

2025 AiRMAPS Coordination Workshop
September 3-4, 2024
University of Maryland, College Park

Agenda - <https://csl.noaa.gov/events/airmaps2025/baqmms-workshop/agenda.pdf>

Sep 3, 2024

Workshop Goals

- Discussion of field activities, planned or desired
 - Air quality & climate generally
- Best use of combined satellite remote sensing, airborne and ground based observation assets
- Leverage organizational structure of the USGHGC
- Identify needs of local stakeholders

Structure

- Short talks + open discussion
- Modeling coordination will take place at a later time

USGHGC - Lesley Ott, Barry Lefer

- Facilitate coordination across fed and non-fed entities to integrate and enhance
- NASA's Earth Action Strategy: foundational knowledge up to virtuous cycles
- Ultimate goal - provide stakeholder driven GHG info to enable science based decision making
-

National Strategy - Ben Poulter

- Coordinates USG investments in GHG Measurements/monitoring
- All of society approach, GHG data needs to be actionable
- Stakeholder driven ID of GHG data needs across all sectors
- Biden/Harris admin aims for 50% emission reduction by 2030 (2005 levels)
 - Inflation reduction act + infrastructure law
- 3 objectives
 - Improve bottom up estimates
 - How to include/coordinate top down estimates
 - How to converge the two
- Interest in how to progress airborne events from testbed framework to operational systems?
 - Phase 2 of national strategy is how to sustain and integrate activities in phase 1
 - How to move towards operational systems

Questions/comments on Above -

- Building resiliency is incredibly important to operate

- Establishing requirements of activities 2-3 years in advance
- Comment on data mgmt aspect?
 - USGHGC, seeing a lot of reqs for types of data, how data is responsive to diff stakeholder needs, all done through USGHGC

US GHG inventory - Erin McDuffie

- Overview of the US GHG Inventory
 - Annual report of anthropogenic GHG sources and sinks by gas and econ sector, from 1990 to current year minus 2
 - Tiered methods through IPCC
 - Dev'd and submitted to UNFCCC annually by april 15th
- Methods
 - IPCC guidelines
 - Tier 1 - use of default emission factors at the segment level, applied to national activity data
 - Tier 2 - use of country and segment specific emission factors
 - Tier 3 - use of detailed emission models of measurement data at individual facility or subnational level
 - USGHG Inventory uses tier 2/3 methods
- GHG inventory improvement prioritization
- Role of Atmospheric observations in inventory improvements
 - Specific measurements -> direct use
 - Facility scale measurements -> extrapolate to quantify annual emissions
 - regional/continental scale observation -> broad evaluations of regions/sectors can be used to inform inventory improvement planning

USGS Coal Mine Methane - Peter Warwick and C. Ozgen Karacan

- Coal Mines accounts to 11.5% of global anthro methane emissions
 - Energy sector responsible for nearly 37% of total anthropogenic methane emissions
- Coal mine emissions working group, described in 2023 National strategy USGHGCMMS (focused in Buchanan Mine in SW Virginia) (Karacan et al 2024)
 - Objective- reconcile methane emissions estimates from satellite and airborne approaches
 - Acquire coal mine measurement data dna satellite /airborne monitoring at multiple mine locations
 - Estimate concurrent bottom up and top down methane fluxes from mine vent exhaust fans
 - Compare methane emission fluxes
 - Reconcile BU and TD quantified results

DOE Controlled Releases - Jared Ciferno

- DOE FECM methane R&D Program - collab with Col State
- METEC (methane emissions technology evaluation center) Facility and Diverse test program
 - Testing leak detection solutions
 - Field measurements and experiments
 - “As operating” measurements across most sectors of NG industry
 - Emissions simulation
 - MAES toolset for high temporal spatial resolution simulation
- METEC 2.0
 - Task 6.2 - satellite testing protocol and design
 - Goal: set up controlled release system to emit a known amount of natural gas to the atmosphere to test satellite abilities to detect and quantify methane plumes
 - Locations: looking at Denver Julesburg, Piceance, Permian
- Questions -
 - Ariel - plans for surface concentration measurements downwind for releases?
 - Not now
 - Modeling plan for high res meteorology?
 - Yes

