Record Total Ozone Loss in the Arctic in winter 2010/2011

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Objectives and Method

- To quantify the chemical ozone loss inside Vortex
- Comparison between modeled passive ozone and measurements

MODEL
- 3D CTM
  initialized on December 1, 2010 from ECMWF ozone fields
  => REPROBUS (ECMWF, 1000 - 0.1 hPa)
  => SLIMCAT (ECMWF, 1000 - 0.3 hPa)

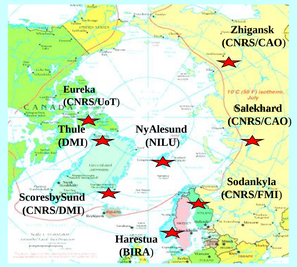
  2 runs: a) Passive Ozone
  b) Full chemistry

MEASUREMENTS
- Total ozone => SAOZ UV-Visible network - Twice daily

UV-Visible SAOZ

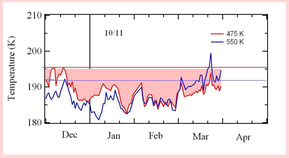
- Zenith sky visible spectrometer
- Differential Optical Absorption Spectroscopy
- Ozone: Chappuis bands (450-550 nm)
- Consistency between stations: 3% (NDACC Intercomparisons)
- PSC days removed using a color index

UV-Visible SAOZ network

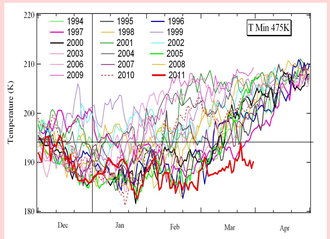


METEOROLOGY

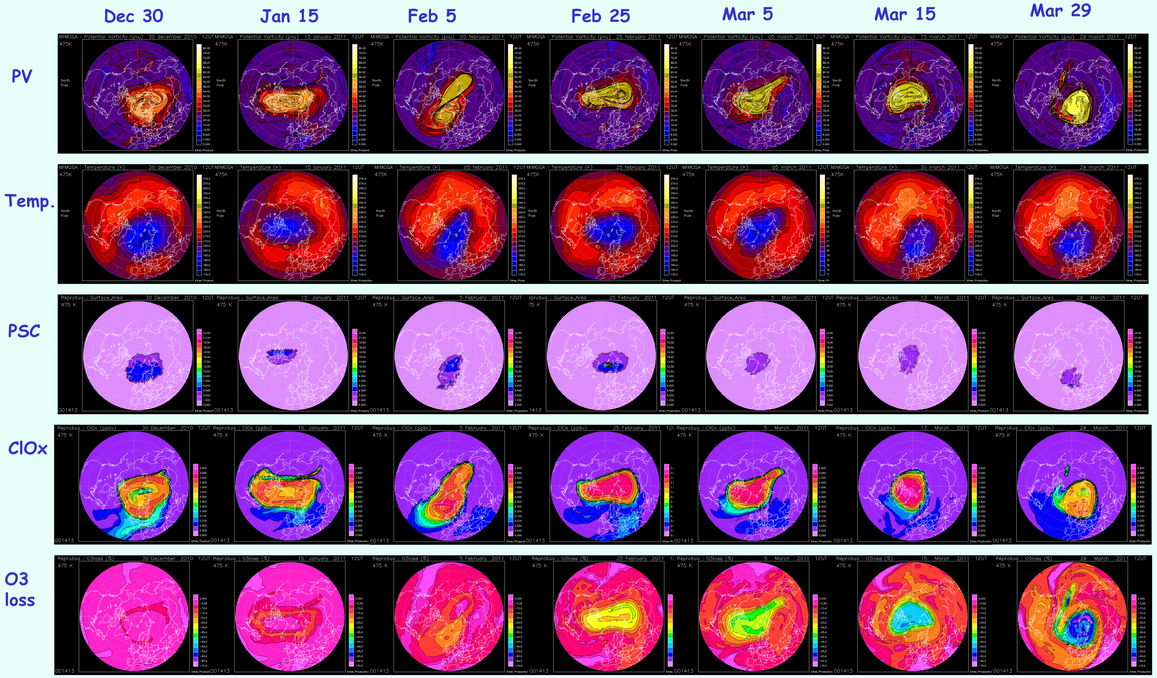
Cold Temperatures from Mid-December to end of March



- Temperatures < PSC since December
- Minor warmings in early January, early February and early March.
- Major warming in progress at the end of March



REPROBUS 3D CTM SIMULATION (475 K) - MIMOSA PV FIELDS



Chlorine activation at vortex edge.

