Networking in Carbon Observations: Looking Back, Scoping Forward

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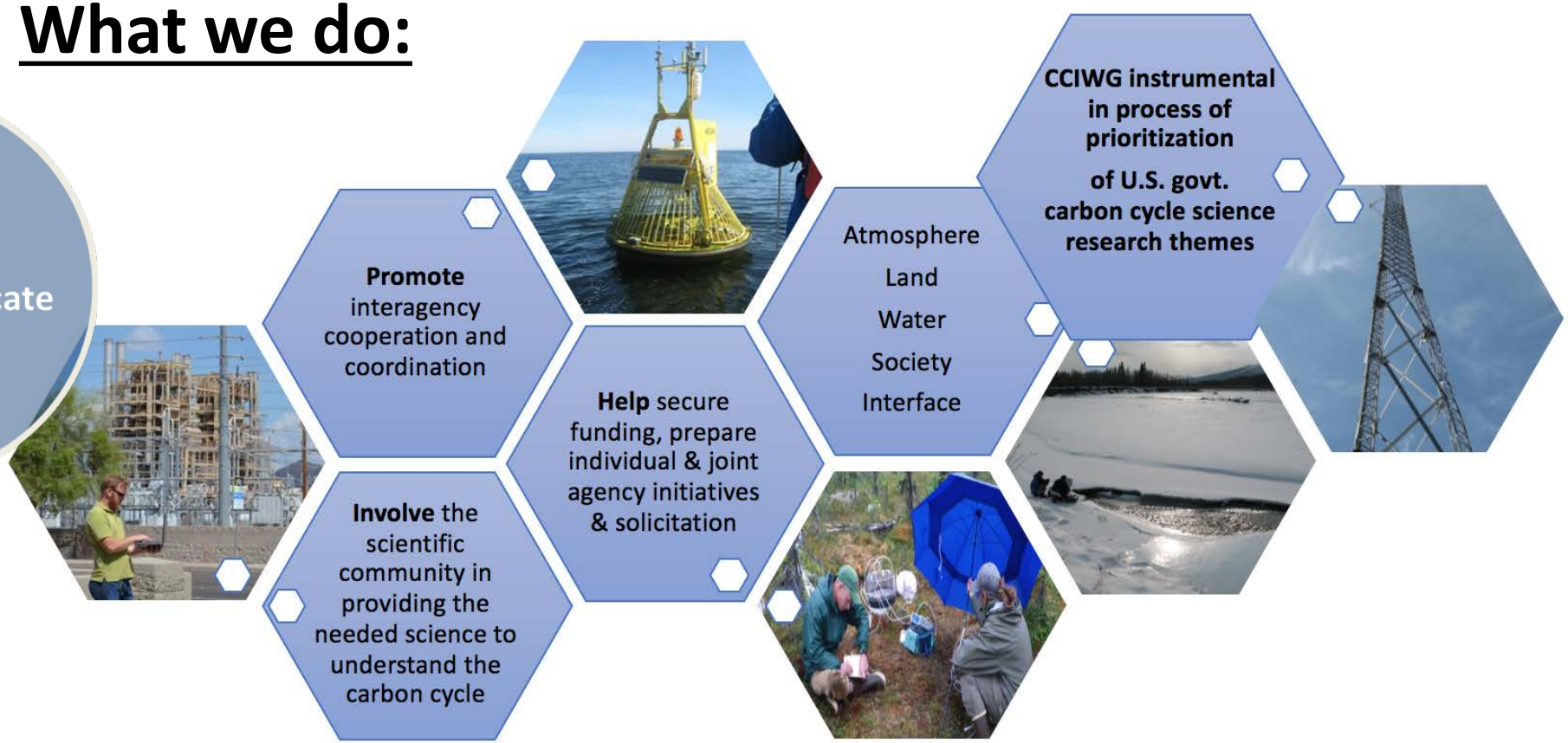
Carbon Cycle Interagency Working Group (CCIWG) since 1998/1999

What we do:



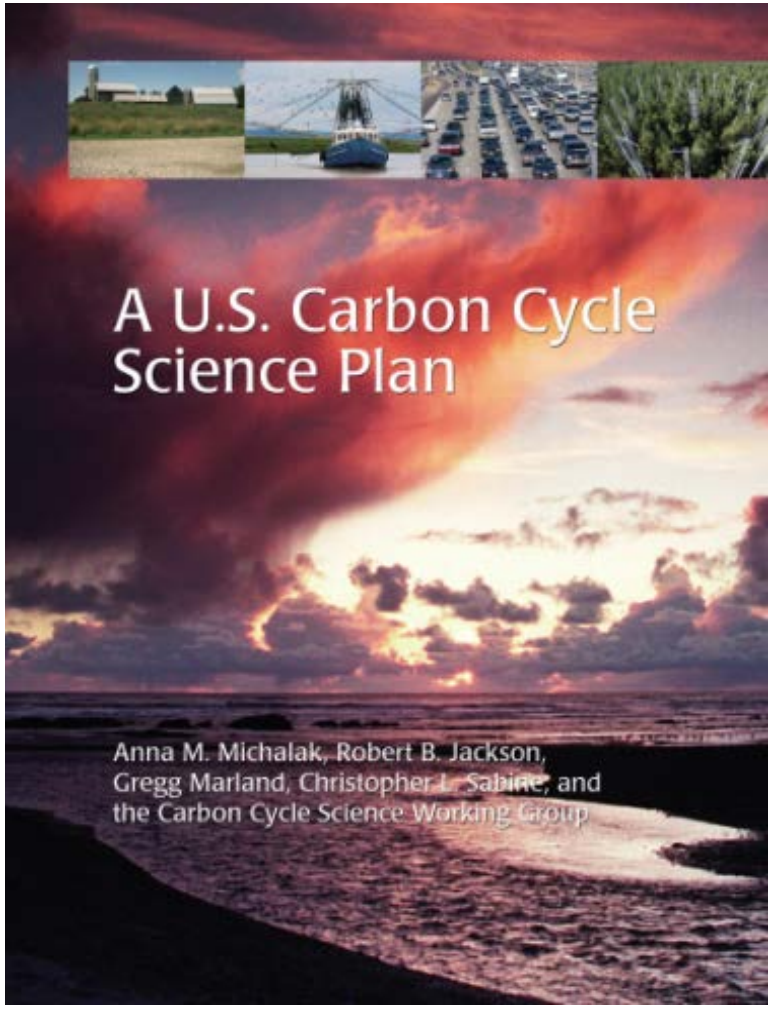
November 2018: 2nd State of the Carbon Cycle Report (SOCCR2)

- Follow-up to the 1st SOCCR (2007)
- Led by CCIWG, under USGCRP auspices
- Supporting science requirements addressed in/related to U.S. Carbon Cycle Science Plan (2011), U.S. National Climate Assessment, and USGCRP Strategic Plan (2012-2021)
- Based on large body of scientific, peer-reviewed research, as well as other publicly available sources, including well-established and carefully evaluated observational and modeling datasets.
- Latest findings on U.S. and North American carbon cycle science, policy implications, and monitoring needs

Major highlights:

- Carbon dynamics in North America and the United States in a global context
- Fossil fuels and economic impacts
- A changing landscape
- Ocean acidification
- Arctic changes
- Carbon in crops
- Indigenous communities
- Urban areas and carbon
- Societal relevance

