The Unified SAM, SAGE, POAM 22-year Stratospheric Aerosol & Cloud Database: Enhancements & Applications

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First SOSST Meeting
May 6-7, 2003
Williamsburg, Virginia

Outline

A. Overview of existing Unified database

B. Examples of long-term, Unified statistics
   * Clear-sky Background extinction
   * PSC probability

C. POAM and SAGE together

D. Volcano and fire together

E. Unified plans

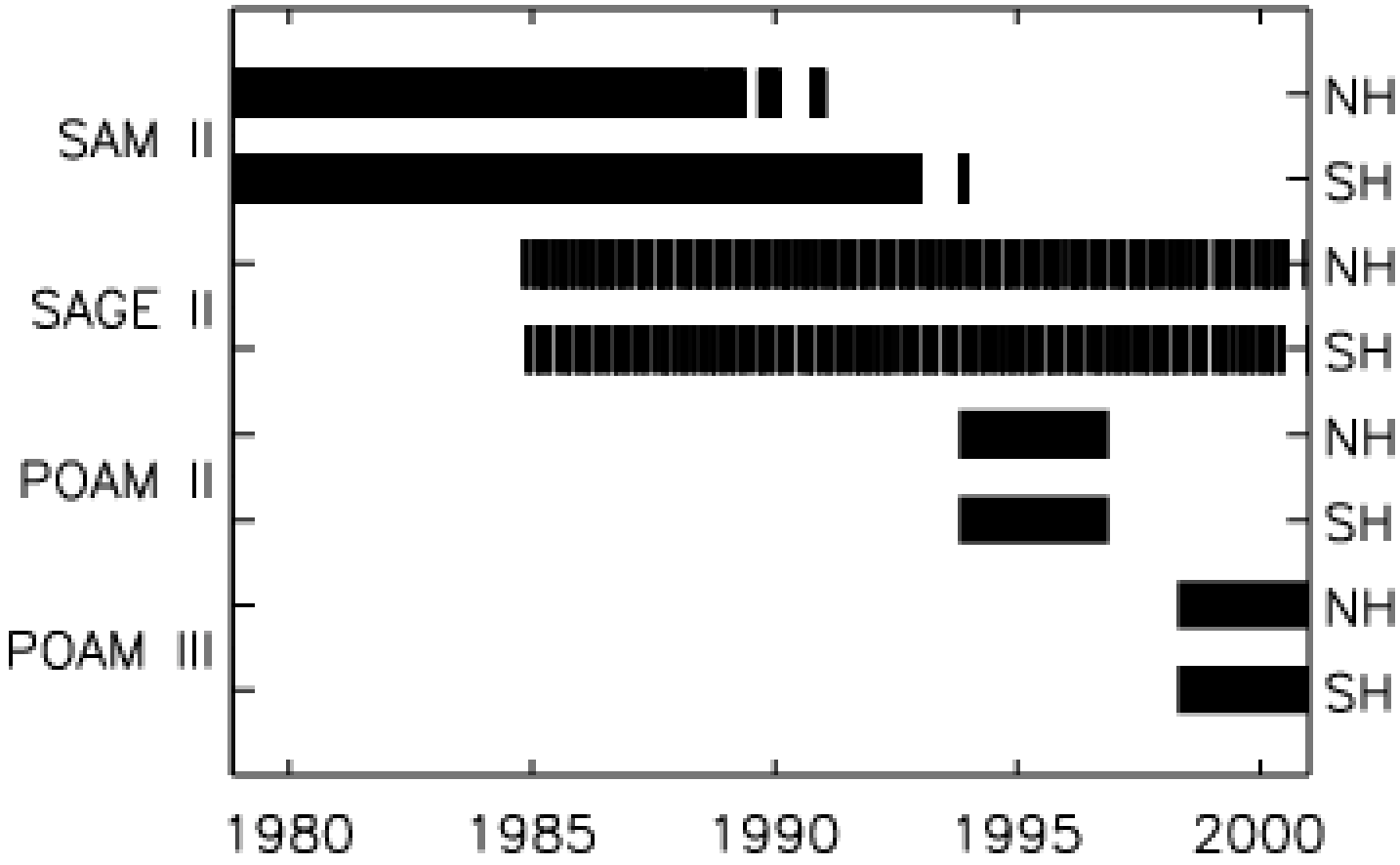
Original Concept

* Construct a single, long-term, high-latitude strat aerosol and cloud resource
* Unify instrument data sets: **SAM II, SAGE II, POAM II/III**
* Unified meteorology dataset: NCEP Reanalysis
* Unified algorithm
* Open access

Method

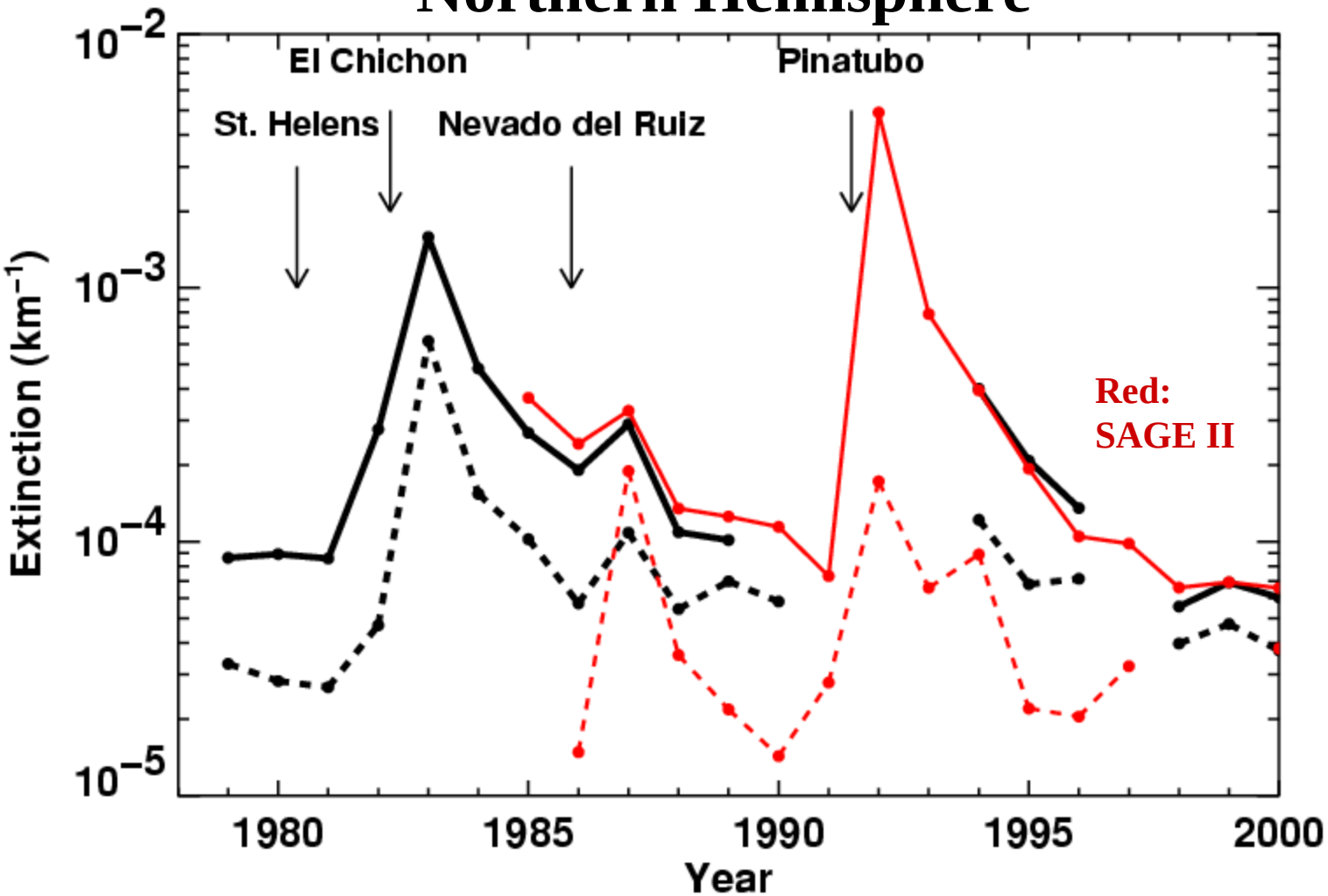
* Enhancement-based. Uses 1 micron extinction.
* Vortex air-mass segregation – Nash it is.
* Create “background” extinction dataset.
* Compute cloud threshold.
* Cloud and PSC detection for every data point, 13-29 km.

