

The HO₃le Story

ESA Advanced Atmospheric Training Course
(Group 2)
20 Sep 2008
Oxford, UK

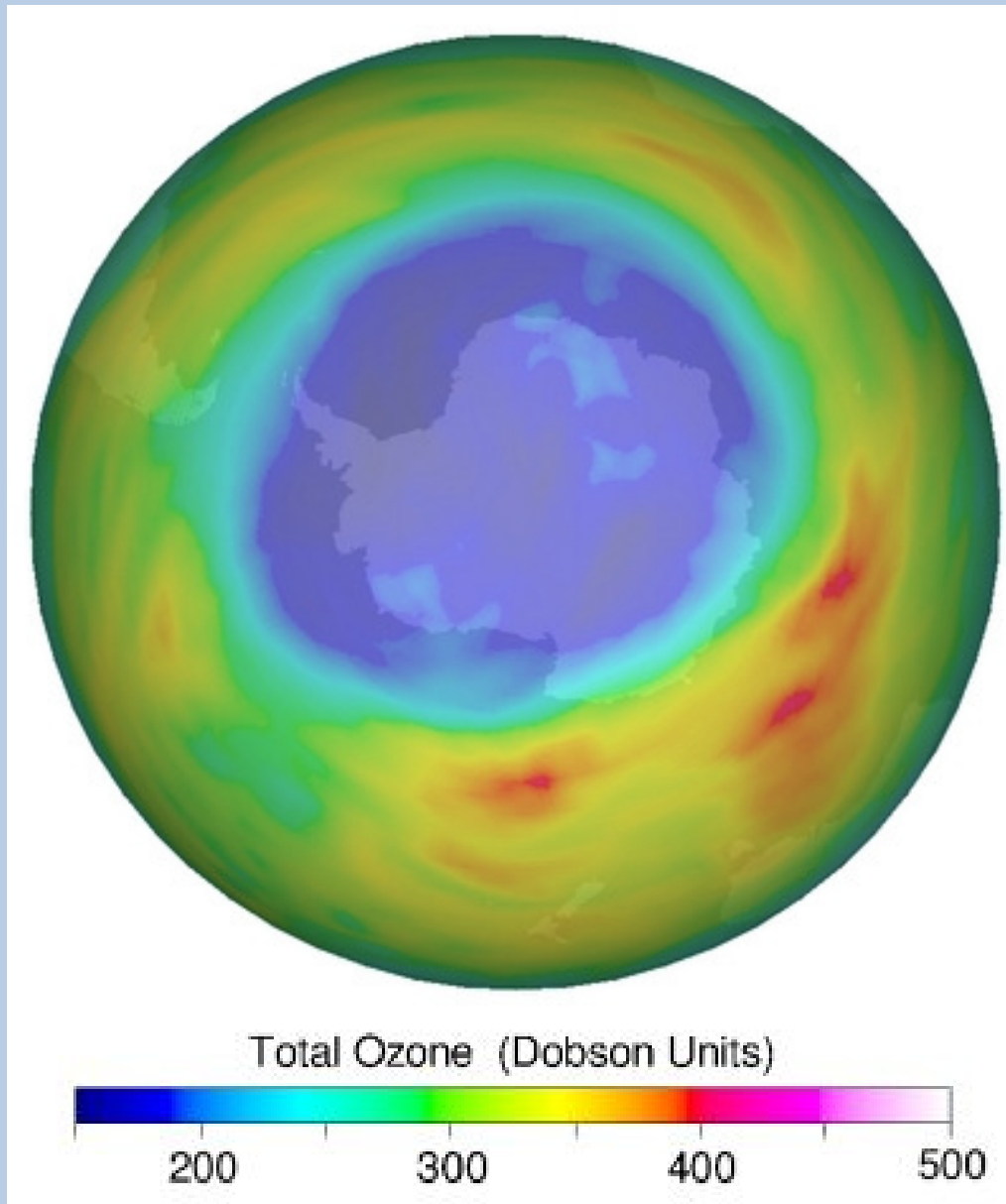
Introduction

- Balloon-sonde anomalies → Global scale scientific experiment
- Satellite Global Coverage: new innovation to capture complex spatial structure
- Interaction of Science and Policy
 - Montreal Protocol
- TOMS heritage → GOME, SCIAMACHY, & OMI
- Tools for monitoring: TEMIS

Monitoring

- TEMIS Diagnostic tools
 - Ozone Hole Extent - Area
 - Amount of Ozone Loss
 - Minimum Vortex Concentration / Depth
- Satellite data products available
 - Ozone, Cl- Related Trace Gases, Met Fields
- Interaction of Chemistry & Meteorology

Yesterday...

