U.S. Approach to Greenhouse Gas Inventories and NOAA's Contributions to Carbon Accounting

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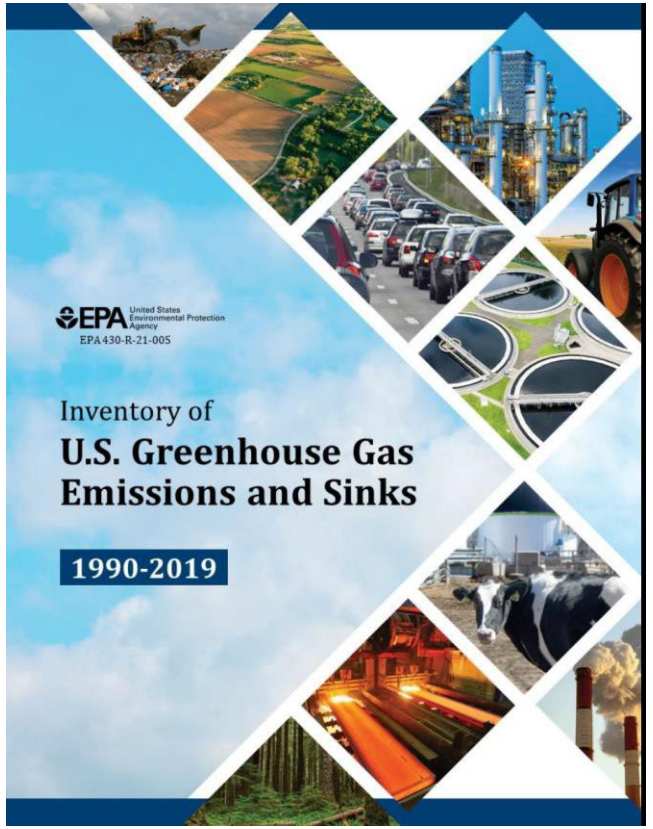
US National GHG Inventory

- Produced for more than 30 years to fulfill the U.S. annual commitment under UNFCCC
- Reported by gas species, source and sink amounts
- Includes all primary GHGs: CO_2, CH_4, N_2O, HFCs, PFCs, SF_6, NF_3
- Accounts for anthropogenic GHG emissions and removals from 1990 to the present
- Five methodological chapters
  - Energy
  - Industrial Processes and Product Use (IPPU)
  - Waste
  - Agriculture
  - Land Use, Land-Use Change and Forestry (LULUCF)

  } Agriculture, Forestry, and Other Land Use (**AFOLU**)

- Key deliverables to the UNFCCC:
  - National Inventory Report (NIR)
  - Common Reporting Format (CRF) Tables



Courtesy John Steller, U.S. EPA

United States Greenhouse Gas Inventory Institutional Arrangements

Courtesy John Steller, U.S. EPA

Inventory Submission

United Nations Framework Convention on Climate Change

U.S. Department of State

Inventory Compilation

U.S. Environmental Protection Agency
Inventory Compiler

Emission Calculations

AFOLU Team:
- EPA-ORD

U.S. Environmental Protection Agency

Other U.S. Government Agencies

AFOLU Team:
- USFS (FIA)
- CSU-NREL
- USDA (OEEP, ARS, NRCS, NRI, NASS)
- Eastern Research Group
- NOAA (CWCWG)
- USGS

Data Collection

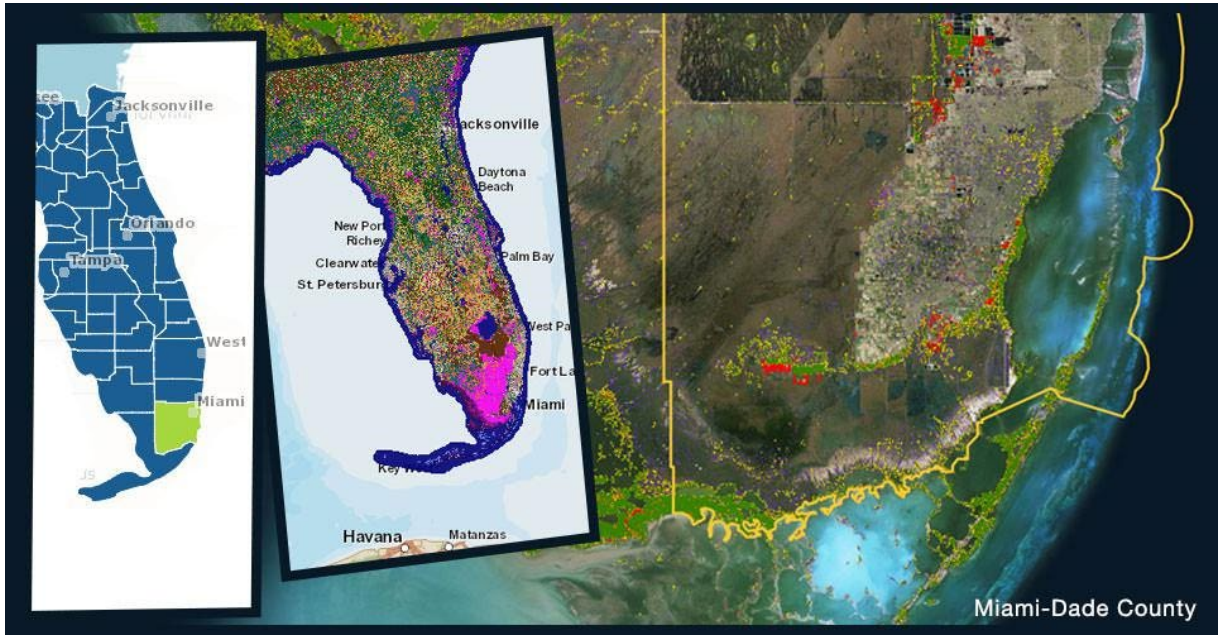
Energy
- Bureau of Ocean Energy Management
- Bureau of Transportation Statistics
- Federal Aviation Administration
- Federal Highway Administration
- EPA GHGRP
- U.S. Department of Defense
- U.S. Department of Energy
- Energy Information Administration
- U.S. Department of Transportation

Agriculture and LULUCF
- Census of Agriculture
- NASS
- FIA
- NRI
- NLCD
- **Landsat/MODIS/VIIRS**
- CEAP
- APHIS
- CTIC
- Ag. Waste Mg. Handbook

Industrial Processes and Solvents
- Alliance for Responsible Atmospheric Policy
- American Iron and Steel Institute
- EPA GHGRP
- U.S. Aluminum Association
- U.S. Bureau of Mines
- U.S. Census Bureau
- U.S. Department of Commerce
- U.S. Geological Survey
- EPA Voluntary Reporting by Manufacturers

Waste
- EPA GHGRP
- EPA Office of Solid Waste and Emergency Response
- Various publications and experts

