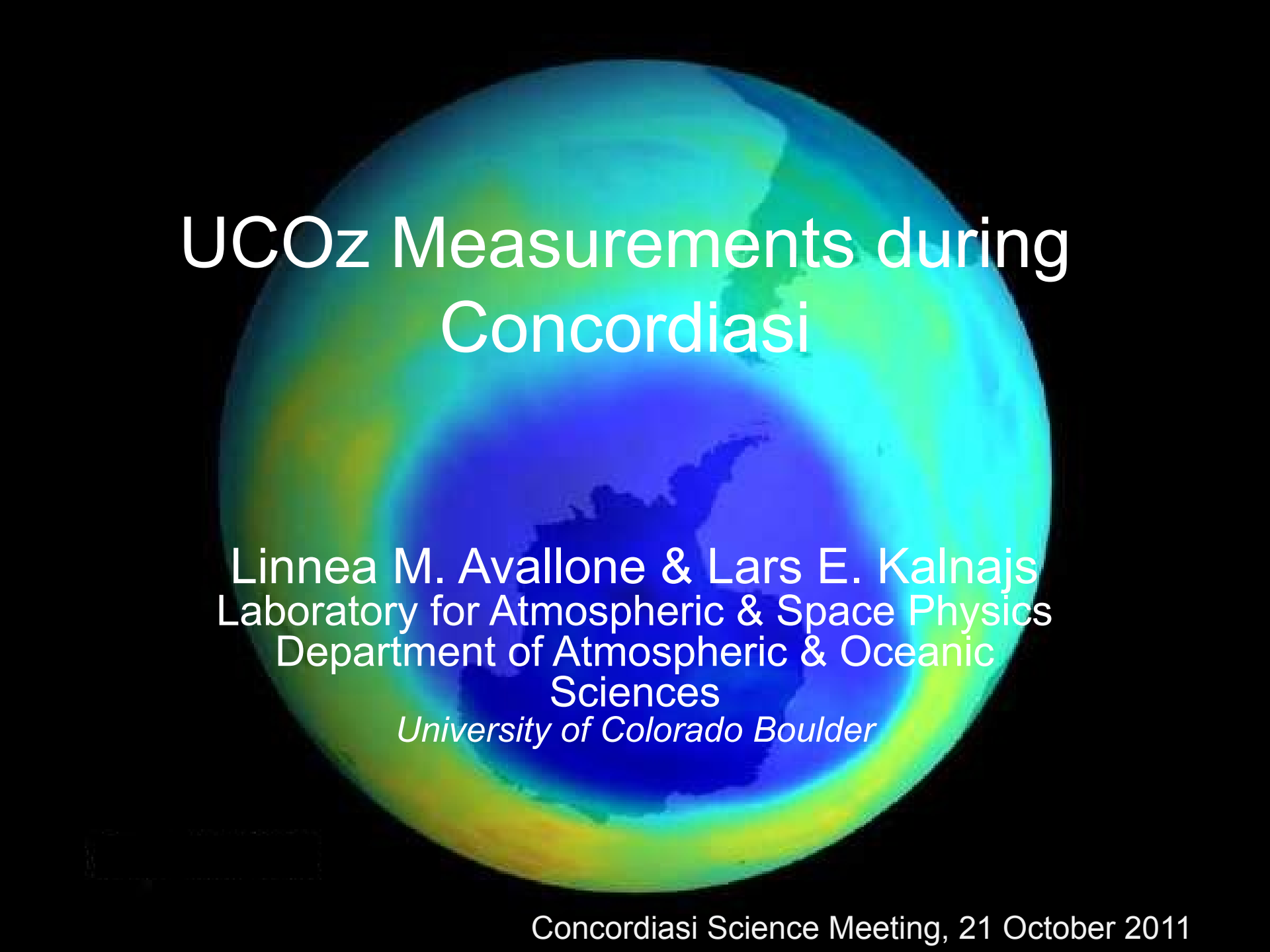


UCOz Measurements during Concordiasi

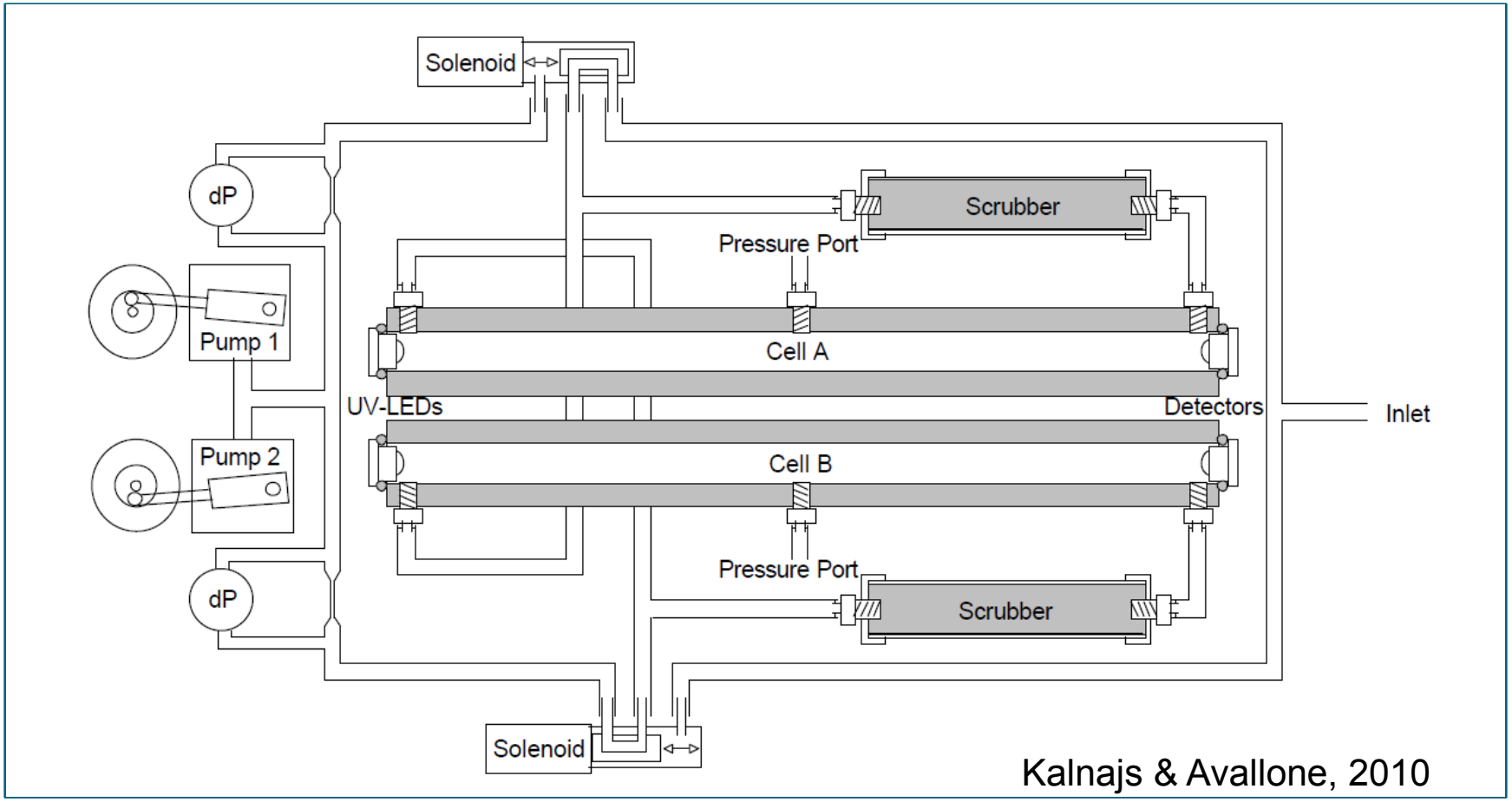
Linnea M. Avallone & Lars E. Kalnajs
Laboratory for Atmospheric & Space Physics
Department of Atmospheric & Oceanic Sciences
University of Colorado Boulder

Concordiasi Science Meeting, 21 October 2011

Outline

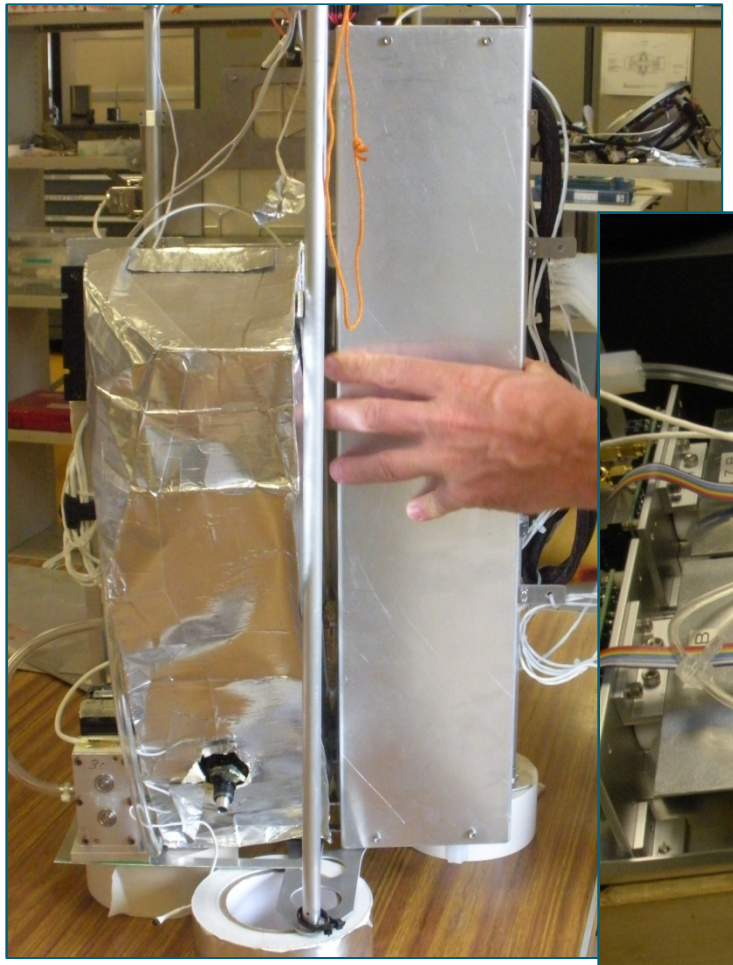
- UC Ozone Instrumentation & Calibration
- UCOz data from Concordiasi
- Post-mission data validation
- Preliminary analyses & future plans