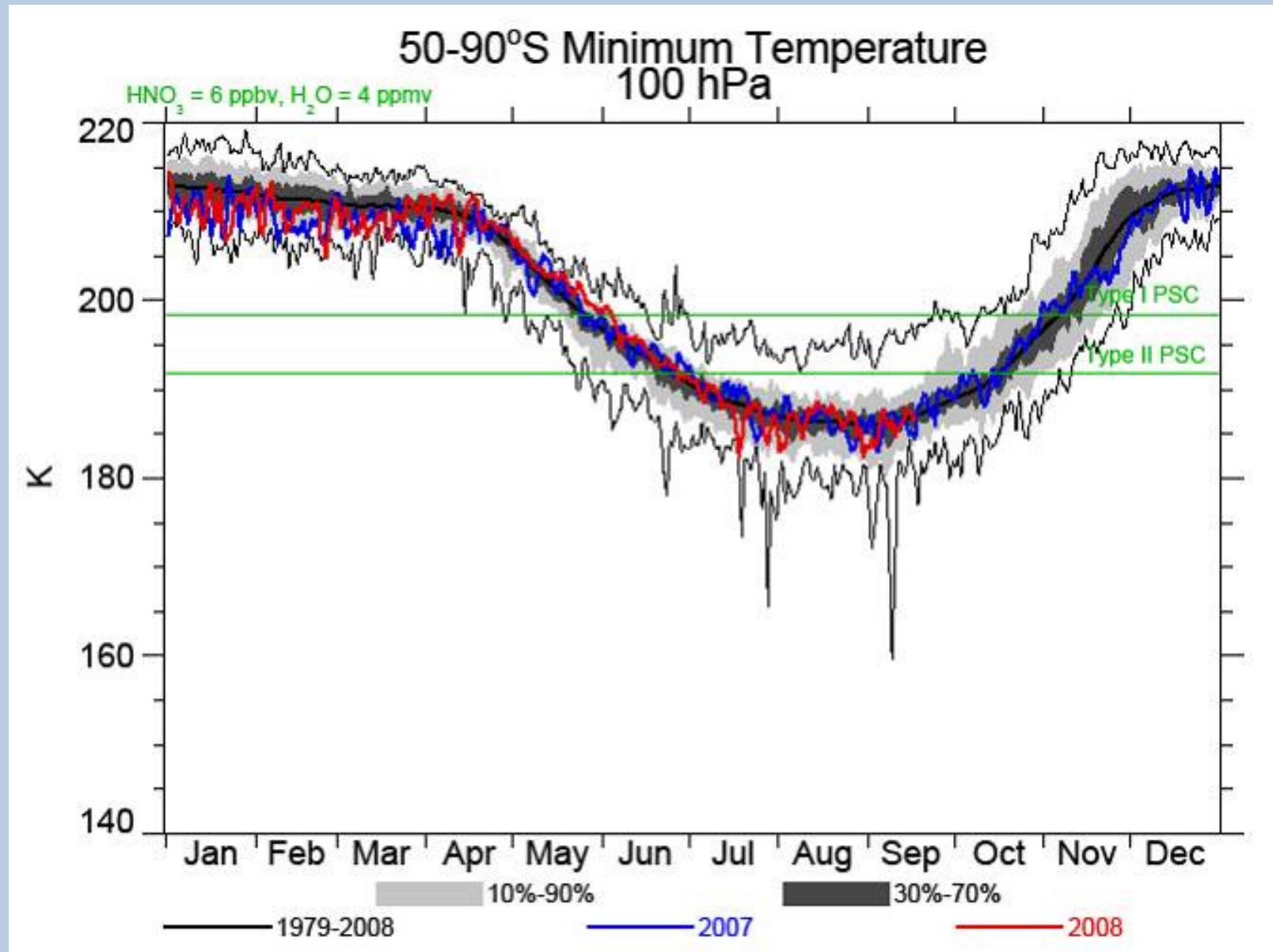


From: <http://www.temis.nl>

Current state of the Ozone Hole

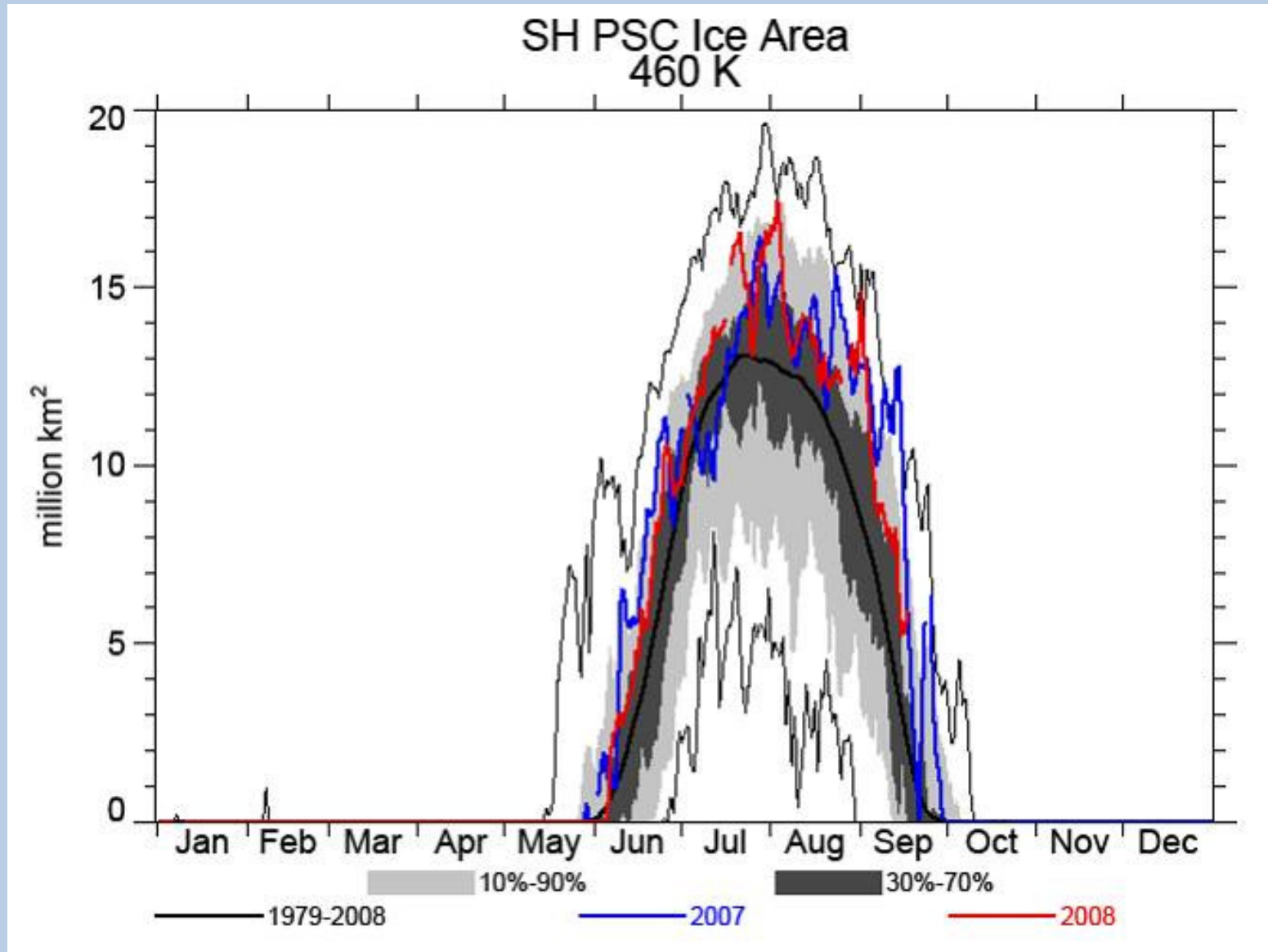
- State of stratospheric chemistry
 - PSCs (80% vortex coverage)
 - NAT (Type 1), ice clouds (Type 2 – colder)
 - Chlorine reservoir
- State of atmospheric dynamics
 - Very stable, concentric vortex
 - Limited sunlight exposure