Current Unified Timeline & Instruments



[Fromm, Alfred, Pitts, JGR, in press]

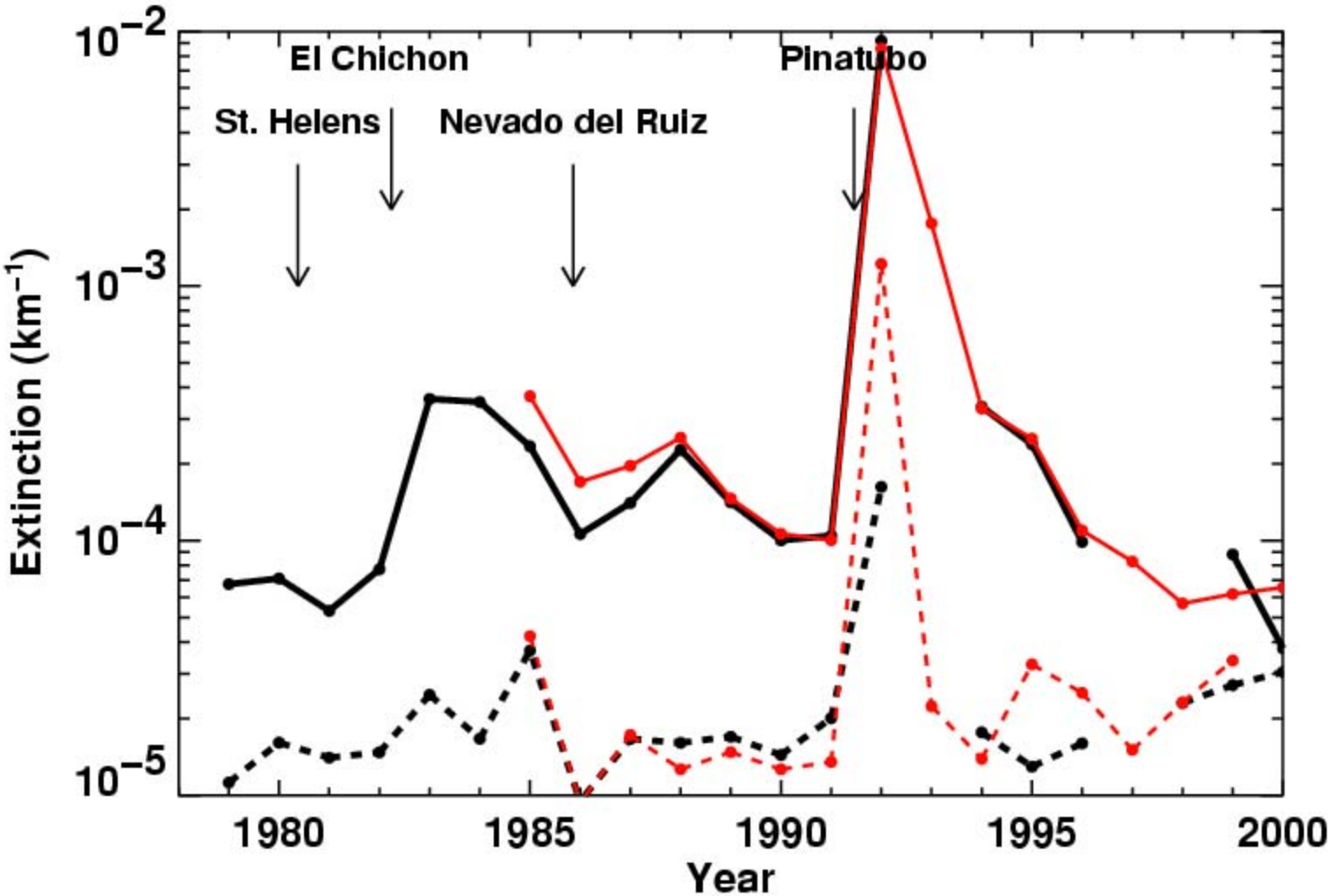
Unified "Background" extinction, 20 km Northern Hemisphere



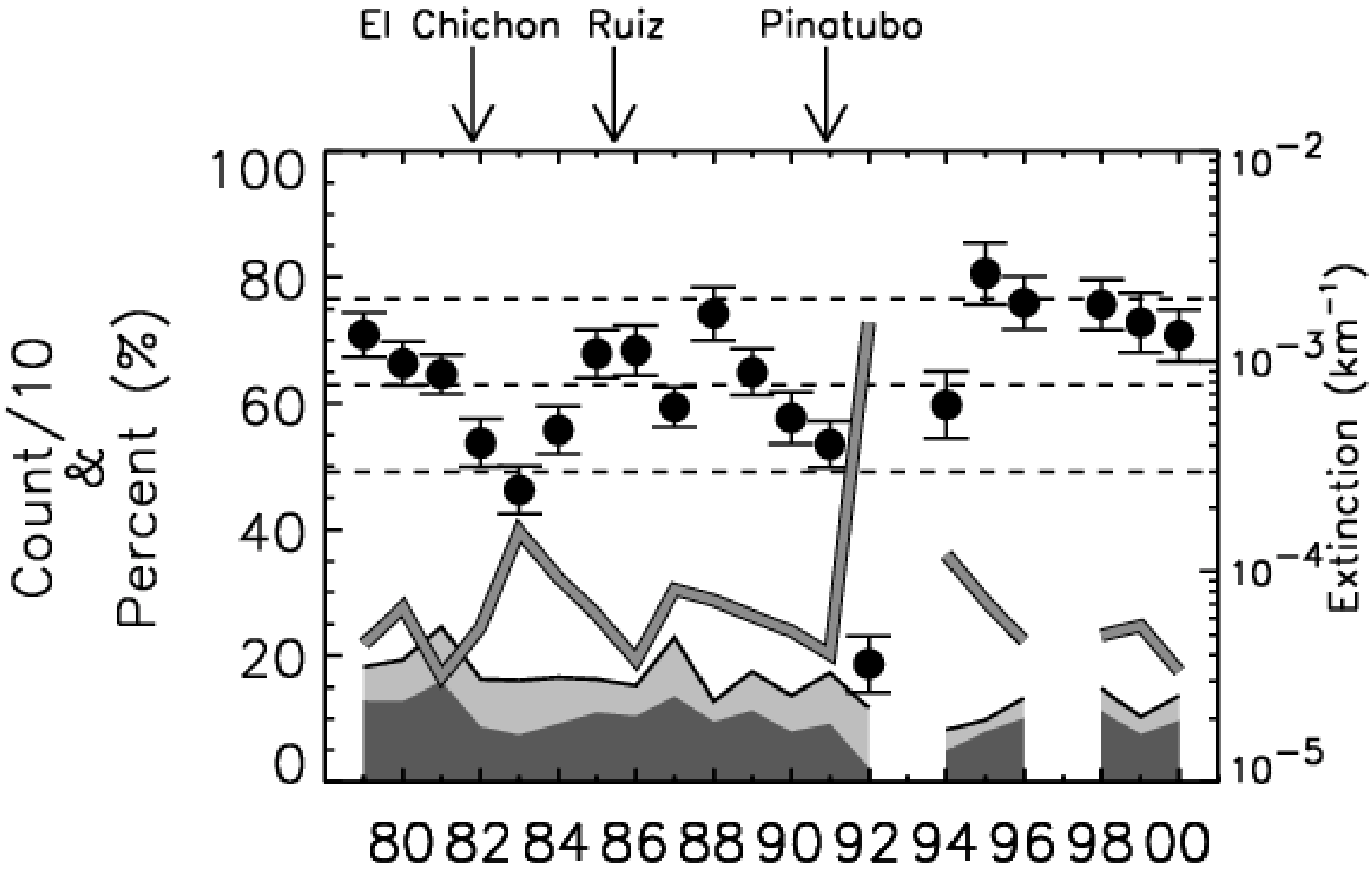
No vortex (summer)

Inside vortex (spring)

Southern Hemisphere



Unified PSC Probability (dots), Antarctic Denominator: 20-km Measurements 190-195 K



