Preliminary Results from the First Atmospheric Study on the NASA Global Hawk Unmanned Aircraft System (UAS)

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Global Hawk Pacific 2010 (GloPac) Objectives

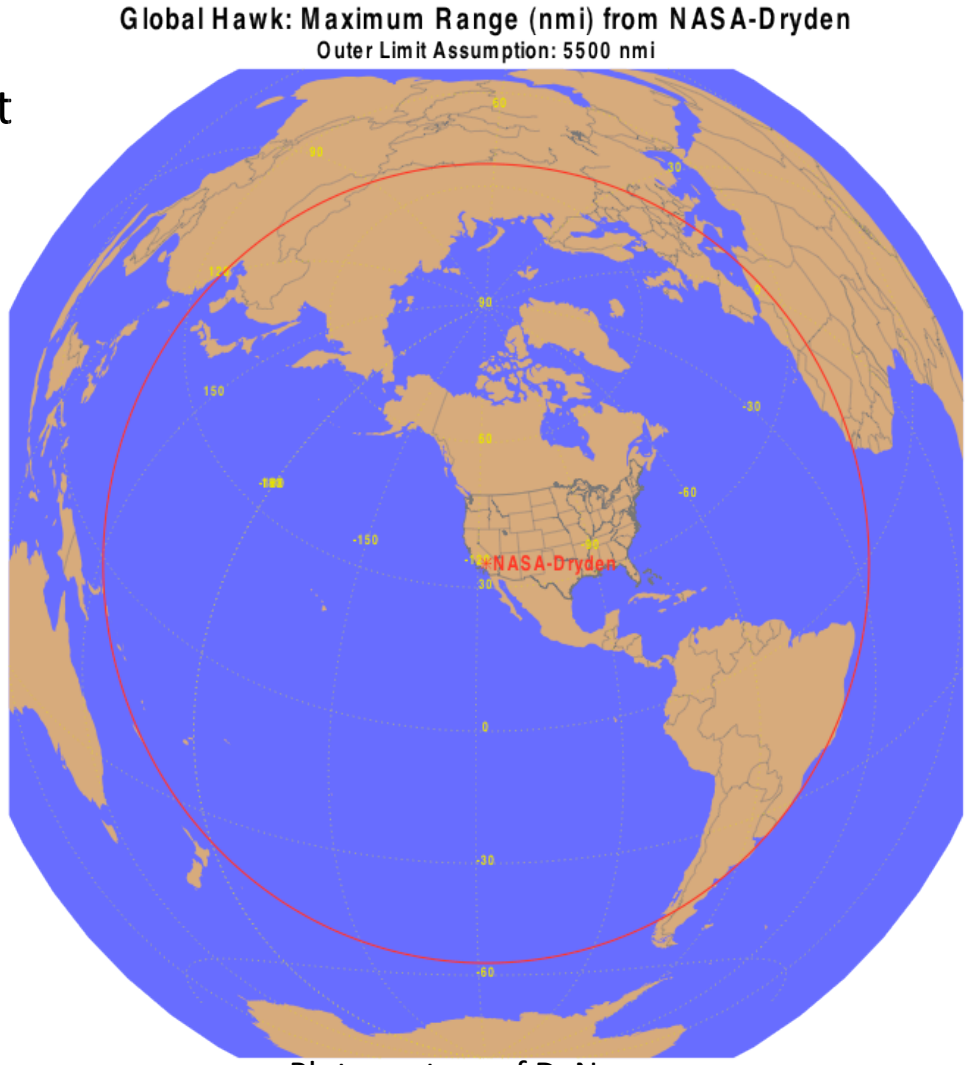
- First demonstration of the Global Hawk unmanned aircraft system (UAS) for NASA and NOAA Earth science research and applications
  - Development of science-operation protocols & procedures
  - Long duration Pacific Ocean and Arctic flights
- Exploration of trace gases, aerosols, and dynamics of remote upper troposphere and lower stratosphere regions
  - Aura satellite instrument validation
  - Sample Arctic vortex fragments, and aerosol plumes
- Risk reduction for future Global Hawk missions

  - NASA GRIP hurricanes study (Aug-Sept 2010)
  - Pending Earth Venture (EV-1) proposals

Courtesy of Co-project scientists (David Fahey NOAA/ESRL and Paul Newman NASA/Goddard.)

