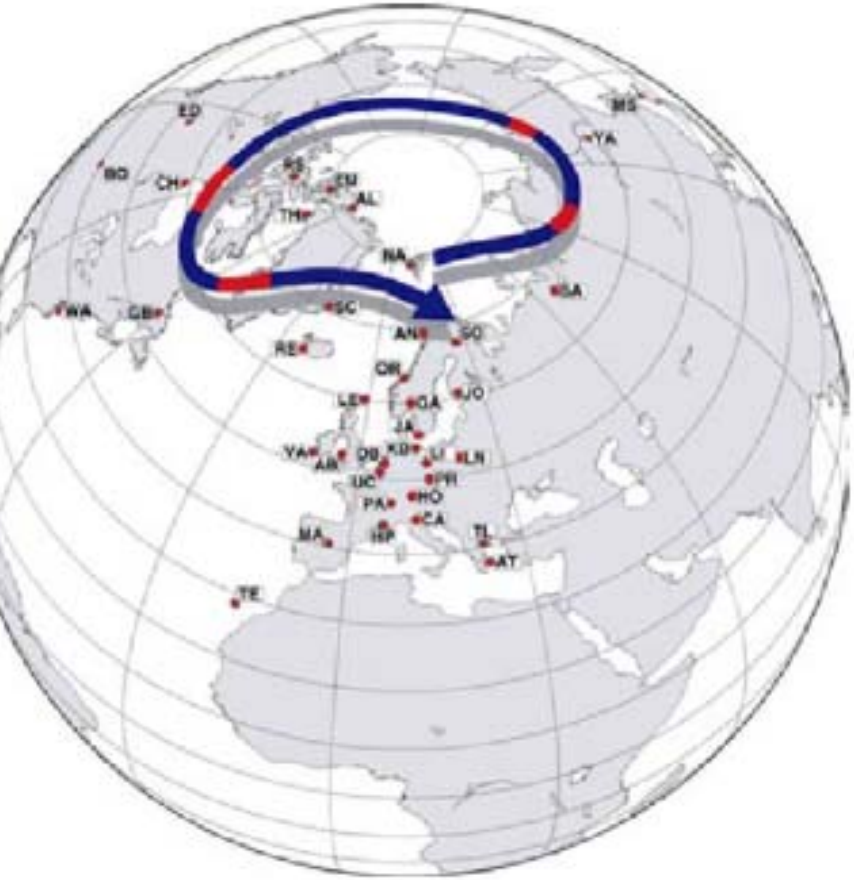
Ozone Loss Rates from the Match Technique using Occultation Measurements

Karl Hoppel (NRL), Richard Bevilacqua, (NRL), Markus Rex (AWI)



Outline:

1. Project goals
2. Motivation for Match techniqu
3. Preliminary results.

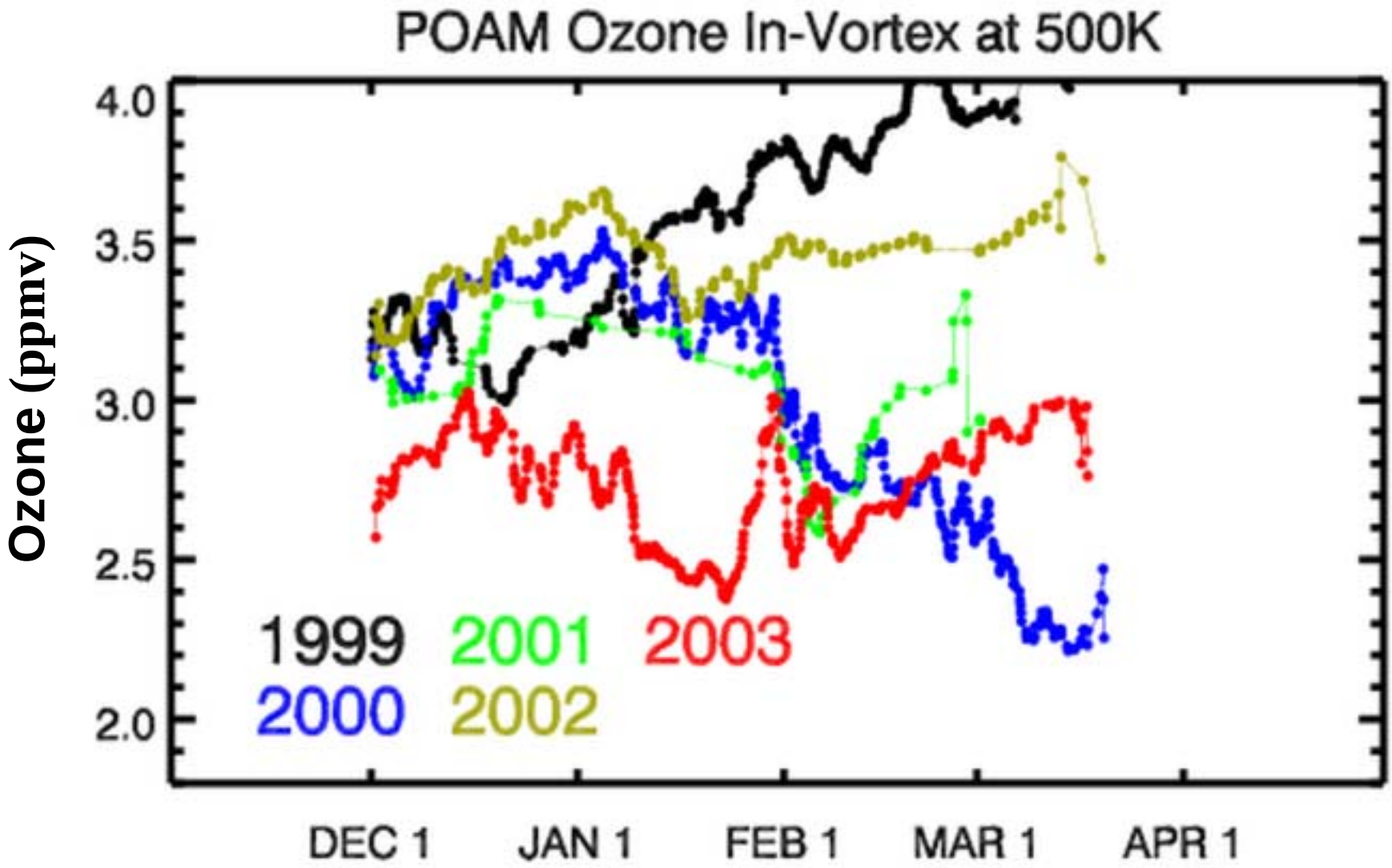
Why occultation matches?

- Direct measure of ozone photochemical change.
- Overcomes sparse sampling.
- High vertical resolution is required.
- Requires good precision.