Start of ozone loss at vortex edge

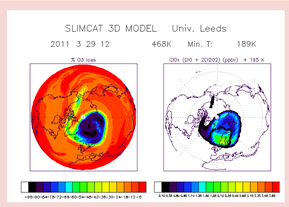
Vortex split in two bulbs

Ozone loss homogeneous inside vortex

Fastest ozone loss period

Maximum ozone loss reaching 55%

**Maximum ozone loss reaching 65%
Vortex is still present and compact at 475K
Chlorine activation is decreasing**



Compared to Reprobus, on March 29, Slimcat is simulating

- Larger maximum ozone loss of 95 %

- Similar chlorine species: ~ 2 ppbv

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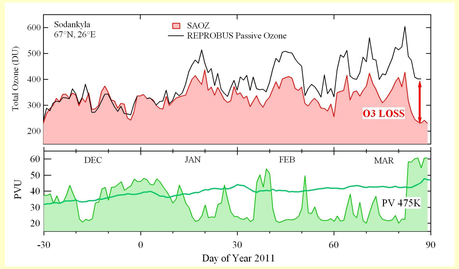
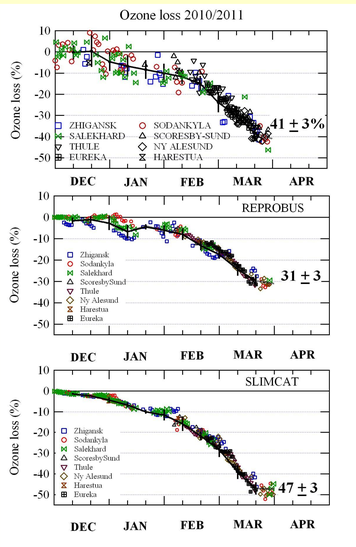
TOTAL OZONE LOSS

Example: Sodankyla (Finland)
Top
- Black: REPROBUS passive O3
- Pink: SAOZ O3 columns

Bottom
- Mimosa PV and vortex edge (Nash criteria)



All stations



Observed: SAOZ

Simulated: REPROBUS

Simulated: SLIMCAT

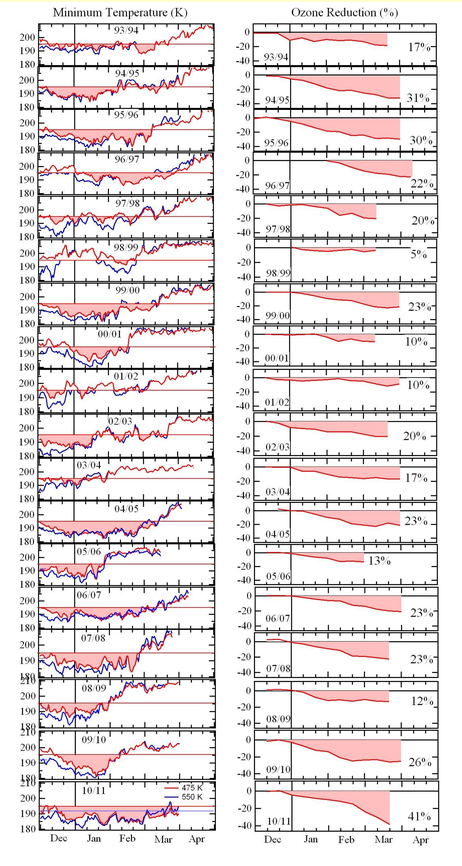
Observed

- Total ozone reduction in Vortex: 41 % ± 3% or ~ 165 DU
- Loss rate
  - **0.2% per day** until mid-February,
  - **0.8% per day** between February 20 and March 20

Simulated

- **REPROBUS:** 31 % or ~ **124 DU**
- **SLIMCAT:** 47 % or ~ **190 DU**

Comparison to Previous Winters



RECORD OZONE LOSS in 2010/11