The NASA Global Hawk UAS Platform

- Autonomous drone, single jet engine, 44.4 ft (13.5 m) long, 15.2 ft (4.63 m) high, wingspan 116.2 ft (35.4 m)
- Max. Altitude 65,000 ft (17.1 km)
- Max. Range 11,000 nm (20,400 km)
- Duration 30+ hours
- Payload 1,500 lbs. (680 kg)



Plot courtesy of D. Nance

GloPac Payload

Stratospheric tracers		
H_2O	ULH	Herman, JPL
O_3	Ozone	Gao, NOAA ESRL
Long-lived gases		
N_2O, SF_6, CO, H_2, CH_4	UCATS	Elkins, NOAA ESRL
Aerosols		
NMASS (0.04 – 0.60 μm)	NMASS	Wilson, Denver U
FCAS (0.09 - 1 μm)	FCAS	Wilson, Denver U
UHSAS (0.05 - 200 nm)	UHSAS	Kok, Baumgardner
Meteorological parameters	MMS	Bui, NASA Ames
UV-Vis spectrometer (column O_3, NO_2)	ACAM	Janz, NASA GSFC
Cloud properties (downward lidar)	CPL	McGill, NASA GSFC
Microwave Temp Profiler (MTP)	MTP	Mahoney, JPL
HD-VIS (camera)	HDvis	Myers, NASA Ames

In situ sensors, remote sensors

(Payload investigators from government agencies, universities, and private companies.) Slide courtesy of Fahey and Newman, co-mission scientists.

GloPac Flight Tracks (Three of Five)

April 7th
14 hrs, 4600nm, 61200 ft

April 13th
24 hrs, 8000nm, 62300 ft

April 23rd
28.6 hrs, 9700nm, 65200 ft

Subtotal: 66.6 hrs

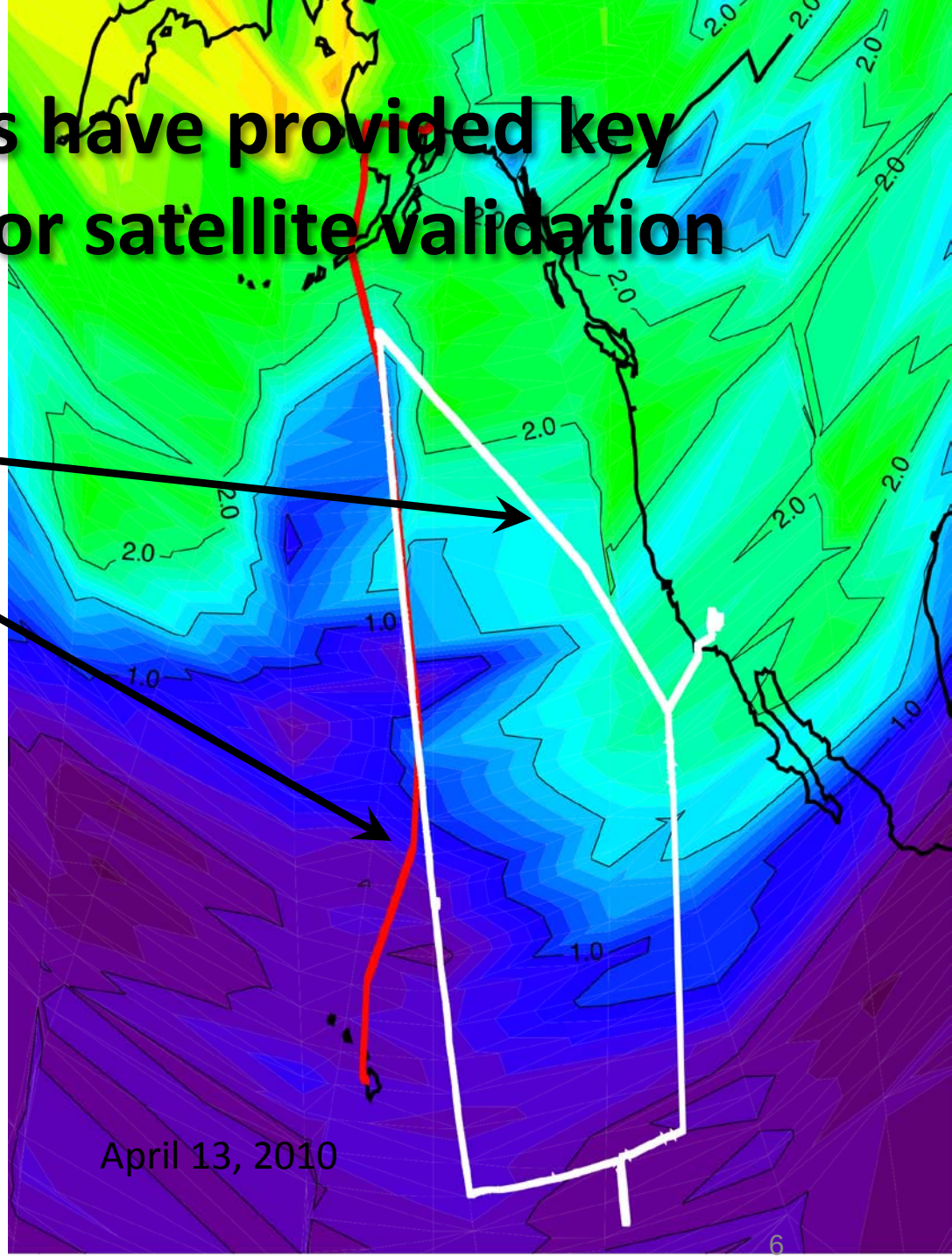
(2 Apr. test flight: 6 hrs)