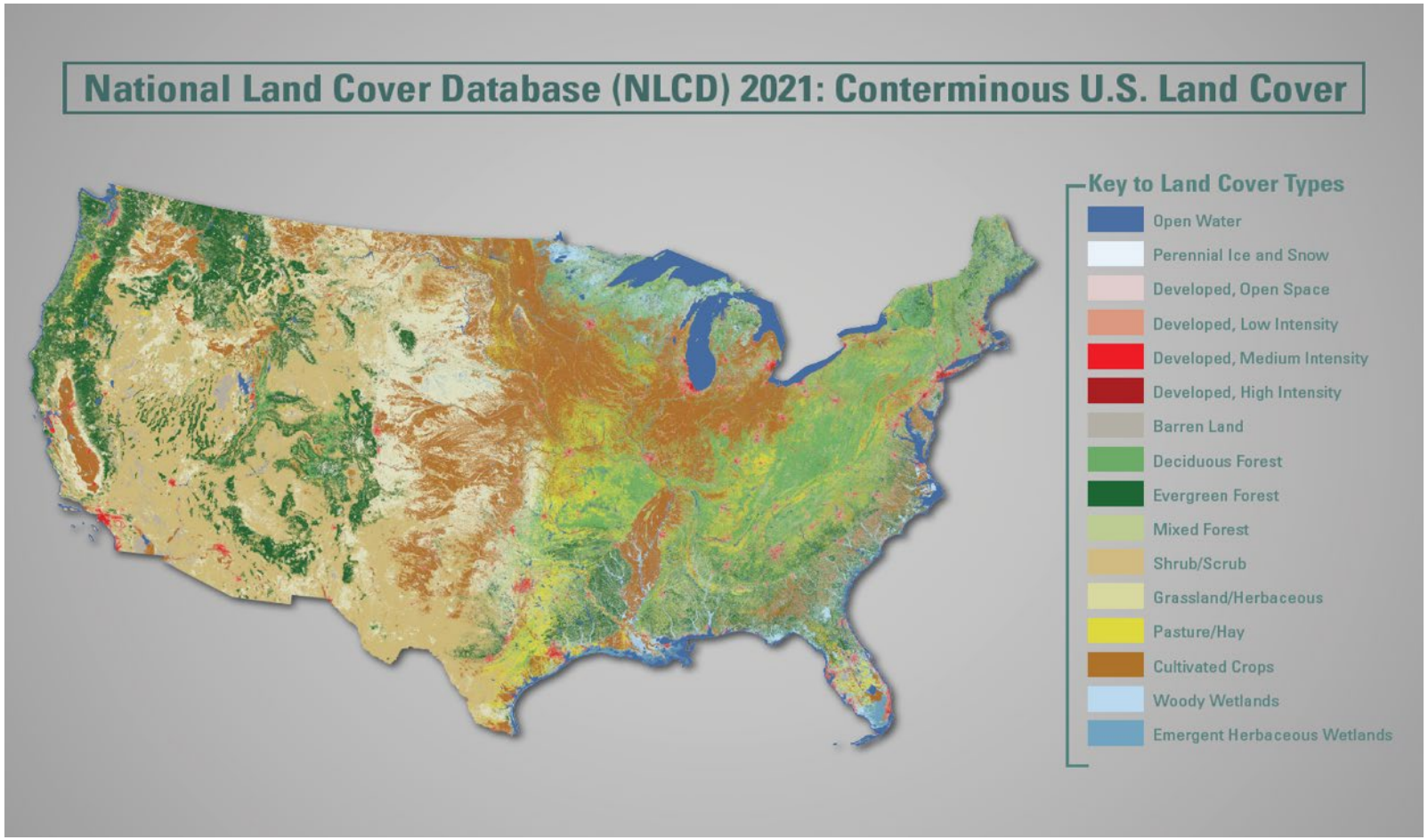
Coastal Land Cover Atlas Tracks Carbon Changes



NOAA's Land Cover Atlas tracks how land cover usage is changing over time.

- Supports coastal Blue Carbon carbon inventories
- Landsat 30m data on the Land Cover Atlas encompasses the intertidal areas, wetlands, and adjacent uplands of 29 states fronting the oceans and Great Lakes
- High-resolution data are available for select locations

Mapping Land Cover and Change Using Landsat



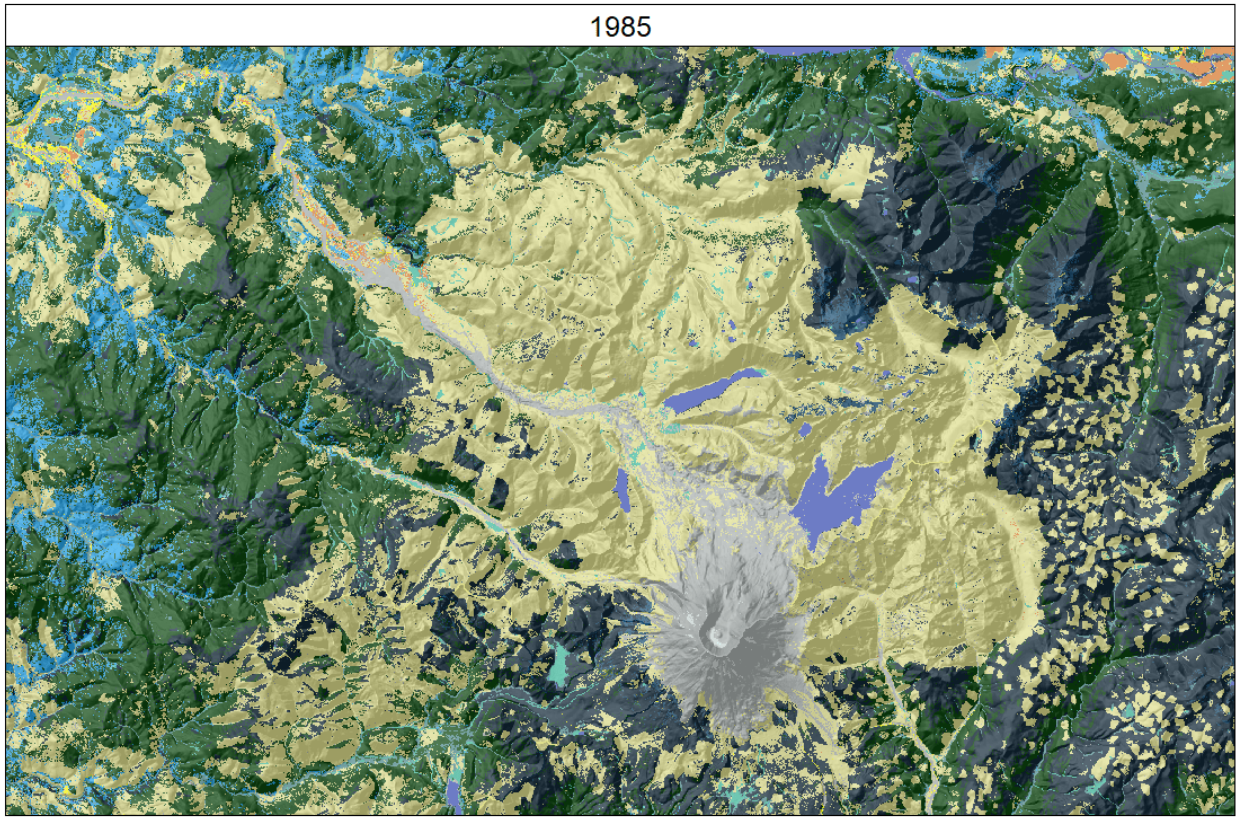
National Land Cover Database (NLCD) 2021

- Landsat-based national scale land cover product as foundation for ecosystem carbon modeling
- Product suite includes land cover, change, disturbance, and urban imperviousness at 30-meter spatial resolution
- NLCD 2021 characterizes land change from 2001 to 2021 *(Previous NLCDs: 2001, 2004, 2006, 2008, 2011, 2013, 2016, and 2019*)
- For ~2024 release: Next-generation land cover and change product suite *Land Cover Next (LC Next)* to quantify annual land cover and change from 1985 to present