Scientific framing of SOCCR2



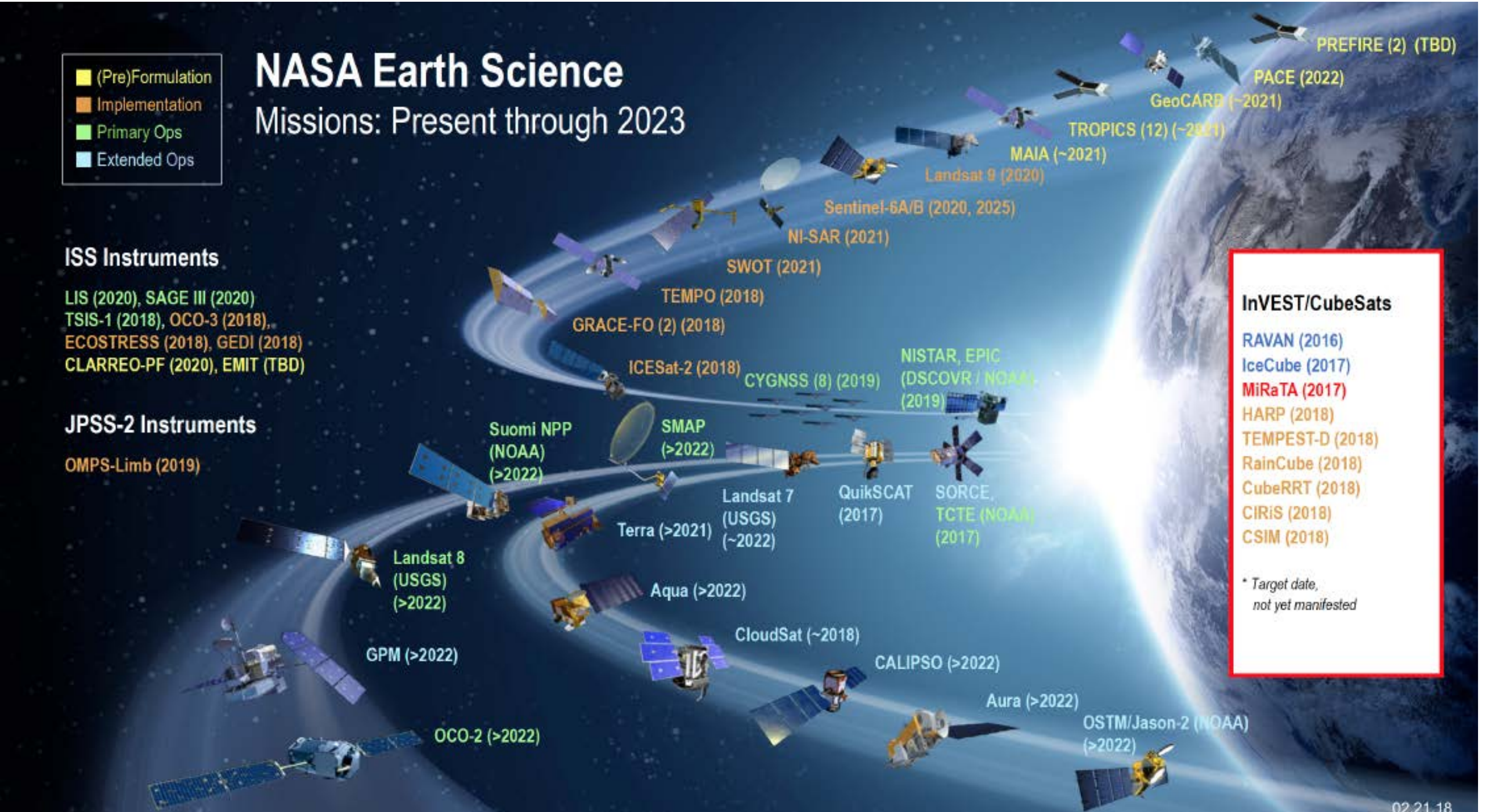
A U.S. Carbon Cycle Science Plan (Michalak et al., 2011) emphasizes global-scale research on long-lived, carbon-based GHGs, and major pools and fluxes of the global carbon cycle.

1. How have natural processes and human actions affected the global carbon cycle on land, in the atmosphere, in the ocean, and at ecosystem interfaces?
2. How have socioeconomic trends affected the levels of the primary carbon-containing gases, CO_2 and CH_4, in the atmosphere?
3. How have increasing GHG concentrations, associated changes in climate, and carbon management decisions and practices affected species, ecosystems, natural resources, and human systems?