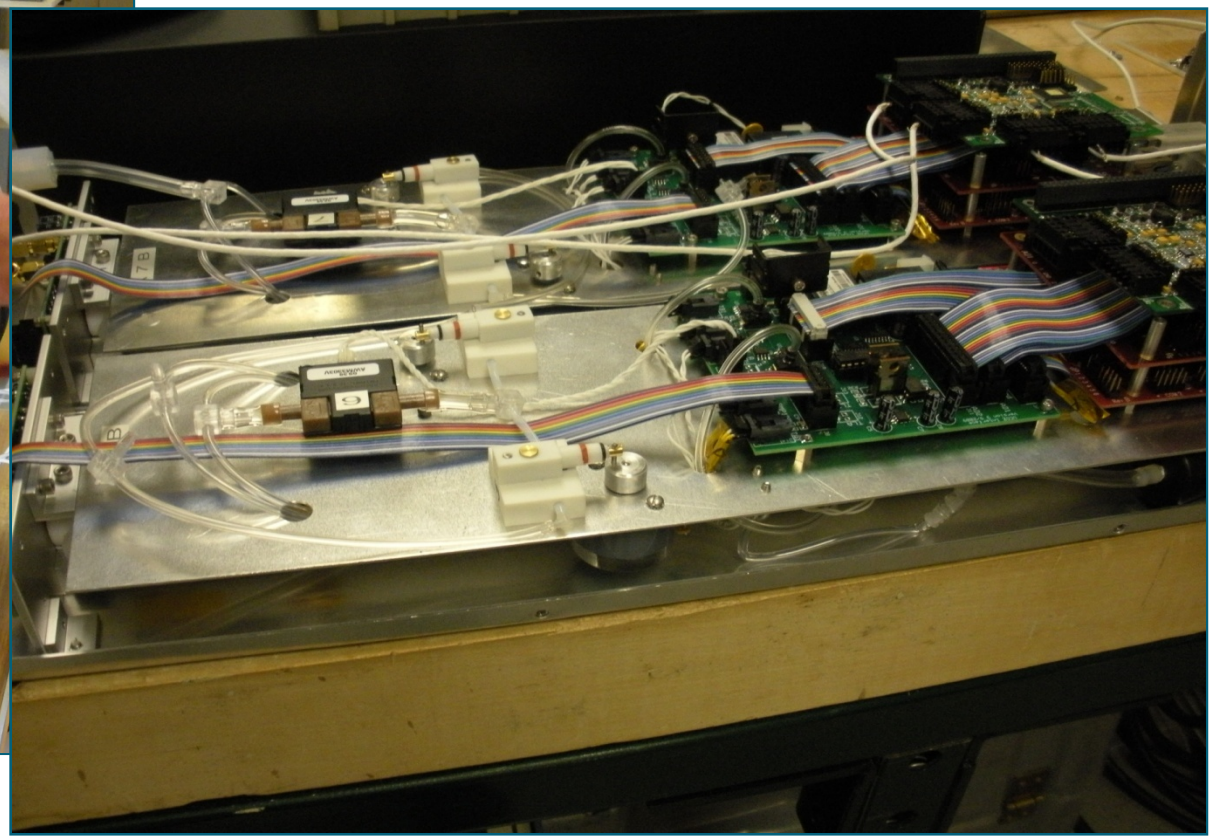
UCOz Instrument Design



- UV absorption at 254 nm – Beer-Lambert Law
- UV-LED light source – low power
- Fully redundant detection and flow system components

UCOz on Gondola and in Lab

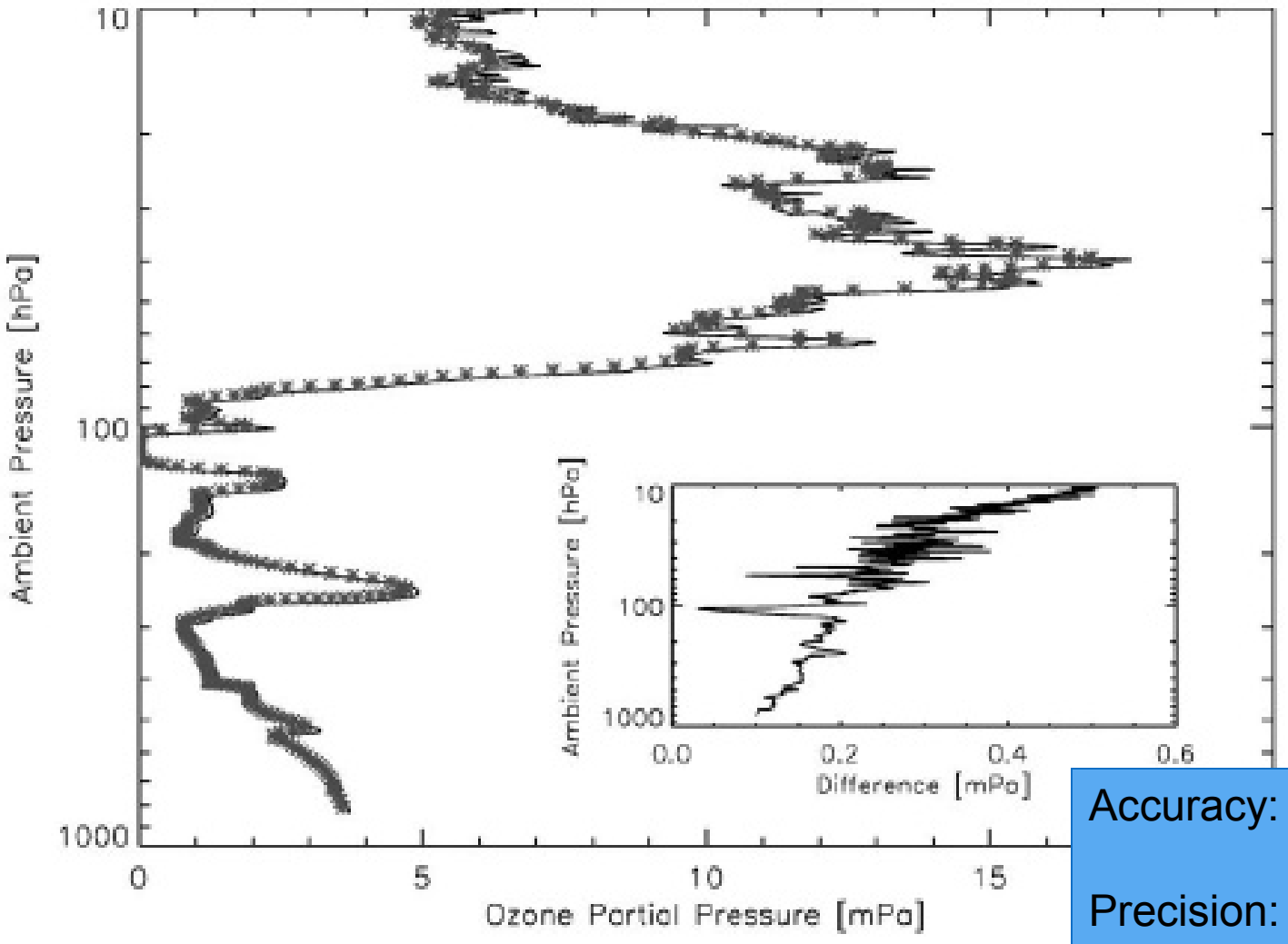




Instrument Design Details

Weight	2.8 kg
Power	7 W peak/2 W average
Cost per instrument	About $4000
Data transmission	6 kbyte/day
Sampling period	2 min every 30 min
Accuracy (designed)	7 – 10 %
Precision (designed)	<1 ppb in 10 sec