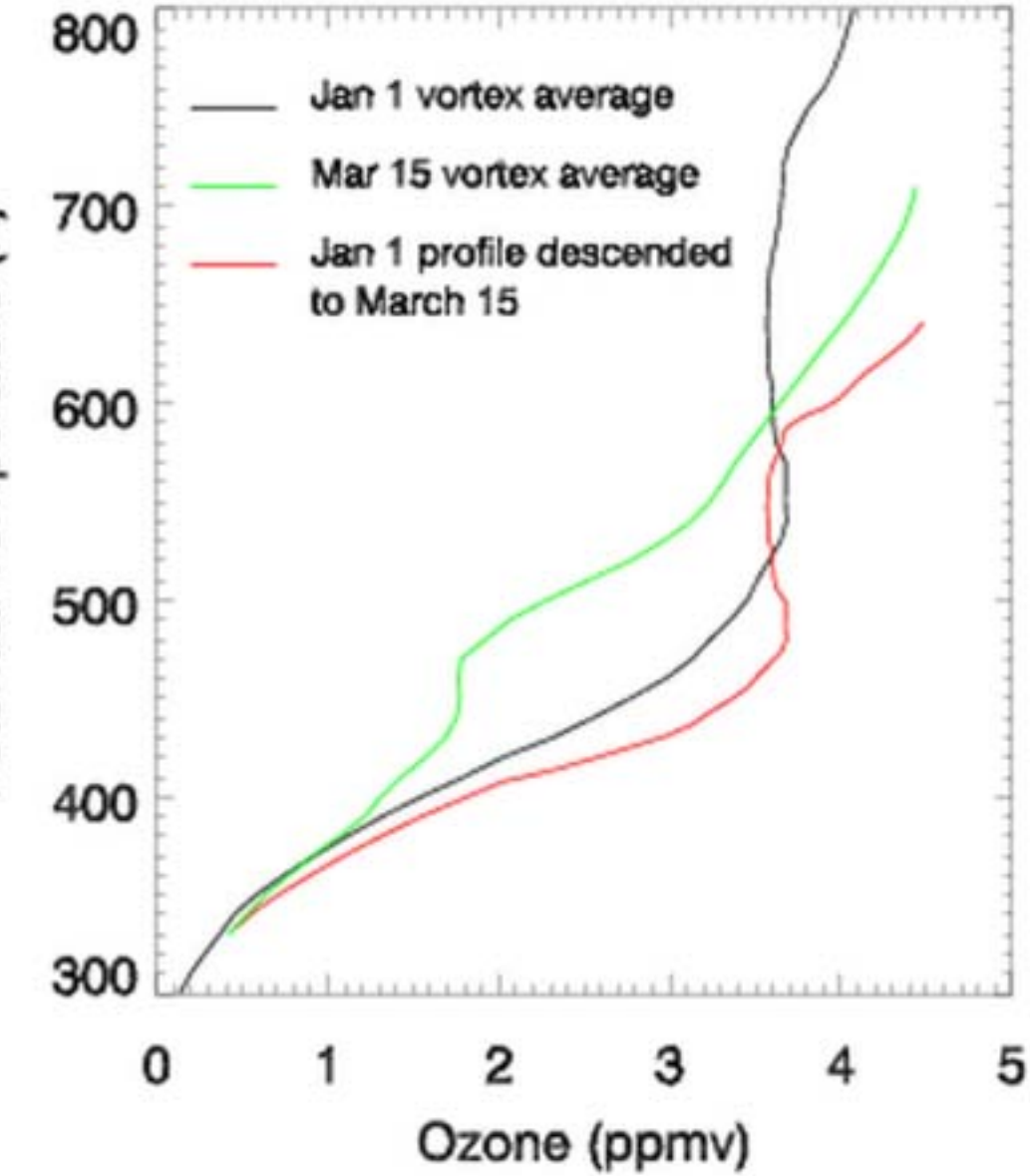
GOALS

- Refine the occultation match technique.
  - e.g. Terao et al., 2002; Sasano et al., 2000
- Validate the method.
  - QUOBI/Antarctic match inter-comparison
- Use all available occultation data to calculate loss rates for multiple years and both hemispheres.
- Do science.

