DISCOVER-AQ Breakout on GEO-CAPE Studies:

North American Atmosphere and Ocean

Temporal Evolution (1hr) and Spatial Morphology (10km)

Mike Newchurch

Purpose and Outcomes

- This day is devoted to intense breakout sessions intended to organize and coordinate research responsibilities, establish collaborations, and identify areas lacking sufficient attention. These breakout sessions should provide opportunity for brief presentations on relevant work that is planned or ongoing.
- Outcome: Take names and …
  - **Identify work started**
  - Identify intended work
  - **Identify missing work**
  - **List manuscript titles**
  - Identify special section m/s.

GEO-CAPE Research Related to DISCOVER-AQ: Summary

Laminae characterization

Vertical sensitivity and accuracy

DISCOVER-AQ constraints on nature runs for GEO-CAPE OSSEs

Lightning-Nox-O3 radiative forcing

NO2 diurnal variation

High-spatial-resolution NO2 morphology

Gas/aerosol retrieval separation with PANDORA, AERONET, et al.

Atmospheric spatiotemporal variability and climatology

Aerosol column/PM2.5 surface relationships

AQ model forecast evaluation

Vertical information content and retrieval: ACAM

GEO-CAPE Ocean and Interdisciplinary Science

- Carolyn Jordan
- Maria Tzortziou (pronounced Georgio)

A Research Initiative for Ground-based Lidar Profiling of Tropospheric Ozone

Background

- Interagency initiative started by NASA R&A 7/2011
- NASA providing funding to modify existing instruments, begin/continue acquiring data, archive data, and facilitate data usage
- NOAA and EPA providing funding for instrument conversion, deployment, data analysis, and policy assessment
- Coordination with regional/local organizations to conduct specific campaigns and analyses
- Addresses fundamental air-quality science questions and supports GEO-CAPE mission science studies

Science and Goals

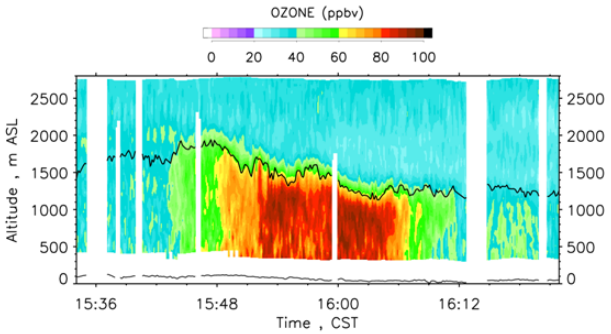
- Provide frequent tropospheric O_3 and aerosol profile observations for use by the GEO-CAPE science team
- Discover new structures and processes at the PBL/FT boundary, particularly their diurnal variation
- Foster use of these high-resolution O_3 and aerosol observations to improve air-quality models
- Exploit synergies with EV-1 DISCOVER-AQ and existing networks, including regulatory surface monitors and thermodynamic profilers
- Improve understanding of relationships between O_3 and aerosols aloft and surface O_3 and PM values
- Advance understanding of processes controlling atmospheric regional background (including STE and transport) to prepare for the GEO-CAPE era

FY12 Objectives and Deliverables

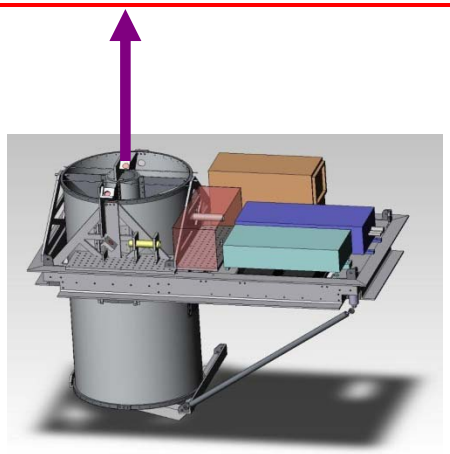
- Complete hardware modifications for tropospheric configurations, including mini-receiver or scanning system for improved near-surface capabilities
- Deploy NOAA ESRL mobile TOPAZ system for 1-month winter 2012 O3 field study
- Continue operating JPL system at TMF site on NDACC schedule and test near-field mode
- UAH system to join NDACC, operate on NDACC schedule, and test upgraded system
- Operate LaRC mobile system at CAPABLE supersite for 1 month during summer 2012
- Acquire initial in-lab observations with GSFC system
- Determine common data protocol and demonstrate ingest of a sample from each instrument

NOAA/ESRL Mobile Ozone Lidar

Since 2006 NOAA has operated a downward - looking ozone lidar in a Twin Otter aircraft to characterize horizontal and vertical structure of ozone for air quality research.