Pre-mission Instrument Performance Testing

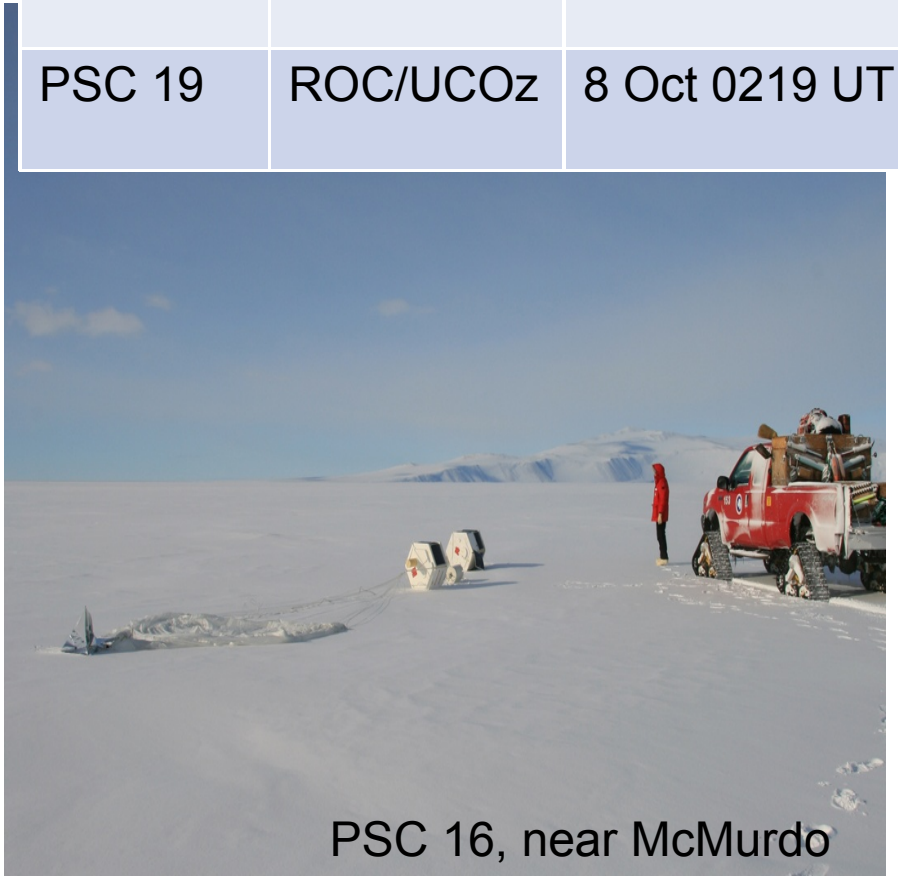


Accuracy: 7 – 10 %

Precision: 0.7 ppb @ 10 sec

Launch Statistics

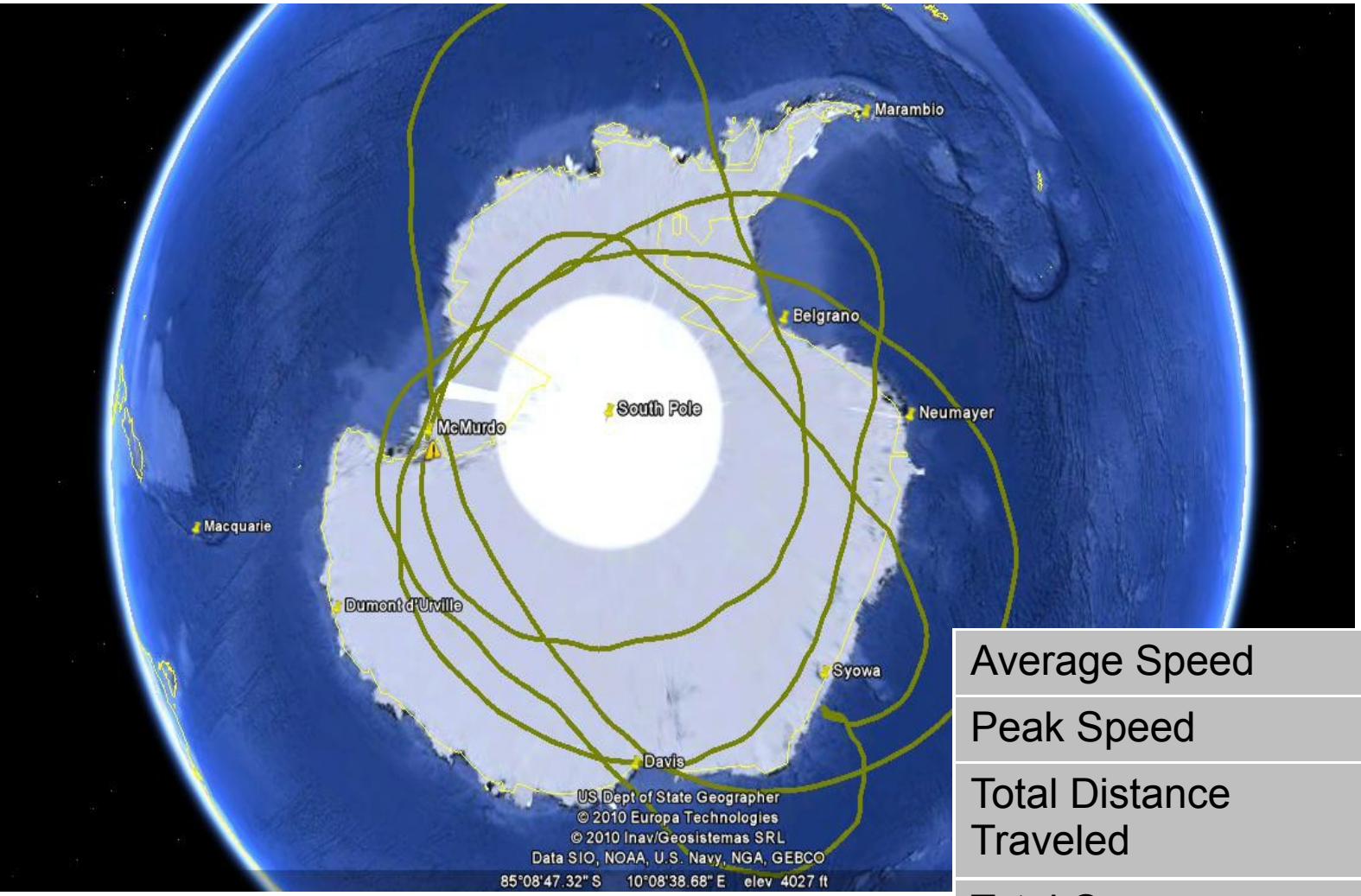
Gondola	Payload	Launch Date	Last Data Received	Termination
PSC 16	WPC/UCOz	11 Sep 0300 UT	4 Oct	11 Oct, recovered
PSC 17	WPC/UCOz	14 Sep 0150 UT	15 Oct	10 Dec, recovered
PSC 19	ROC/UCOz	8 Oct 0219 UT	23 Nov	24 Dec



PSC 16, near McMurdo

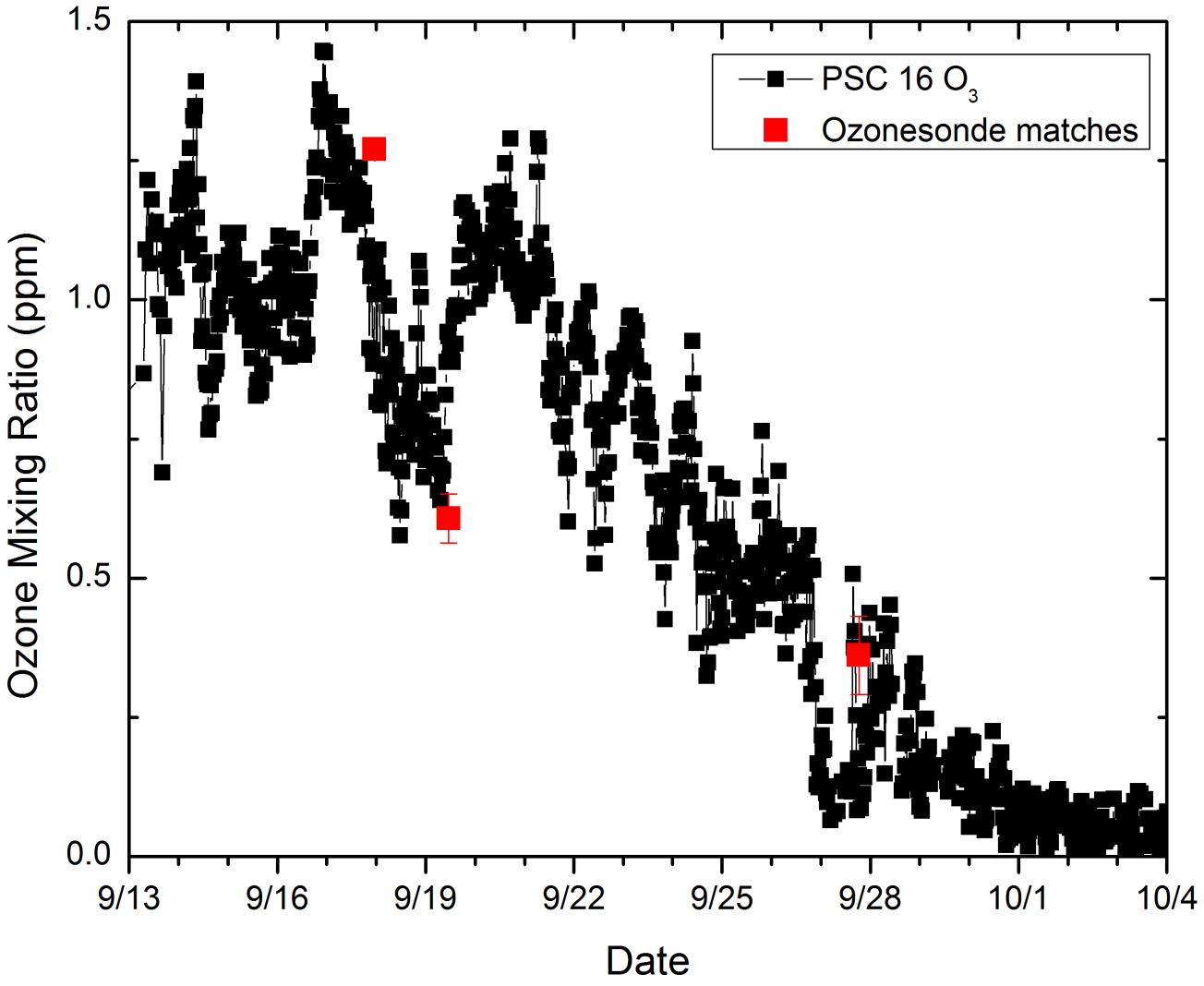
PSC 17 in Tasmania

PSC 16: 11 Sep – 4 Oct 2010



Average Speed	66.2 km/hr
Peak Speed	129 km/hr
Total Distance Traveled	34565 km
Total Ozone Measurements	1009
Average Spatial Resolution	34 km