POAM III

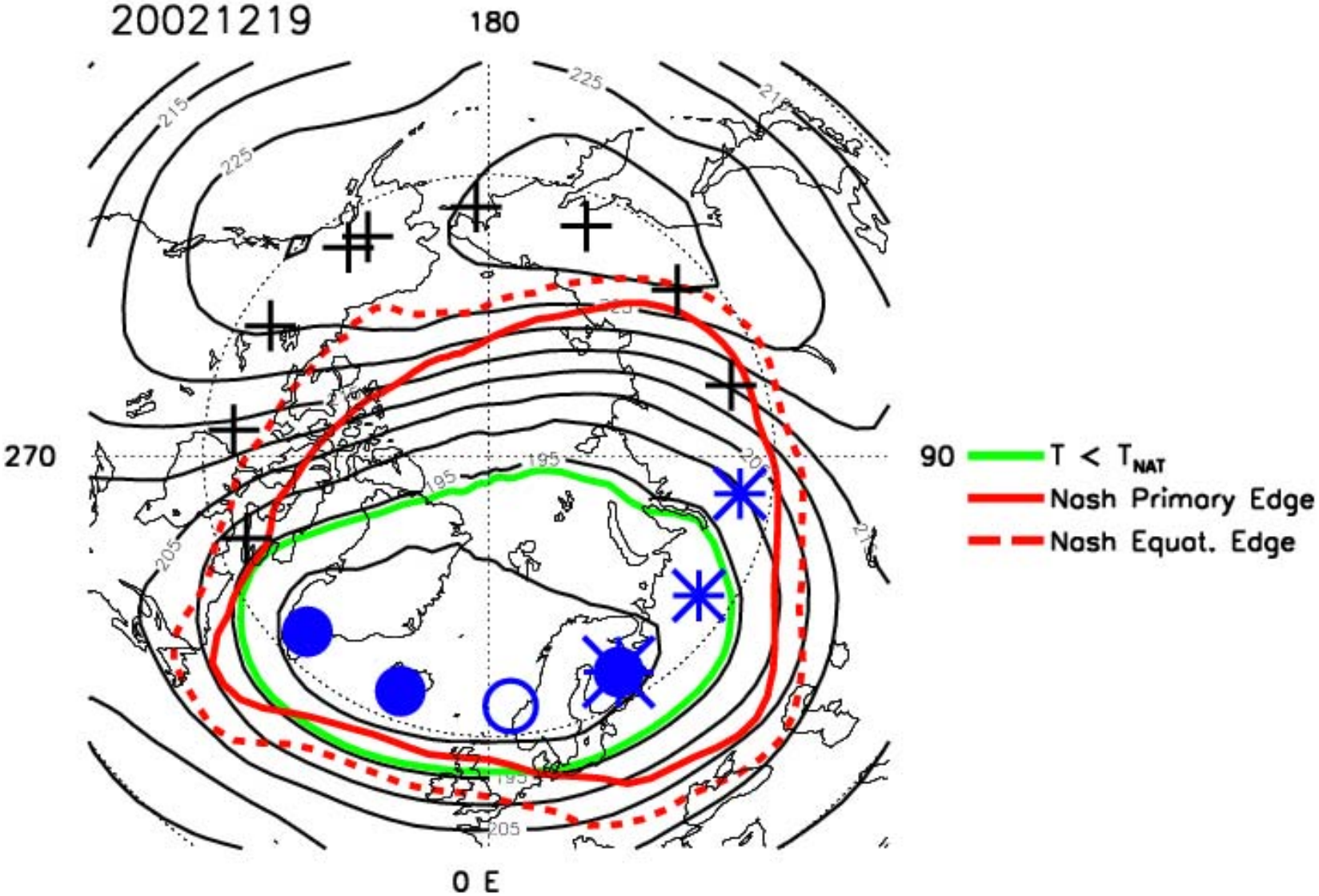
&

SAGE III

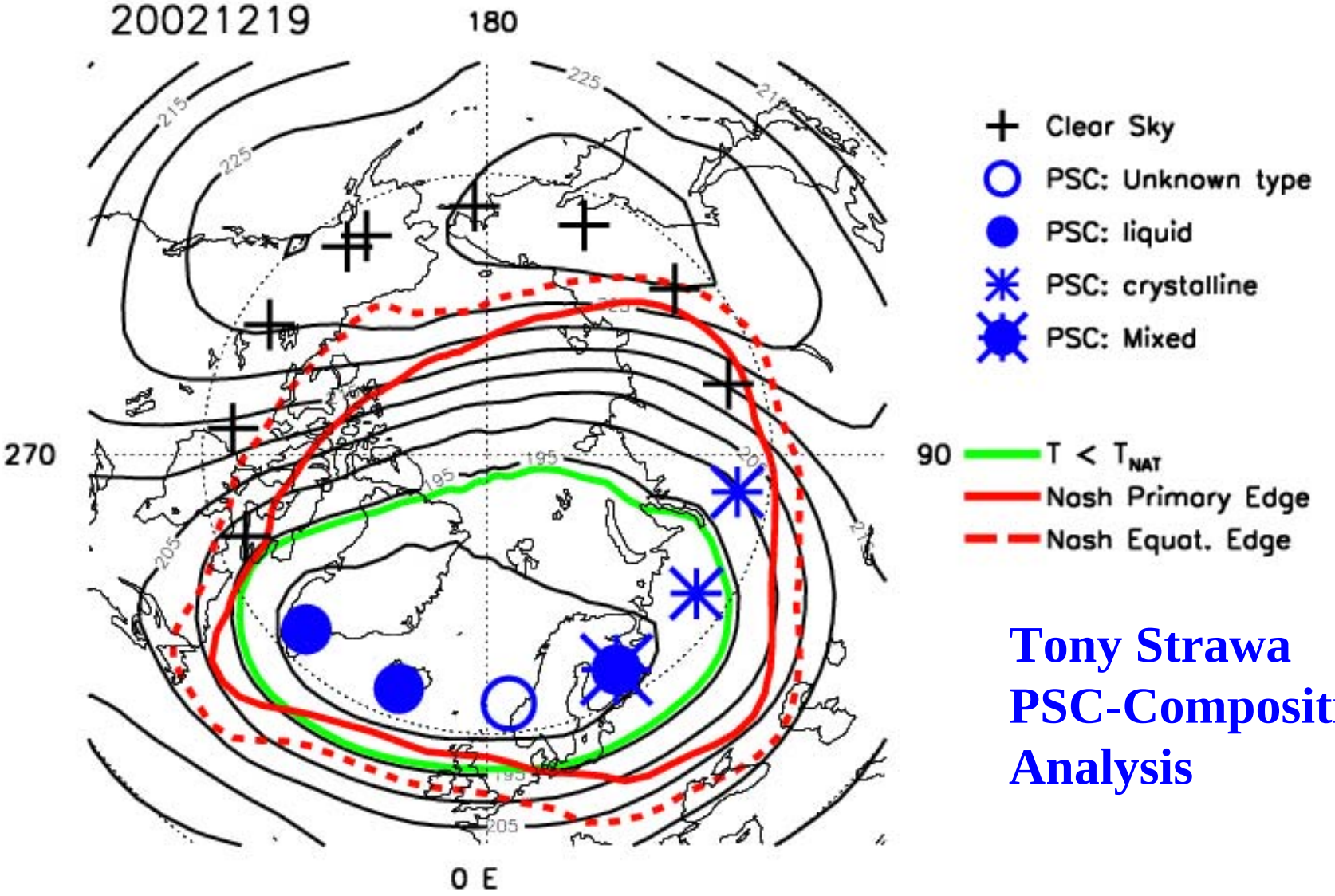
PSCs Together

SOLVE II, December 19, 2002

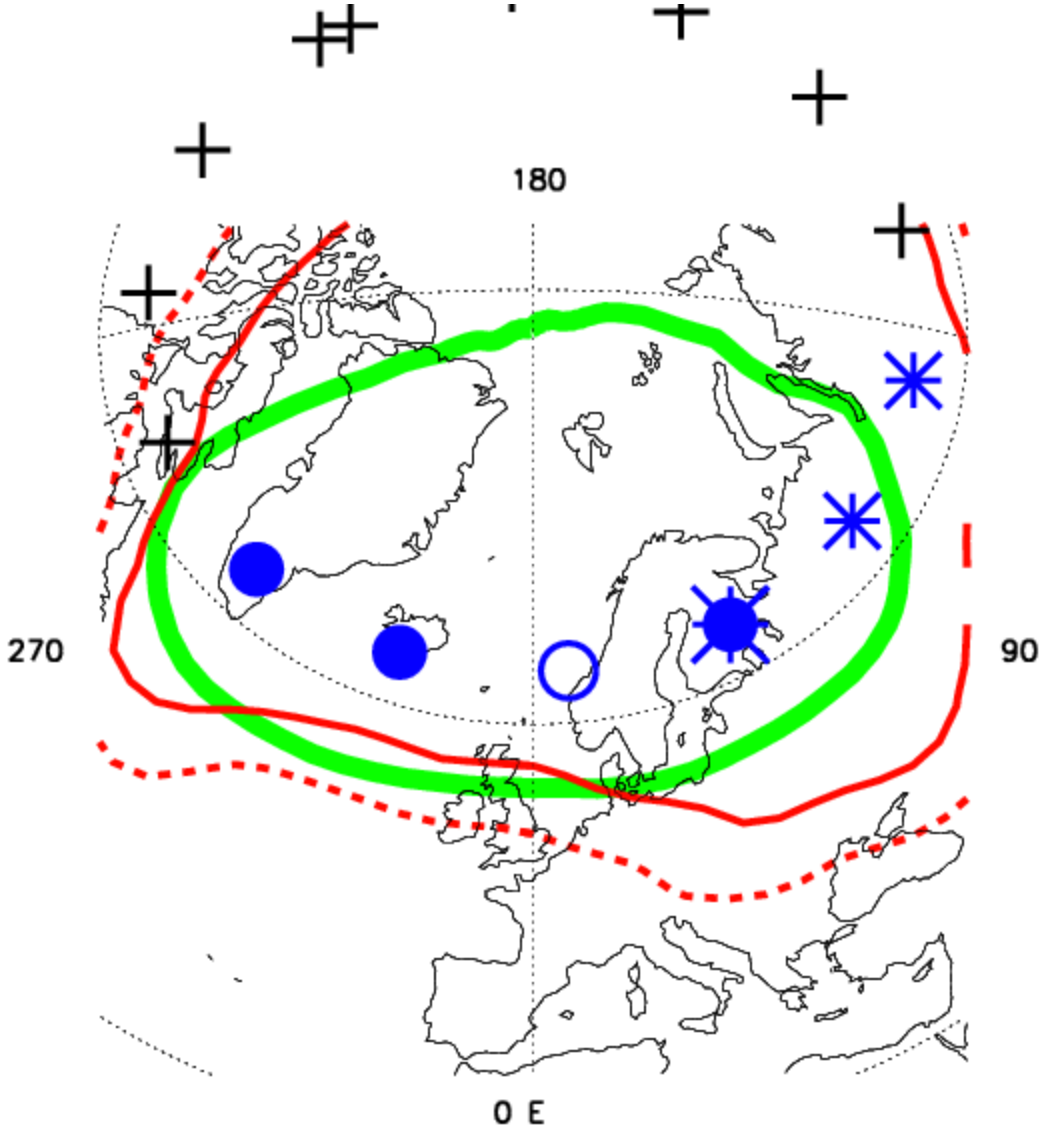
500 K UKMO Temperature (K), Nash Vortex, and POAM Events