Northern Hemisphere



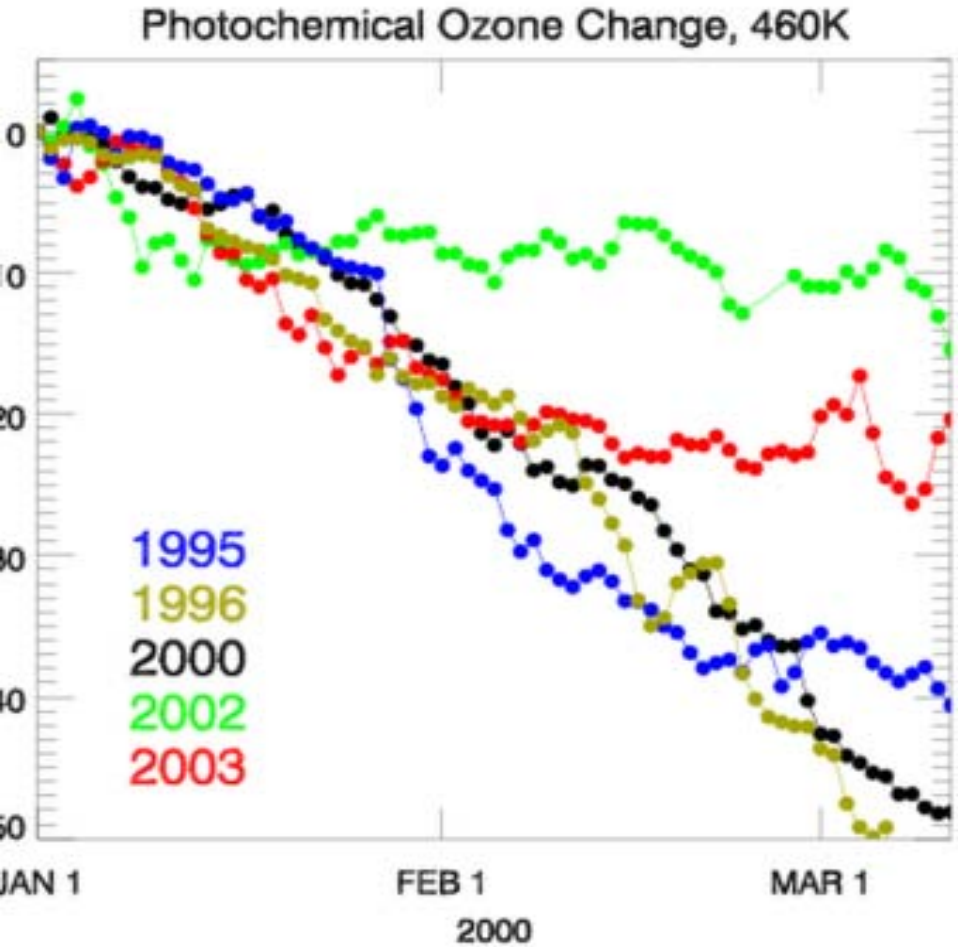
Vortex Average Ozone Loss Technique

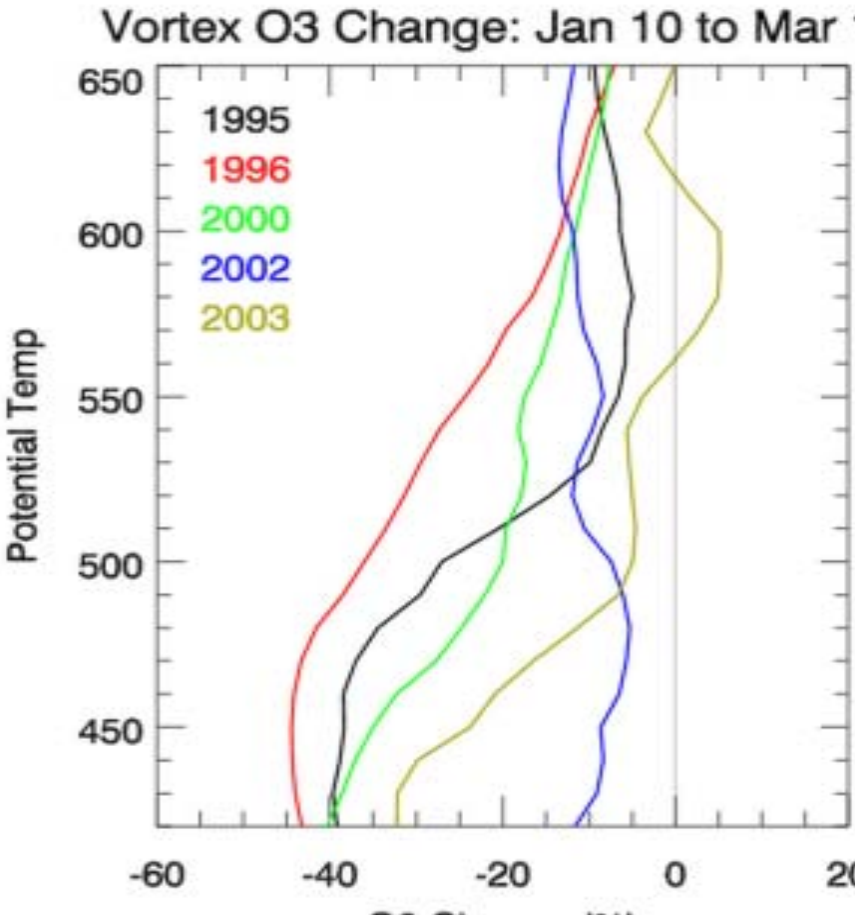


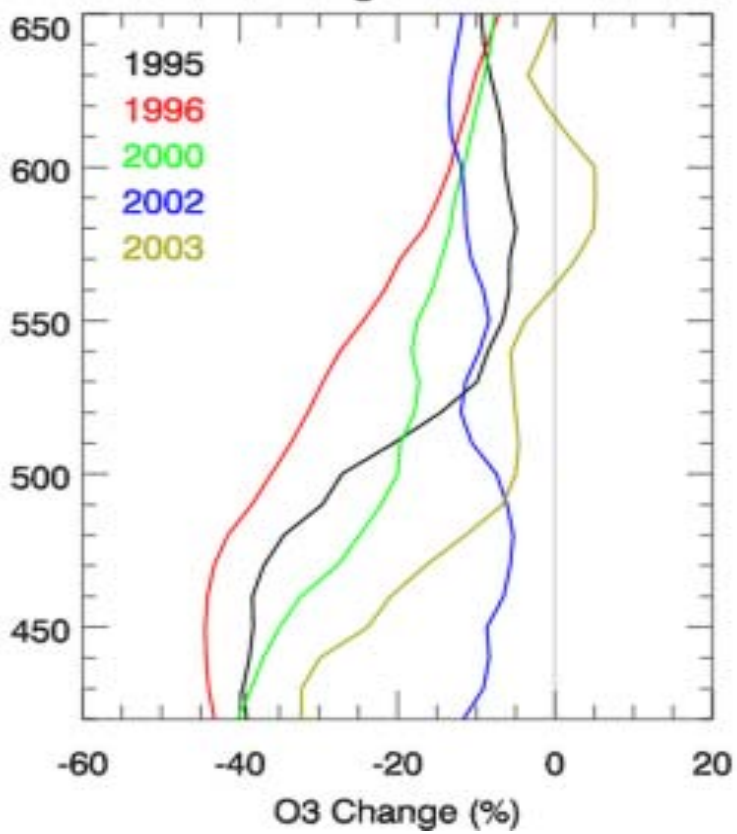
Assumptions/error sources:

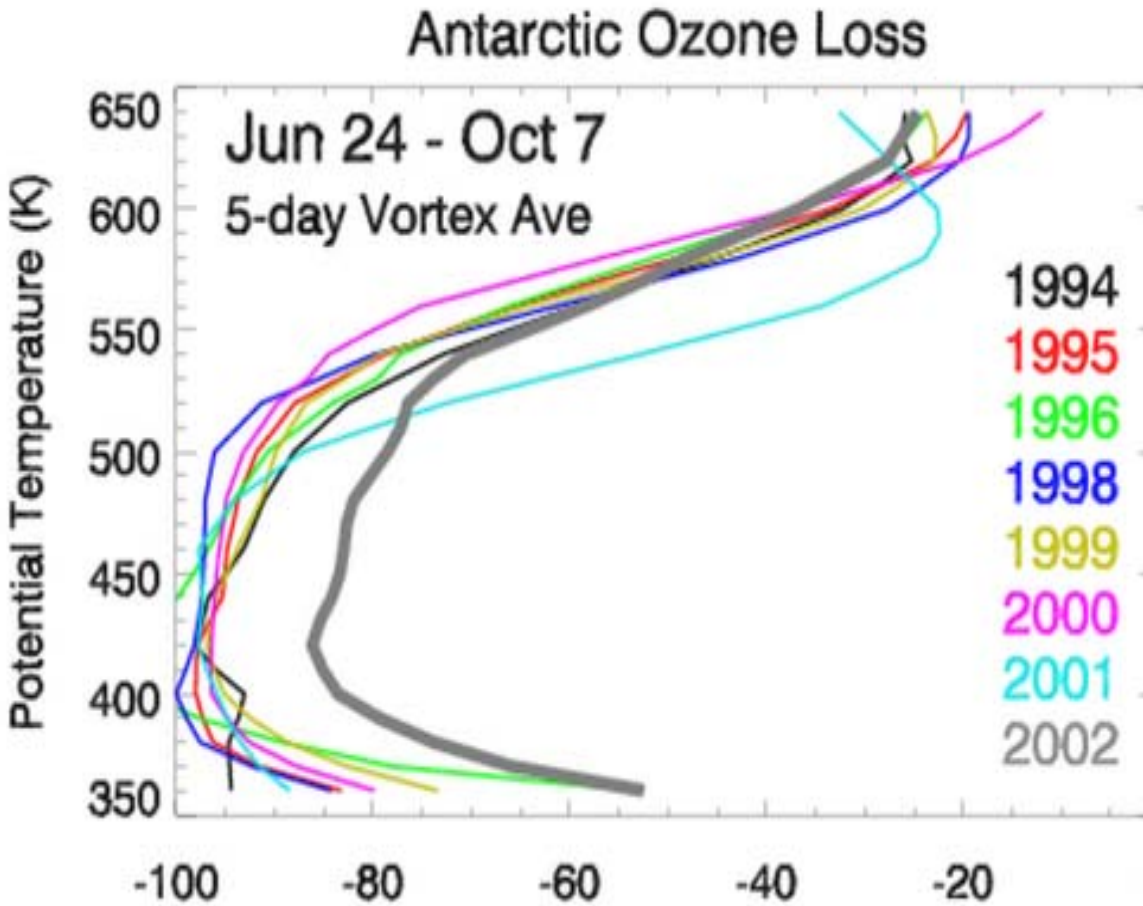
1. **No mixing across vortex**
2. **Sampling = vortex average**
3. **Descent (heating) accurate**

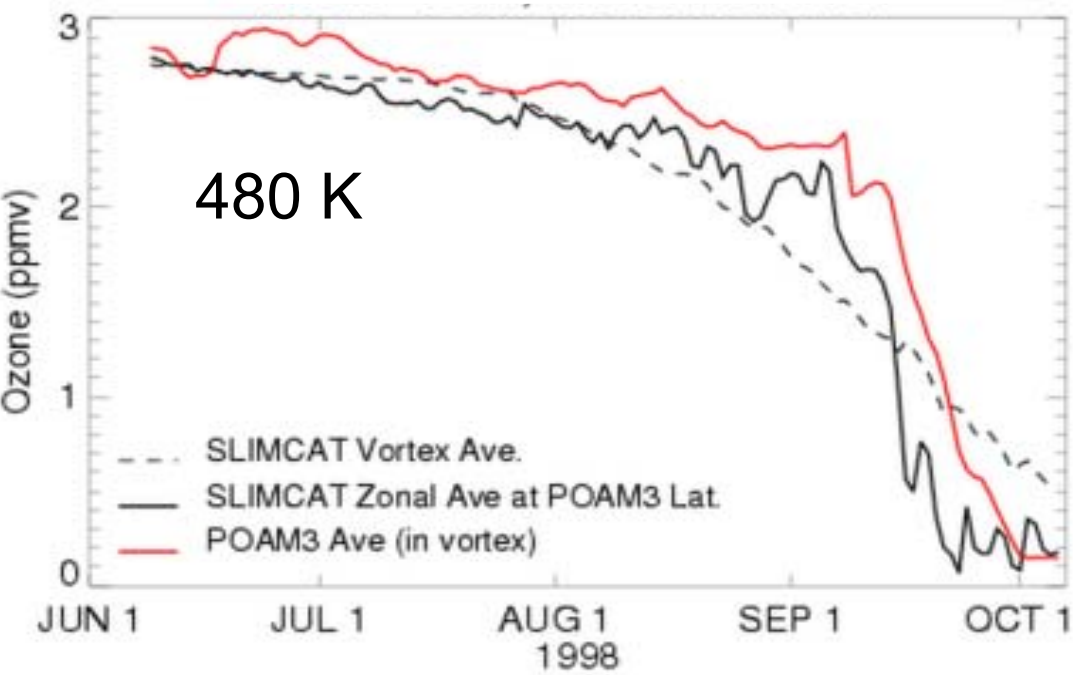
Northern hemisphere ozone loss estimated from vortex-average technique