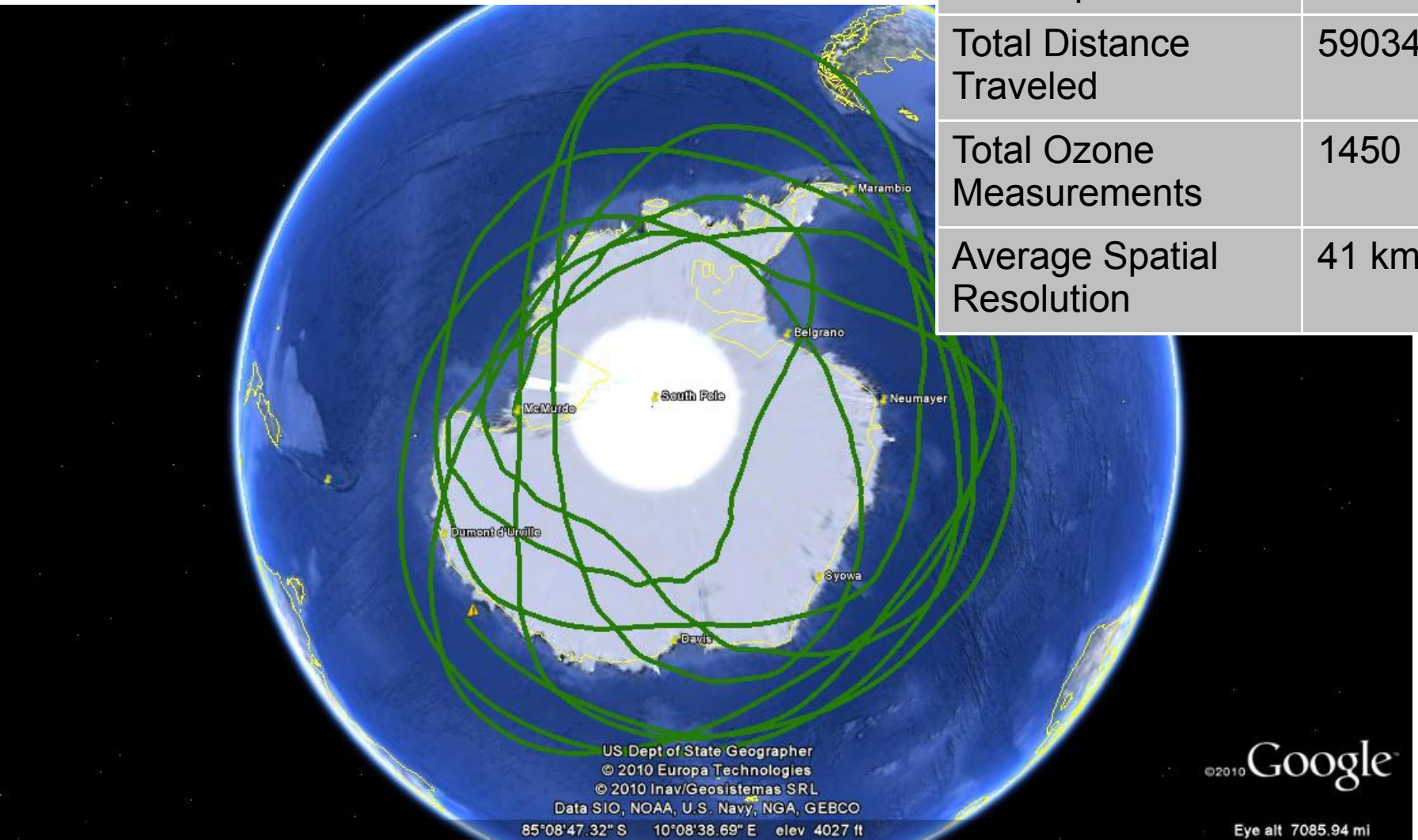
PSC 16 Observations



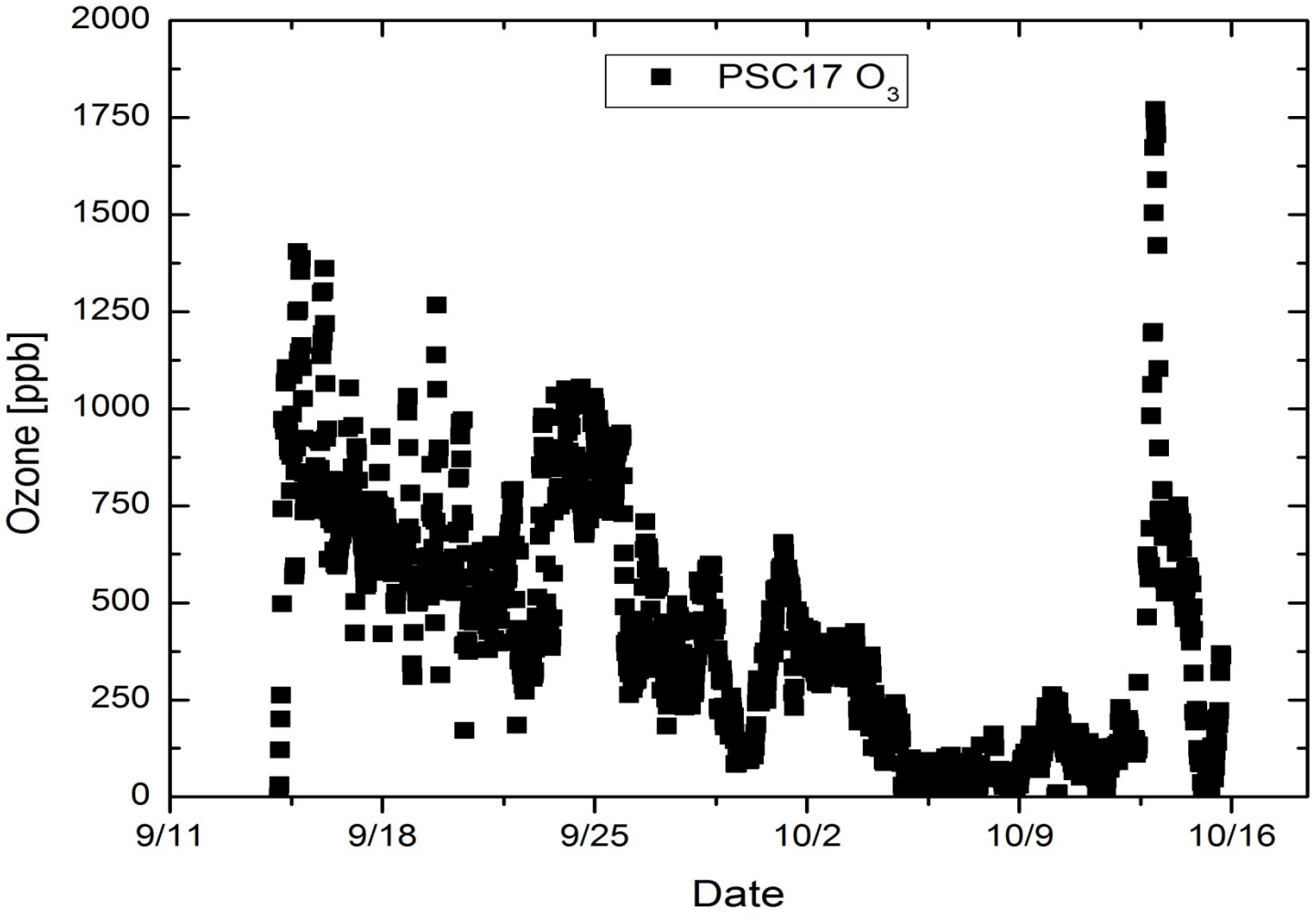
PSC 17: Polar Vortex & Midlatitudes

14 Sep - 15 Oct 2010

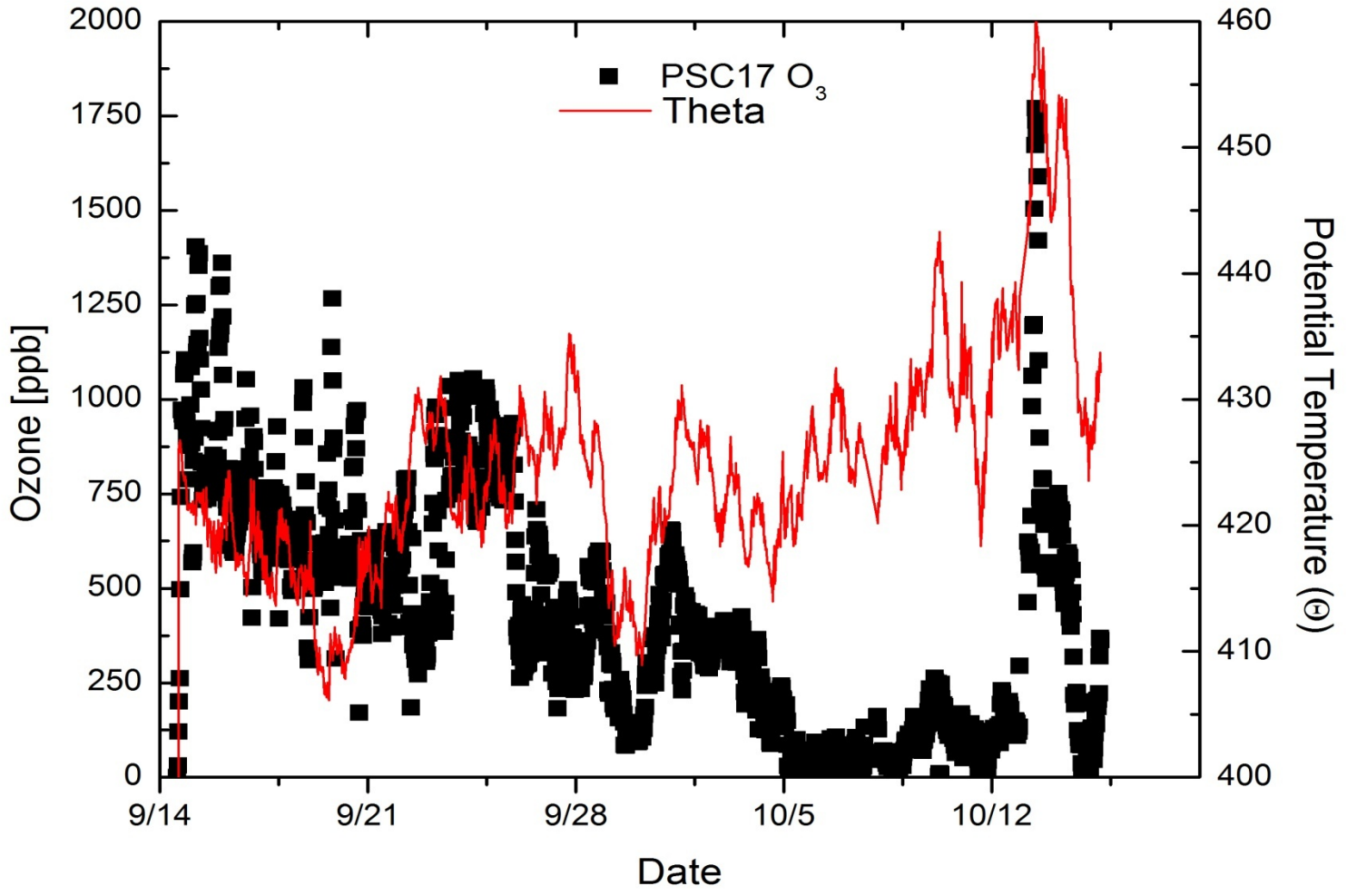
Average Speed	79.7 km/hr
Peak Speed	209 km/hr
Total Distance Traveled	59034 km
Total Ozone Measurements	1450
Average Spatial Resolution	41 km