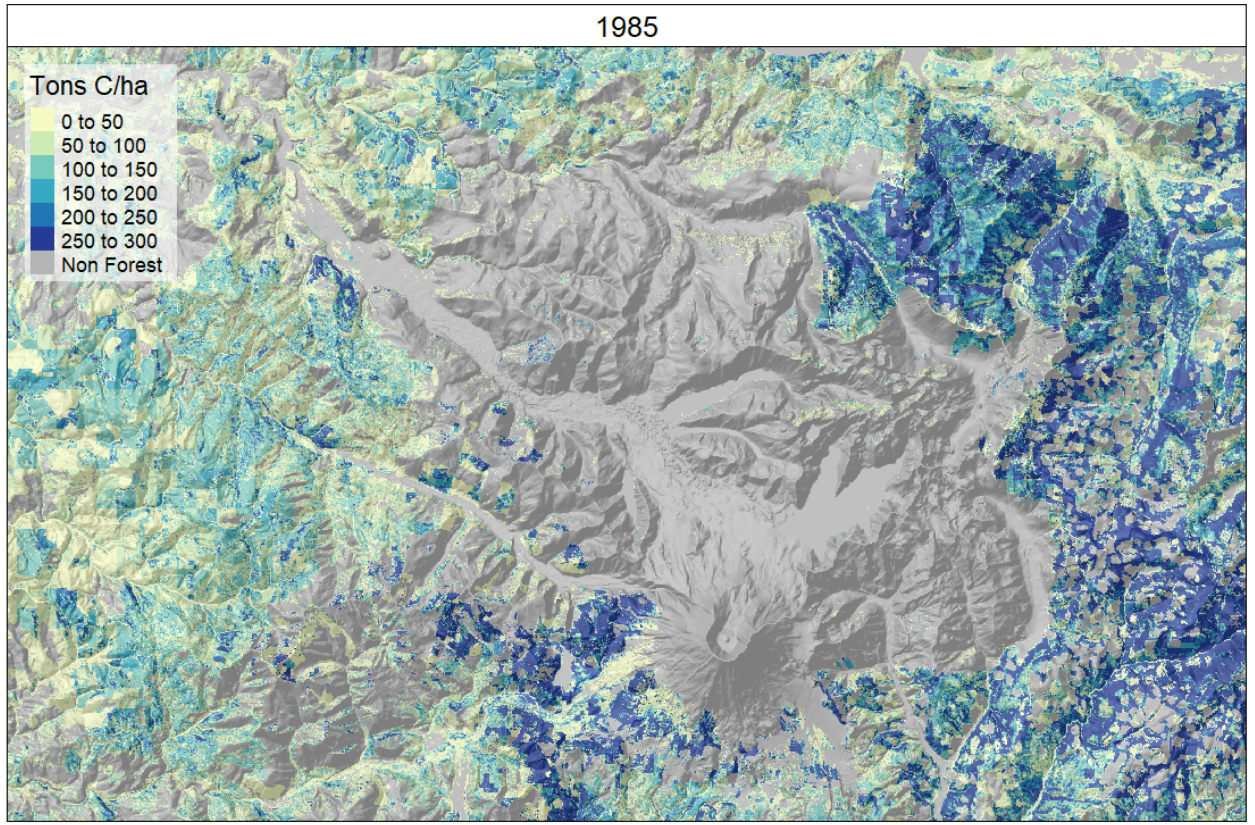
Courtesy Zhiliang Zhu

Estimating Carbon Flux Change Using Landsat

Land cover



Carbon

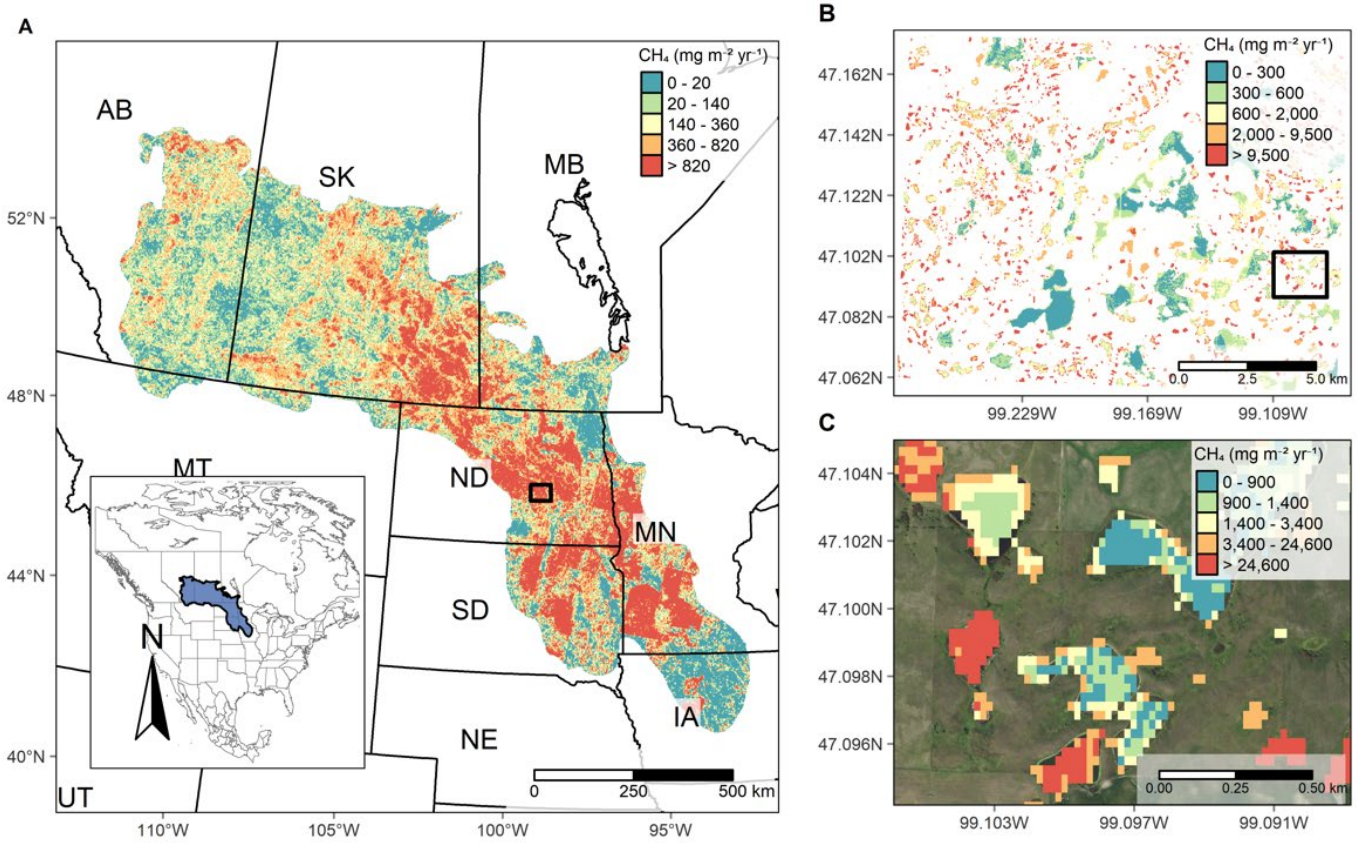


The Land Use and Carbon Scenario Simulator (LUCAS) is a state-and-transition simulation model designed to track changes in land use, land cover, land management, and disturbance, and their impacts on ecosystem carbon storage and flux.