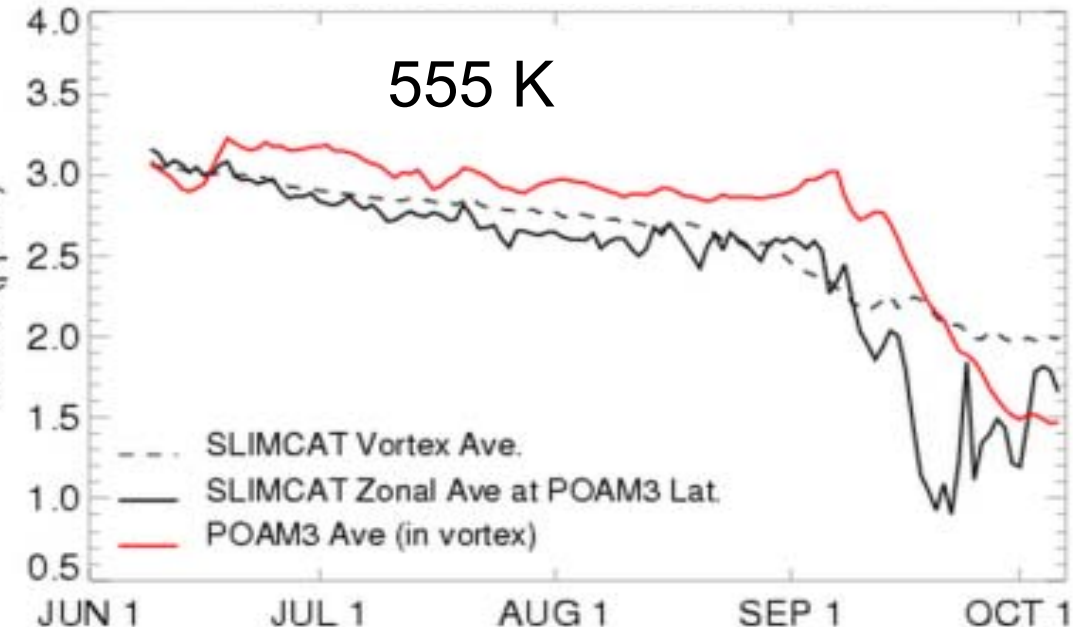

1995
1996
2000
2002
2003
650
600
550
500
450
-60
-40
-20
0
20
O3 Change (%)

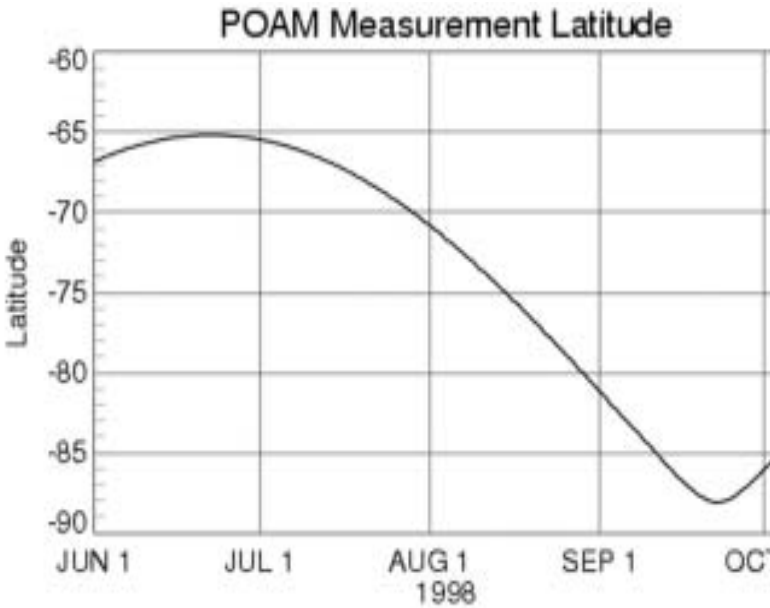

Antarctic Ozone Loss
Jun 24 - Oct 7
5-day Vortex Ave
1994
1995
1996
1998
1999
2000
2001
2002
Potential Temperature (K)
650
600
550
500
450
400
350
-100
-80
-60
-40
-20



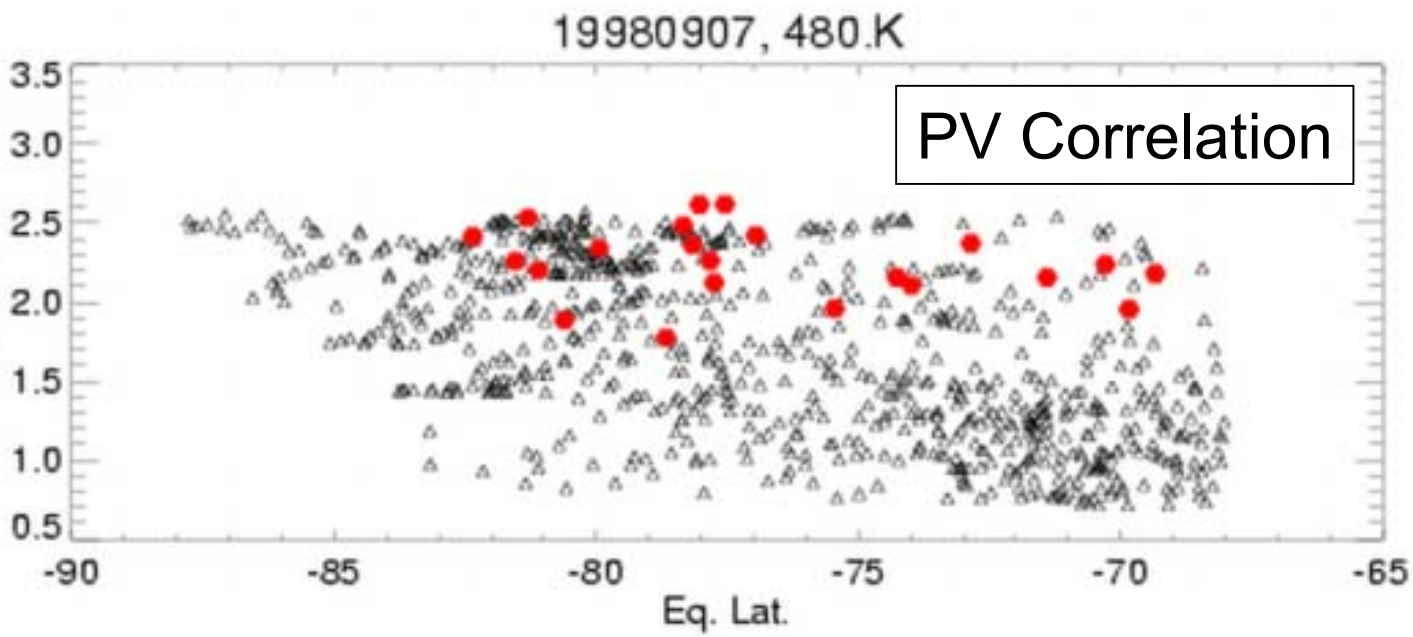
Is the POAM average the same as a vortex average?