GloPac flights have provided key observations for satellite validation

GloPac GH track in white

HIPPO NCAR GV in red

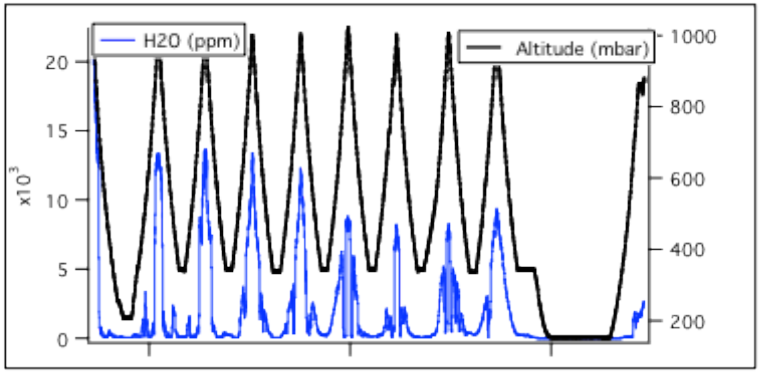
Aura satellite track follows the western side of the GloPac flight.

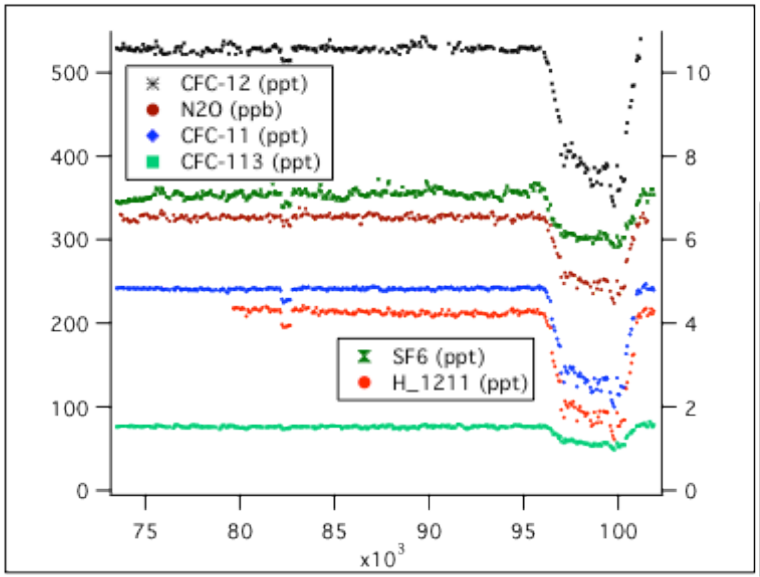


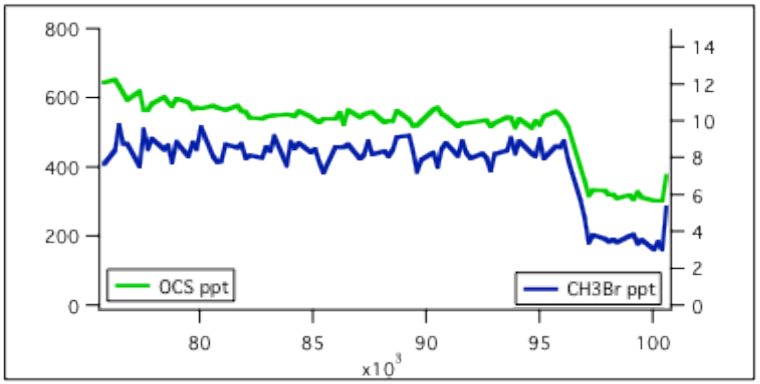
Ozone data from Microwave Limb Sounder (MLS), figure courtesy of Dr. Karen Rosenlof

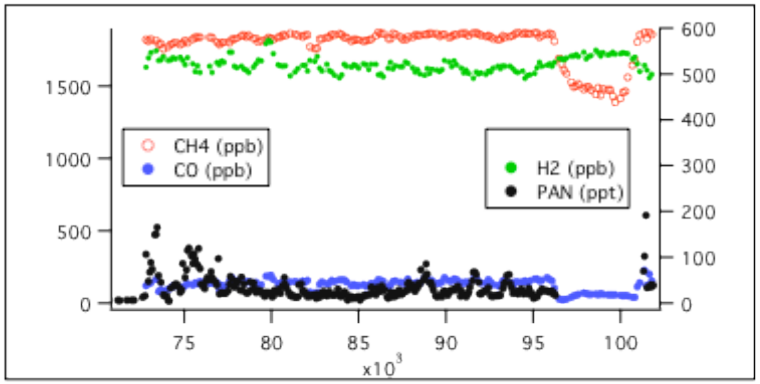
HIPPO/3 Kona, HI to Anchorage, AK 13 Apr 2010

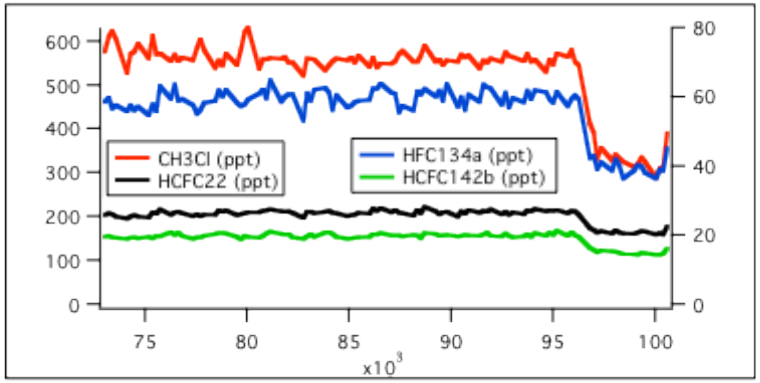
PANTHER data on NSF GV.
HIPPO-3
Research Flight 9
Kona HI <-> Anchorage AK.
Coinsident with Global Hawk near mid-flight.
CCG PFP data was also taken.