Overview of AiRMAPS from 2024 - Steve Brown

- Objectives
 - Establish current top-down eval of US oil and gas methane and air pollutant emissions
 - Demonstrate the use and value of tiered, integrated satellite, airborne and ground based GHG observing system
 - Evaluate civilian and commercial spaceborne remote sensing methods and long term modeling
- Tiered observing systems
 - NOAA OAR
 - 3-5 year deployments of twin otter and P3 aircraft
 - NOAA NESDIS
 - Partner with airborne observations to augment and validate satellite based air quality GHG instruments
 - Airborne methods for Quantifying emissions
 - Mass balance
 - Doppler lidar + column DOAS
 - Trace relationship
 - Eddy covariance
 - Inverse modeling
- O&G basin measurement in tandem with Urban regions to look at effects of basins on urban areas

- AiRMAPS colorado -
 - Top down methane emissions show declines despite rapid production increase

AiRMAPS 2024-2026 - Carsten Warneke

- P3
 - NOA CSL confirmed payload
 - GHG, NOx/O3, VOCs, I-CIMS, aerosol size and compositions, BC
 - not confirmed
 - Wind lidar, HCHO, NH3
- Other targets include coal mines, landfills, CAFOs, urban
- High winter time PM Values

MDE perspective on AQ and GHG's - Joel Dreessen

- AQ, GHG, Co-benefits
- NAAQS policies
 - Better temporalization and spatial tracking of emissions
 - Attainment of ozone and continued attainment of PM2.5 is dependent of continuing to understand changing emissions of atmos chem
 - Suspect diesel vehicles for NO2 spike
- Biggest issues for MD
 - Uncertainty in inventory, specifically for sectors such as O&G
 - Knowing what actions are the most beneficial for the state to meet its climate goals
 - Understanding the ghg picture better
 - Temporally
 - Annually
 - Missed gasses (other hydrocarbons?)
 - Methane source reduction co-benefits?

First Discussion

Ariel -

- Moving to more operational types of products - what's the definition of operational?
 - Ben Poulter - question for the community to discuss, no direct answer
 - No formalized program for drivers of methane
 - How do we sustain the Airmaps program, are there inter-agency synergies there to explore use-cases?

Shobha

- Excited for 2026 P3 campaign - have seen wider regions of non-attainment than what the EPA is reporting
 - Carsten - there are discrepancies

Mike Newchurch

- Time series from Utag campaign that has sharp spikes, do you have a sense of horizontal or vertical dispersions of sharp/large methane sources
 - Steve - haven't dug into the methane sources

Ken Jucks

- How do you deal with uncertainty in airborne measurements?
 - Steve - relating/integrating single day measurements to longer or episodic measurements
 - Erin - historically EPA has taken the approach with the inventory of annual averages, using info from different platforms, there's no observation that gives you all the info you need, need integrated observation approaches

John Sullivan

- 2 of our most famous greenhouse gases are ozone and water vapor, is there space in the USGHGC for these?
 - Lesley - top priority given need to have manageable scope, is CH₄ CO₂ and others, somethings that the community has to address, water vapor is hard because humans have little effect
 - Steve - have to understand the emissions that go into ozone so we might as well focus on emissions, adds the caveat of "and air pollutants" to include the suite of emissions

Xinrong Ren

- Showed map with coal mine methane emissions - what about southwest PA marcellus?
 - Peter - working on contact with mines - can reach out to mines based on potential flights - let him know when to coordinate, reluctance from coal mines to cooperate

Joel Dreessen

- Snapshot of sources is great but doesn't help
 - State perspective and goal/inventory perspective it isn't useable or useful realistically
 - Needs context relevant to a policy

Ken Davis-

- Have to build smaller measurements in a multi scale capacity

Glenn Wolfe

- Thinking at a systems level - wondering where does the scientists job stop? Archive or publishing? How to prevent burnout? How to keep capacity of keeping the data useful
 - Carsten- our job is to provide a highly detailed snapshot to set the trajectory right, make sure we get the long term emissions records right for the right reasons, only get this kind of detail in the field campaigns
 - Steve - handicapped by general under-resourcing,
 - Lesley - are there other ways that we can use snapshots?