Courtesy Ben Sleeter and Zhiliang Zhu

CH4 Fluxes Over N. America's Largest Wetland Complex

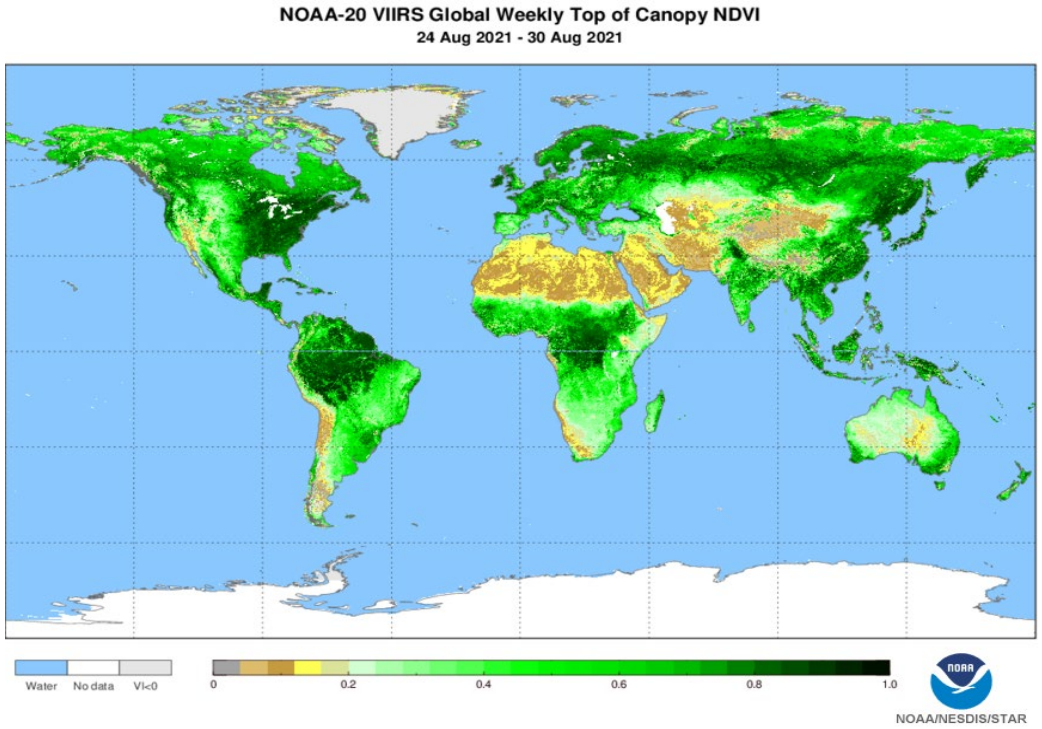
- Emissions depend significantly on climatic precipitation gradient and landscape drainage
- Predicts landscape-scale impacts of climate and land use change
- Suggests land-use strategies to manage methane fluxes

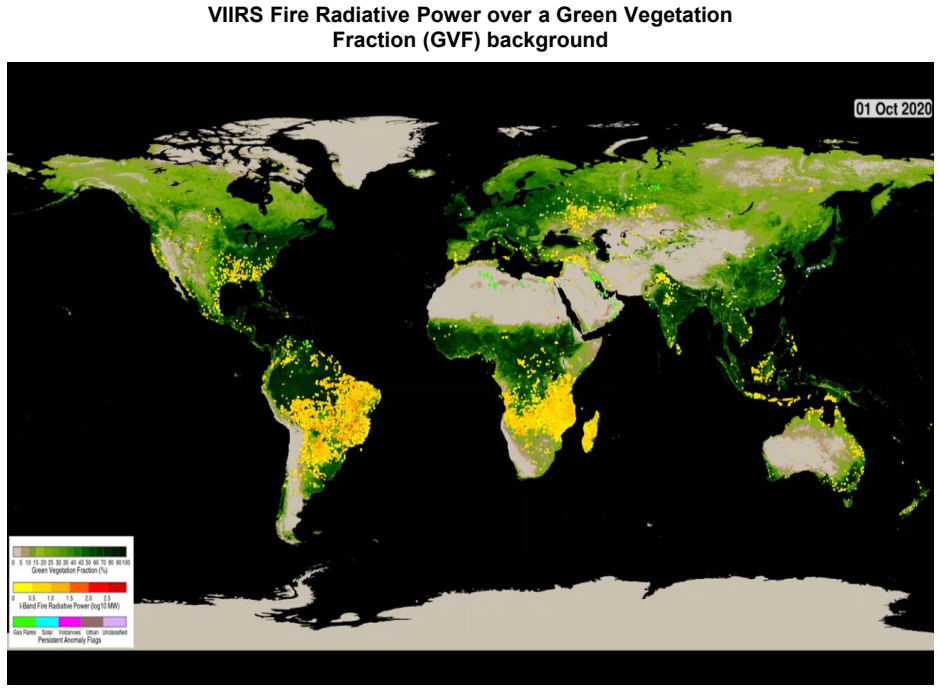


Courtesy Zhiliang Zhu

NOAA's Current Contributions and Evolving Capabilities

NOAA's Long Satellite Records Support GHG Accounting

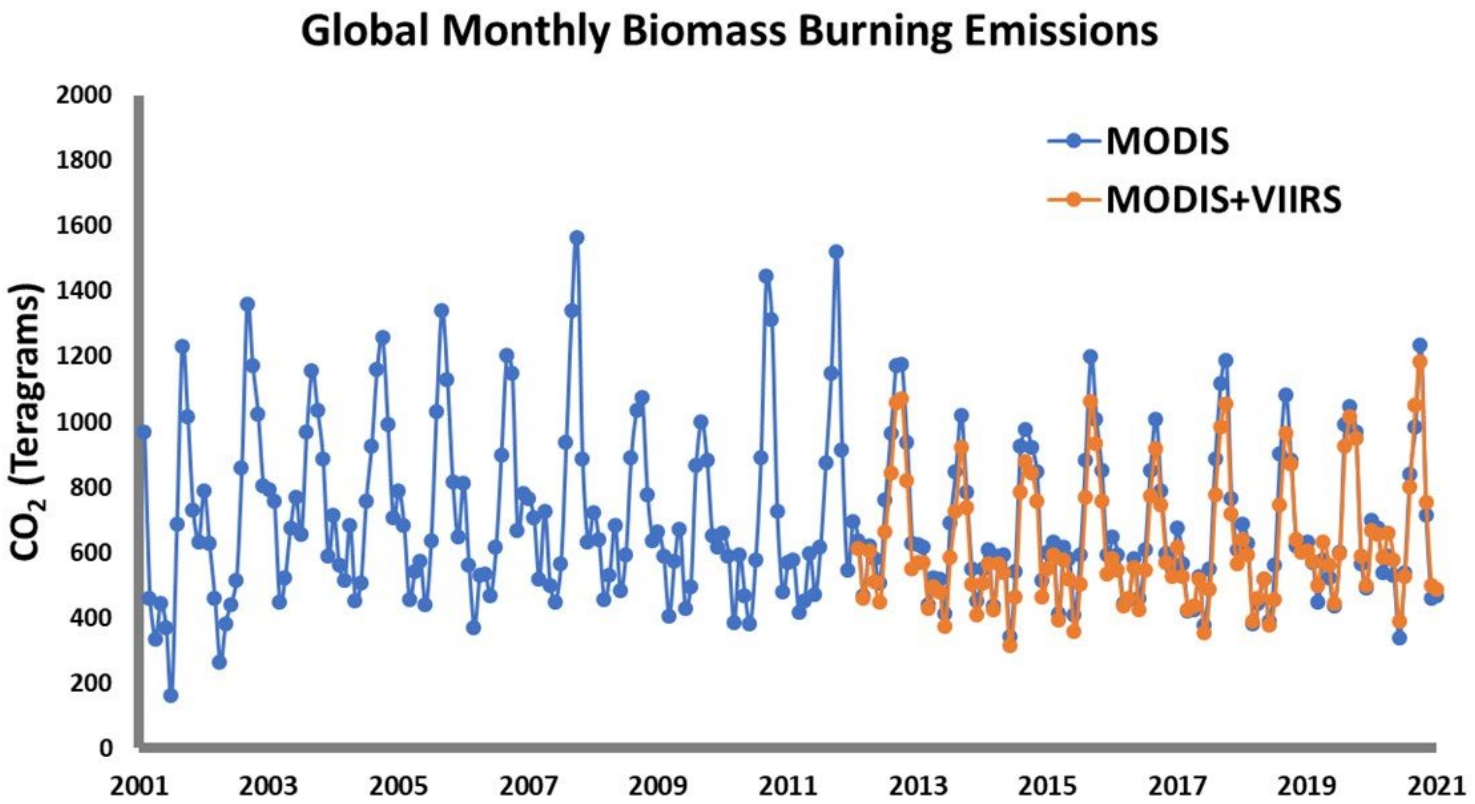




- **Visible Infrared Imaging Radiometer Suite (VIIRS; 2012- to ~2040) and Cross-track Infrared Sounder (CrIS)**
- **Operational Land, GHG and Fire Emissions products (CO2, CO, SO2, OC, BC, PM2.5, CH4, TPM, VOC)**
- **VIIRS overlaps Advanced Very High Resolution Radiometer (AVHRR; 1978- to present)**
- **Merged Climate Data Records from 1978- to ~2040**