Stratospheric Chemical Drivers



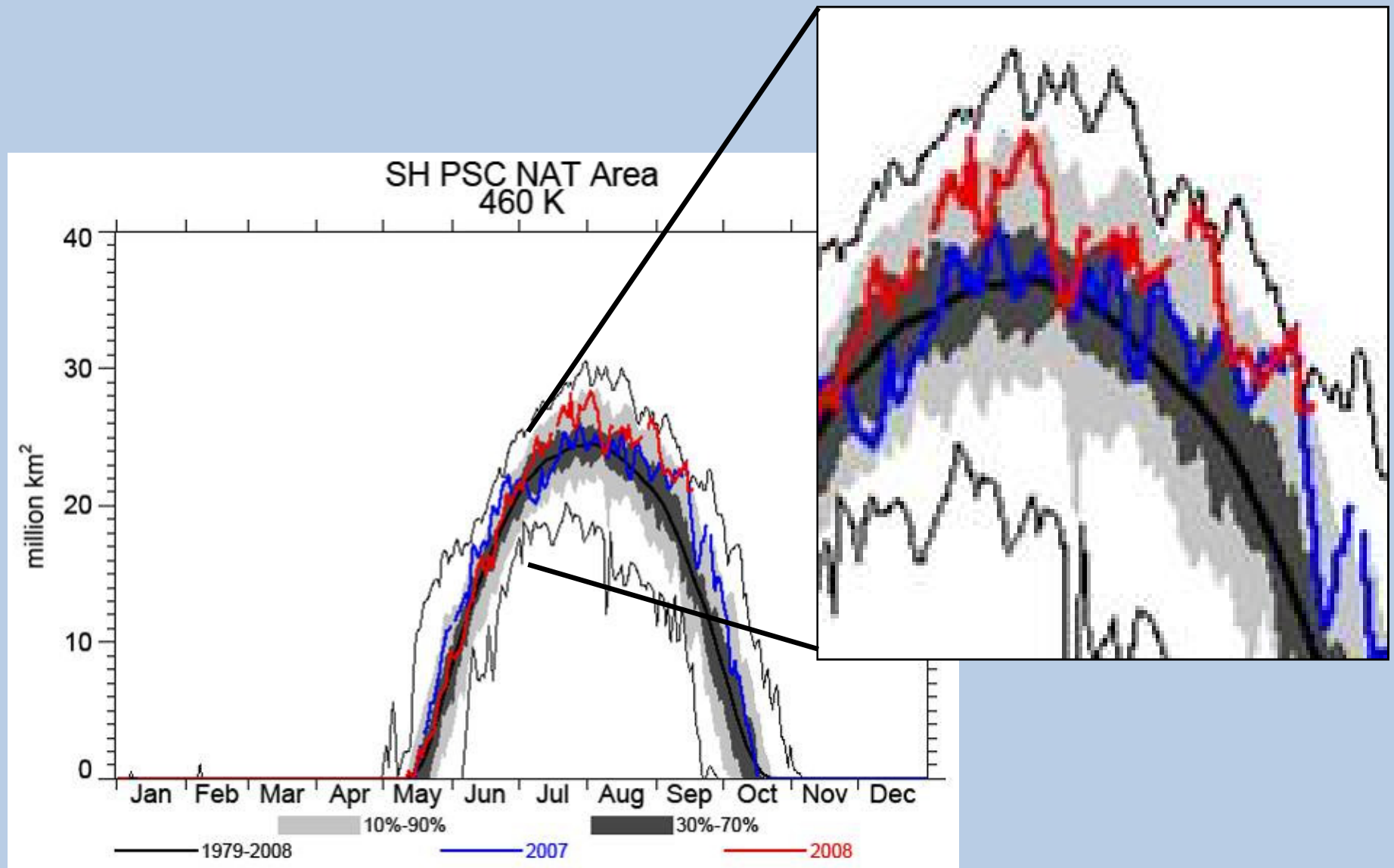
From: <http://ozonewatch.gsfc.nasa.gov>

Stratospheric Chemical Drivers



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Stratospheric Chemical Drivers