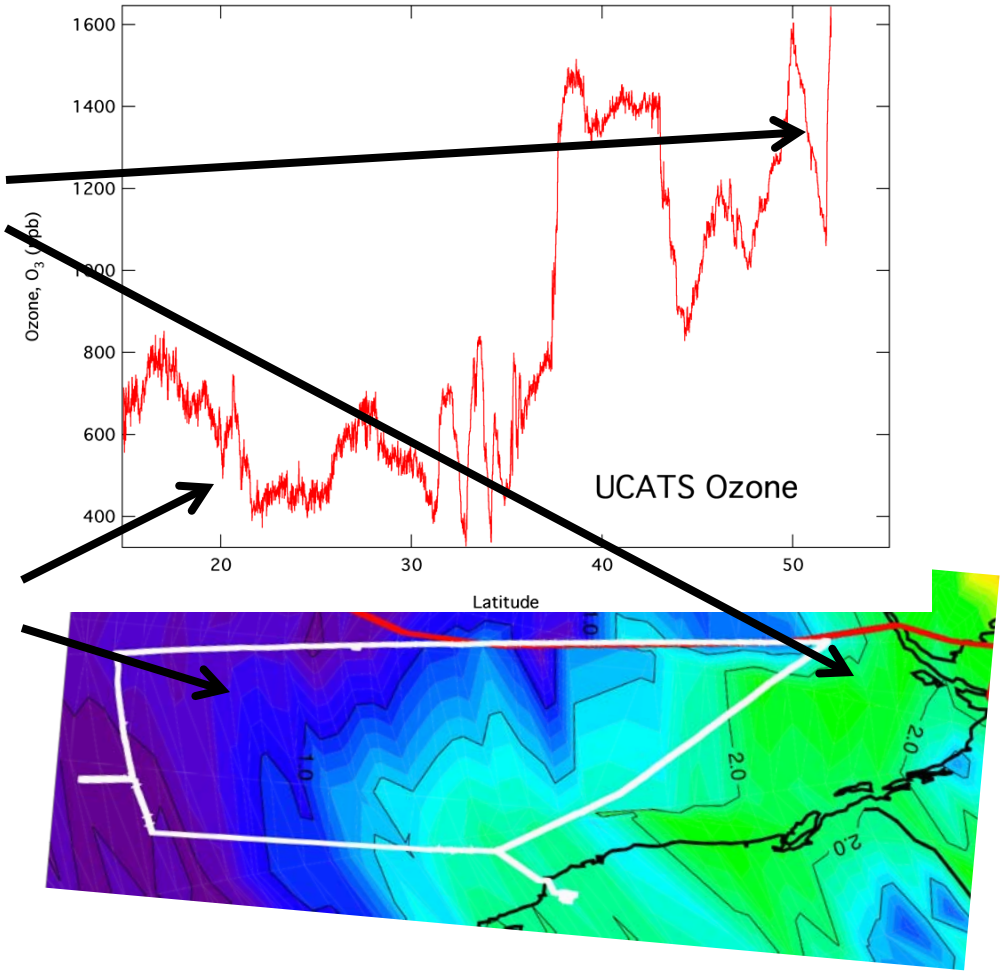


Fred Moore, CIRES/ESRL, PANTHER instrument