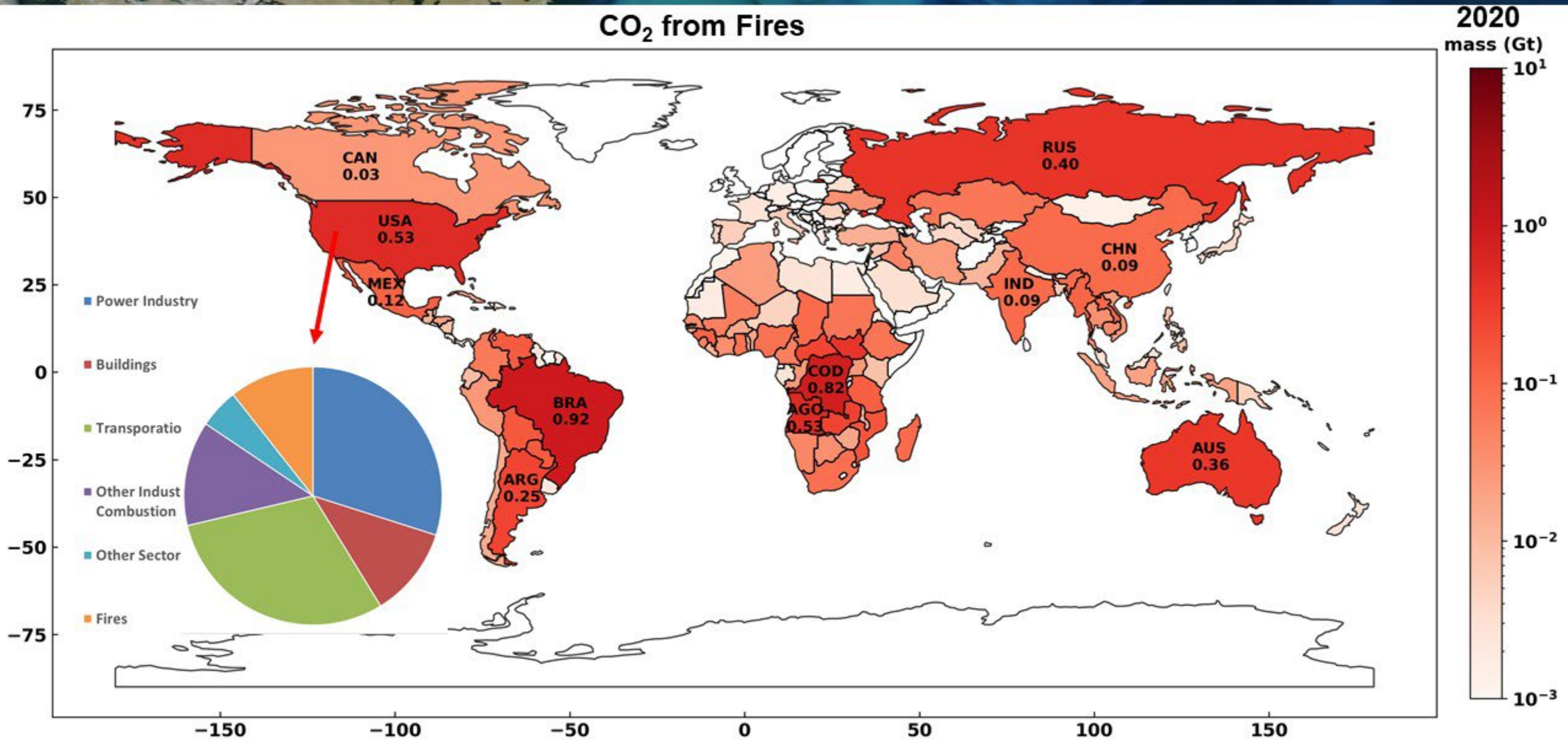
Long-Term Global GHG Emissions Record

- NOAA operationally provides near real-time GHG emissions from fires
- Global Biomass Burning Emissions eXtended (GBBEPx) system uses fire intensity data
- -- MODIS (Aqua, Terra): 2001+
  -- VIIRS (S-NPP, JPSS+): 2012+
- Determines contributions of agricultural fires vs. wildfires to national and global GHG budgets