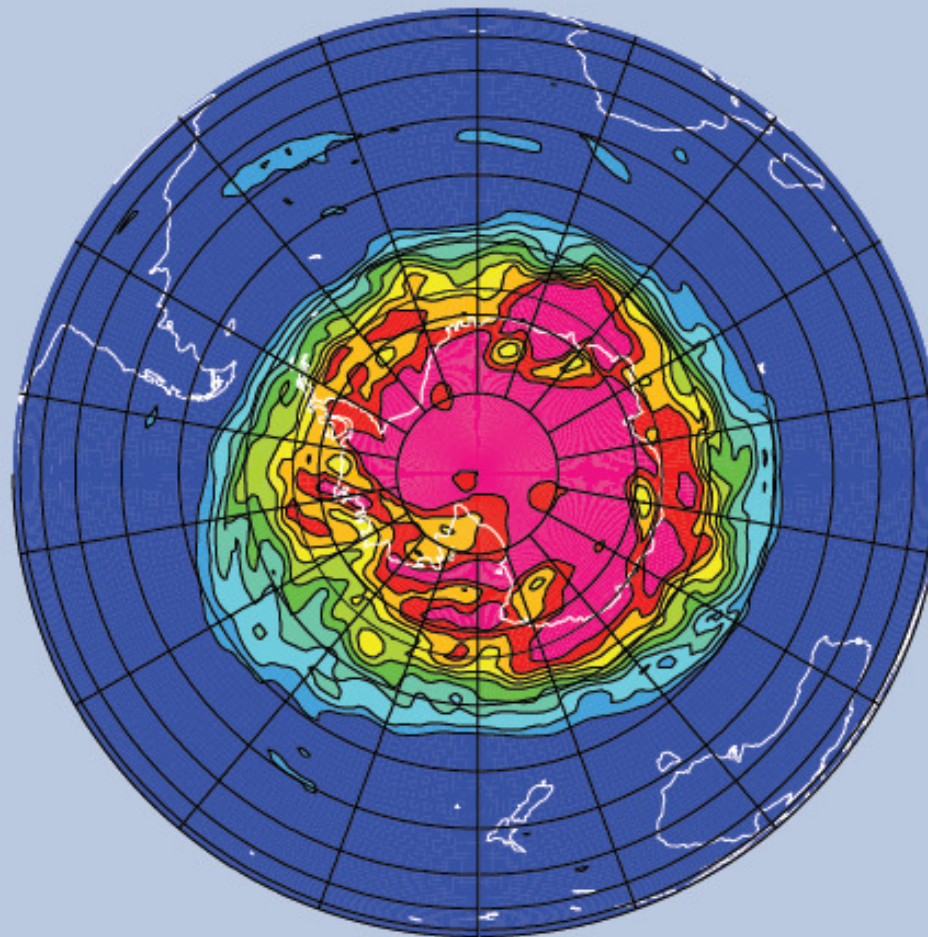


From: <http://ozonewatch.gsfc.nasa.gov>

Current state of the Ozone Hole

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Potential Vorticity Fields



ECMWF

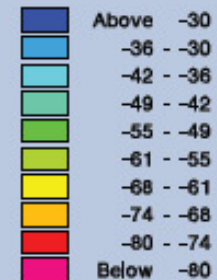
Analysis of PV
(10^{-6} Km²/kgs)