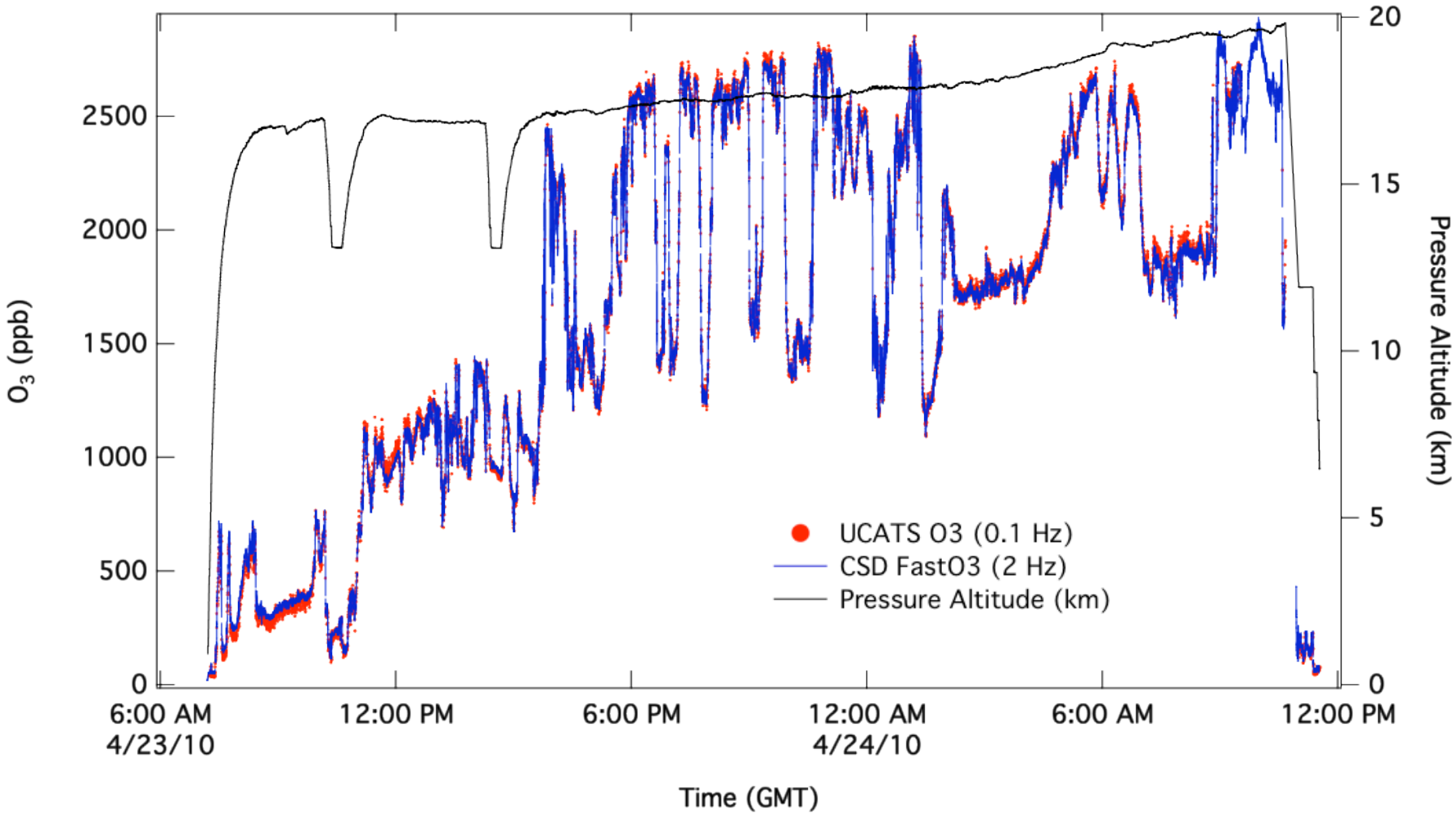
The NOAA UCATS instrument provides data that can be directly compared to Aura MLS