← Slimcat model comparis





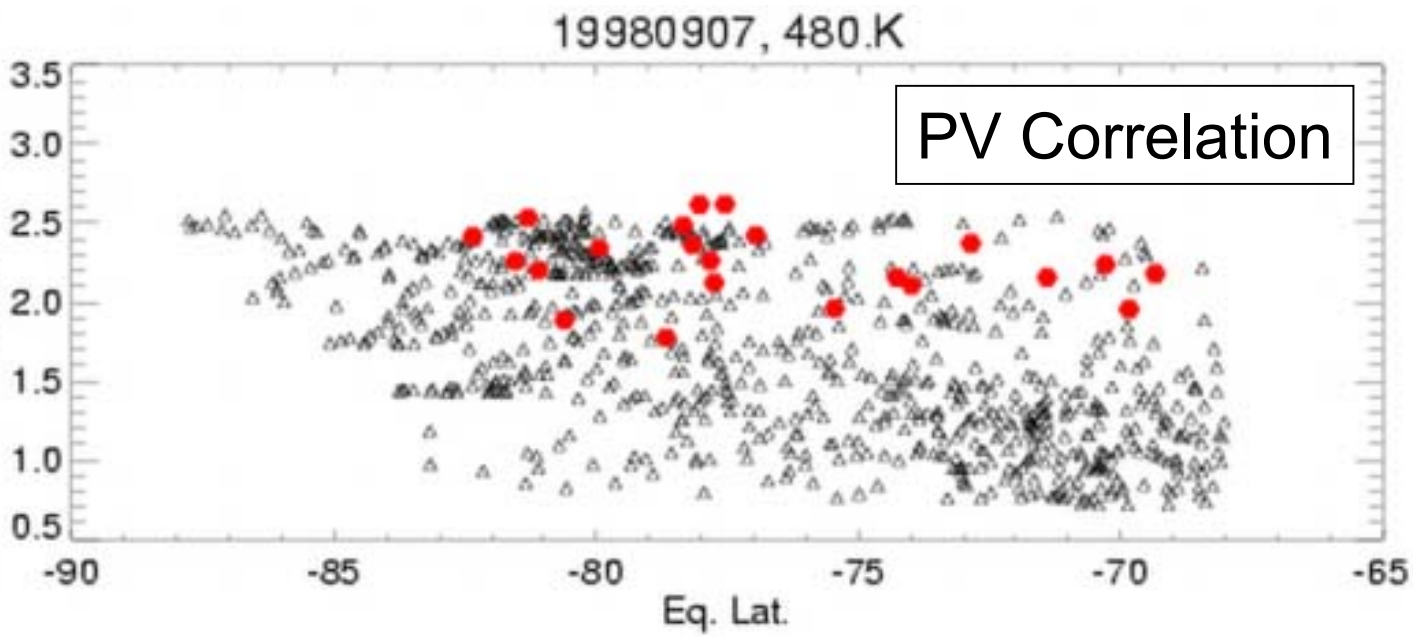
Poam & Slimcat Model Comparison

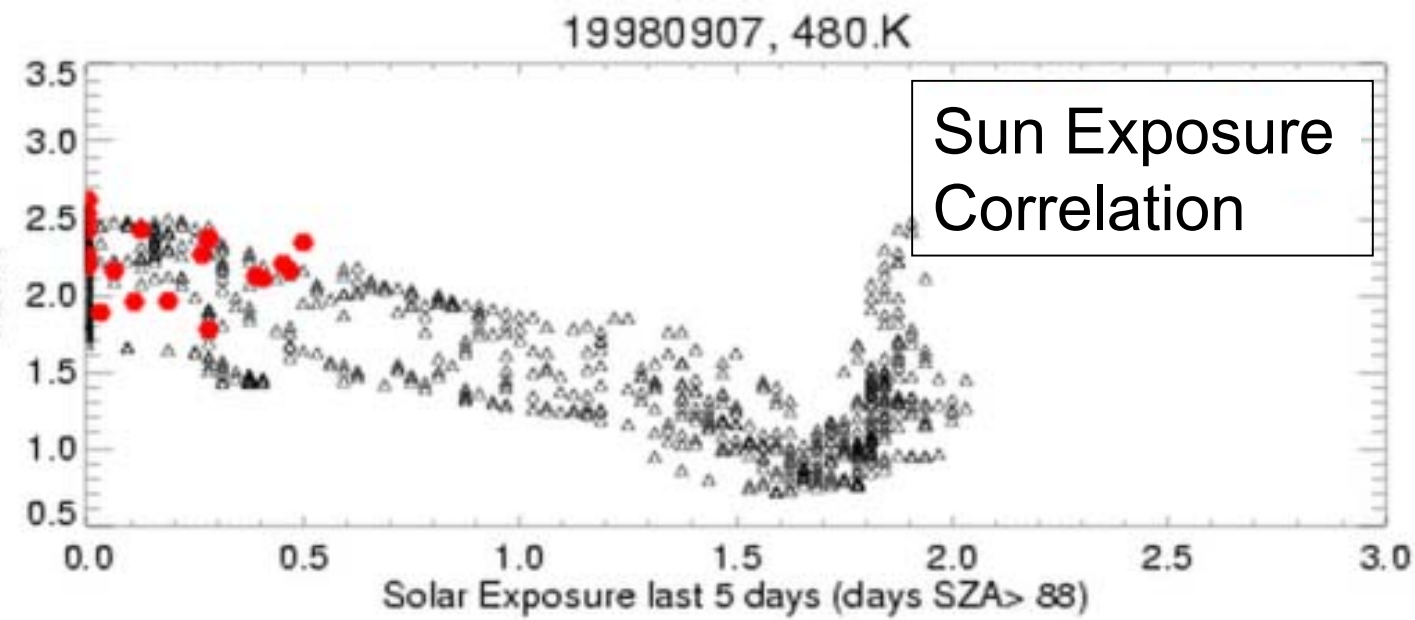


Δ SLIMCAT Mod

● POAM +/- 2 day

Poam & Slimcat Model Comparison

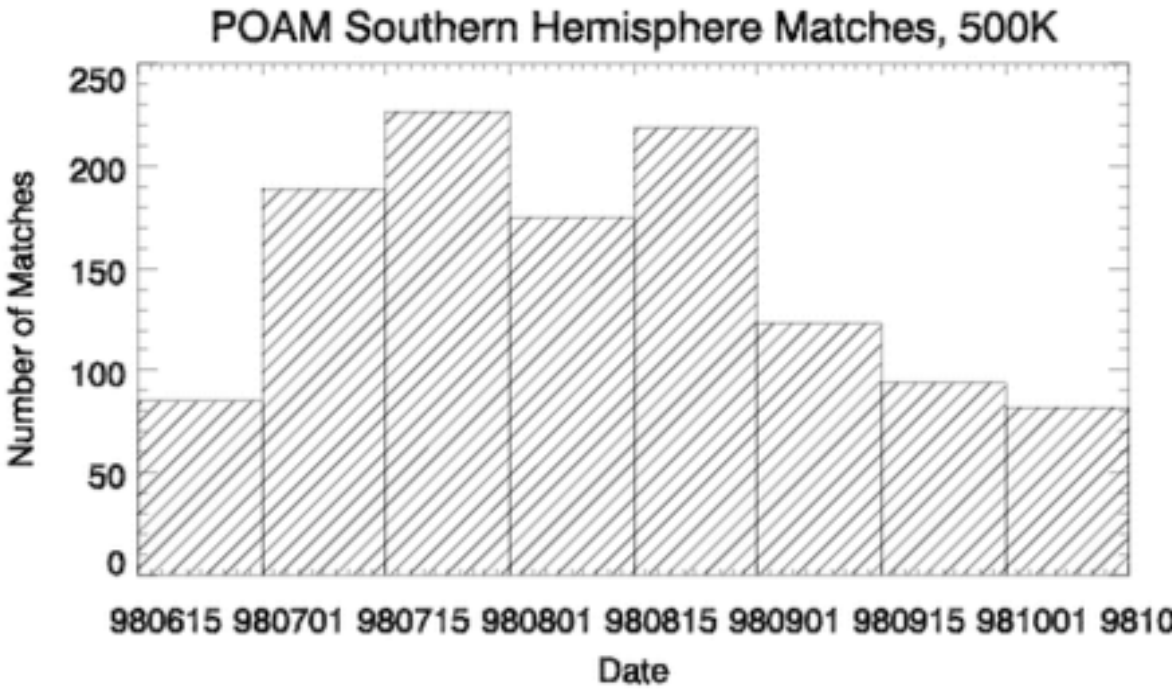




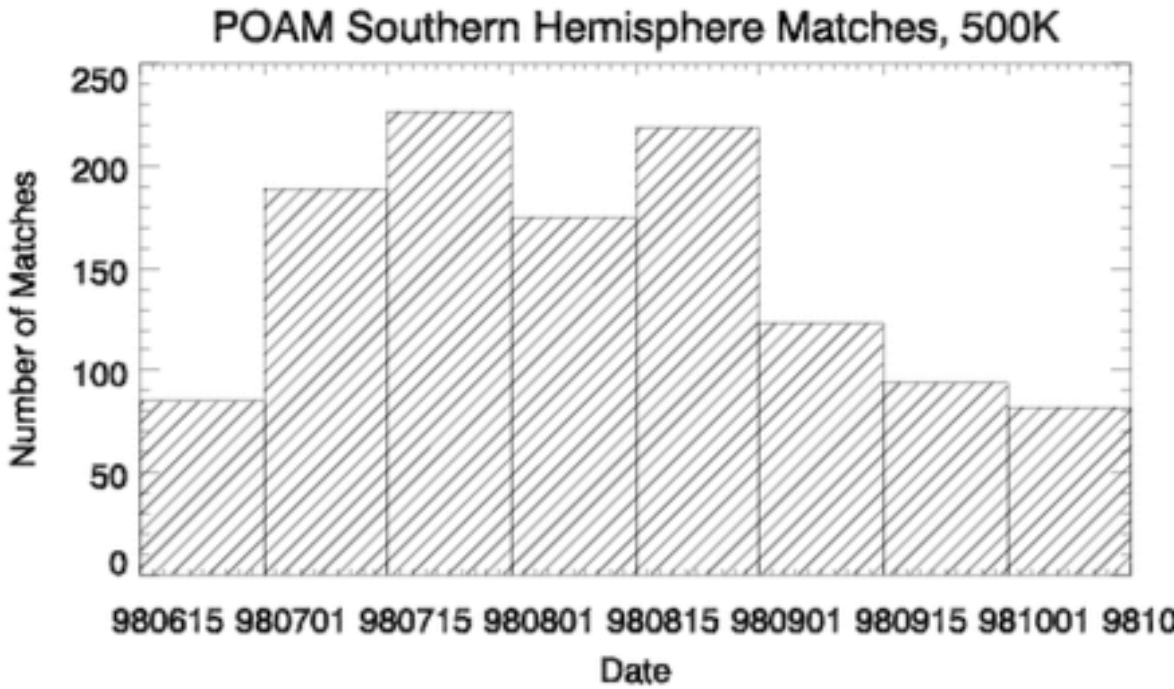
Δ SLIMCAT Mod

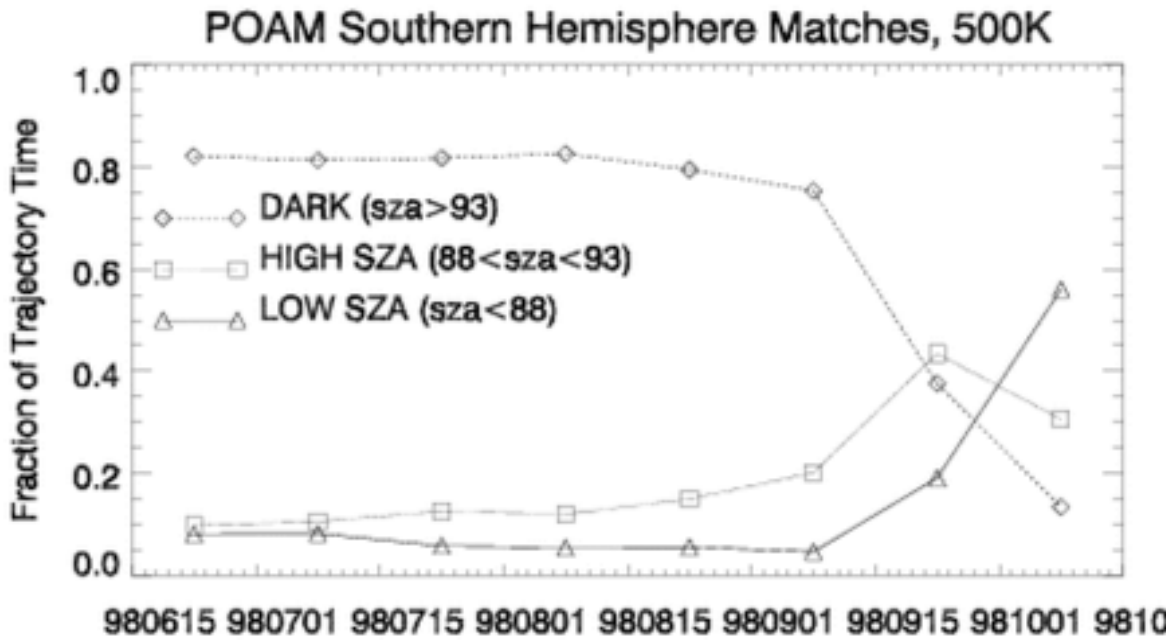
● POAM +/- 2 day

Match technique applied to POAM measurements