Mike Newchurch

- Following up on Xinrongs comments - does the USGS have episodic or routine air testing or do you rely on flights of opportunities

- Some drone measurements but mostly rely on other agencies

Paul Miller -

- Air regulators don't regulate methane for the effects of the ozone, curious if there's info coming from field studies that may help inform regional methane reduction that could reduce the background that the spikes build off of
- Steve - short answer - no, long answer - great comment and should be thinking about that, rarely think about ozone background

Anna Karion

- Snapshot vs long term? Feel like there are a lot of data that are only used once, go back and look at various data from before, should we synthesize or model the data that's already out there? NIST has long-term values but doesn't give you all the gases. Could you do some sort of long term trend analysis? Lots of data that has not been fully leveraged
- Carsten - fully agree, field campaigns are designed in that thinking to revisit campaigns from before, trying to keep the trend going and align with long term measurements

Ariel

- Would like to offer lab in tracer experiments, - inviting Jared to work with us, would be great to collaborate

Edward-

- Urban supersites have become more common, come up with a standardized way to ingest data and data assimilate, easily port data in and do a combined data analysis. ARM team is interested in ways to ingest data and have a template

Aircraft instrumentation and Flight Plans - Xinrong Ren

- Baltimore Air Quality and Marcellus Methane Surveys
- Objectives
 - Assess emission of greenhouse gases and air pollutants

Airborne Doppler Lidar for boundary layer dynamics measurements - Sunil Baidar

- Micro doppler
 - Scanning mode for horizontal wind
 - Vertical stare - pointing is actively stabilized

BSEC and COURAGE Research Plan - Ken Davis

- Baltimore Social-Environmental
 - Also measuring boundary layer properties and surface fluxes within the city
- CoURAGE
 - Coast urban rural atmospheric gradient experiment

- Determine the dependence of Baltimore's atmospheric environment
- Baltimore's atmospheric environment is more than the

NASA SARP - Barry Lefer
NSF GOTHAAM - John Mak

- GreaterNY Oxidant, Trace Gas, Halogen and Aerosol Airborne Missions
- What makes GOTHAAM unique?
 - Biogenic precursors to SOA are among the highest outside the SE
 - Proposed diel study of night into day chem mechanisms would be a first, especially with proposed instrumentation
 - The NYC region is one of the most densely populated within the US
- Objectives
 - Quantify the relative contributions from the various VOC sources (biogenic, fossil fuels, consumer products) and how they contribute to chemical activity
 - Determine the relative potential contribution of each VOC class to secondary organic aerosol as the anthropogenic plume evolves
 - Quantify the relative importance of the various oxidation processes for both gas phase and aerosol species and how the relative importance of these processes vary across the diel cycle and as a function of the chemical system
 - Investigate how the nighttime chemical processes influence the subsequent days measurements
 - New for 2025 - hoping to deploy ground based capabilities on Governors Island, including MET, Doppler lidar, PTR-TOFMS - collab with NY climate exchange

NIST Urban Test bed in Baltimore/DC and inversions - Anna Karion

- 3 urban test beds

Discussion #2

Ben Nault-

- Wondering if it would be worth talking to Langley about AMS about them being operators and we analyze the data?
- Barry - would be good to use theirs and had students get experience

Russ-

- An idea that Ken was showing the various measurements around the area with a hole over the Chesapeake Bay - ship called the Rachel Carson that goes up the bay often, could load it up with instruments

Shobha - are low cost sensors easy to operate?

- Anna - periodically calibrate, but put a few in each box so a few can fail and it doesn't matter, meant to run on their own

Carsten - how many flight hours per each plane?

- Barry - Sarp baseline is 20 hours east coast + 20 hours west coast , 3 flights a day b-200

Carsten - can you run inversion models on aircraft flights as well?

- Anna: Israel probably can

Steve - are you early enough in your planning that your flight team is open to flights in baltimore?

- Glenn - we don't know , cant make promises

Mike Newchurch - 3500 foot bottom altitude, would 100 foot bottom altitude be better?

- Can't - not happy about flying low altitude over complicated airspace, but we should look at previous data to figure out the bottom altitude

Shobha - with arc measurements, did you analyze the ratios of co2 and no2 to so how stable they are

- Xinrong - very variable

Steve - interface between longer term networks - is there a good sense of the history of comparison, how much are we adding to those types of network comparisons

- Anna - use the data to compare and do due diligence
- Ken - ideally you can look at spatial context with planes before you look at the towers

Airborne GHG Remote Sensing - Andrew Thorpe

- MEDUSA
 - Methane Emissions Detection Using Satellites Assessment
- Objective -
 - To develop the techniques and a preoperational system to harmonize and integrate global information on subnational to facility scale anthropogenic methane emissions derived using diverse satellite instruments and algorithms
- Setup -
 - 1 validation of emission estimates
 - 2. Intercomparison of different results from similar satellites
- Hyperspectral instruments PRISMA and EnMAP
 - Can be targeted with higher priority for specific opportunities such as measurement campaigns, to be arranged with DLR and ASI
 - Best to first establish possible opportunities for a certain time window
- Questions

Shobha - on the time series plot tropomi picked up plumes that GHGsats missed - thoughts?