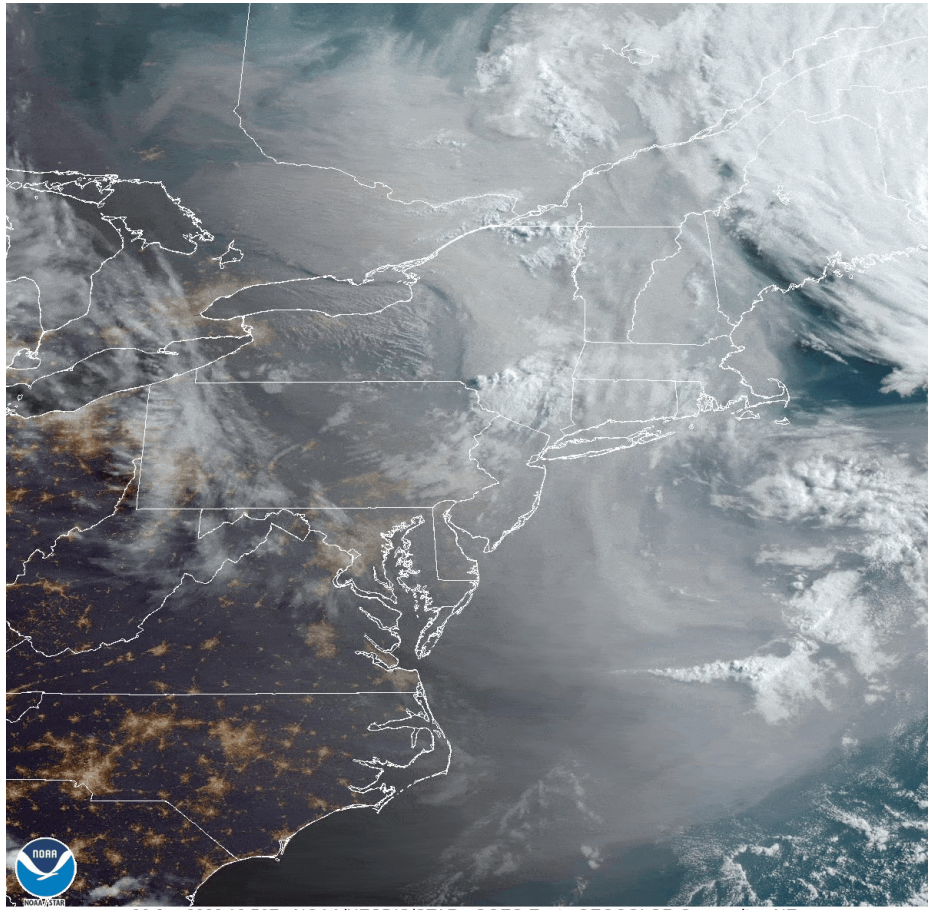


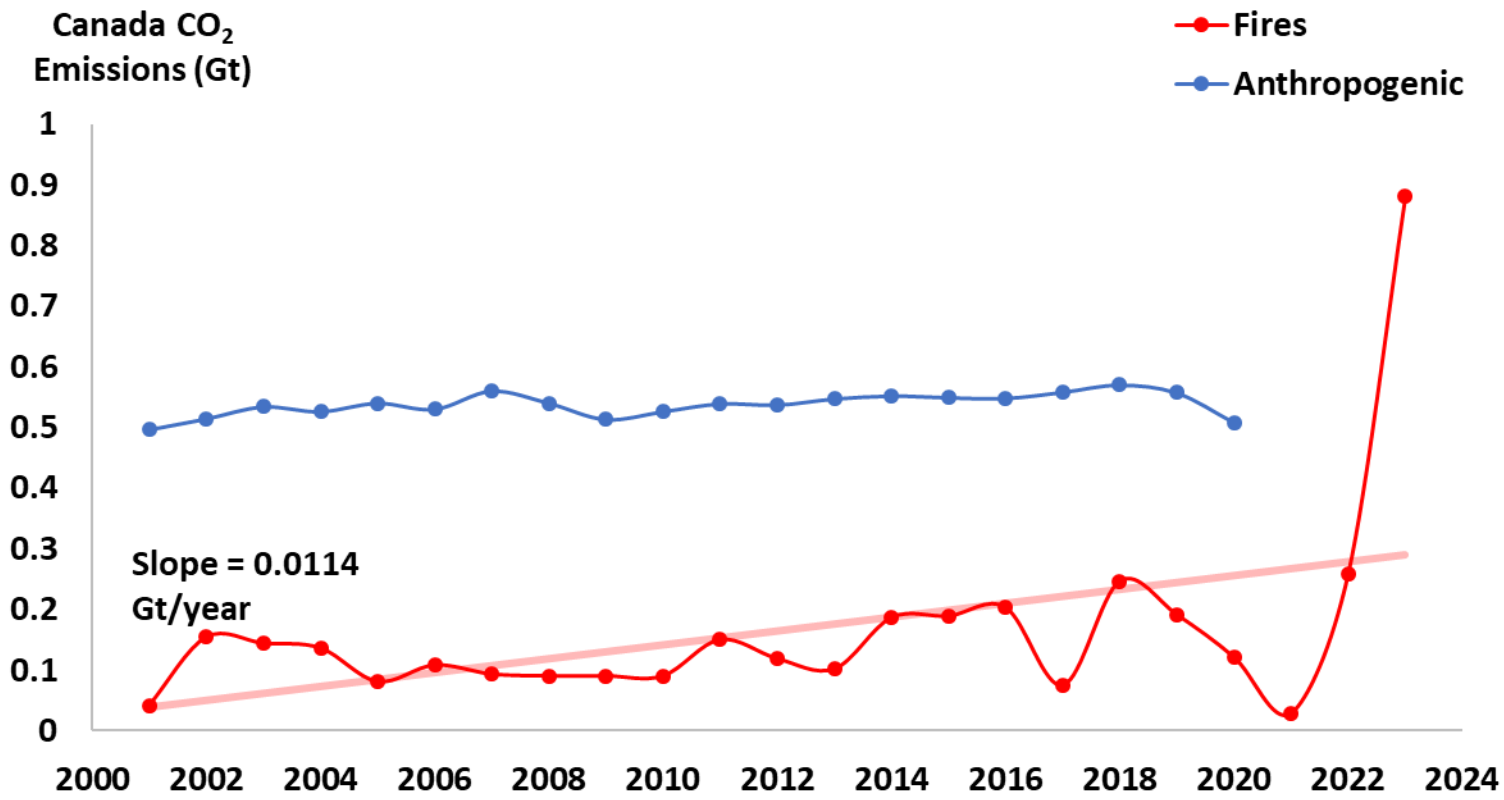
NASA MODIS: MODerate resolution Imaging Spectrometer
NOAA VIIRS: Visible Infrared Imaging Radiometer Suite

CO_2 from Fires



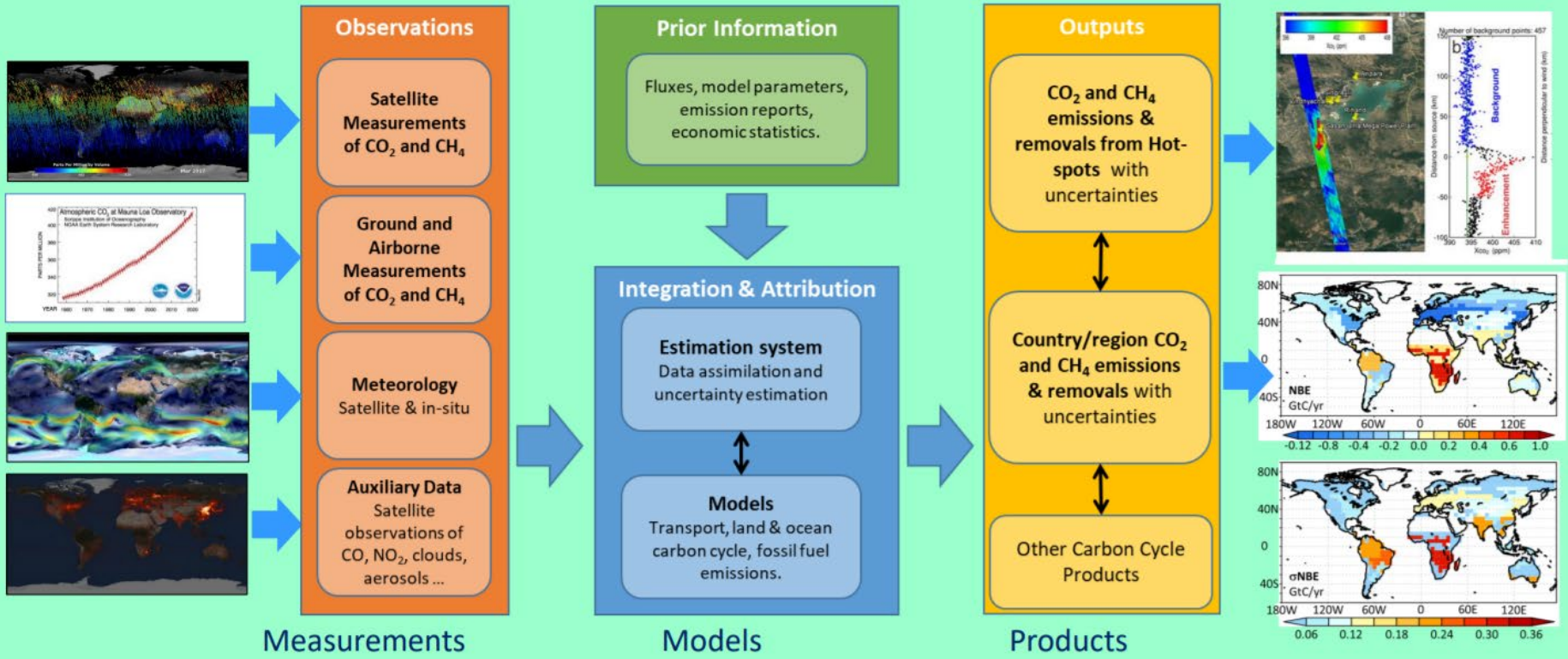
GHG Emissions from Fires Are Significant: Occasionally Exceed Anthropogenic Sources Regionally