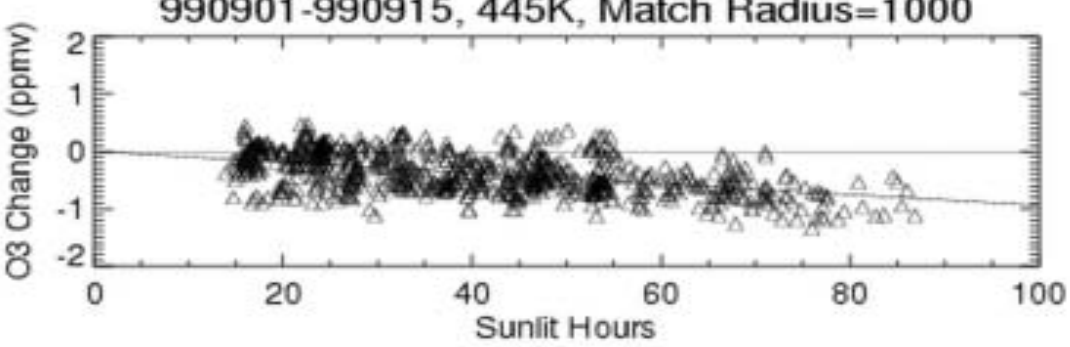


Match technique applied to POAM measurements



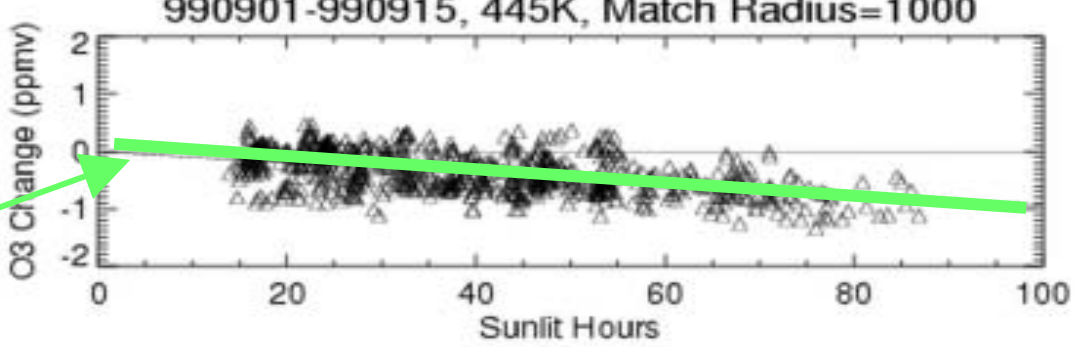


Loss rate calculation



Loss rate calculation

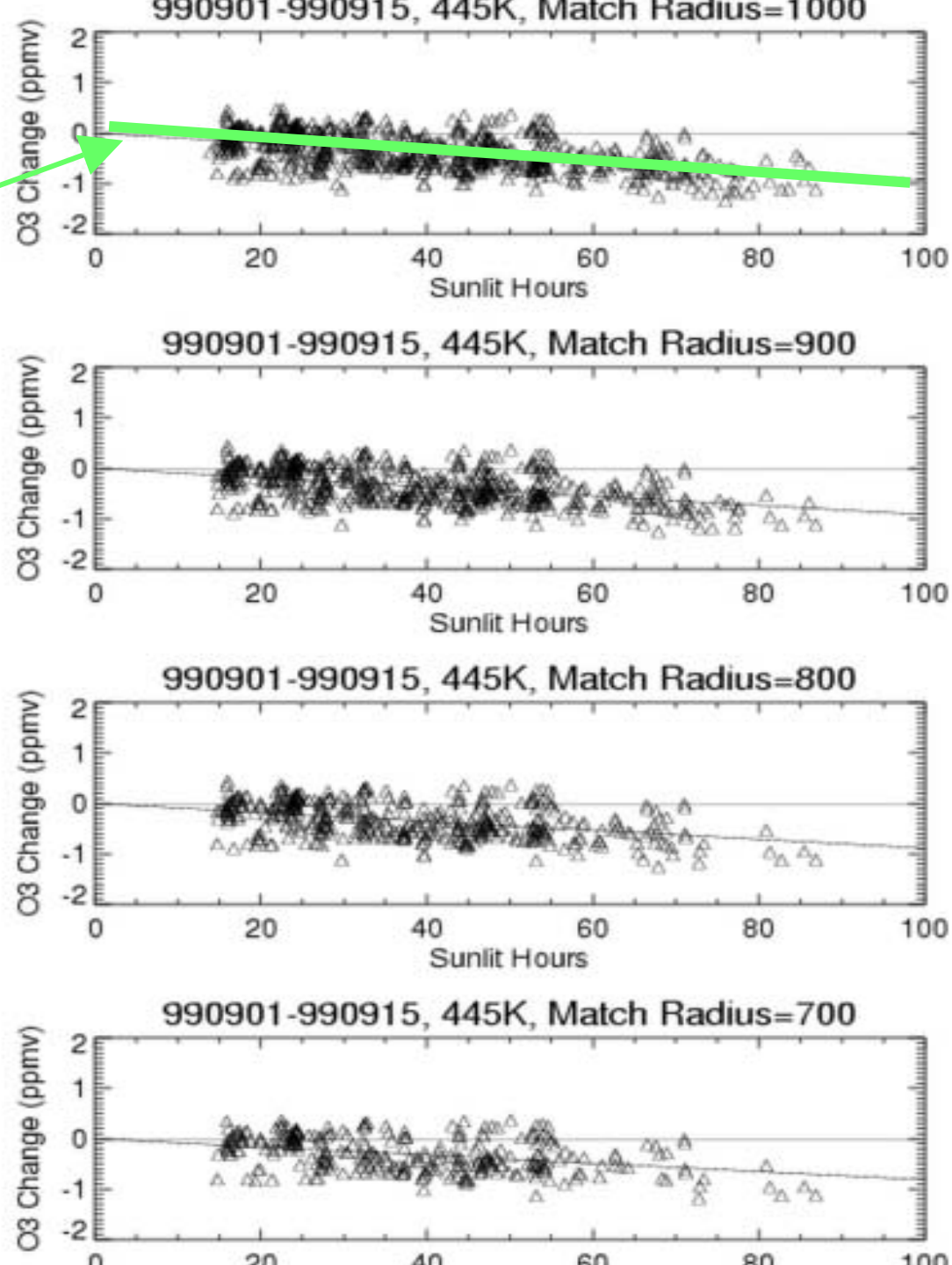
loss rate = slope



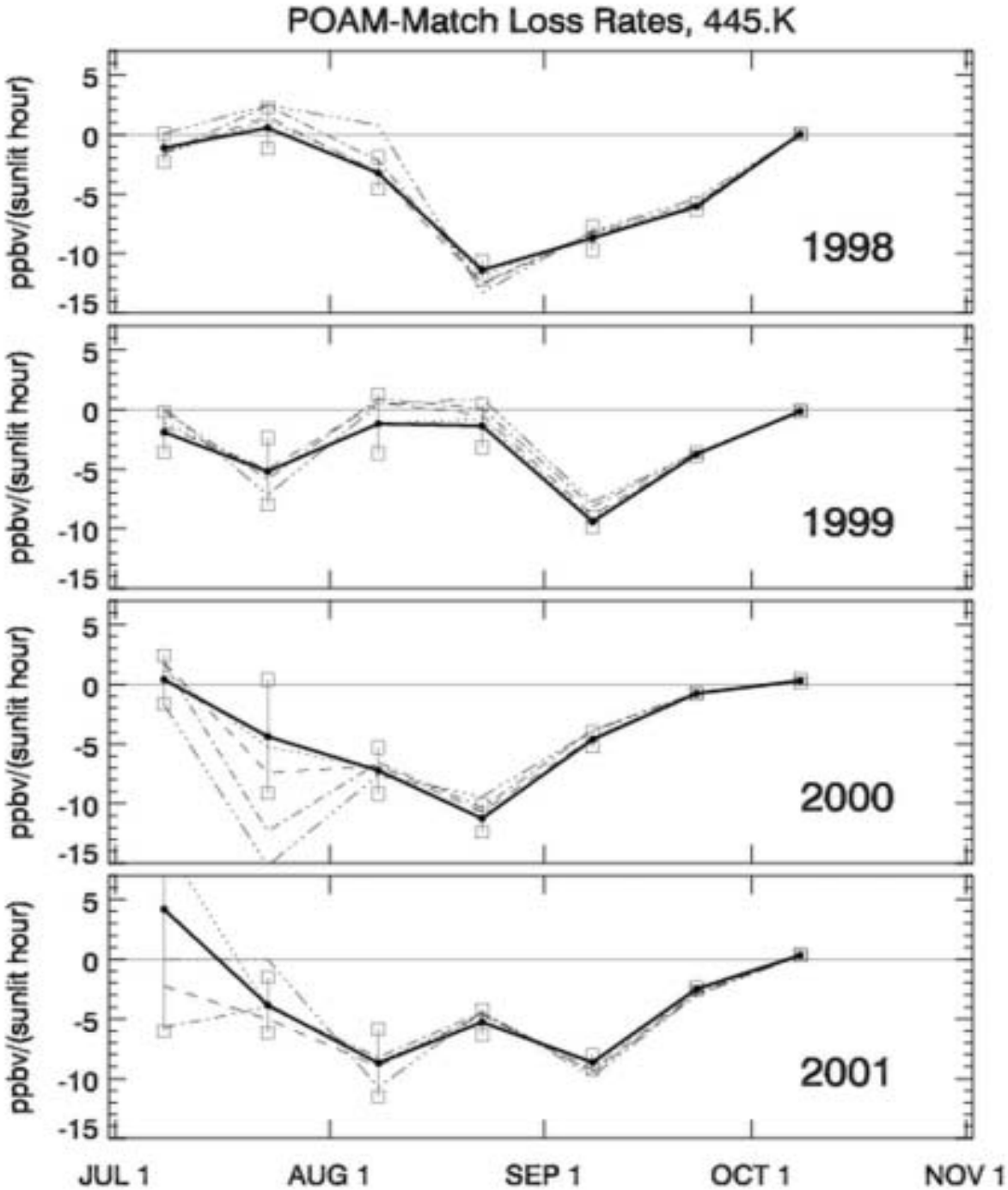
Loss rate calculation

loss rate = slope

Decreasing Match Radius

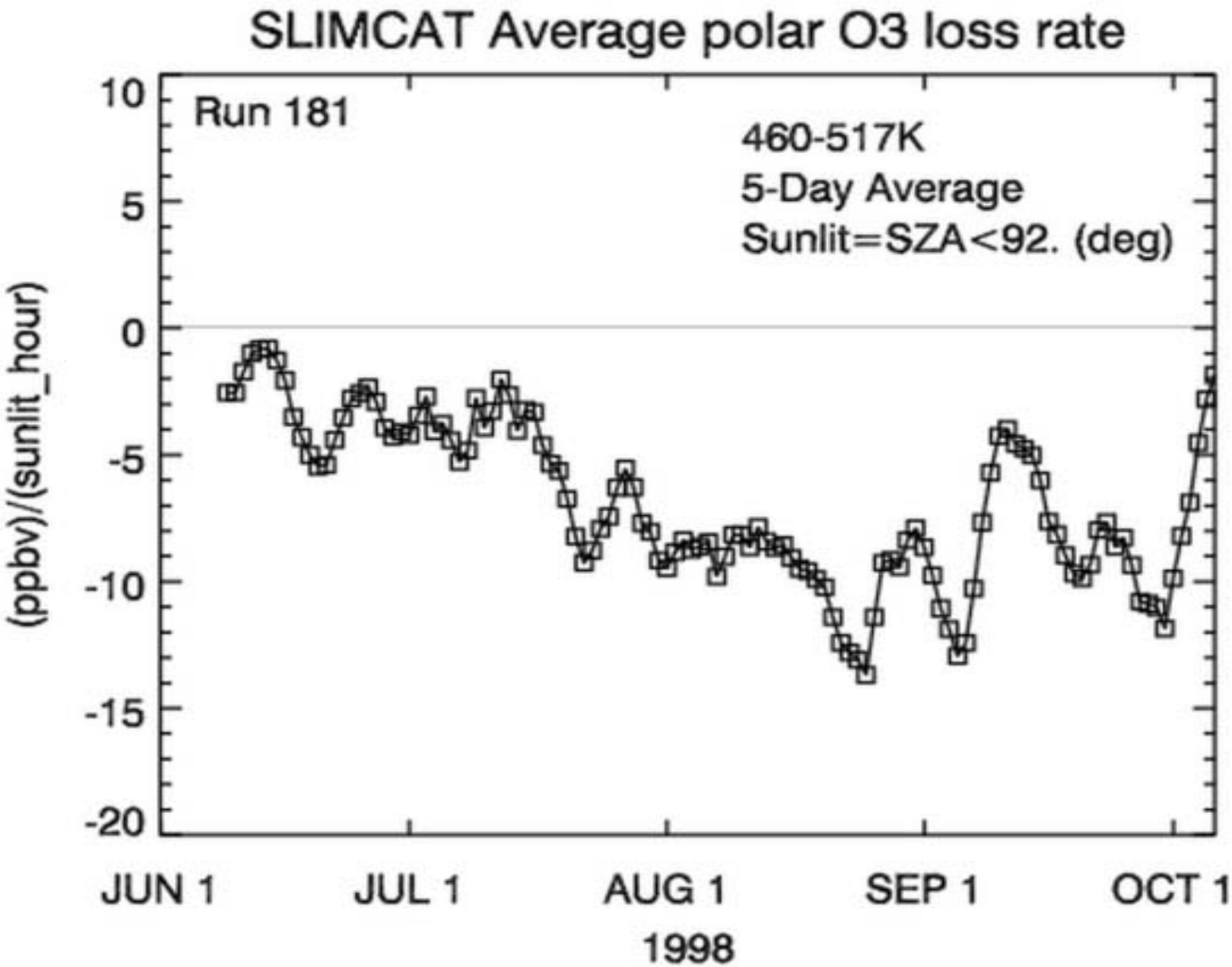