AURA MLS captures high ozone in the northern part of the track in agreement with UCATS ozone

AURA MLS captures low ozone in the southern part of the track in agreement with UCATS ozone

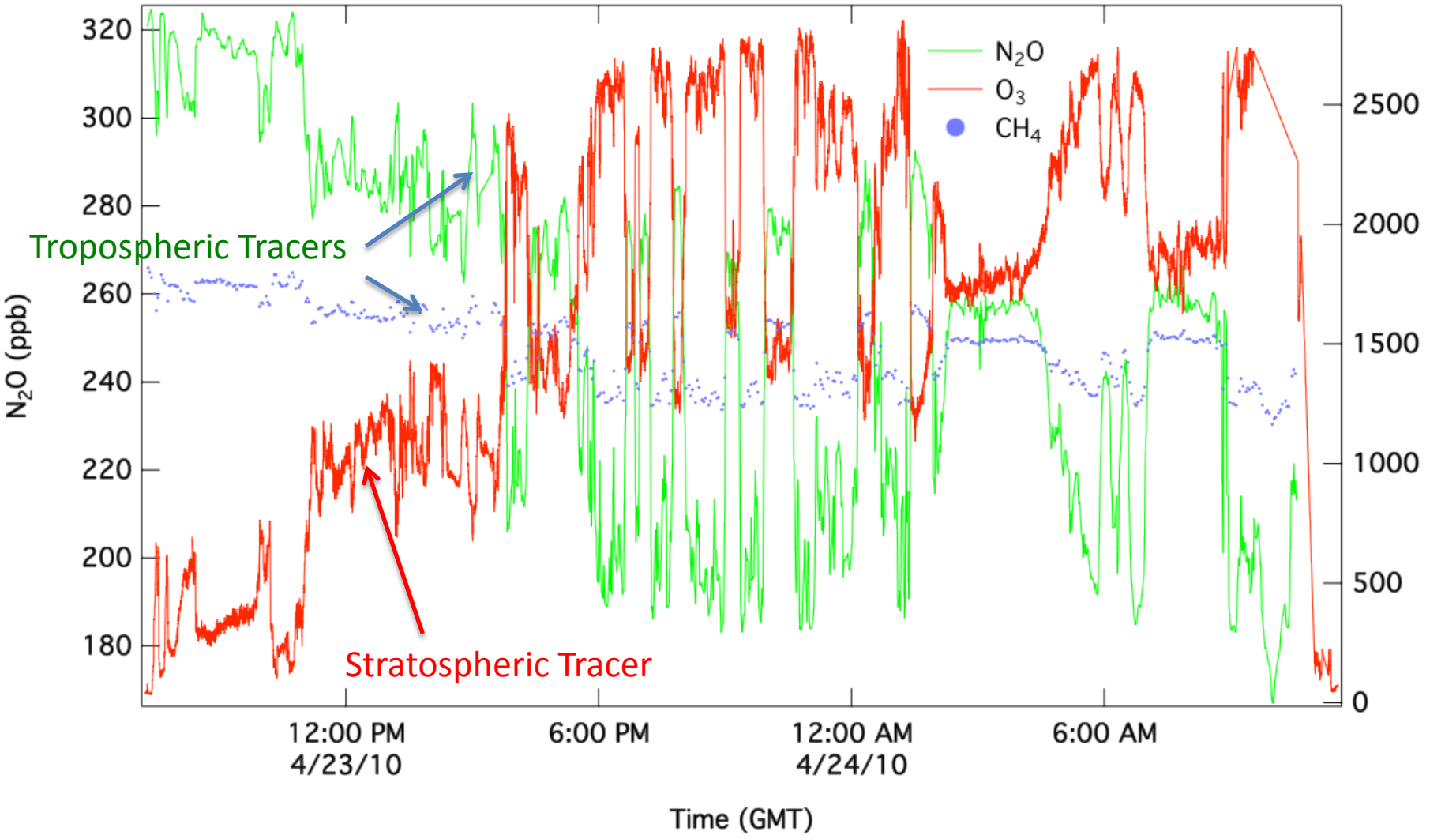


Ozone Comparison 2010 Apr 23



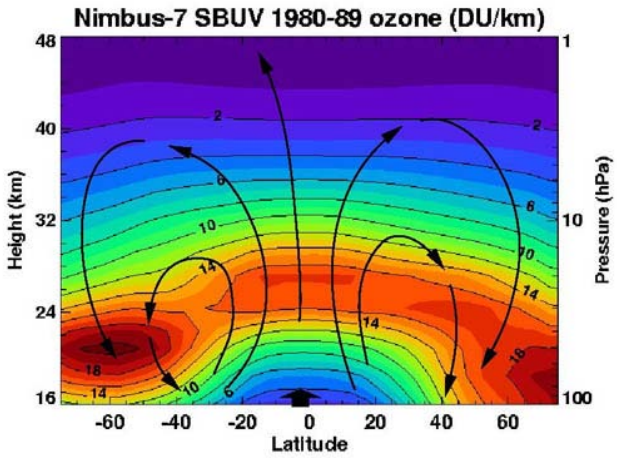
Preliminary CSD results from R. Gao