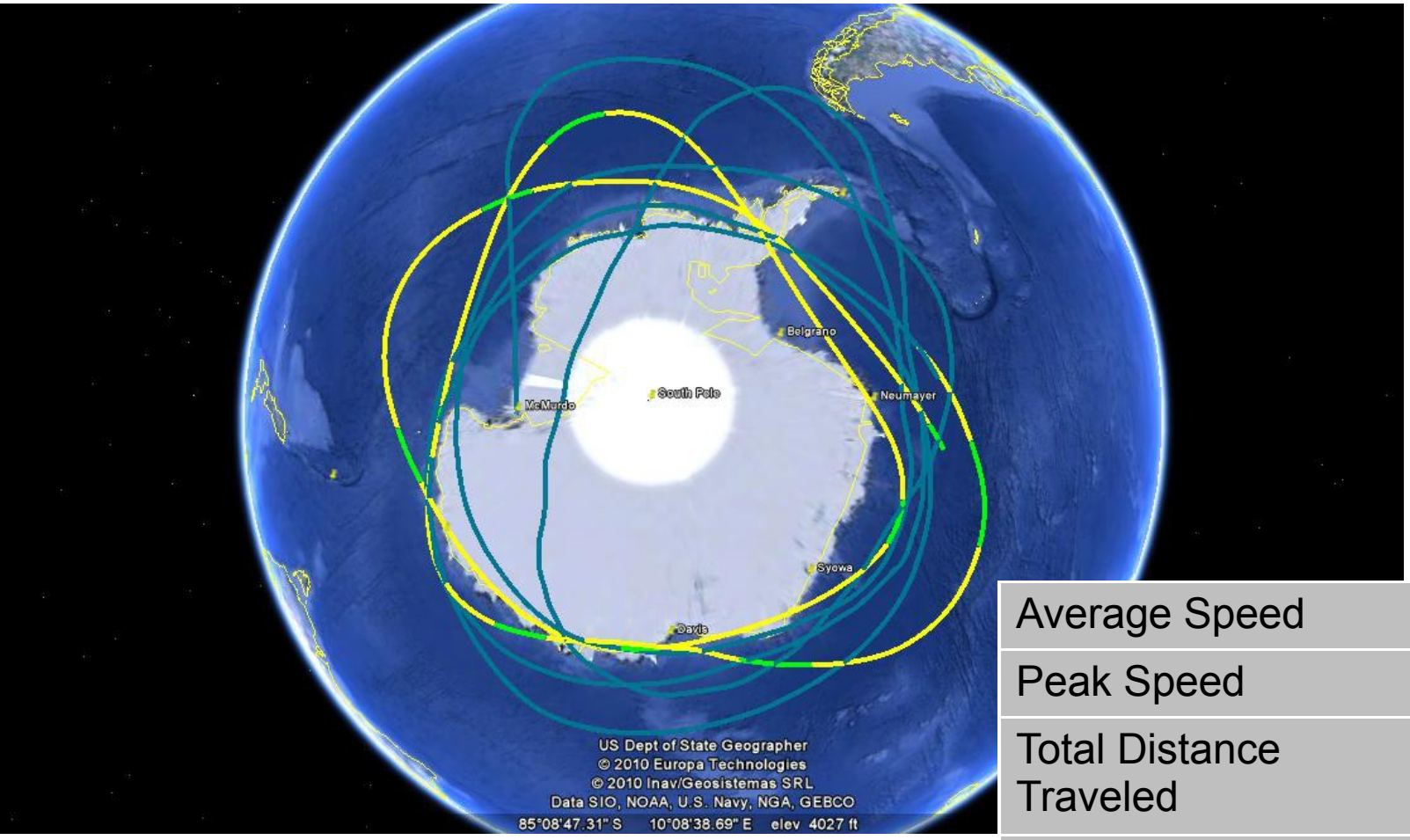
PSC 17 Observations



PSC17 – visits midlatitudes



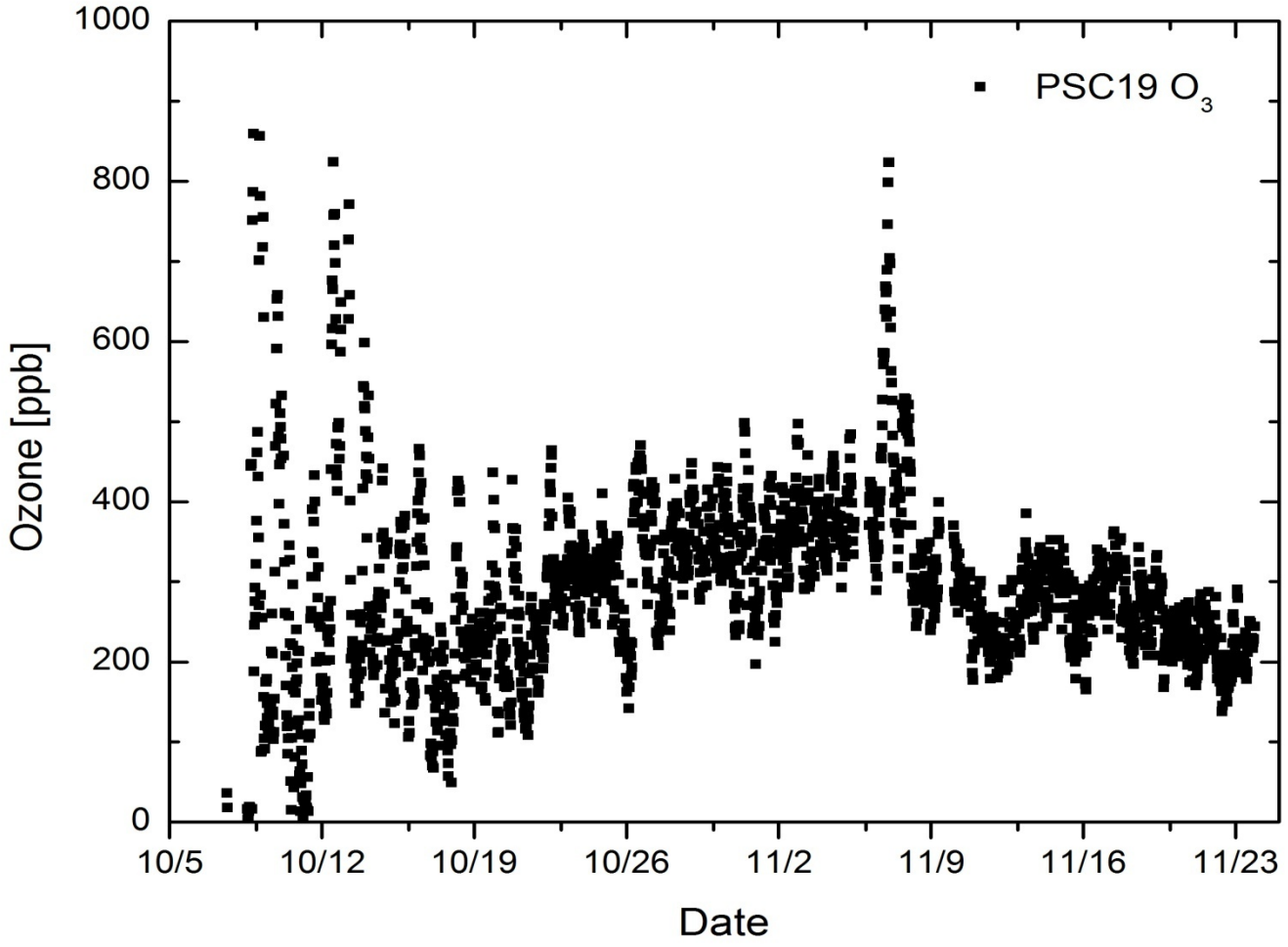
PSC19 – Ozone Hole Recovery?



8 Oct –
23 Nov 2010

Average Speed	128.7 km/hr
Peak Speed	230 km/hr
Total Distance Traveled	41015 km
Total Ozone Measurements	638
Average Spatial Resolution	64 km

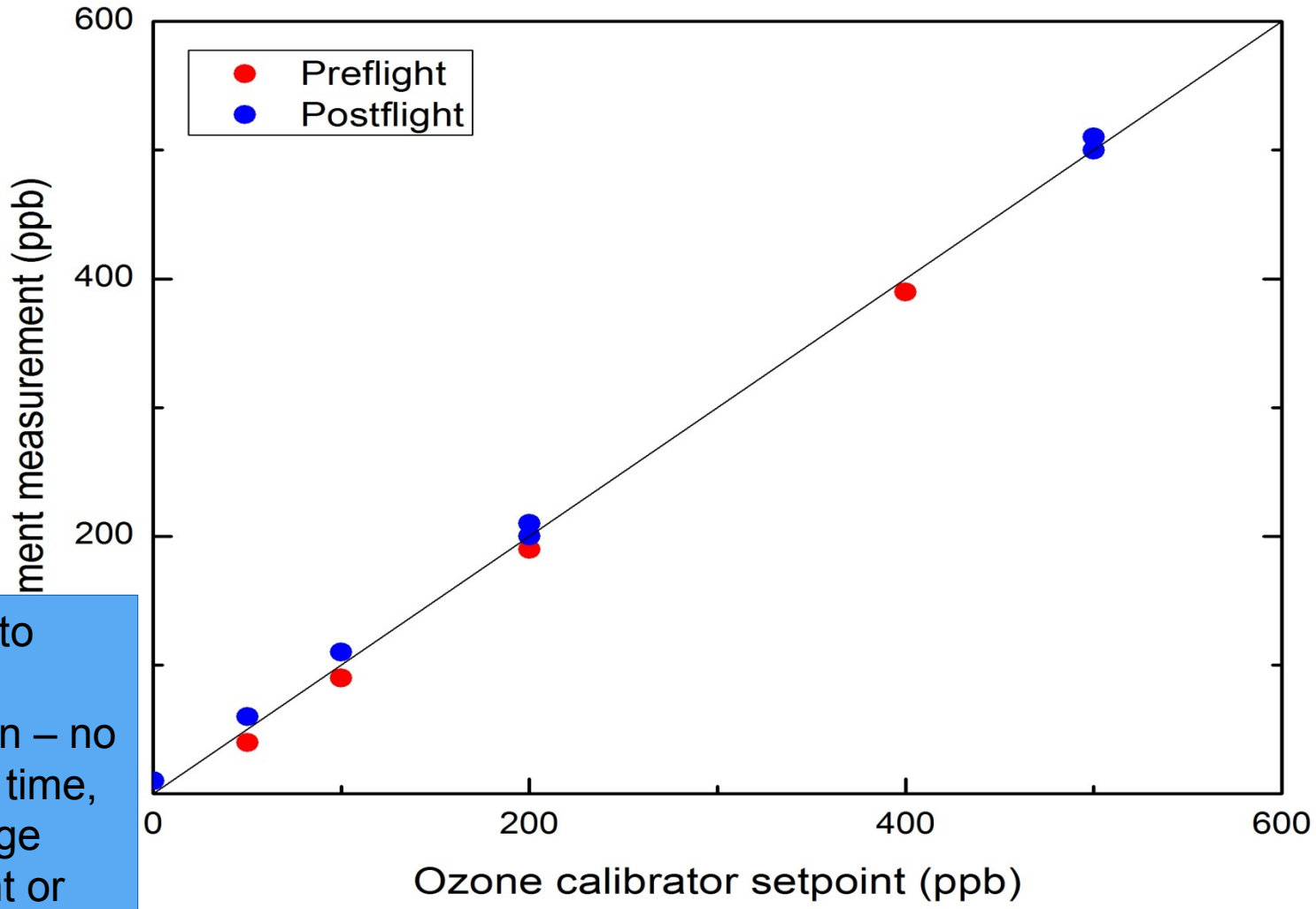
PSC19 Observations



Data Analysis

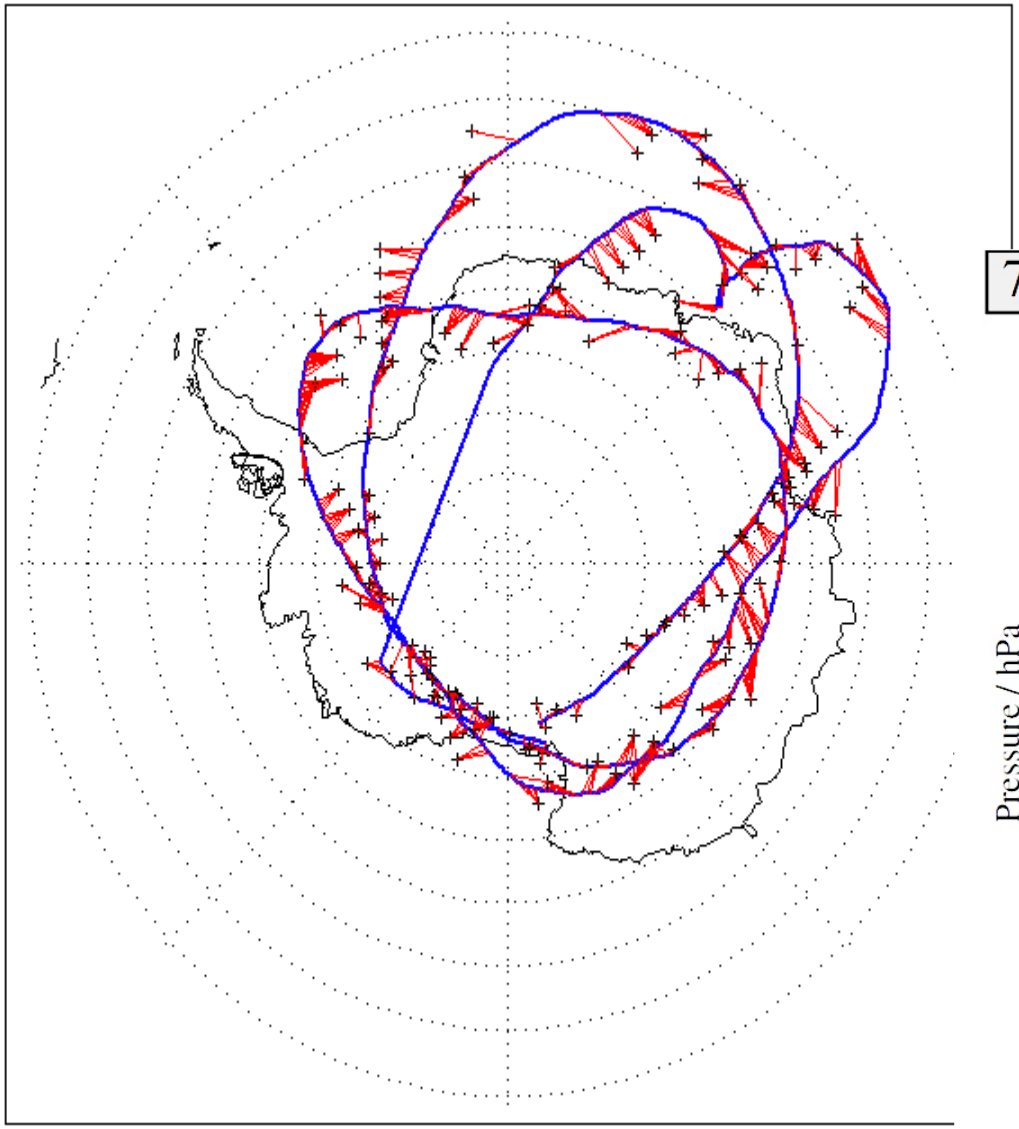
- Data validation - calibrations
- Ozone loss estimates directly from balloon data
- “Self- match” technique