- Because they weren't looking at the same spots

Steve - we will be working in the marcellus shale and baltimore urban area for 2025 - thoughts for how to proceed within the detection restraint?

- Can detect 500 km/h, can look at satellite data before the test to see if there are plumes worth targeting

Peter - happy to coordinate with the SW VA coal mine with this

Airborne CH₄ and CO₂ observations using image spectrometers -

- Nasa imaging spectrometers deliver new understanding of ghg emissions
- 5 planned flights per year through 2024 + 2025

Quantification of source specific methane emission using MethaneAIR and MethaneSAT - Jasna Pittman

- Rapid methane emissions reduction
- Quantify emissions from over 80% of global O&G
- Bridges gap between global mappers (tropomi) and point source satellites (GHGsats) by observing at the basin scale at high resolution
- 598 km altitude in atmosphere
- MethaneAIR flown on Lear Jet and NCAR
 - 10m x 10m resolution
 - 4.5 km swatch ~ 10000 km per day in zamboni pattern
 - Sampled >80% of us onshore O&G
- 2024 flights coordinated with MethaneSAT
 - Denver and Uinta Basin
 - Goal of providing rigorous test of top down regional area flux models
 - Designed to temporally resolve atmospheric burden of methane as it sets up and evolves over a 2 day period
- Single blind controlled release experiment
 - mIME and Divergence integral methods used to estimate methane plume fluxes

HALO and MethaneAIR on NASA G-III - Amin Nehrir

- Validated ch₄ retrievals against co-located in-situ observations
- Excellent agreement with b300 in situ, PBL sensitivity over column
- STAQS - synergistic TEMPO air quality
- NY AM/PM flights
 - Broad city scale enhancements observed between am/pm flights
 - Many small point sources identified from landfills, power plants, and wastewater plants
 - Good correlation with in-situ ch₄, DC-8 obs
- Flight plans optimized for switch of passive imagers
- Disentangling sources
- Summer 2025
 - Benchmarking methane area emissions with MethaneAIR and HALO

- Goals - provide rigorous test of top down regional are flux models

JAXA GHG monitoring plan 2025 - Hiroshi Suto

- GOSAT - GW
 - Wide swath, solar induced chlorophyll fluorescence
 - TANSO - 3 onboard
- 11 observation points in both DC and Baltimore
 - GOSAT 2 continuously observing since 2021
 - Near surface h₂o, SIF, and CO are simultaneously retrieved
- Remote sensing from a commercial airliner
 - No hardware mods to aircraft
 - Compact instruments on cabin seats
 - Observing through cabin window
 - Small power consumption with mobile battery operation
 - 3 modules
 - 3 modules 450nm, 740nm, 1.6um
 - Observing no₂ as a co₂ emission marker
 - Wind speed and direction are essential for no₂ distribution
 - In Nagoya, emissions are flown out of megacities during winter season
 - In Osaka, emissions stay over cities

Discussion

Anna -

- How will water in pixels affect MethaneAIR/SAT
 - From MethaneSAT perspective is that they cannot retrieve data where there is water. From MethaneAIR they can retrieve the data there
 - Works fine for lidar - insensitive to albedo and topography

Mike Newchurch

- Can you characterize your precision accuracy of methane near the surface and over history of making measurements can you summarize points of correspondence between low level latitude and surface measurements
 - Amir - either average vertically or average horizontally a lot - comes down to radiometric accuracy
 - Column is very hard if you don't get all the way down - profiling is nice to have
- Do you see erratic correspondence that's hard to resolve?
 - Haven't had a chance to do detailed assessments with ground sites

- Trends were captured partially due to the spectroscopy that is weighted towards the surface, variability and correlation is there although surface is muted
- Uniform sensitivity from about 8km down
- aerosol layer that allows them to look at the boundary layer
- High flying and low flying in situ to

Shobha - update on GOSAT GW launch

- Hiroshi - Next march

Hiroshi -

Regarding the MethanSAT satellite, is it over commissioning phase?

- Jessica - Don't know if it's officially over the commissioning phase, submit for first light starting this month

Ken - Talked about adding points about adding points around DC/Baltimore, but also target mode -

- Hiroshi - can easily modify target point

Steve - level of certainty and flight hours for next summer?