500 K UKMO Temperature (K), Nash Vortex, and POAM Events

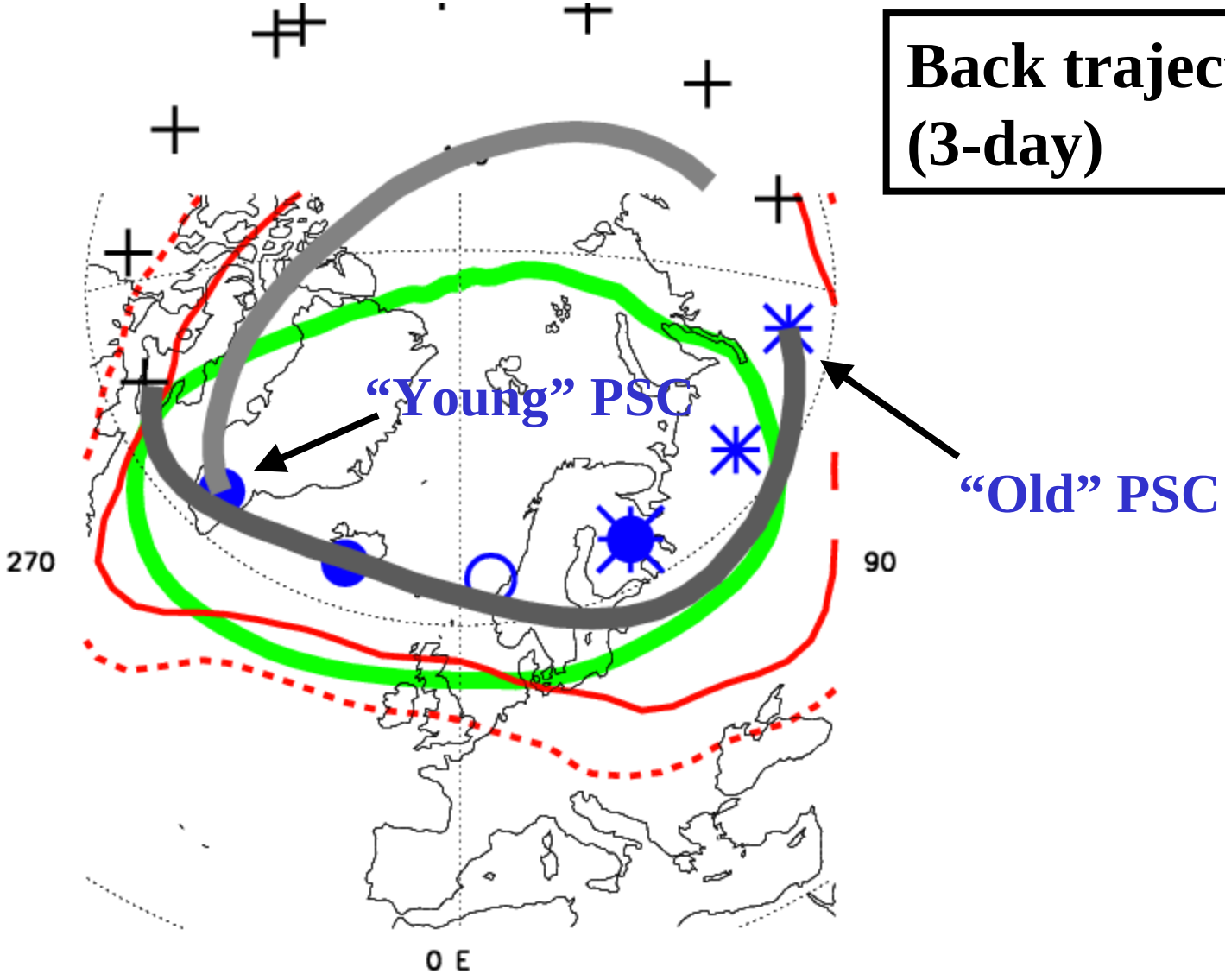


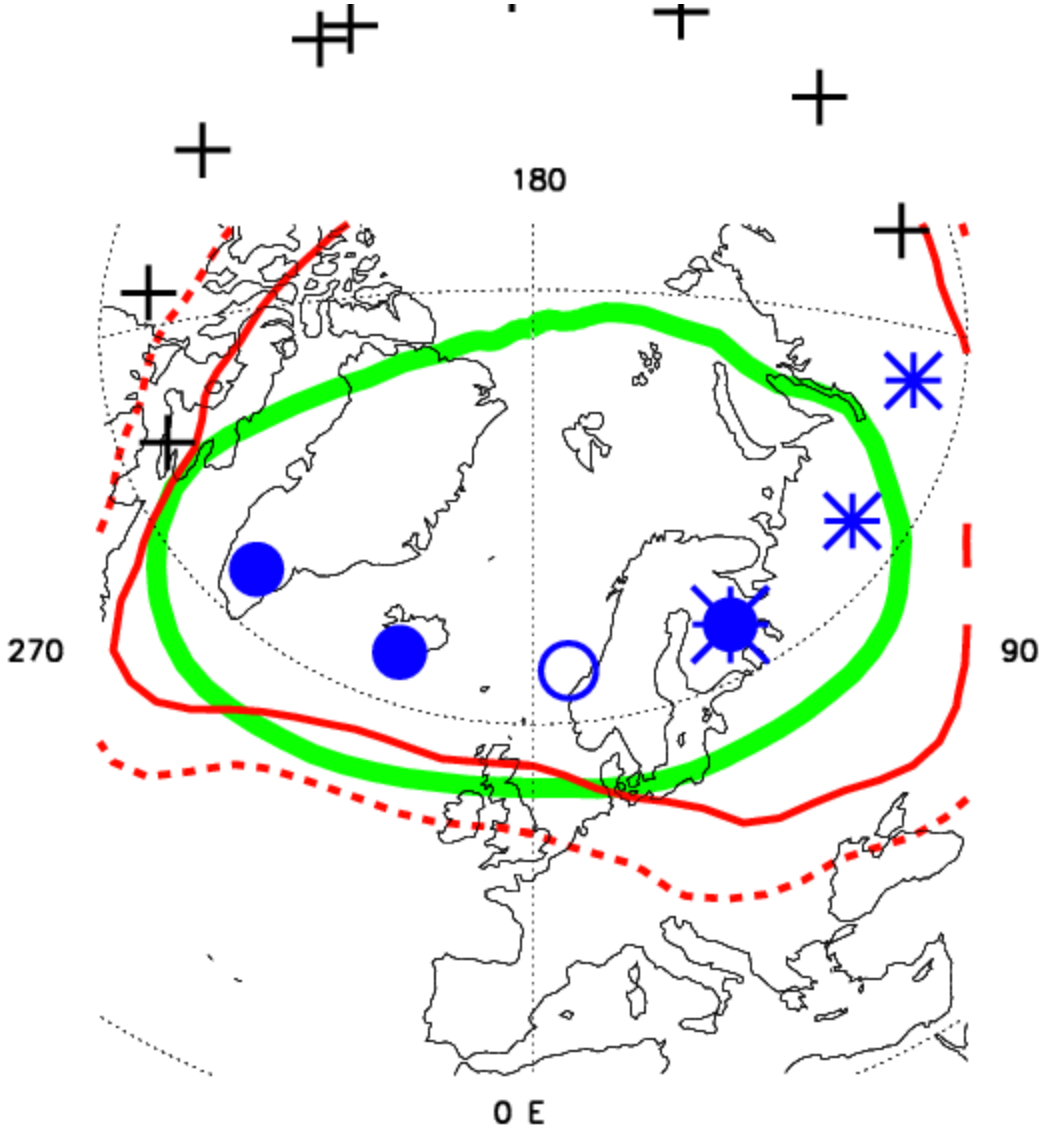
Tony Strawa
PSC-Composition Analysis



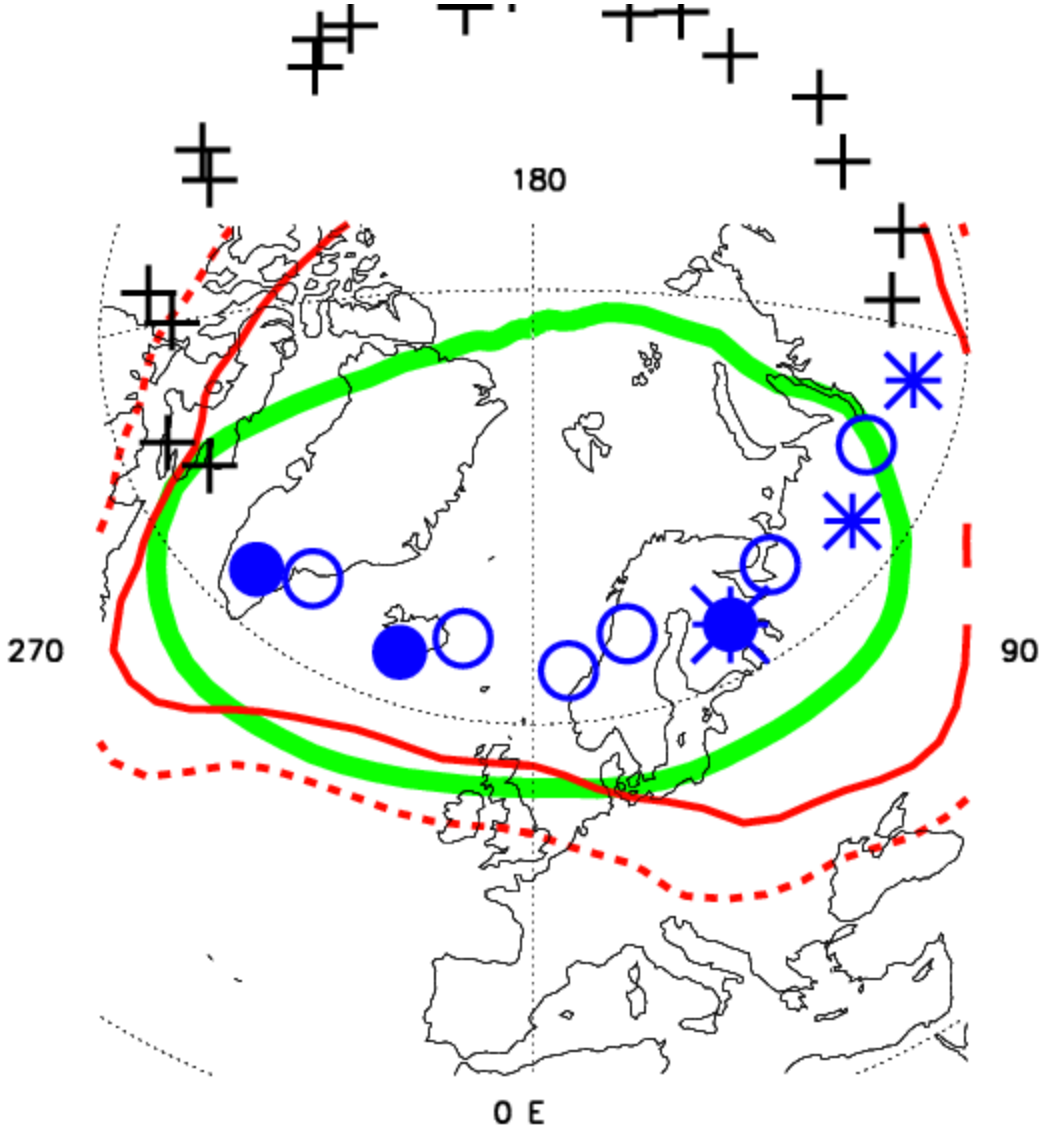
Let’s zoom in

Back trajectories (3-day)