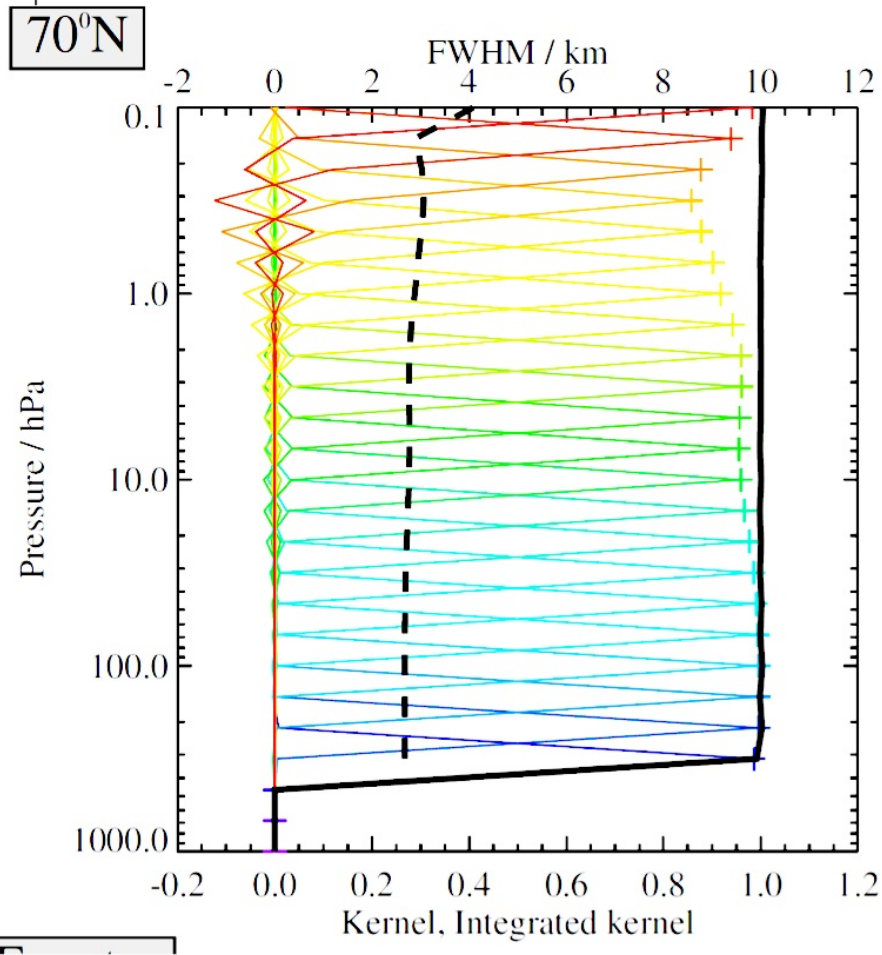
Post-flight Calibrations



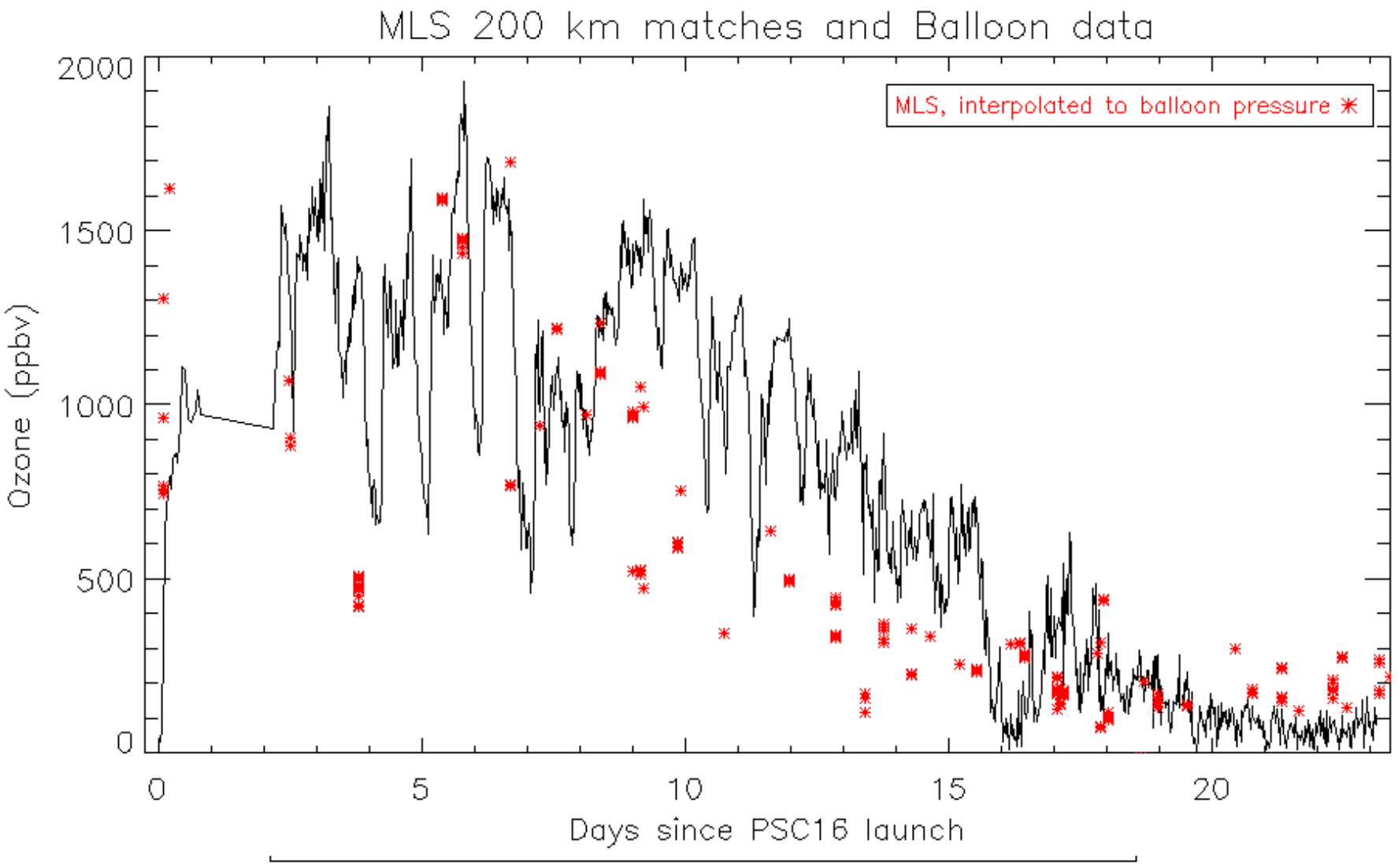
Identical to pre-flight calibration – no drift over time, no damage from flight or landing