- Andrew - Don't have details but probably AVIRIS 3 on the king air or the AVIRIS 5 in the future in the king air, or another platform. Increased desire for more mapping - could have both in operation in the future. Commitment from our side to support the AiRMAPS campaign and allocate our budget to make sure we're successful in PA
 - 150 hours for the Marcellus area
 - MethaneAIR - proposal is submitted, in the review state
 - Flying on G5 in september 2025, looking for funding to fly the lear jet - aiming for Texas

Sep 4, 2024

Historical and Current policy relevant on GHG's and AQ in the Baltimore/DC area

- Russ Dickerson

- RAMMPP Regional atmospheric measurement modeling and prediction program
 - Discovered ch4 emissions inventories were low

- Lagrangian Modeling (Israel L-C)
- Ozone interstate transport
 - Supreme court argument
 - 2024 refused to consider re-argument
 - State of Utah v EPA and Michael Regen
- PBL venting and transport
- Photolysis rates
 - Black carbon vs brown carbon photochemistry inhibitions
- On going and future projects
 - Less FF burning, more biomass burning?
 - Biogenic CH₄ and organic aerosols, VCPs
 - Increased attention on GHGs inc. N₂O
 - BrC flux
 - NH₃
 - Microplastics in atmosphere?
 - Environmental justice, hyper-local
 - Short lived or primary species, e.g., BC, metals, PM₁₀

TOLNet Support of AirMAPS - John Sullivan

- TOLNet SMOL - smaller portable ozone lidar system for profiling at bay or cliffon park sites
- Using TOLNet to contextualize ozone aloft and surface exceedances
- TOLNet broad support for future needs
- Improve fundamental understanding of the diurnal PBL cycle
 - Recirculation
 - Entrainment nocturnal residual layers
 - Long range transport
- Quantify chem perturbations from offshore transport of urban emission, ship, boats, and offshore O&G
- Identify novel and viable pathways derived from interaction of land-ocean-atmosphere that can drive PBL content and structure

LMBreeze- Studying emissions over lake michigan - Mike Newchurch

- Lake Michigan Boundary-Layer Regional Environmental Evaluation of Ozone and Emissions
 - TOLNet was born as an adjunct to TEMPO

- 180 drone flights over 16 flight days - surface to 120 meters

Using meteorological data from commercial aircraft for urban boundary layer and air quality applications - Edward Strobach

- How is the ACARS data used?
 - Assimilation of aircraft observations into the model improves
 - Nearly a continuous set of profiles showing diurnal structure
 - BL height derivations focused on convective BL use different methods
 - Theta method
 - Bulk richardson number
 - Third method edward will discuss
 - Decision tree type slide that has different variables that can determine list of airports on a given day, airport location, derive BL height, aggregate, smooth, and interpolate data; plotting/visualization, and writing out netcdf files
 - Studies show good agreement with other observations
- Diurnal temps and wind profiles with different approaches to deriving BL depth
 - Comparisons with models to understand pollution transport in an urban setting
- descending/ascending flights into/out of an airport overlaid with flight level winds and profiles averaged +/- 30 minutes within an hour
 - Useful for providing spatial context of how meteorology is represented across a complex landscape
- Log-p/skew-T plots with hodographs and severe weather indicators
 - Can serve as a data point for determining severe weather in an urban environment
- NExt steps- BLH determination and field deployments
 - Theta method - identifying instance in the vertical where theta equals the surface value
 - Works only for convective BL
 - Bulk richardson method (zhang et al 2014)
 - Wavelet smoothing approach
 - Under dev
 - Plans underways between csl, gsl, and umd, to determine best algorithm

PM2.5 is not the same across seasons: Characterization of PM2.5 composition at a fixed urban site for the DOE BSEC project - Ben Nault

- Compositional changes in PM_{2.5} appears to be driving consistency, but measurements challenge to attribute sources
- Large changes in SOA while POA stays relatively constant, small uptick in black carbons through 3-7 months of the year

Alegros and Sarp 2024 - Glenn Wolfe

- Beechcraft king air b200
- SARP east - norfolk, richmond, baltimore, philly
- SARP west - LA

Open-path dual comb spectroscopy of GHGs and small trace gases - Kevin Cossel

- Broadband high spectral resolution with no instrument lineshape and fast temporal resolution enables
 - Multispecies detection
 - Long open air paths - spatial averaging so sample line bias
 - Accurate concentration retrievals
 - Multiple measurement paths
 - ~minute time resolution
- NIR
 - 1-5km
 - CO₂, CH₄, H₂O, HDO
- MIR
 - 0.1-1km
 - CH₄, H₂O, HDO, C₂H₆
- Urban measurement goals
 - Characterize urban emissions of GHGs and spatial temporal variability
 - Compare point and open path measurements
 - Estimate city or neighborhood scale emissions
 - Estimate emissions of Major Point sources
 - Use C₂H₆ to apportion thermogenic and biogenic sources of CH₄
 - Look at other tracers e.g. N₂O for source apportionment look at sources of HCHO
- NYC: measurement in upper manhattan