Adding SAGE III

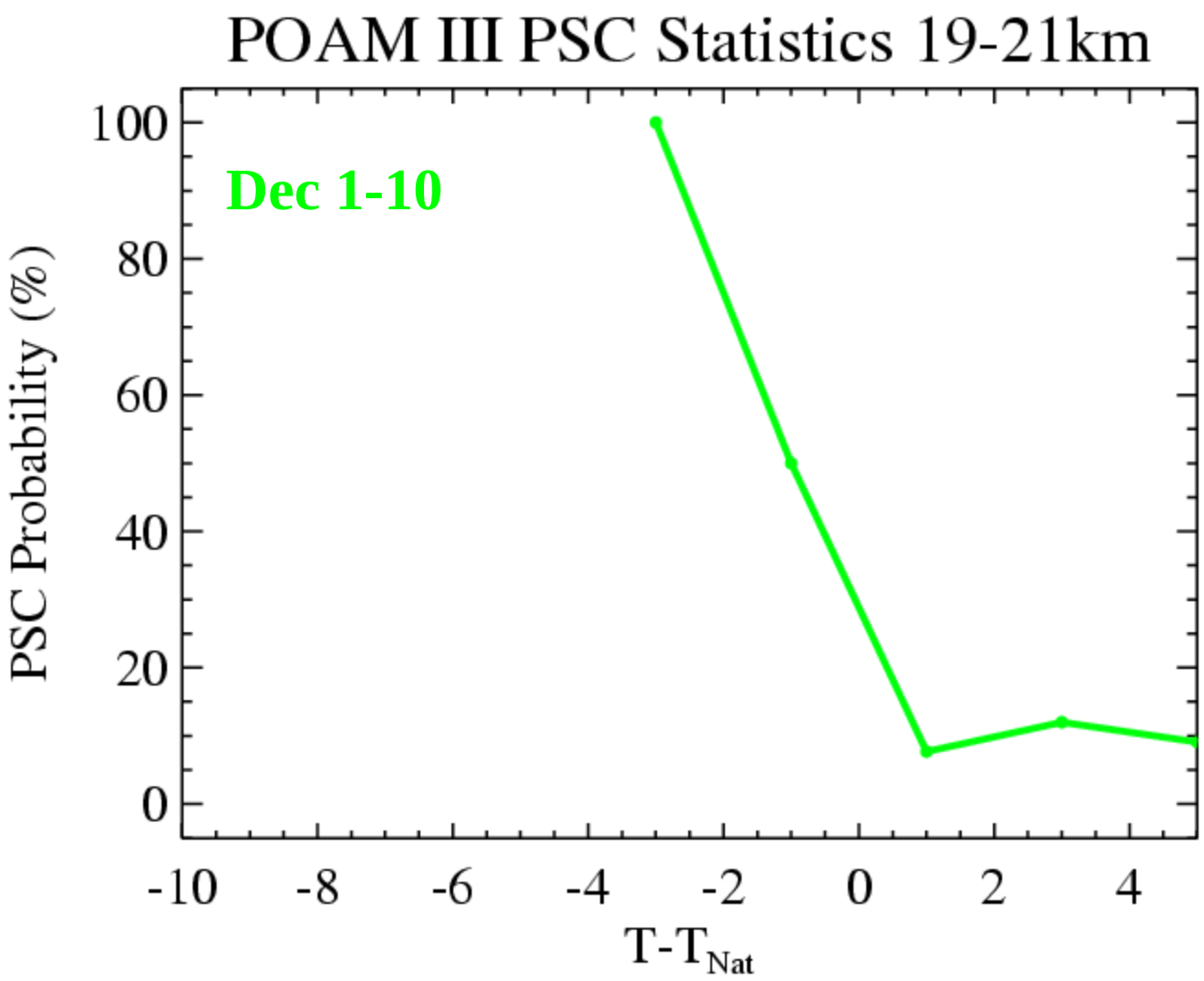


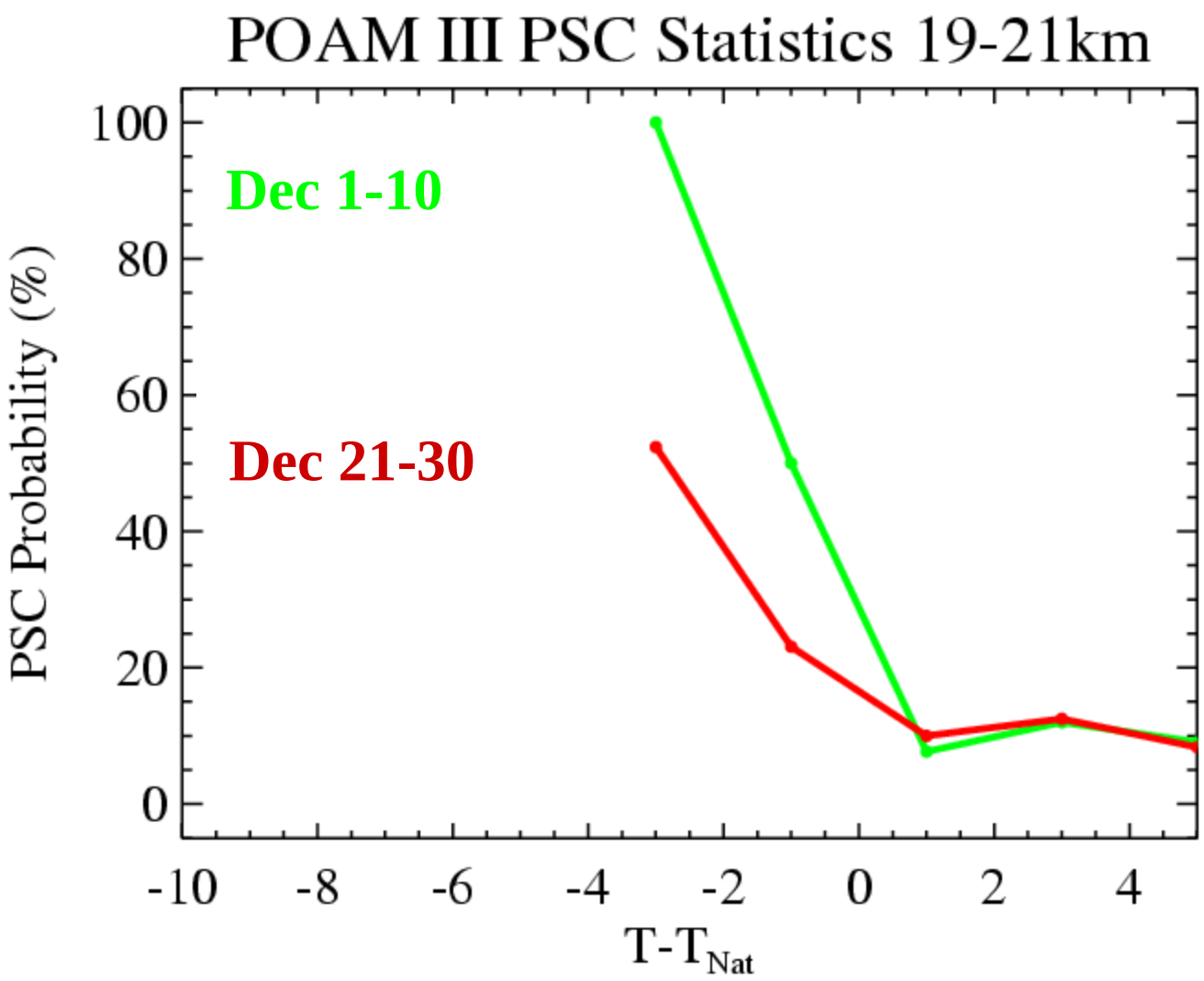
Adding SAGE III

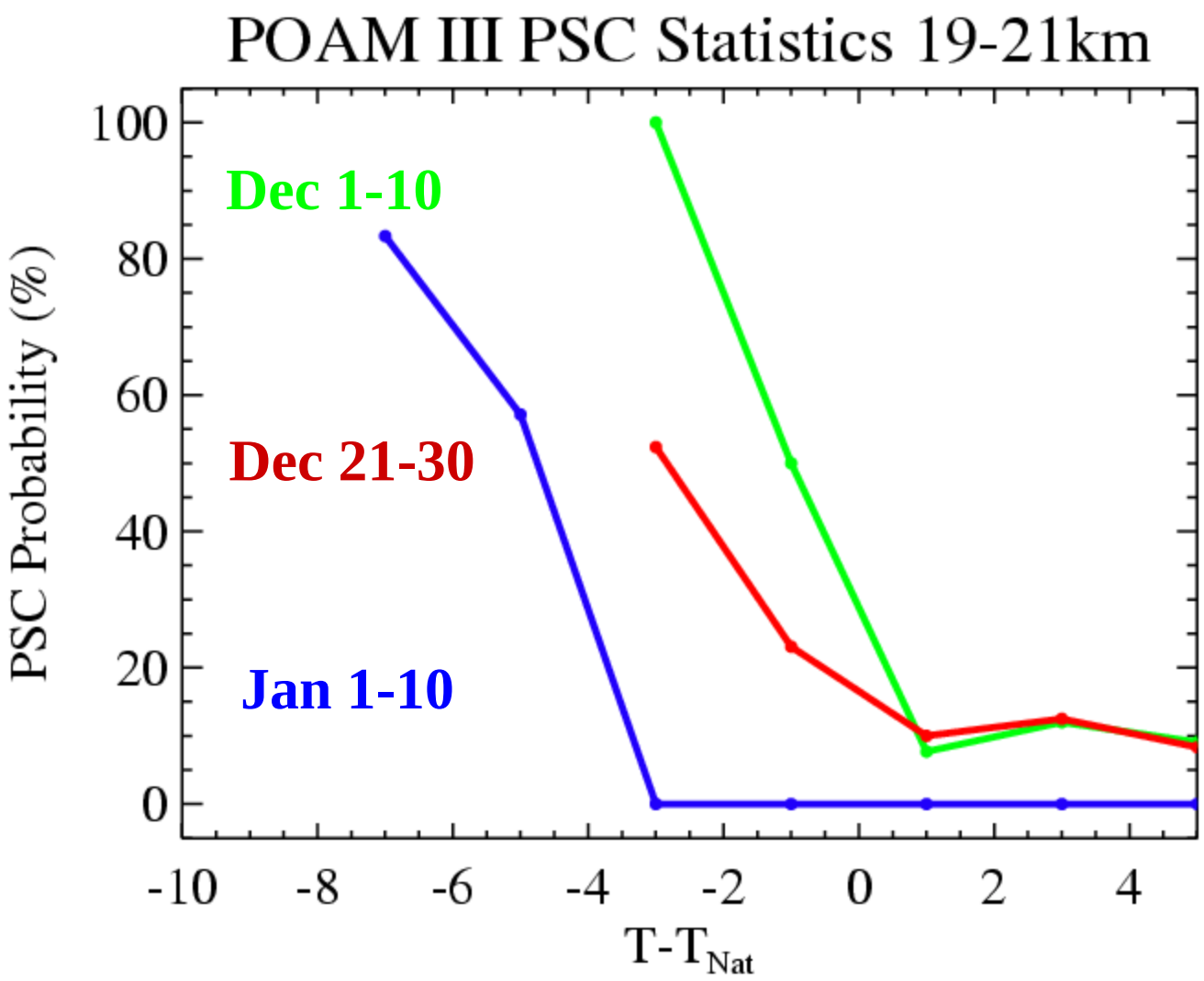
Imagine the possibilities!