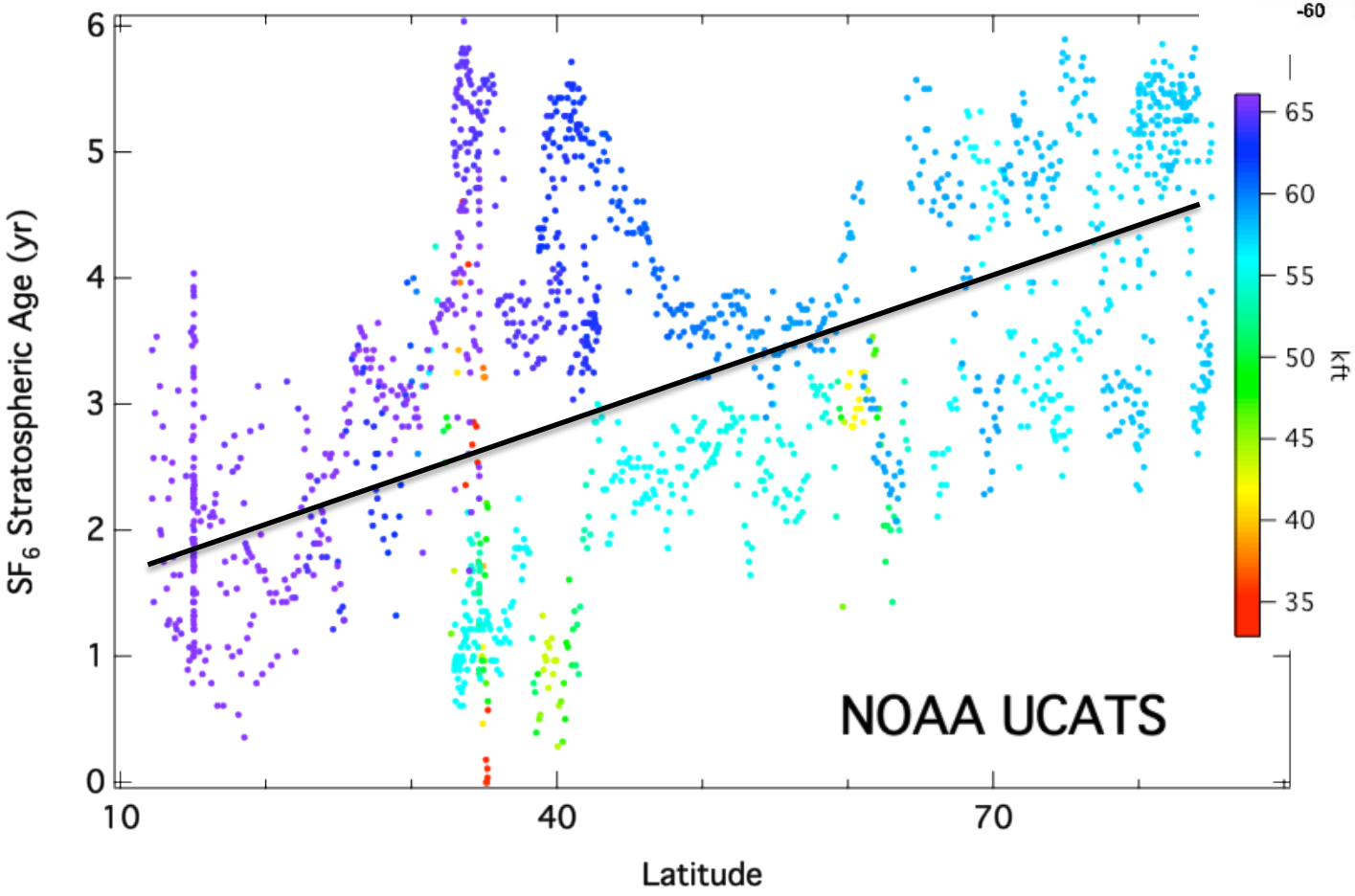
Tropospheric (N_2O & CH_4) and Stratospheric Tracers (O_3)



Latitudinal Profile of Stratospheric Age

Brewer-Dobson Circulation: Age Increases with Latitude



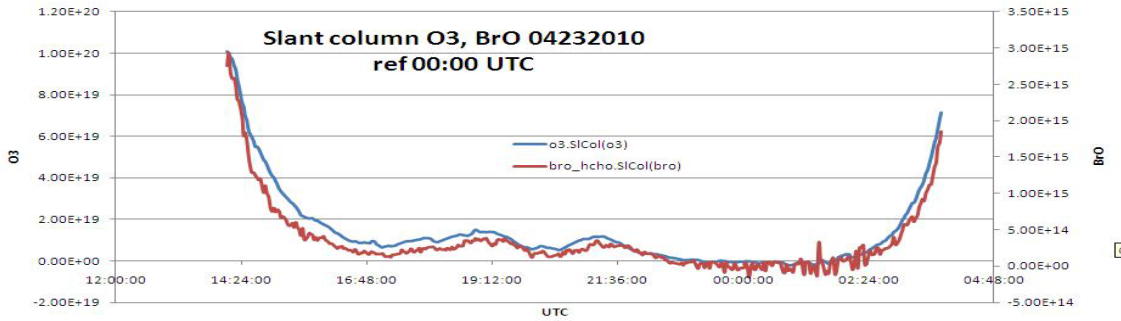


Sea Leads (77 N near Barrow, Alaska)

- Results from ACAM (Scott Janz NASA/Goddard) similar to OMI instrument on Aura satellite.

- ACAM camera can quantify sea ice and leads distributions.

- Measures slant column densities of BrO and O_3 (Preliminary data)



Summary of GloPac

- Huge Potential for Atmospheric Science, Profiles and Endurance.
- Hurricane, Climate, Pollution, Polar Sea Ice, Forest Fires, Emergency Surveillance (Volcanoes, Oil Spills,

Takeoff 7 Apr 2010-Questions