Since SOCCR1 (2003-2007): new achievements

Thanks to improved carbon observations, SOCCR2 achieved:

- More complete and attributed carbon budget in North America
- Convergence between top-down (atmospheric observations) and bottom-up (in-situ and inventories) estimations
- Future projections more robust with enhanced observations
- Coastal wetlands, estuaries and coastal waters included in the budget for the first time
- Lateral transports consistently determined over space and time
- High –latitude data collections and synthesis


(Pre)Formulation
Implementation
Primary Ops
Extended Ops
NASA Earth Science
Missions: Present through 2023
ISS Instruments
LIS (2020), SAGE III (2020)
TSIS-1 (2018), OCO-3 (2018),
ECOSTRESS (2018), GEDI (2018)
CLARREO-PF (2020), EMIT (TBD)
JPSS-2 Instruments
OMPS-Limb (2019)
PREFIRE (2) (TBD)
PACE (2022)
GeoCARD (~2021)
TROPICS (12) (~2021)
MAIA (~2021)
Landsat 9 (2020)
Sentinel-6A/B (2020, 2025)
NI-SAR (2021)
SWOT (2021)
TEMPO (2018)
GRACE-FO (2) (2018)
ICESat-2 (2018)
CYGNSS (8) (2019)
NISTAR, EPIC
(DSCOVR / NOAA)
(2019)
Suomi NPP
(NOAA)
(>2022)
SMAP
(>2022)
Landsat 7
(USGS)
(~2022)
QuikSCAT
(2017)
SORCE,
TCTE (NOAA)
(2017)
Terra (>2021)
Landsat 8
(USGS)
(>2022)
Aqua (>2022)
CloudSat (~2018)
CALIPSO (>2022)
GPM (>2022)
Aura (>2022)
OSTM/Jason-2 (NOAA)
(>2022)
OCO-2 (>2022)
InVEST/CubeSats
RAVAN (2016)
IceCube (2017)
MiRaTA (2017)
HARP (2018)
TEMPEST-D (2018)
RainCube (2018)
CubeRRT (2018)
CIRiS (2018)
CSIM (2018)
* Target date,
not yet manifested
02.21.18

SOCCR2: Analysis of major observation platforms supported by government science programs

Aquatic-ocean	Aquatic-inland	Terrestrial in-situ	Inventories	Atmospheric
NOAA	USGS, EPA	DOE, USDA, NASA, NSF	USDA, USGS	NASA, NOAA
SOCAT mission, other ship-based measurements	Stream gage network, surface water ECV	AmeriFlux, GRACEnet NEON, LTER	Forest inventory, crop inventory, land cover change mapping	OCO-2, SMAP, Landsat, and various airborne missions

Opportunities for CCIWG for more effective carbon observations

- Assimilations between satellite and ground observations and use results in carbon cycle models
- Anomalies from these data products
- Uncertainties from lack of in-situ measurements of methane
- Uncertainties of carbon loss from lateral fluxes of river systems in high-latitude and temperate zones
- High-latitude: observations are still scarce and lack of uniformity

Examples of regional *integrated* collaborative observations

(Work by Dr. Striegl of USGS, see his poster)

$$NECB = NEP - RCH_4 - LF$$

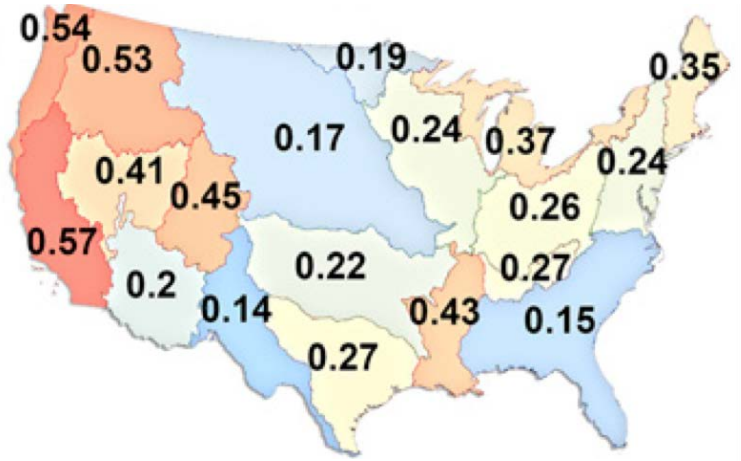


Fig 1: Fraction of terrestrial NEP represented by total flux of aquatic systems, based on remote sensing and stream gage observations