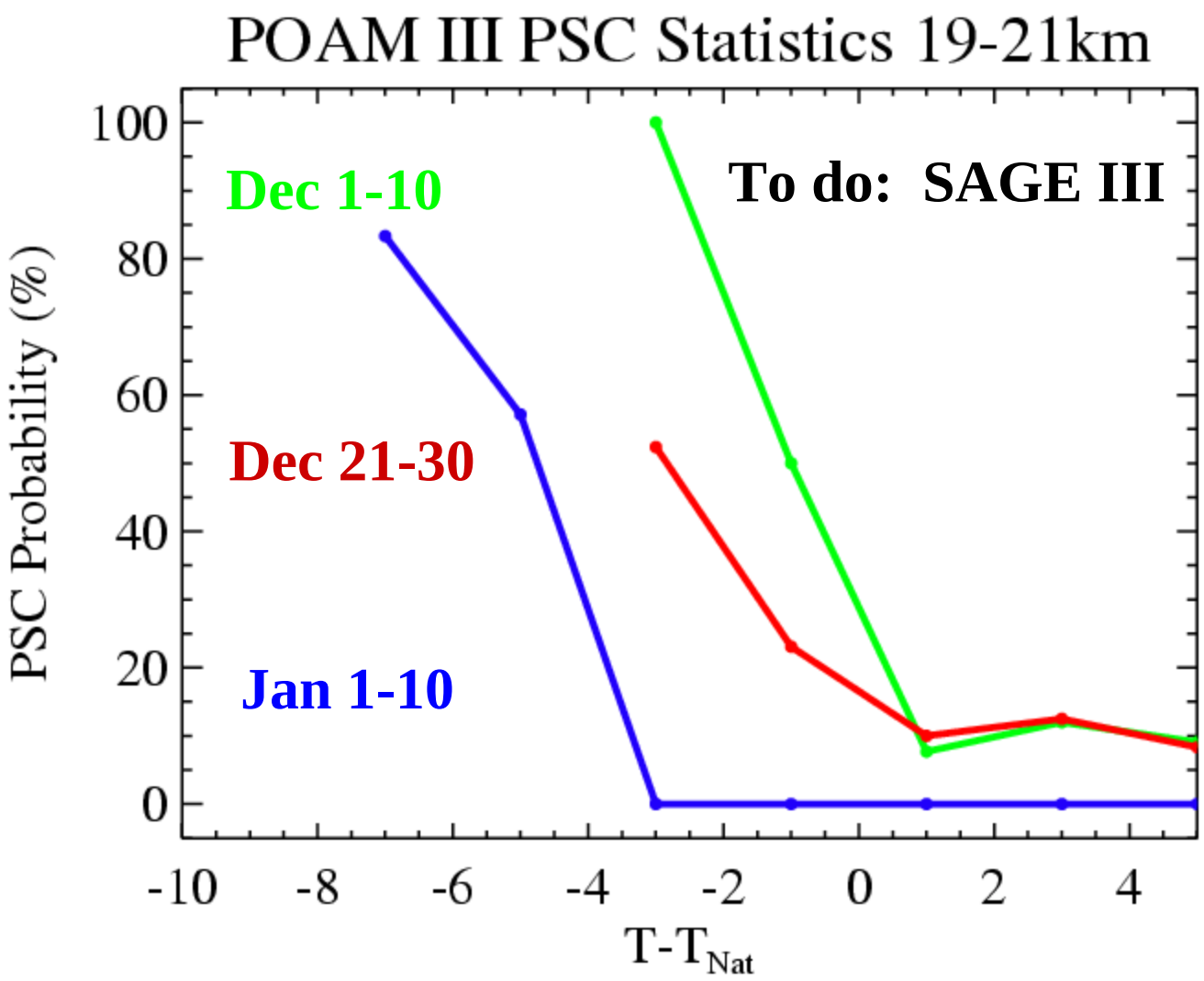
VINTERSOL / SOLVE II (2002-2003) Season

PSCs & Denitrification


POAM III PSC Statistics 19-21km
Dec 1-10
PSC Probability (%)
100
80
60
40
20
0
-10
-8
-6
-4
-2
0
2
4
T-T_Nat


POAM III PSC Statistics 19-21km
Dec 1-10
Dec 21-30
PSC Probability (%)
100
80
60
40
20
0
-10
-8
-6
-4
-2
0
2
4
T-T_Nat


POAM III PSC Statistics 19-21km
PSC Probability (%)
100
80
60
40
20
0
Dec 1-10
Dec 21-30
Jan 1-10
-10
-8
-6
-4
-2
0
2
4
T-T_Nat