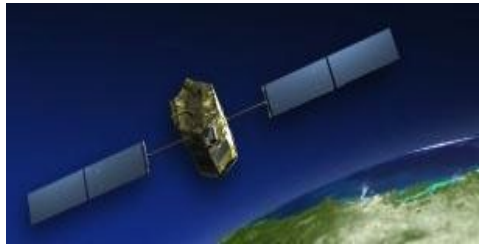


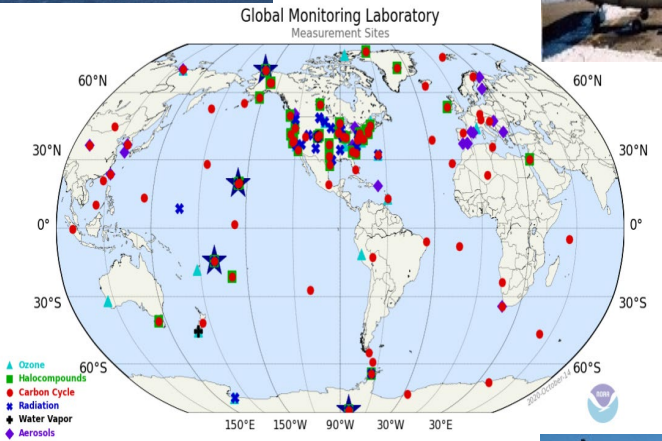
CEOS Global Stocktake Strategy

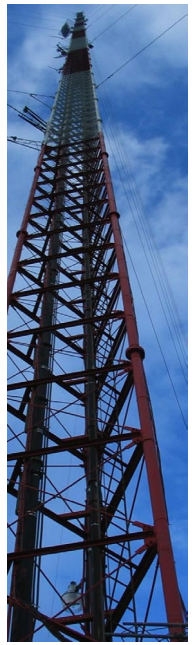
A System-level approach was adopted to develop the pilot atmospheric CO_2 and CH_4 inventory products

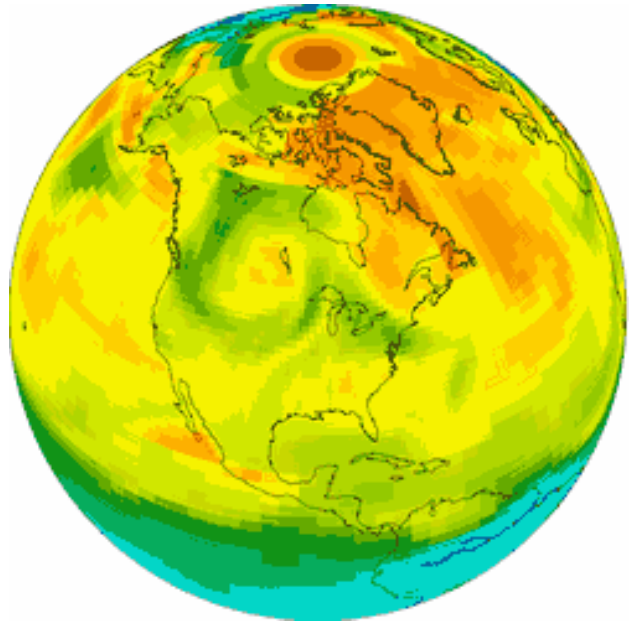


NOAA's GHG Observation Network Feeds CarbonTracker Data Assimilation System









CarbonTracker leverages in situ and satellite datasets to track ecosystem emissions and removals, anthropogenic emissions, and **carbon:climate feedbacks** from regional to global scales to support mitigation efforts.

A U.S. Strategy to Advance an Integrated GHG Measurement, Monitoring and Information System

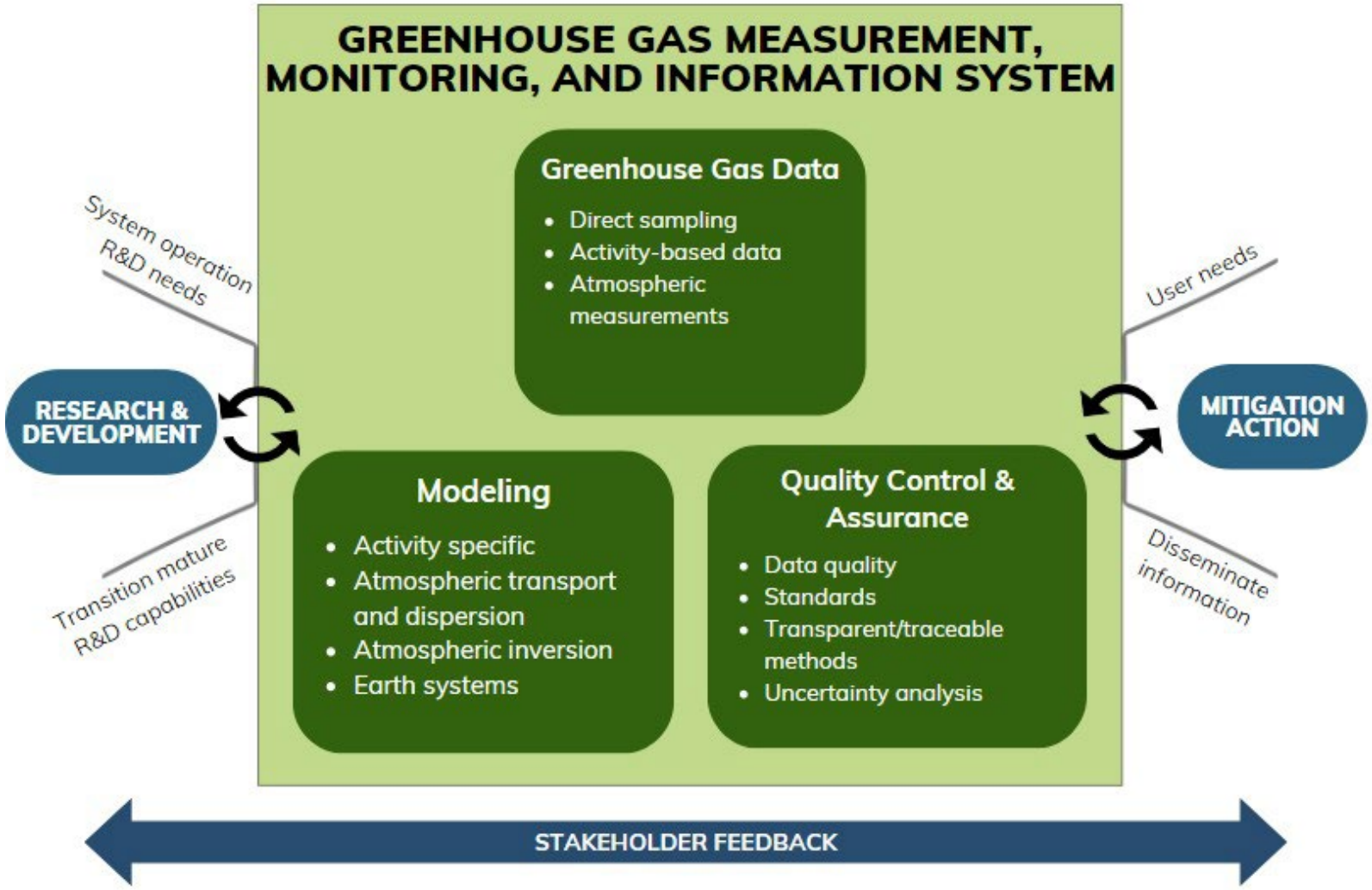
- U.S. has pledged to reduce nationwide GHG emissions by 50% by 2030, and achieve net-zero emissions by 2050. To support these goals, a system is needed to:
  - Track progress towards GHG emissions targets
  - Assess effectiveness of local, state, federal GHG mitigation policies/actions
  - Identify additional opportunities for GHG mitigation (e.g., methane leaks)