- CO_2 , CH_4 , H_2O , and T measured for 3.5 months
- STILT model helps attribute plumes to wastewater treatment plants
- SLC deployment overview
 - 2 systems
 - MIR DCS
 - NIR DCS

Relating Multi-Scale Plume Detection and Area Estimates of Methane Emissions: A Theoretical and Empirical Analysis - Sudhanshu Pandey

- Goal - to quantify methane emissions at increasingly finer spatial and temporal resolution
- Spatial resolution impact on plume detection
 - Coarser resolution instruments detect fumer plumes with a higher emission rate ($N=10 \rightarrow N \geq 1$)
- Emission rate distribution of plume observations
 - Both area emissions and plume counts scale with activity in O&G point source emissions
- Relation between plume sums and area estimates
 - $Y_{ics} = T_{ics} \cdot K_{is} \cdot N_{ic} \cdot X_{cs}$
 - i = plume instrument index
 - s = sector component index
 - c = emissions grid cell index
 - Y_{ics} = sum of plume emissions rate
 - X_{cs} = total emissions
 - $T_{is} = \epsilon [0, 1]$, plume fraction
 - K_{is} = periodicity correction
 - N_{ic} = sampling
- Area emissions eval using plume data
 - Strong agreement between plume and TROPOMI estimates after applying forward model
- Bayesian Plume assimilation
 - After plume assimilation, EDF inventory agrees with weekly tropomi flux inversion
 - Plumes have better spatial specificity than area estimates and thus provide better fine scale constraint

Results from NYC tower network - Roisin Commane

- NYC GHG network: CO₂, CH₄, N₂O
- Trees take up lots of CO₂ but some cause pollution
- Would need to reduce NO_x by more than covid lock down to not make more ozone
 - Planting oak would increase ozone
- Drop in CO and NO₂ emissions during covid
 - 36% drop in NO₂ in manhattan in spring 2020
- No annual trend in wintertime city scale ch₄ emissions
 - City scale methane emissions show strong seasonal trend
 - More in winter during the heating season, minimum in may,
 - Season trend much less in inventories if included at all
 - Drop in vehicle emissions of CO during COVID not accompanied by drop in ch₄, otherwise correlated!

Discussion -

Shobha - Does Baltimore have its own EJ tool, are you seeing gentrification signatures?

- Russ - number of articles about redlining that often have higher GHG/PM estimates - need to look beyond PM_{2.5} for environmental justice, black carbon is easiest to measure, coarse aerosol is difficult
 - Scattering vs absorbing from space?

Ken -

- Aimed at Kevin - it would be cool to have a system running in Baltimore, in the city, not in a coal mine, etc, can you do it if we were going to put effort to find sites?
 - Could probably figure out how to make it work, money to pay for the interpretation of the data
- Aimed at John - you have sites but we need funding
 - Ozone lidar will operate for free at goddard and low-cost to free at other site nearby (Beltsville)
- What's the data mgmt plan?

Steve - strong surface gradient for nox and other things, have you looked at that? What about sharp near surface gradients?

Glenn - we have the profiles, haven't looked at the data, does tempo see this? Surface sensors can help to some extent

Mike - Tempo will never get to the level that we need, for B200 and SEa Ray, maybe both aircraft would be good, can think of ways to put both to work together

Russ - NO₂ stratifies constantly, best hope for satellites is that it averages out in some way, short lived species are hard to deal with

Carsten - How to extend SARP to marcellus?

Glenn - eddy covariance doesn't like rain and marcellus is in the mountains, but we can try for a day

Ken - Liked the idea of using a boat, could we drive Mom and Pop (or something similar?) onto a boat and take it around a bay ?