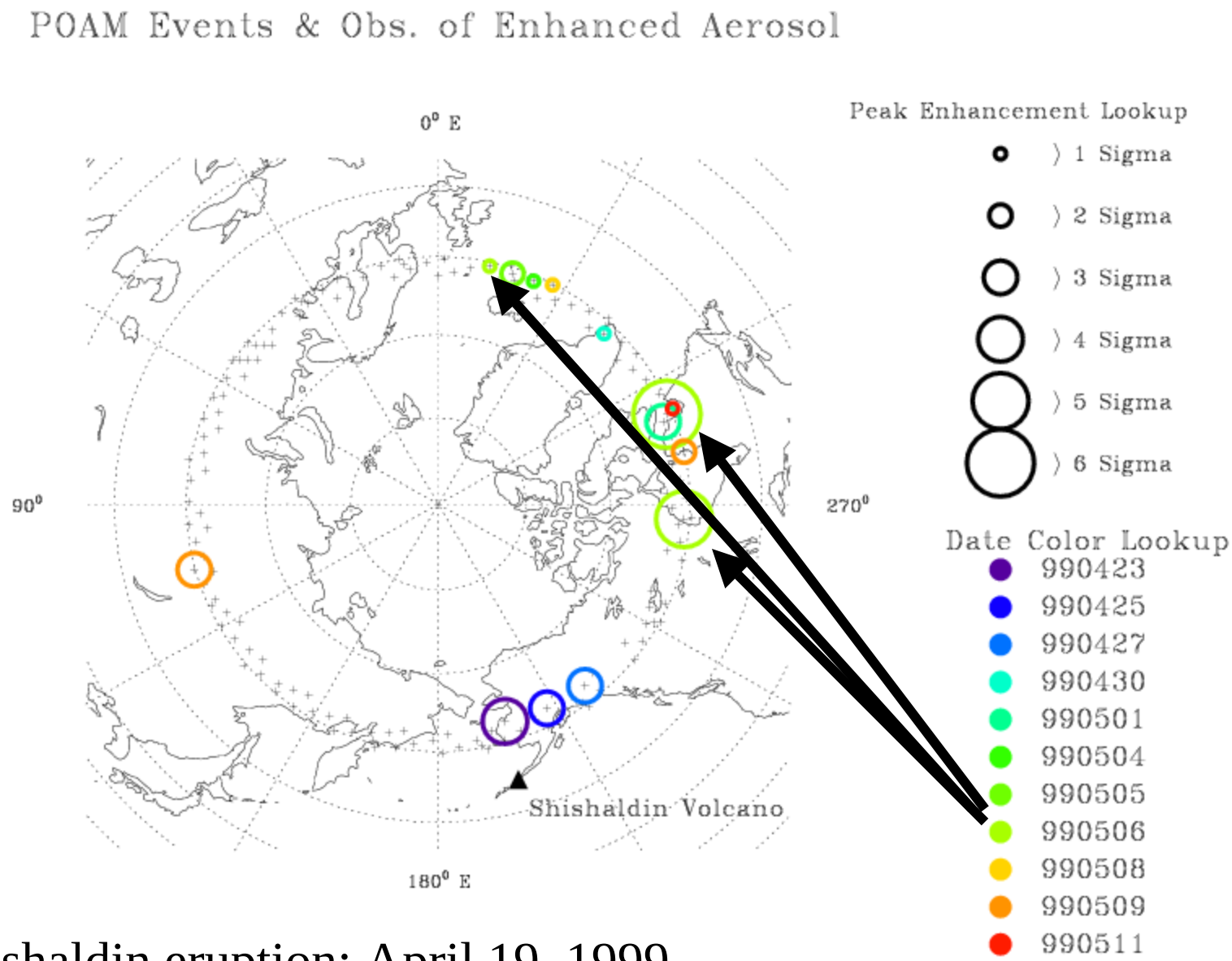


And of course, look at SAM II years and Antarctic

Volcano & Fire Together

Shishaldin effects mixed with forest fire blowup

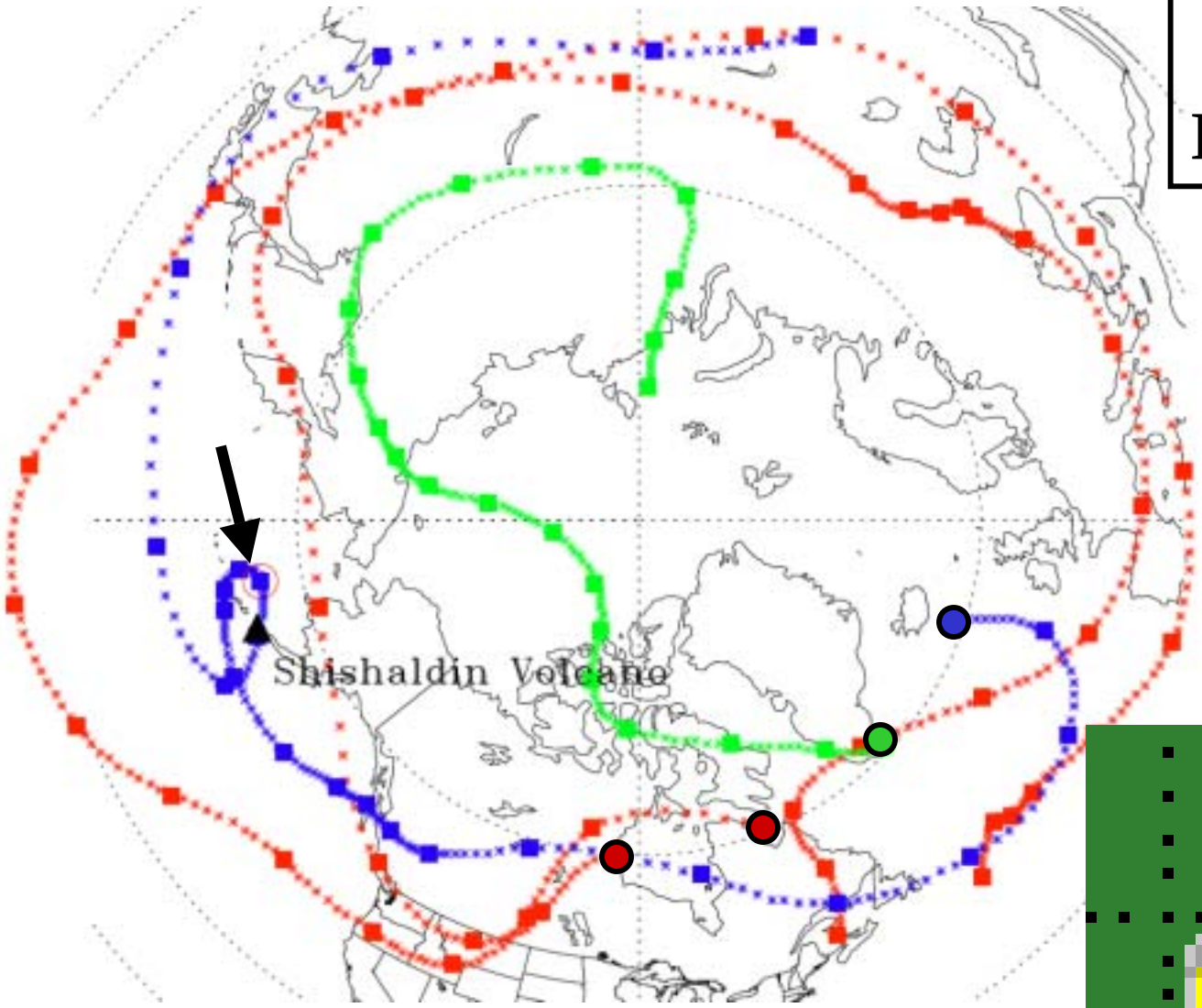
April - May, 1999



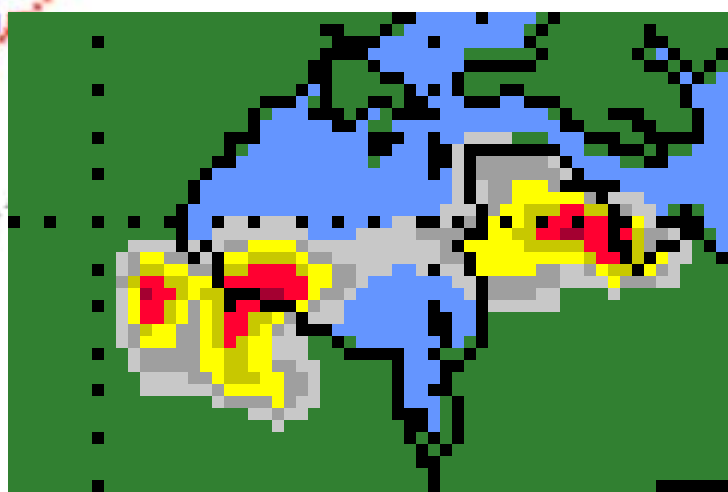
Shishaldin eruption: April 19, 1999

May 6, 1999

Back Trajectories



TOMS AI



Unified future directions:

- **PSC explorations**
  - * denitrification
  - * trends/cycles in cloudiness
  - * PSC formation and composition
- **Mystery Cloud applications**
  - * study global change implications
  - * investigate puzzling events