Comparison to MLS data

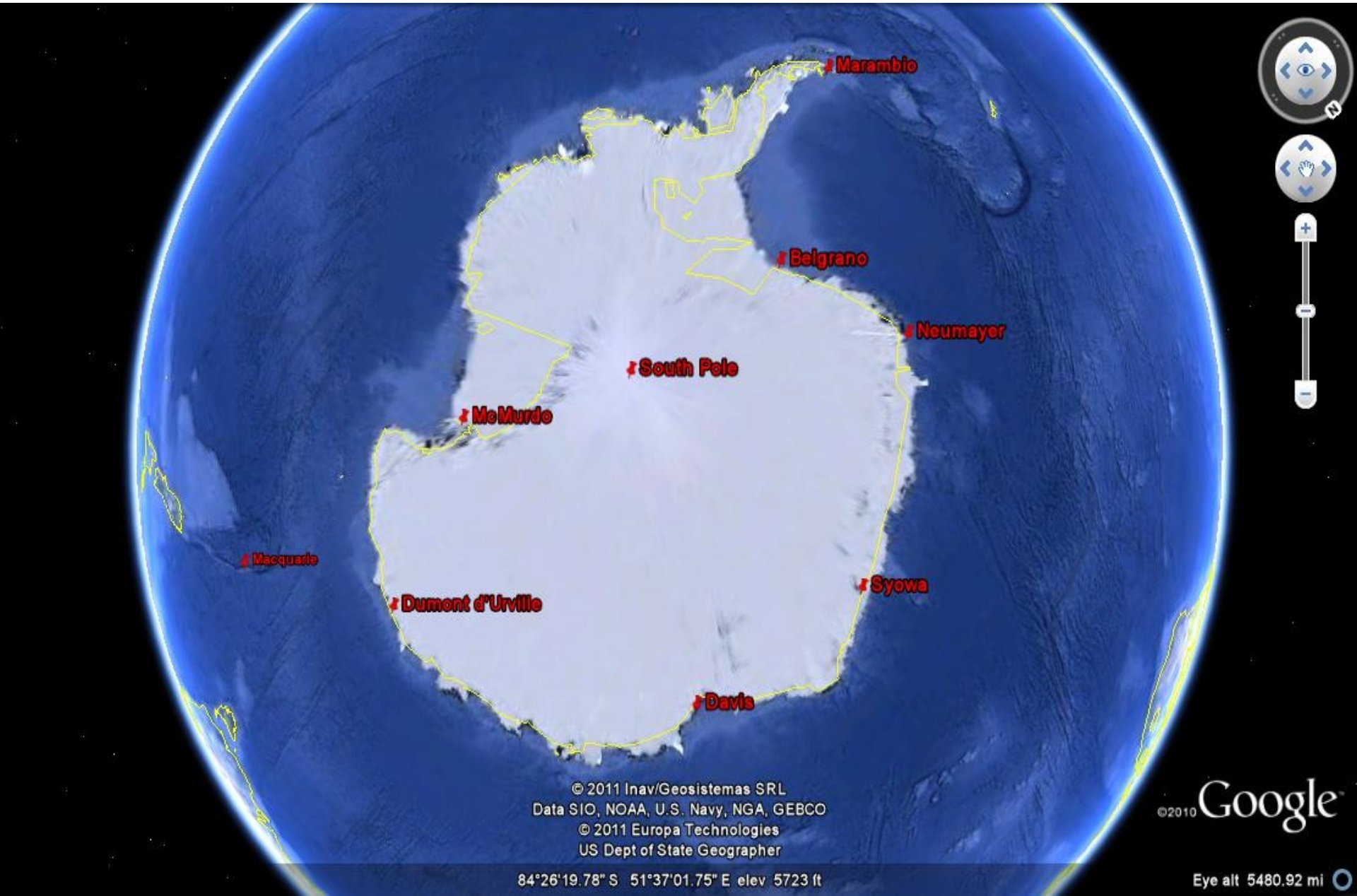




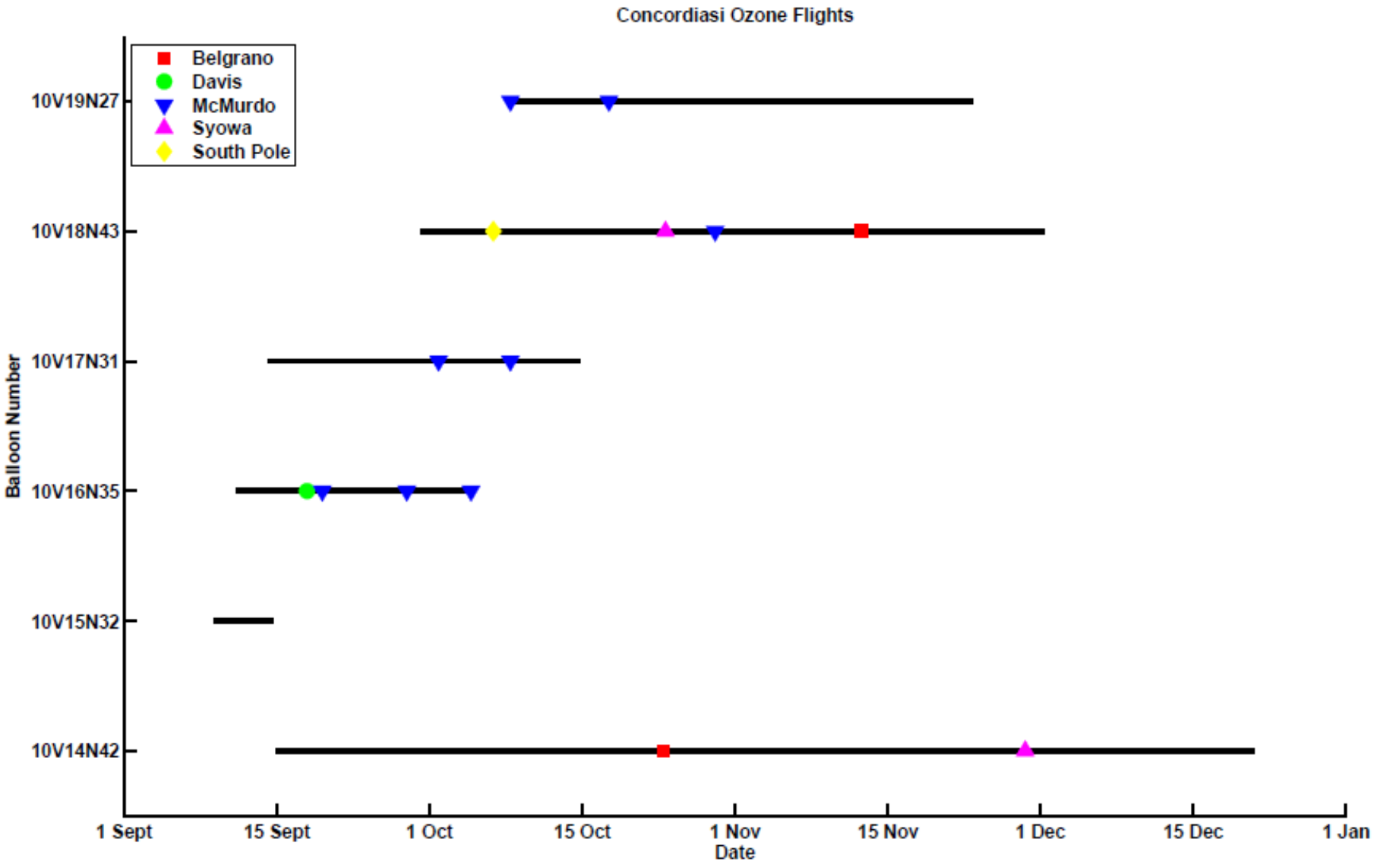
Comparison to MLS Data



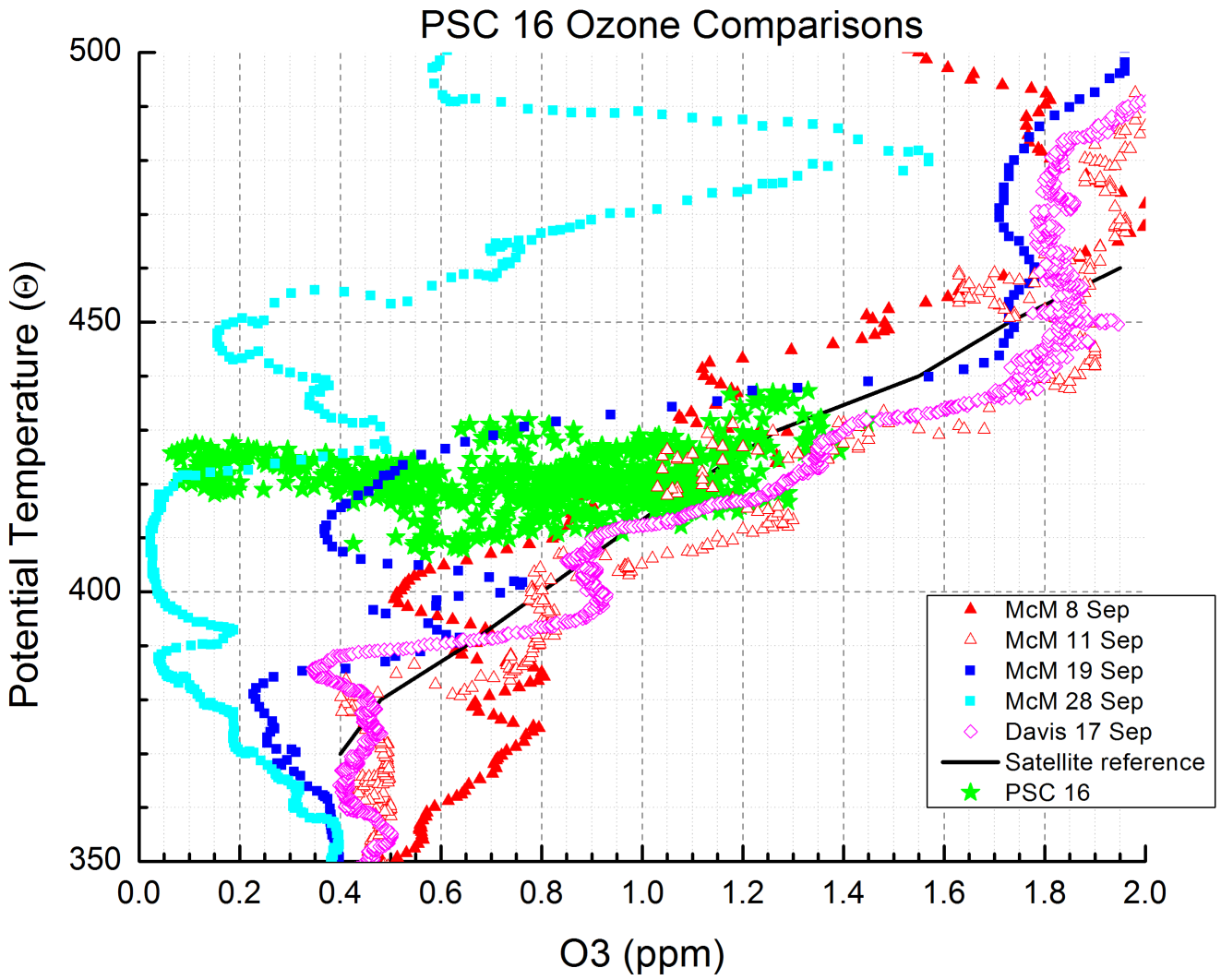
“Match” campaign



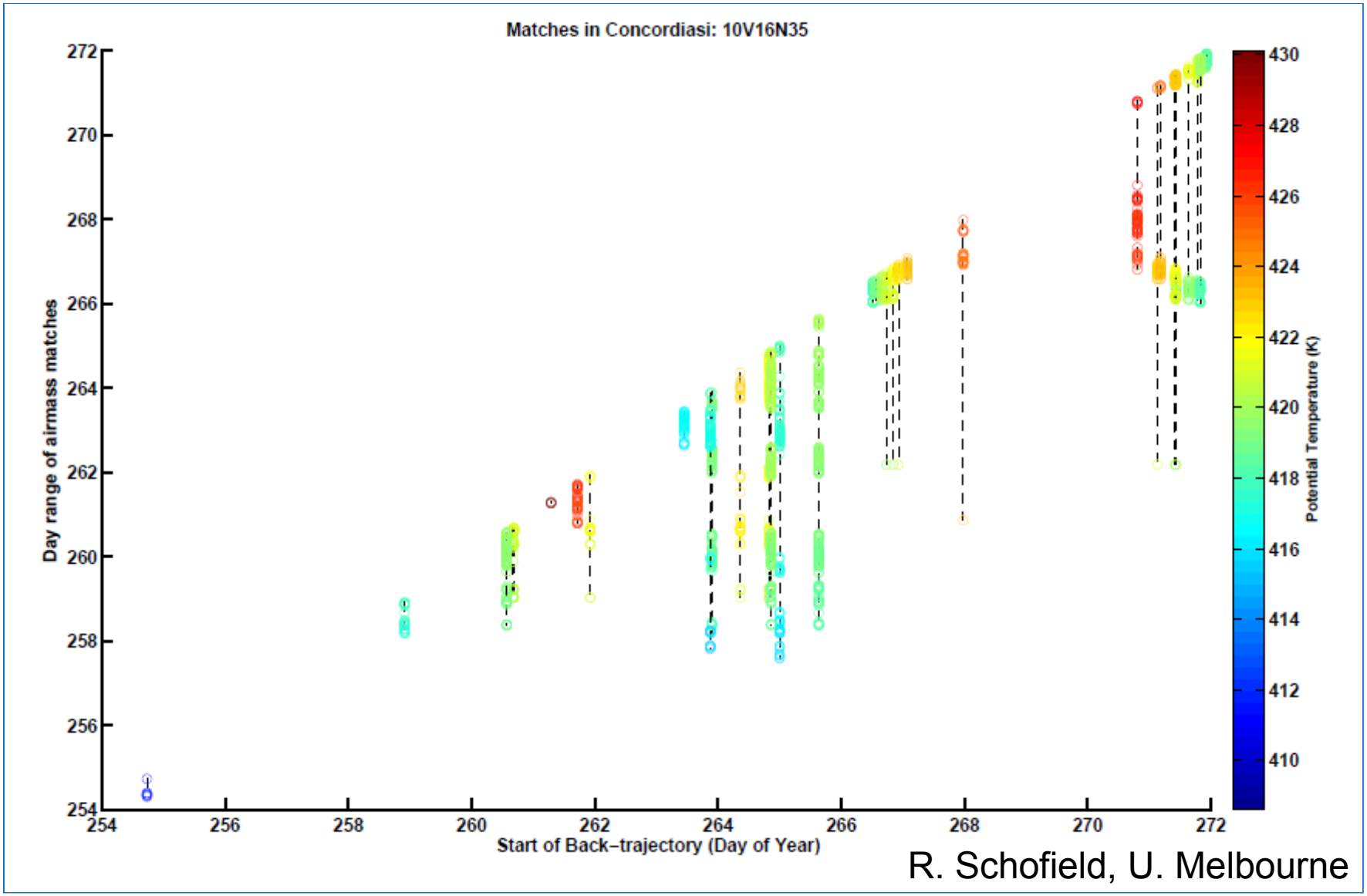
“Match” Campaign



Comparison to Ozonesondes



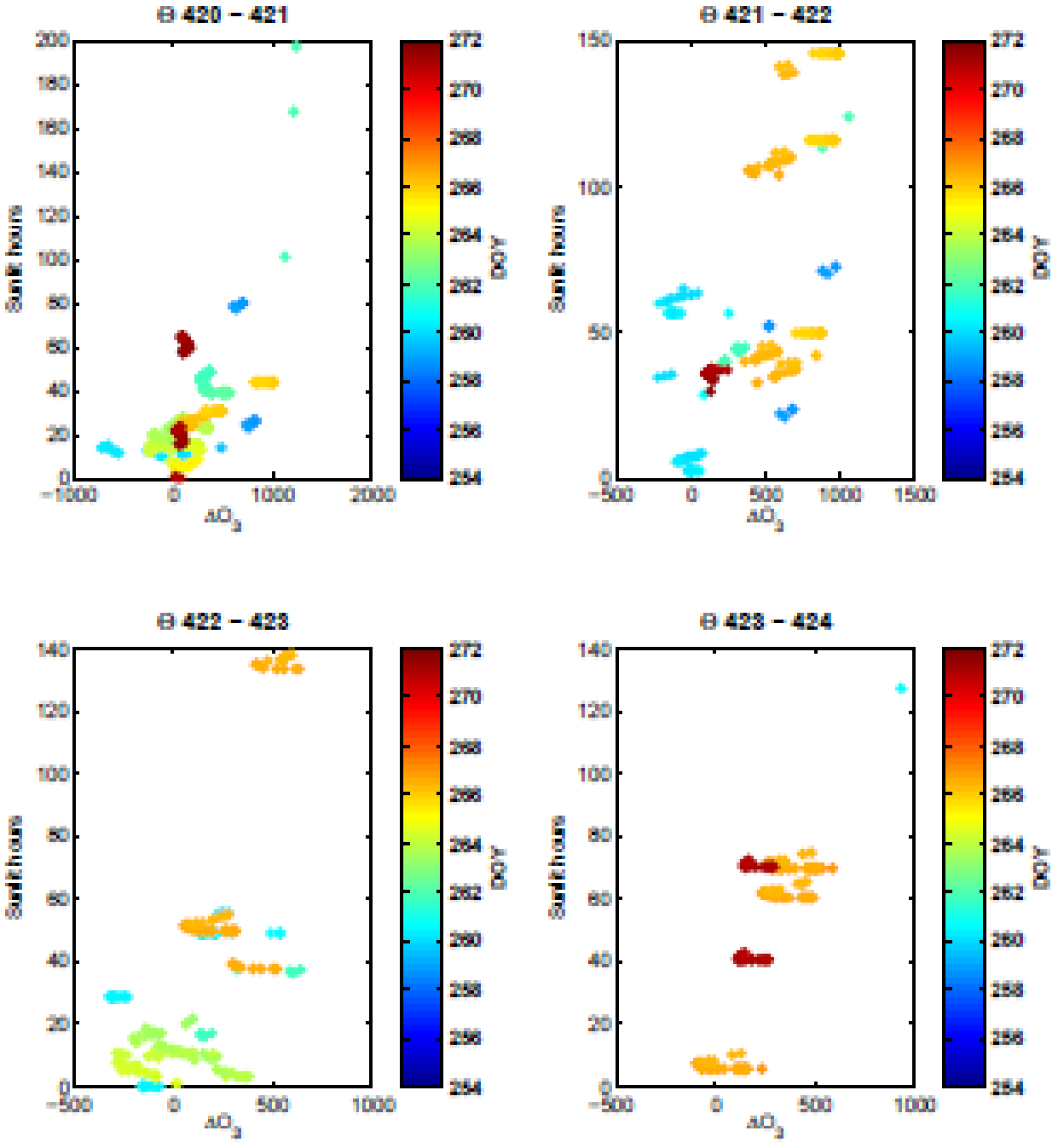
Balloon Self-Matches



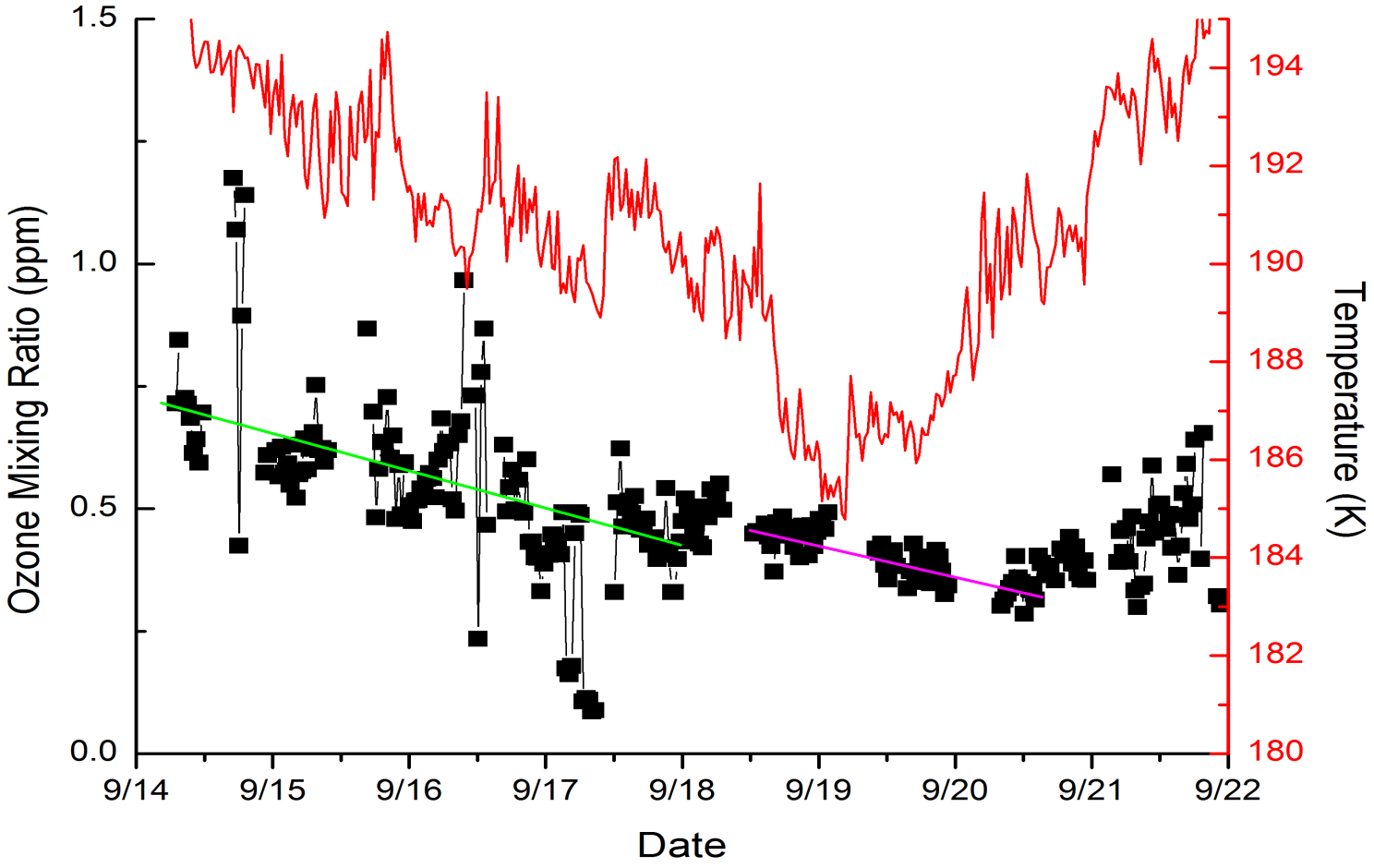
R. Schofield, U. Melbourne

PSC 16 Self-Matches: Ozone Loss

Loss rates are 4 – 10 ppb per sunlit hour



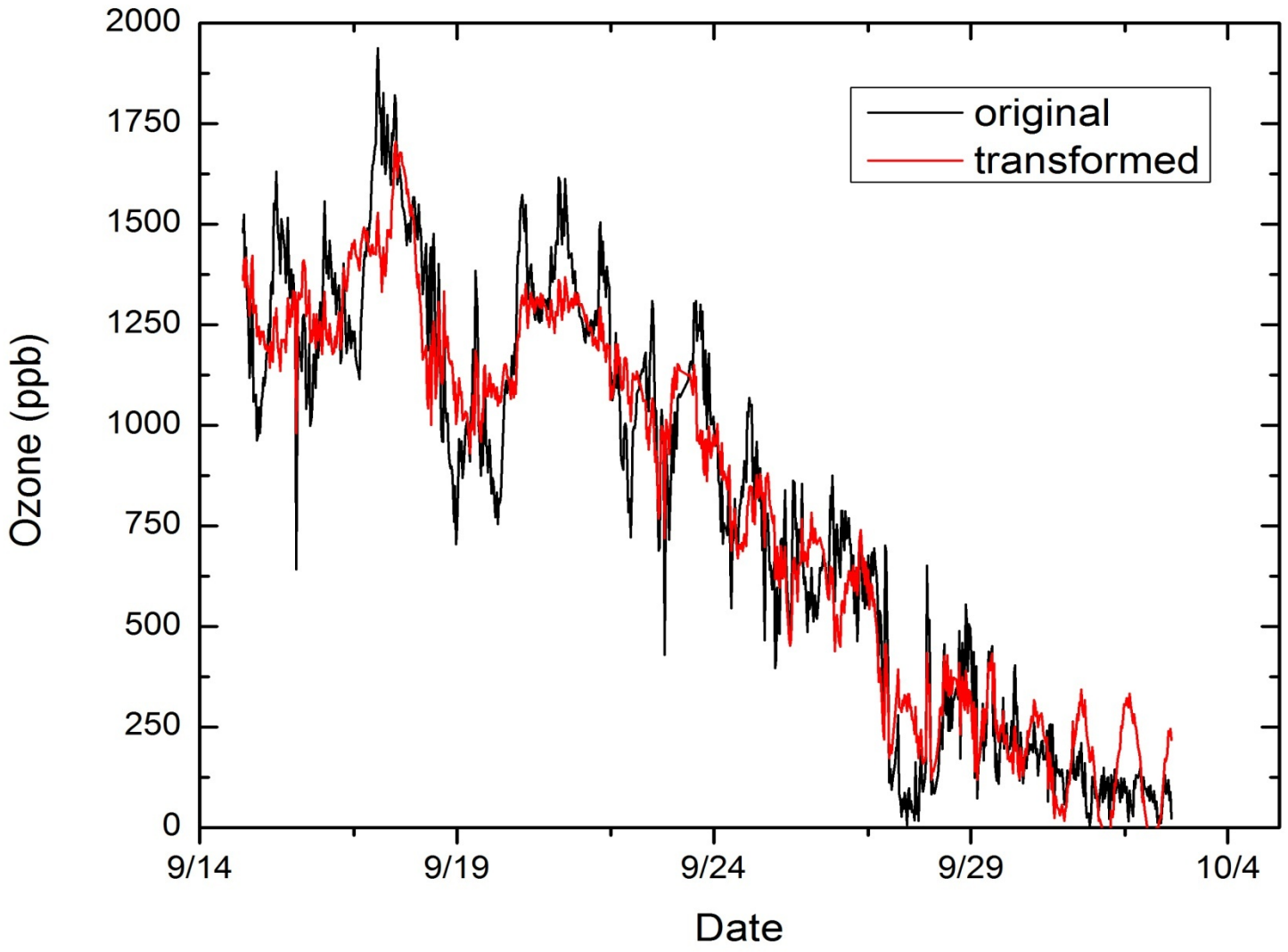
Goal: Use data to test chemistry in models



Cannot be done directly – observed O3 varies for many reasons

- Instrument effects
  - Rapid temperature changes – false ozone values
- Correlations with altitude and solar zenith angle
  - Balloon heats during the day and rises; cools and sinks at night (± 1-2 hPa)
  - Potential Temperature (Θ) changes ± 8-10 K
  - So, O3 changes: gradient is ~ 20 ppb/K

Principal Component Analysis



Yet to come…

- Comparisons with simulations from Whole Atmosphere Community Climate Model(WACCM)
  - *M. Brakebusch, C. Randall; CU & NCAR*

- Further analysis of self-matches
  - *R. Schofield, University of Melbourne*

- Development of a refined O3 time series, accounting for non-atmospheric variations
  - *H. Walsh, CU*

Acknowledgements

- Funding: National Science Foundation Office of Polar Programs
- Centre National Etudes Spatial (CNES) launch team
- “Match” Program Staff
  - Holger Deckelmann, Peter von der Gaathen, Markus Rex, Robyn Schofield
  - Balloon launchers at Antarctic Stations
- Raytheon Polar Support Staff