- Joel - in 2018 we transported ozone lidar on a barge
- Mike - can put Pandora on a boat, has been done

Russ - looked at NIST's tower data and discover that you get the same amount of methane from marcellus as you do the pigs in NC, pay attention to agriculture

NESDIS Perspectives of AiRMAPS 2025 - Shobha

- GHG emissions from fires are significant
- Regionally, contribution of fires to GHG budget can surpass anthropogenic sources as was the case for 2023 canadian fires
- In urban areas dominated by FF combustion, NO₂ and CO₂ are co-emitted
 - Could we derive CO₂ emissions using NO₂ as a proxy?
- Can AiRMAPS help answer key AQ questions
- GeoXO constellation
 - Geo-west
 - Visible infrared imager
 - Lightning mapper
 - Ocean color
 - Geo- Central
 - Hyperspectral infrared sounder
 - atmospheric composition
 - Partner payload

- Looking for a payload to add to this satellite - cheap methane detection?
Decision by 2027
- Geo-East
 - visible/infrared imager
 - Lightning mapper
 - Ocean color

Methane and CO2 Observations with EMIT, AVIRIS-3 and AVIRIS-5 - Rob Green

- Imaging spectroscopy used by nasa
- >1000 methane plumes available through US GHG Center
- Working on algorithms to reduce false positive ch4 detection
- Dim surface backgrounds degrade detection of plumes
- Traditional emission quantification relied on coards summing across the plume
- Advanced methods reduce bias and uncertainty by 2x and 4x respectively

Carbon Mapper - Dan Cusworth

- Non-profit working to deliver actionable localized ch4 and co2
- Leads a public-private partnership to develop and deploy emissions detecting satellites
 - Tanager-1 launched august 16 2024, complete commissioning by jan2025
- Long term goal: scale to a full constellation to track 90% of high emitting ch4 and co2 point sources globally
- Work with industry, partners, gov, and other stakeholders
- Importance of detection limit and spatial coverage in assessing contribution from super emitters on basin level emissions
-

Discussion -

Carsten - how much do controlled releases make up the total emissions

Shobha - 50 tons per hour, we are talking to EPA about it, do they make a dent in the annual inventory? These releases are usually one off. The epa has certain plumes

Rob -

Steve - you're getting AOD on a much longer time average bases, how well do we understand the episodic nature of satellite AOD

- Shobha - My fear is that we're not removing the burning and it's a bio mass signature, as a result we're seeing an artifact in the data. EPA only regulates the anthropogenic source, just make sure you measure speciation

What's the mechanism that we can have carbon mapper do that we would like it to do if we can provide flights etc

Daniel - have a convo offline

Lesley - how do you (agencies) serve what carbon mapper wants to do?
Two way street

Anna - Shobha mentioned controlled release of a pipeline, can we coordinate controlled releases so that others can participate? Are people all aware about the effort that's going forward?

Barry- hoped that USGHGC could facilitate the sharing of info throughout groups that may be interested in

Shobha - have to be careful about media getting a hold of releasing so much methane, but have to let others know it's happening to use data

Ariel

Goals for coordinated experiment?

- Full mapping of landfills with ground monitors, aircraft in situ, aircraft remote sensing, commercial satellite tasking, etc
 - Heterogeneity of landfill methane emissions
 - Diurnal variation in methane emissions
- Gaps and needs not discussed
 - Simultaneous NO₂ and CO₂ observations over Baltimore
- Stakeholder needs, especially at the state level
 - NESDIS already working with MDE
 - NESDIS AA and MDE director of air program exchanged letters
 - NESDIS supporting EPA with GHG inventory verification

Seasonal type of sampling where you can map land fill and then if you fly aircraft etc, overpass of EMIT, sample from all different platforms and variability of methane from a particular source

Glenn - did the middle one (NO₂ and CO₂) so we should talk

- Re: landfills - which ones?, can be quite variable
 - Russ: Xinrong flights discovered there's a landfill near here that's a massive emitter, lawyers won't give permissions to work there, pick a testbed that's more accommodating. Great idea to evaluate landfills and use all methods to measure methane flux and then ask how to manage the landfill to minimize methane emissions, has to be a full year to capture seasonality. Simple things like soil coverage can have a big impact on methane source.
- Kevin: have been thinking about this as well - biggest thing is having a landfill that has bought in to the program and will provide information to you
- Andrew Thorpe - re: landfills: interest on EVIRIS side of things maybe talk to Dan Cusworth, either if we're looking at landfills or O&G, we've seen that

there's value in airborne and sat measurements in tandem, look for more opps to do within private and public partners