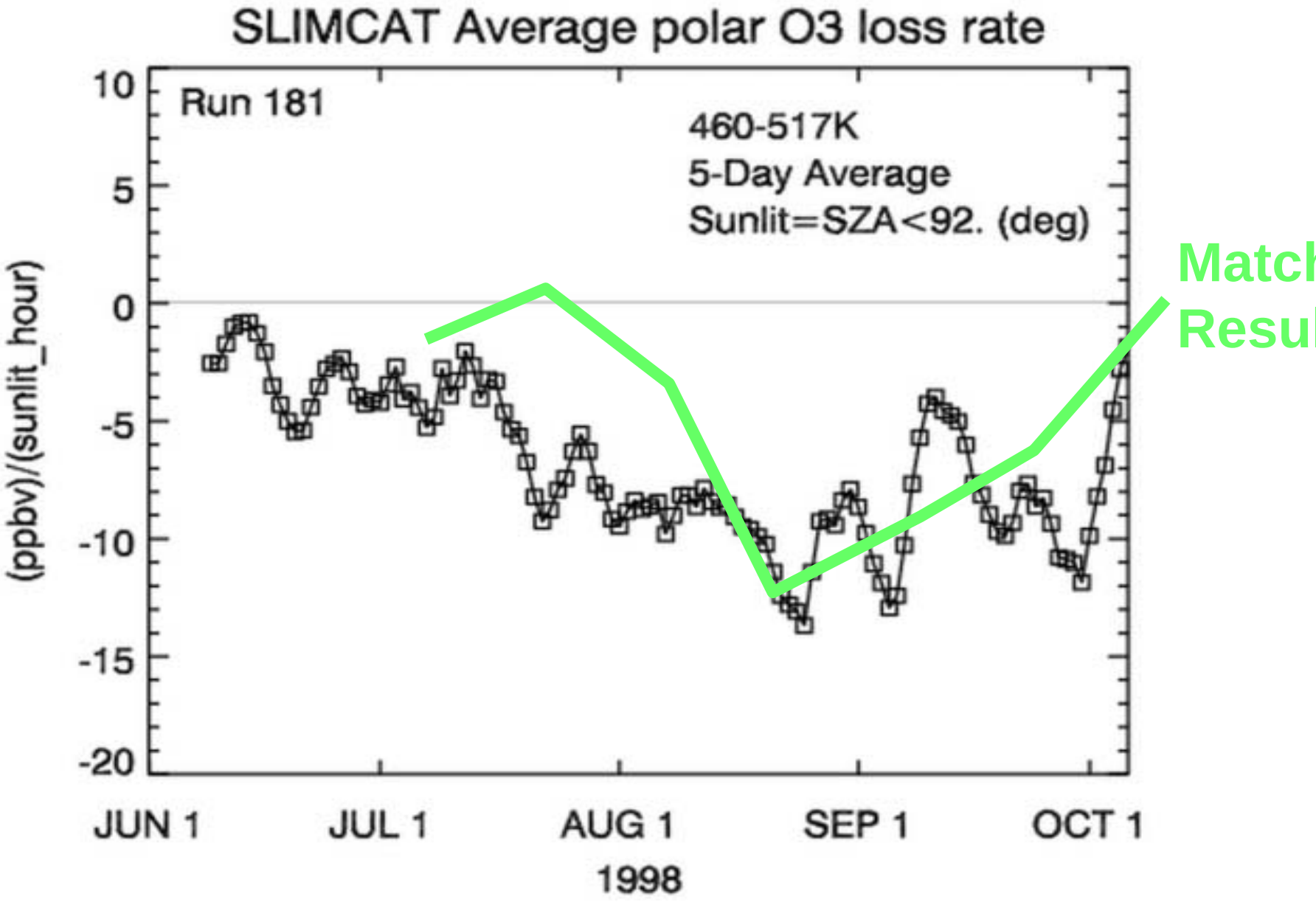
Preliminary Results: Ozone Loss Rates



Match radius:

- 1000 km
- 900 km
- 800 km
- 700 km
- 600 km


SLIMCAT Average polar O3 loss rate
Run 181
460-517K
5-Day Average
Sunlit=SZA<92. (deg)
(ppbv)/(sunlit_hour)
10
5
0
-5
-10
-15
-20
JUN 1
JUL 1
AUG 1
SEP 1
OCT 1
1998


SLIMCAT Average polar O3 loss rate
Run 181
460-517K
5-Day Average
Sunlit=SZA<92. (deg)
(ppbv)/(sunlit_hour)
10
5
0
-5
-10
-15
-20
JUN 1
JUL 1
AUG 1
SEP 1
OCT 1
1998
Match
Resul

Future Steps

- Run match trajectories using NCEP, ECMWF, DAO wind analysis and compare results
- Exchange data with the QUOBI project and analyze/compare southern hemisphere results.
- Compare occultation-match and sonde-match results for the northern hemisphere.
- Compare results with photochemical models.