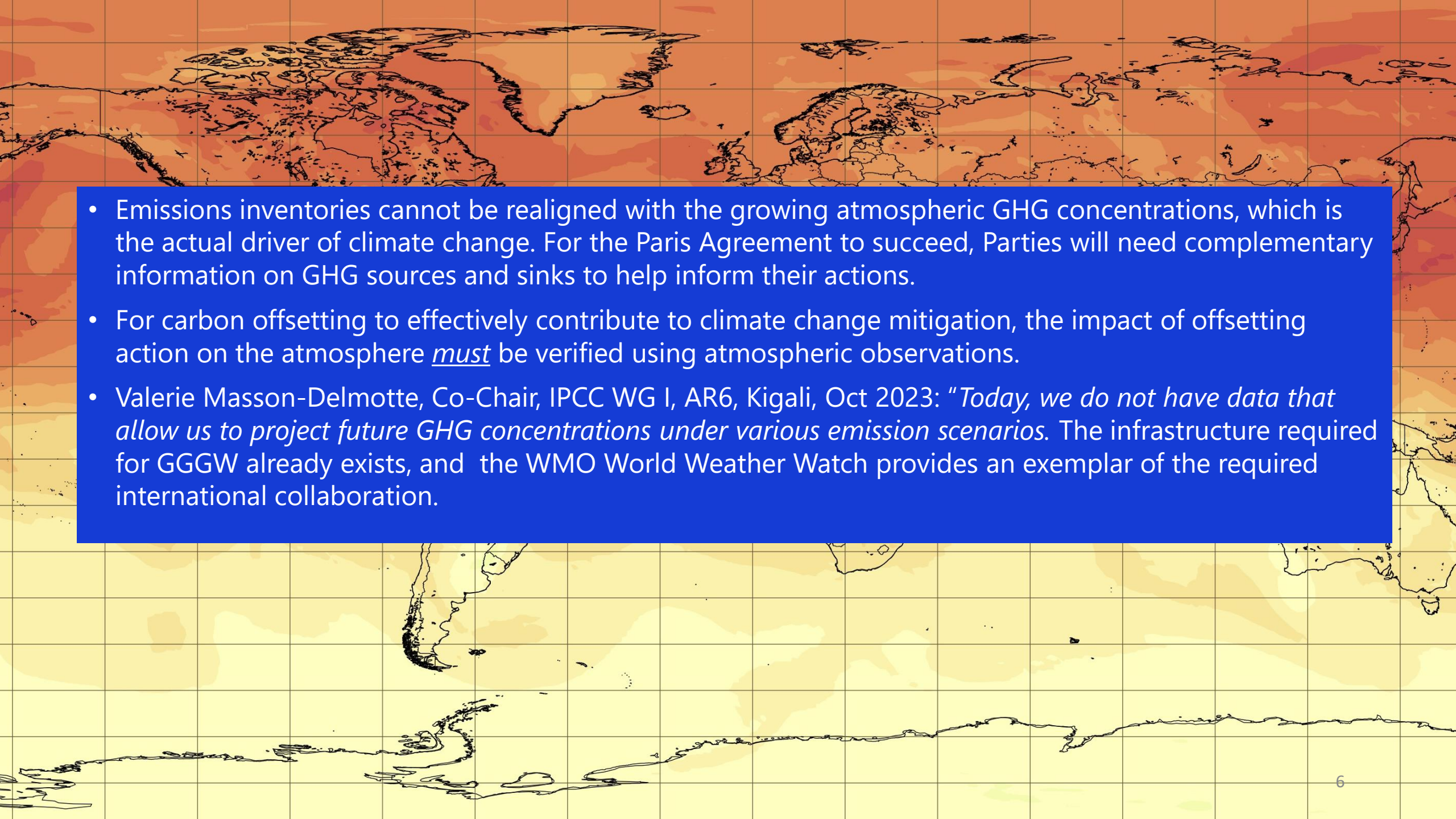
Primary output

- Time-continuous global fields of CO2, CH4 and N2O concentrations;
- Consolidated, top-down, monthly estimates of GHG fluxes at global 100 x100 km resolution (1 x 1 km goal);

Users of GGMI output

- Parties to the Paris Agreement (e.g as input to GST and support for national reporting);
- Regional and local users, e.g. via IG3IS;
- Carbon markets, e.g verification of offsetting;
- Science community working on GHG budgets;
- IPCC, for emission pathways, future scenarios;

- Governments of 193 countries now committed to developing coordinated top-down GHG flux estimation with open access to input and input data;
- Today's briefing is taking place in response to invitation extended to WMO by SBSTA-58:
- WMO's aim is recognition of GGGW as an important tool for implementation of Paris Agreement.



- Emissions inventories cannot be realigned with the growing atmospheric GHG concentrations, which is the actual driver of climate change. For the Paris Agreement to succeed, Parties will need complementary information on GHG sources and sinks to help inform their actions.
- For carbon offsetting to effectively contribute to climate change mitigation, the impact of offsetting action on the atmosphere *must* be verified using atmospheric observations.
- Valerie Masson-Delmotte, Co-Chair, IPCC WG I, AR6, Kigali, Oct 2023: "*Today, we do not have data that allow us to project future GHG concentrations under various emission scenarios.* The infrastructure required for GGGW already exists, and the WMO World Weather Watch provides an exemplar of the required international collaboration.