- Joel - MDE has a hard time regulating - Landfills cannot financially do a lot of the mitigation that's suggested - might be able to offer advice directly to the operations of the landfills
- Glenn - got reached out to by LA city personnel and did whole air sampling
 - Landfill tracers?
- Sudhanshu - is there any thought on looking at seasonal or diurnal cycles of gas fields?
 - Steve - wasn't aware of those cycles - passive remote sensing use sunlight
 - Amin - proposal being reviewed right now to look at basin level diurnal cycle - flights at 4 am midday, 5pm and repeat 2 days back to back and repeat at basin level twice, for 12 flights at each location. Utilize lidar to get early morning emissions in the collapsed boundary layer
 - Bridger photonics

Haven't heard Dams come up at all - policy relevance as they are in the court of appeals due to water quality issues

- Glenn - it'd be tough because it's such a small source, lidar might be better suited
- Amin - so long as we understand the meteorology we can measure downwind and see the signal
- Joel - becomes an interest to the state because it's an anthropogenic source

Russ - What's on the front burner for MDE

- Joel - climate aspect - meet climate goals and climate program, carbon neutrality; climate is really driving things, let's use the climate goals to figure out the AQ benefits are going to be; trying to disentangle the smoke from o_3 + PM attainment; environmental justice
 - Multiple scales

Ben Nault - From an EJ side - having an open house through BSEC, maybe Morgan State or JHU and talk to the community about what they want to learn

Shobha - would be nice for the funding managers to show up

Carsten - heard a lot about what people want to do - where can all efforts be posted?

Ben has a spreadsheet who has been soliciting information, but do we need something on a website through USGHGC or a NOAA website or CSL?

- Can be both internal and external
- GHGC is happy to take that action of airborne planning, make public so people can see what's going on and contribute, community events should be public

How do you translate that to flight planning?

For AEROMMA and STAQS, we went through monthly to bi-weekly meetings and everyone was available and was updated to the website

- Planning horizon for 2025 if we were getting the P3 of c130 could change things, but planning is usually a few months before, regardless should always be open and transparent

If there are specific requests from MDE what's the specific timeline to get to feds (from air campaign perspective)

- Glenn - send us coordinates, think about science later - doing anything fancy is tough in the DC restriction area, baltimore is more straightforward
- We need early lead time on scheduling for people
- Things outside of June and July would be great for both a scheduling perspective and also maybe addressing seasonal scale questions

John Worden - will there be mechanisms for pre and post flight analysis for methane - are there websites we can push analysis through or do we need to attend flight plan meetings? E.g. Planning measurements around expectations

- Steve - part of the flight planning process - as far as the data goes, we will make prelim data available to everyone in the project before quality control
- Lesley - follow up to this is a modeling meeting - will probably have a better answer

JW - just involved in a NASA satellite needs working group, is there discussion about acquiring ghgsat data?

- Shobha - yes

Roisin - some effects are pressure dependant - off gassing sometimes happens post meter in NYC so mat happening in winter in Baltimore as well

Kevin - additional possibilities for funding? Where to find that information?

- Steve - AC4 call?
- Shiv- For 3 year projects usually, start from september then 3 years after,

Lesley - expensive to fly lots of planes lots of places - are there opportunities where you can amplify impact for a relatively low investment?

Ben - Peter Dicarlo has been talk to silvia and is aware and open to funding BSEC programs and will be available in the summer - NSF atmos chem and comp - no call, open

Joel - curious is this group able to assess what we do about the problem itself - once we find it then what we do? Best way to reduce landfill methane?

- Russ - cali colleagues have demonstrated how garbage steepness and amount of soil has impact on how much methane is released
- Aaron Marholis - Elisa from EDF has written paper on that, IPCC has written that landfill methane mitigation is cheap

Gaps in policy implementation once we find and quantify methane

John Worden - causes of methane releases are very heterogeneous,

Data Sharing Discussion-

Broad questions - lot of actors that will be in the same place/same time - whats the extent or mechanism we should make the various data projects available to each other in the context of a larger campaign -

Steve- NOAA CSL is happy to host data

Barry - NASA is happy to as well

Lesley - approach of the USGHGC portal is having partner agencies host their data but allow them control, but trying to bring data sets together for shared analysis capabilities

BEn - BSEC and CoURAGE are making it so that if you want to host data on another site you can find it through BSEC or CoURAGE through a cross link

DOE will use icartt as much as possible

Presentations will be posted as pdf's and emailed around

Papers Mentioned- 8

- JPL paper on Canadian fires
- Karacan et al 2024
- Maasakers, Mcduffie et al 2023
- Nesser et al 2024
- Christiansen et al - Constraining long term nox emissions
- Dickerson et al JAWMA
- DOI - 10