$\Theta = 500$ K

24 Aug 2008 12 UT

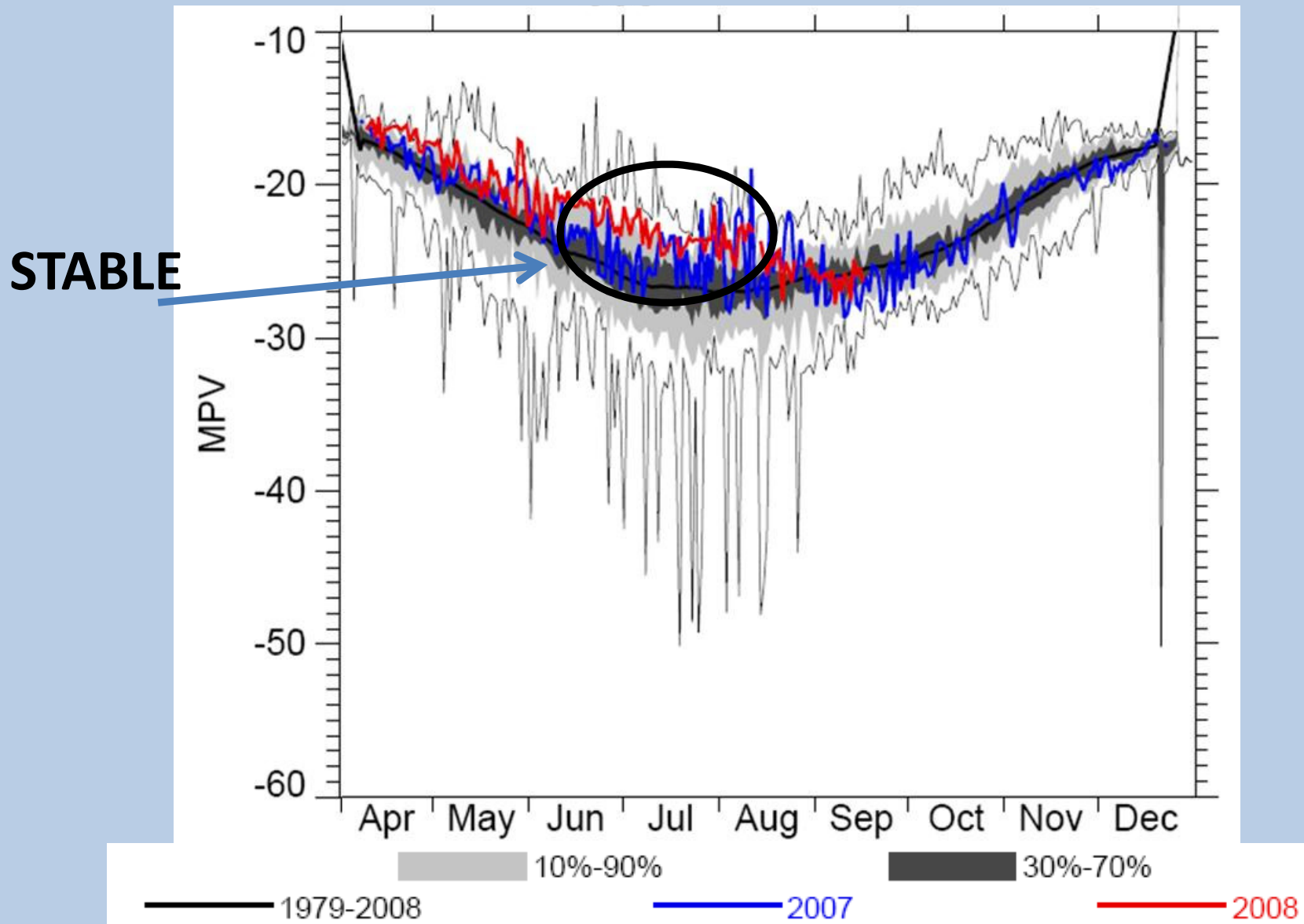
Day number 237

Plotted at NILU
by t106glob



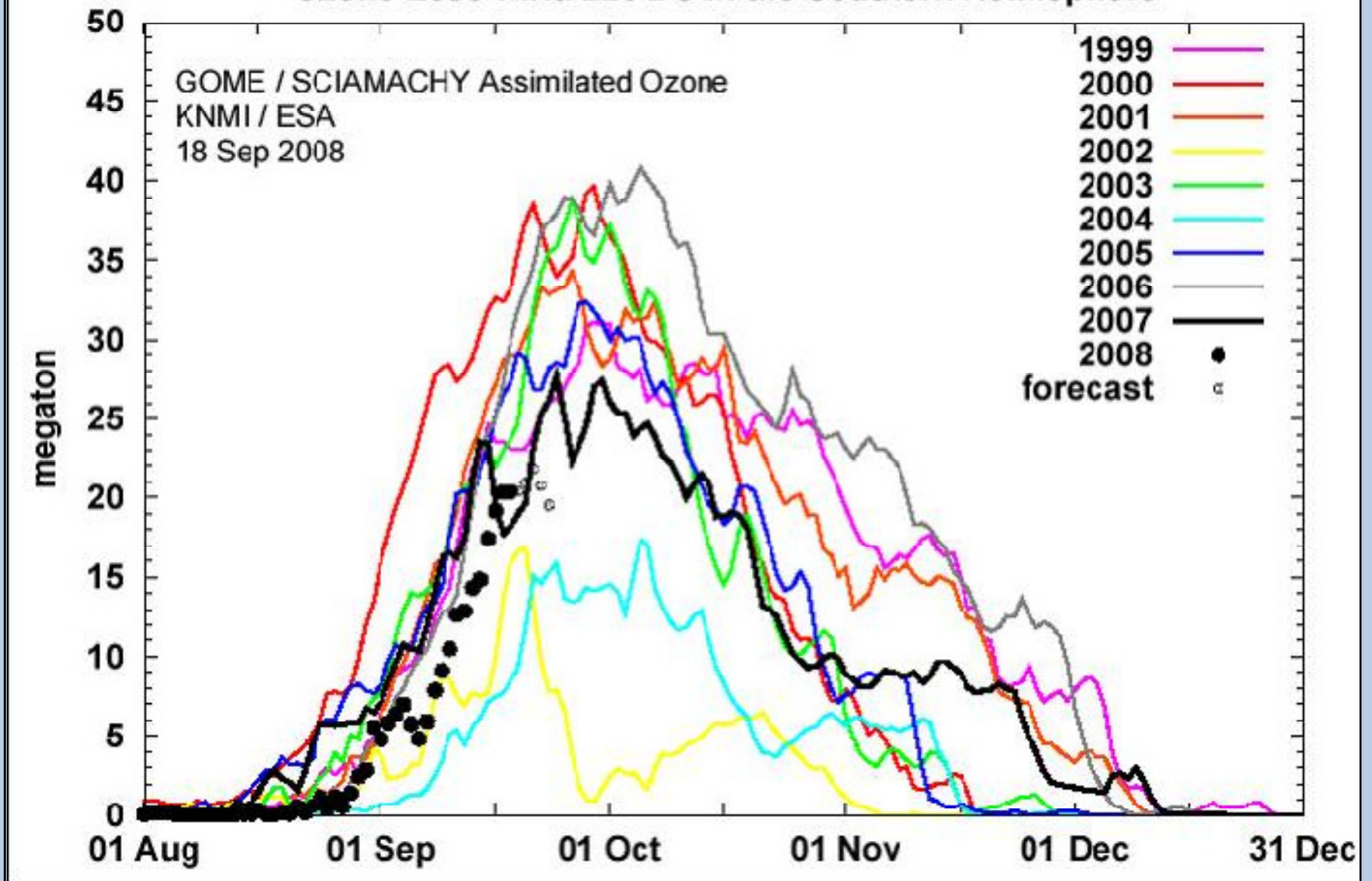
From: <http://www.wmo.ch/pages/prog/arep/gaw/ozone/index.html>