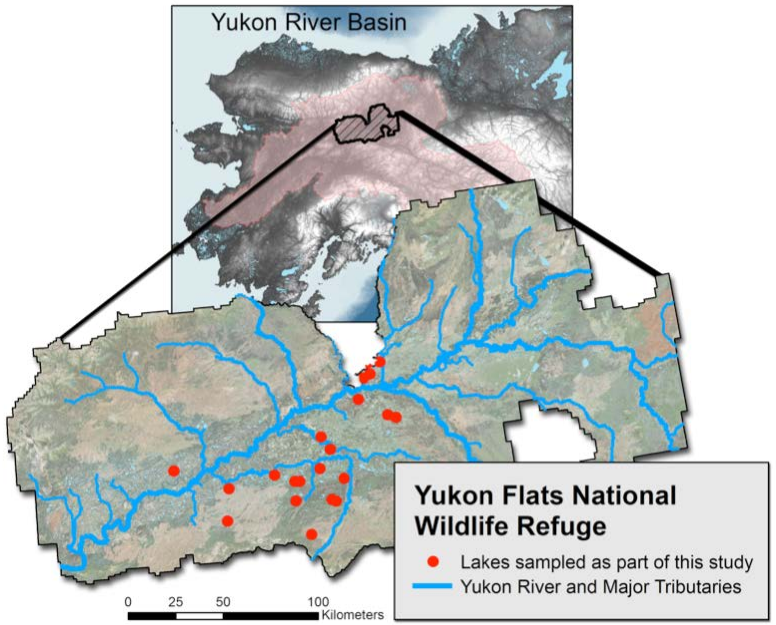


Fig 2: Aquatic sampling sites in Yukon Flats National Wildlife Refuge

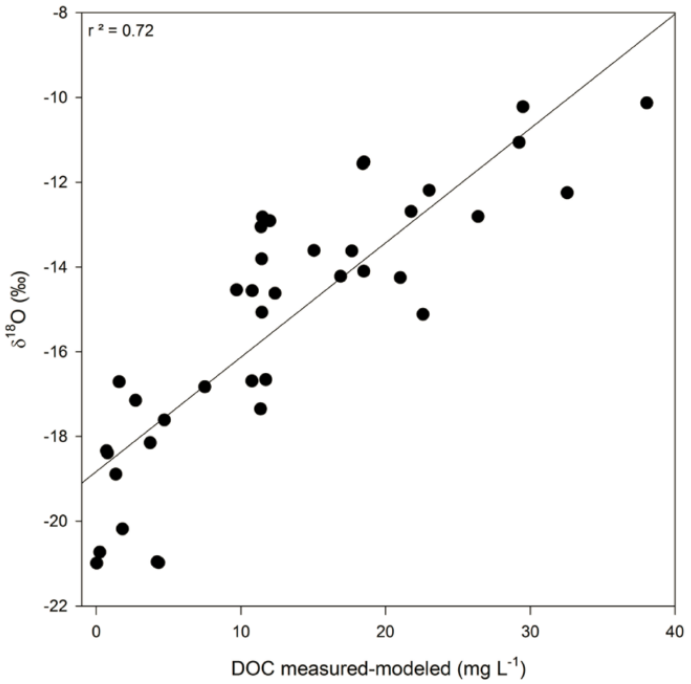


Fig 3: Measured dissolved organic carbon (DOC) vs derived from remote sensing of water body color

Thank you for your time!

I will be happy to answer questions …