- Rapidly increasing demand from a range of users for trusted information about GHG emissions -- U.S. National Academies of Science

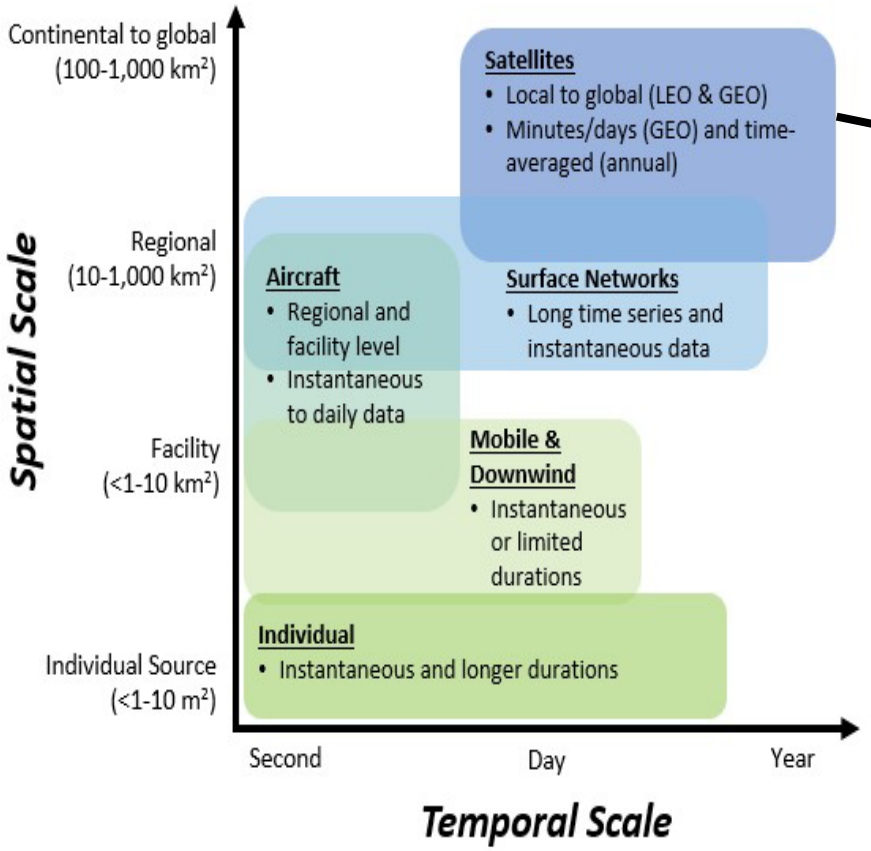
- *The National Strategy will provide a vision, concept and near-term efforts to support a national GHG Measurement, Monitoring, and Information System (GHGMMIS)*

  -- Guides collective U.S. government, commercial, philanthropic, and science community efforts

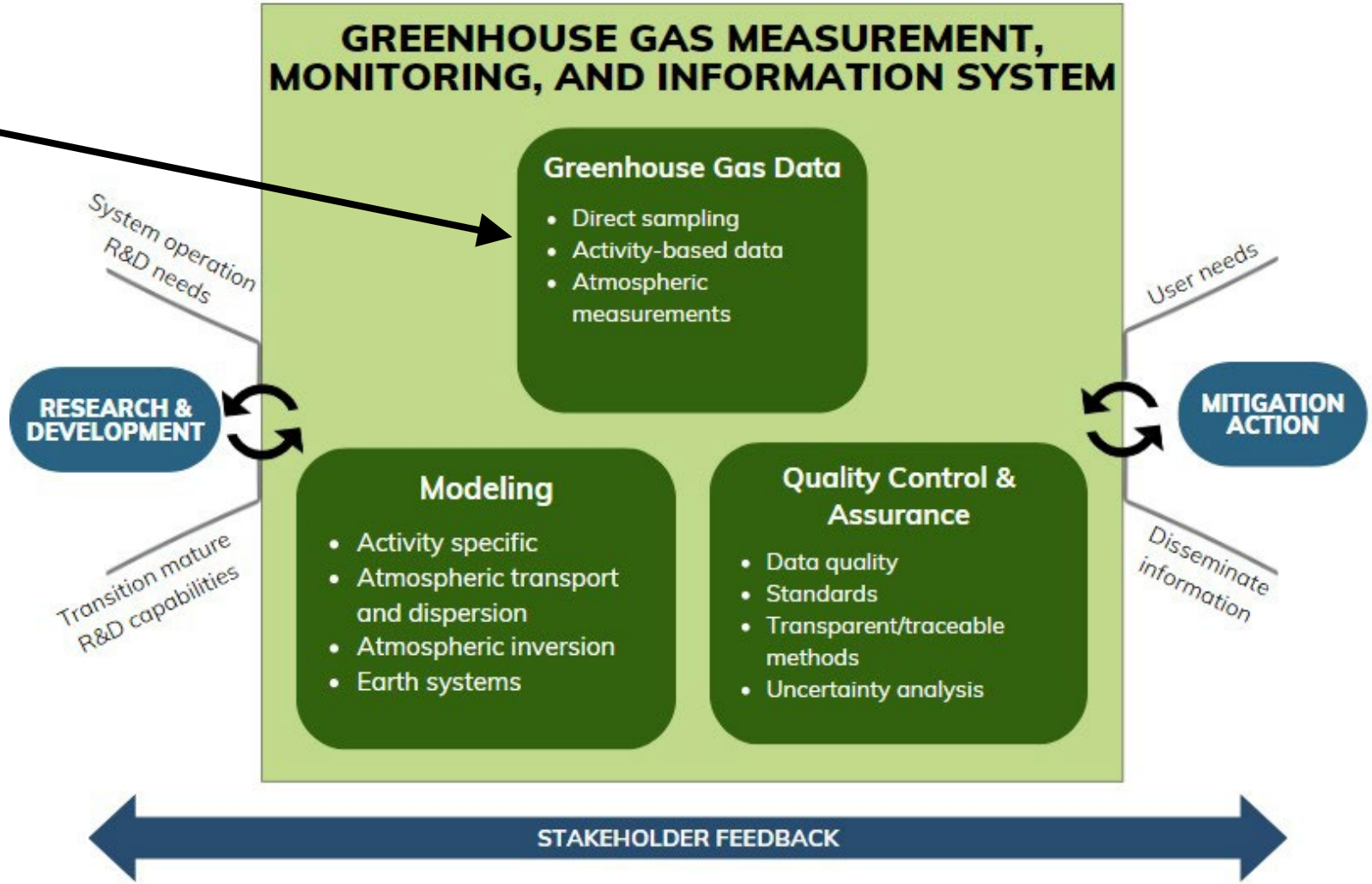
GMGMMIS Integrates Data, Science and Services



GHGMMIS Integrates Data, Science and Services



A Multi-Tiered Observing Strategy Using Atmospheric- and Activity-based Approaches



Summary

- U.S. GHG Inventory is using more satellite-driven biophysical methodologies, but still relies heavily on field surveys and statistics, involves many agencies
- NOAA is increasingly addressing carbon accounting, science and monitoring using its operational capabilities in observations, modeling and services
  - Unique and sustained surface, aircraft, shipboard, and satellite networks
  - Integrated deep-ocean-to-surface-to-space continuum
- NOAA will leverage partner observatories, including NewSpace assets, to meet its mission goals and requirements related to carbon
- U.S. is set to release a Strategy to Advance an Integrated GHG Measurement, Monitoring and Information System that involves public and private sectors

Thank You!

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