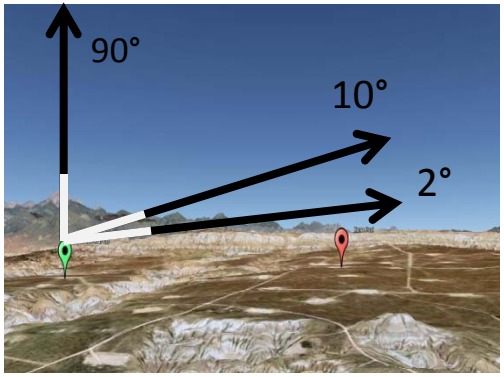


The figure shows a cross section of the Houston urban plume observed from the Twin Otter. The lidar produces profiles of ozone with 90 m vertical resolution, 500 m horizontal resolution, and 1-10 ppb precision (depending on SNR).



The NOAA lidar incorporates a state-of-the-art Nd:YLF pumped Ce:LiCAF tunable ultraviolet laser. Three wavelengths are produced, enabling dual-DIAL ozone measurements . For surface-based profiling, the telescope on the lidar has been remounted to facilitate zenith pointing. Operation from a stationary, surface-based platform will permit extended averaging times to increase the range and improve the precision of the measurements relative to airborne observations

The modified lidar was installed in a truck in January 2012 to permit easy transport and operation at remote sites. A two-axis scanner has been constructed and installed on the roof of the truck. By using the scanner to direct the beam to low elevation angles measurements can be obtained to within a few meters of the surface. Azimuth scanning will provide information on horizontal structure of ozone.



The ground-based ozone lidar is being deployed in the Uintah Basin study to investigate high wintertime ozone levels observed in the oil and gas fields of northeast Utah . Because very thin boundary layers created by stable conditions are thought to be a contributing factor to the high ozone, the lidar will be scanned to provide measurements to within a few meters of the surface. Following the study, additional modifications and measurements will be carried out in Boulder.

2 February 2012

DISCOVER-AQ Related GEO-CAPE publications in preparation

4: Laminar ozone structures and their relationship to column and surface ozone	Newchurch, Lihua Wang, Pierce
5: Accuracy and Sensitivity Studies for GEO-CAPE	Chatfield, Newchurch, et al.
6: Multi-variate OSSE studies for GEO CAPE using DISCOVER-AQ constraints on WRF/CMAQ nature runs.	Daniel Jacob and Peter Zoogman, Pickering, Chatfield, Eldering, Natraj, Kulawik, Neu, Chance, Liu, Edwards.
13. Radiative Forcing Associated with Upper Tropospheric Ozone Enhancements Due to Lightning Nox	Ken Pickering, Melanie Follette-Cook, Lihua wang, Mike Newchurch
20. Observed and Modeled Diurnal Variation of Tropospheric NO2 using GOME-2 and OMI	Kondragunta, Beck (NOAA/NESDIS), Krotkov, Celaria(GSFC)
21. Analyses of High Spatial Resolution Measurements of NO2 columns: Planning and Imagining the GEOCAPE Revolution	Cohen et al.

23: DISCOVER-AQ, satellite (OMI), and ground based (PANDORA, AERONET, MFRSR) measurements of trace gases and aerosols for measurement accuracy, aerosol interference, and radiative effects	(Nick Krotkov, Lok Lamsal, Antti Arola)
24: On the relationship between surface, near-surface, boundary layer, and free tropospheric atmospheric conditions related to air quality: characterizing the spatio-temporal variability seen in D-AQ	Newchurch and Wang
25: DISCOVER-AQ, CalNEX, and CalARCTAS trace-gases and aerosols climatology.	Bob Chatfield, Ken Pickering
26: Evolution of the relationship between column AOD and surface PM during the day: Analysis of Discover AQ data for GEO-CAPE study	Qian Tan, Mian Chin, Ken Pickering, Allen Chu
27: Evaluating the efficacy of current forecasting models processes using DISCOVER-AQ aircraft, surface, and ozonesonde data.	Brad Pierce, Jim Crawford, Ken Pickering
28. Vertical information content and retrievals from ACAM	Liu and Janz