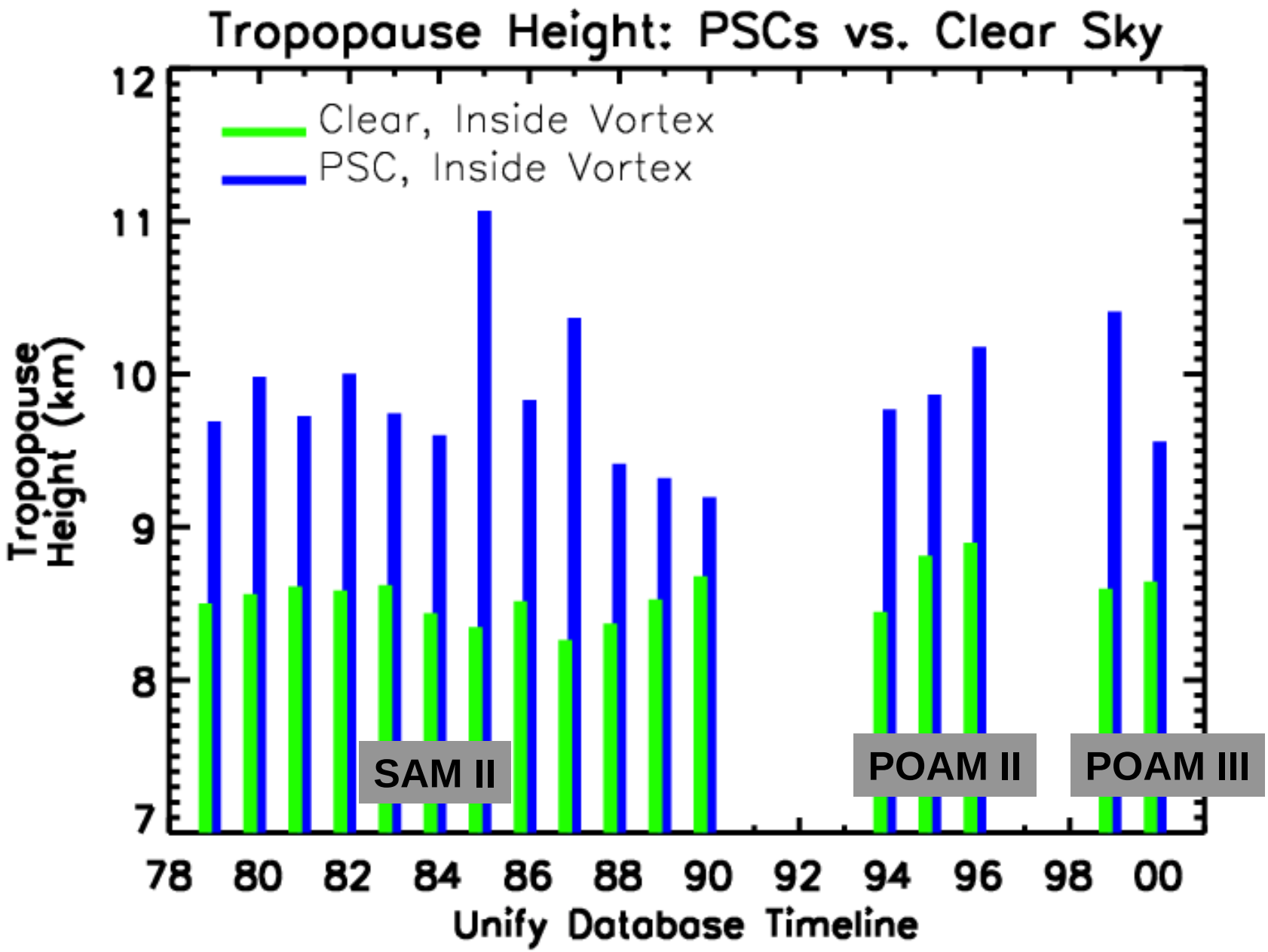
- **Database enhancements:**
  - extend to UT/LS
  - extend Unified with POAM, SAGE III, ILAS II
  - add ILAS, HALOE, CLAES to fill in gaps
  - add multi-wavelength information
  - merge in ECMWF met. data

Unified catalog on www.cpi.com

Unified PSC-Forcing Studies

Finding: Tropopause heights are almost always high* during Arctic PSC sightings.

*** relative to clear-sky observations.**


Tropopause Height: PSCs vs. Clear Sky
Clear, Inside Vortex
PSC, Inside Vortex
Tropopause Height (km)
12
11
10
9
8
7
SAM II
POAM II
POAM III
78
80
82
84
86
88
90
92
94
96
98
00
Unify Database Timeline