MPV Vortex Edge 500K



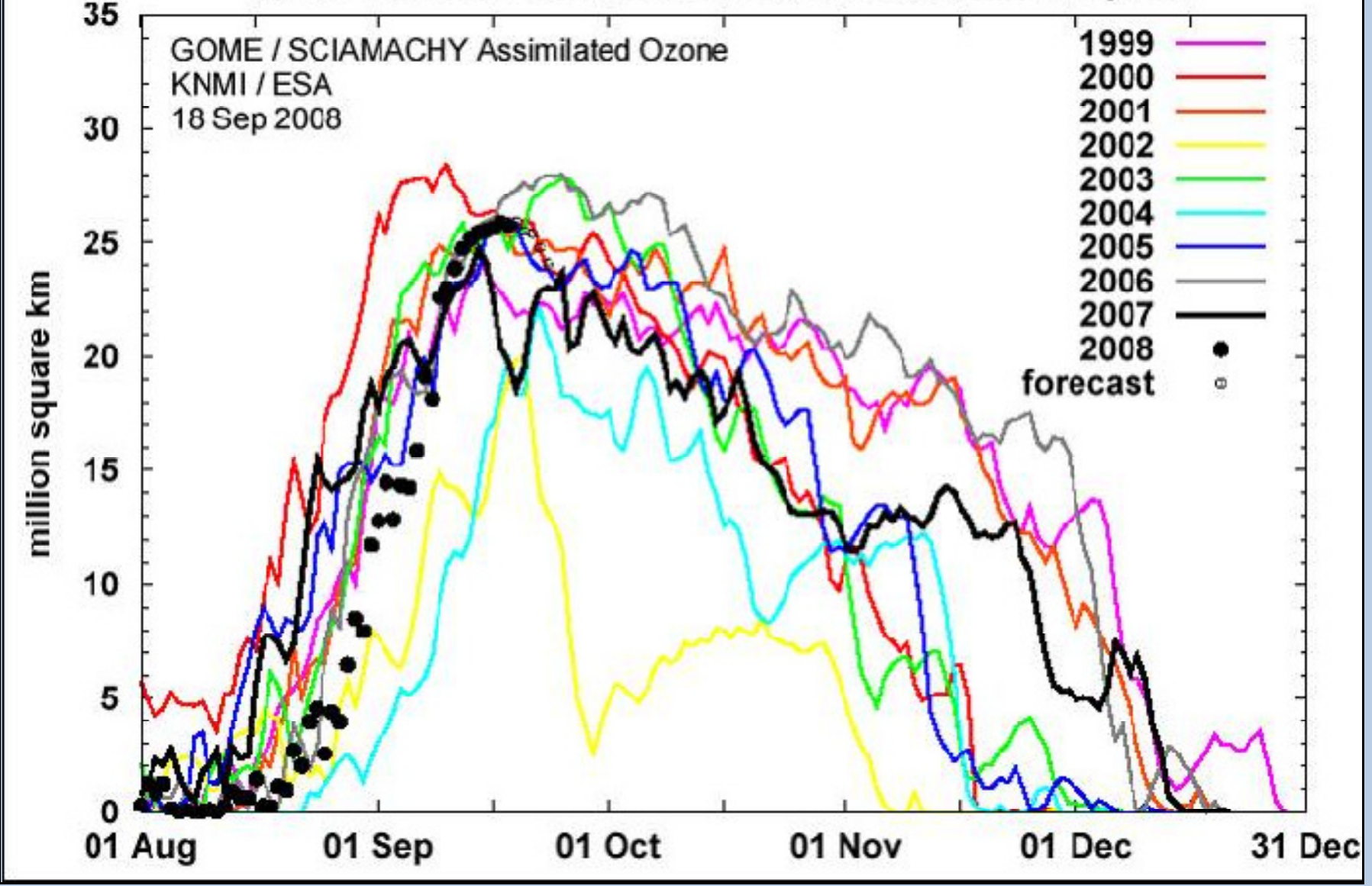
From: <http://ozonewatch.gsfc.nasa.gov>

Ozone Loss w.r.t. 220 DU in the Southern Hemisphere



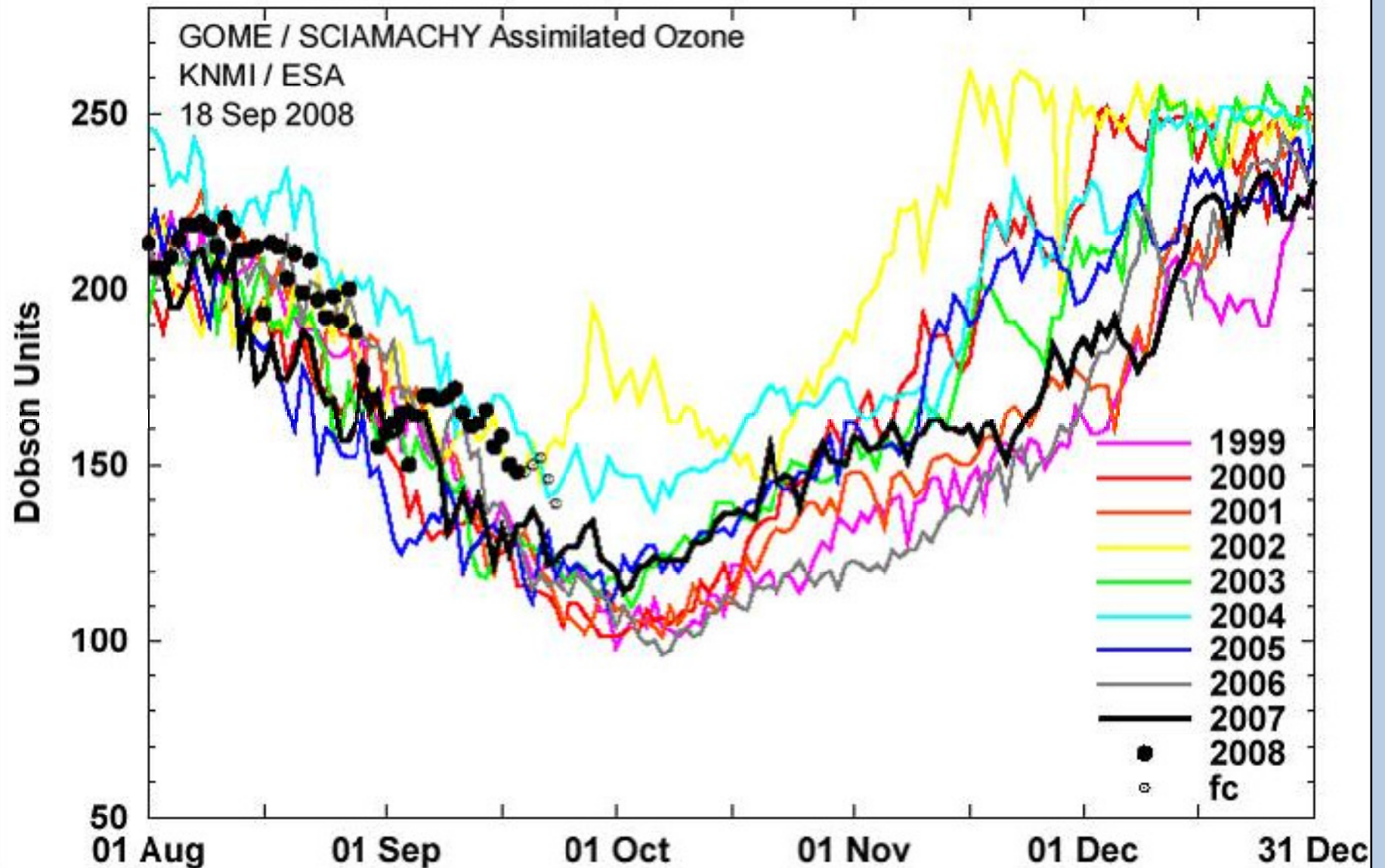
From: <http://www.temis.nl>

Ozone Hole Area w.r.t. 220 DU in the Southern Hemisphere



From: <http://www.temis.nl>

Minimum Ozone Column in the Southern Hemisphere



From: <http://www.temis.nl>

Summary of the 2008 O₃ Hole

- Hole development slightly delayed
- Above average PSC coverage and relatively large chlorine reservoir
- Large vortex size but not below average minimum ozone due to vortex stability
- Forecast: Ozone Hole not likely to expand/intensify beyond current state

Implications

- More Questions....
- Evaluation of ozone hole response to
 - Increased GHGs
 - Synergistic changes in atmospheric dynamics
 - Recovery... How soon?
- Motivation for the next generation of satellite-based ozone monitoring

Thanks!

- ESA – For providing this learning opportunity
- Lecturers who have educated and entertained
- Oxford for hosting in such a historically important academic environment
- All the students who helped shape this report
- Final Thought:
 - “If your not part of the solution.... You are part of the precipitate!”