

Ozone data assimilation based on GOME, SCIAMACHY and OMI measurements

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Ozone assimilation at KNMI

Chemistry-transport assimilation model TM3DAM:

- TM model: 2 degree lat-lon resolution, 44 layers
- ECMWF analyses of winds, temperatures
- Stratospheric chemistry parametrizations
 - Gas-phase
 - Heterogeneous
- GOME/SCIAMACHY/OMI ozone columns
- Kalman-type data assimilation scheme
- Operational analyses and forecasts since 2000

<http://www.temis.nl>

<http://www.gse-promote.org>

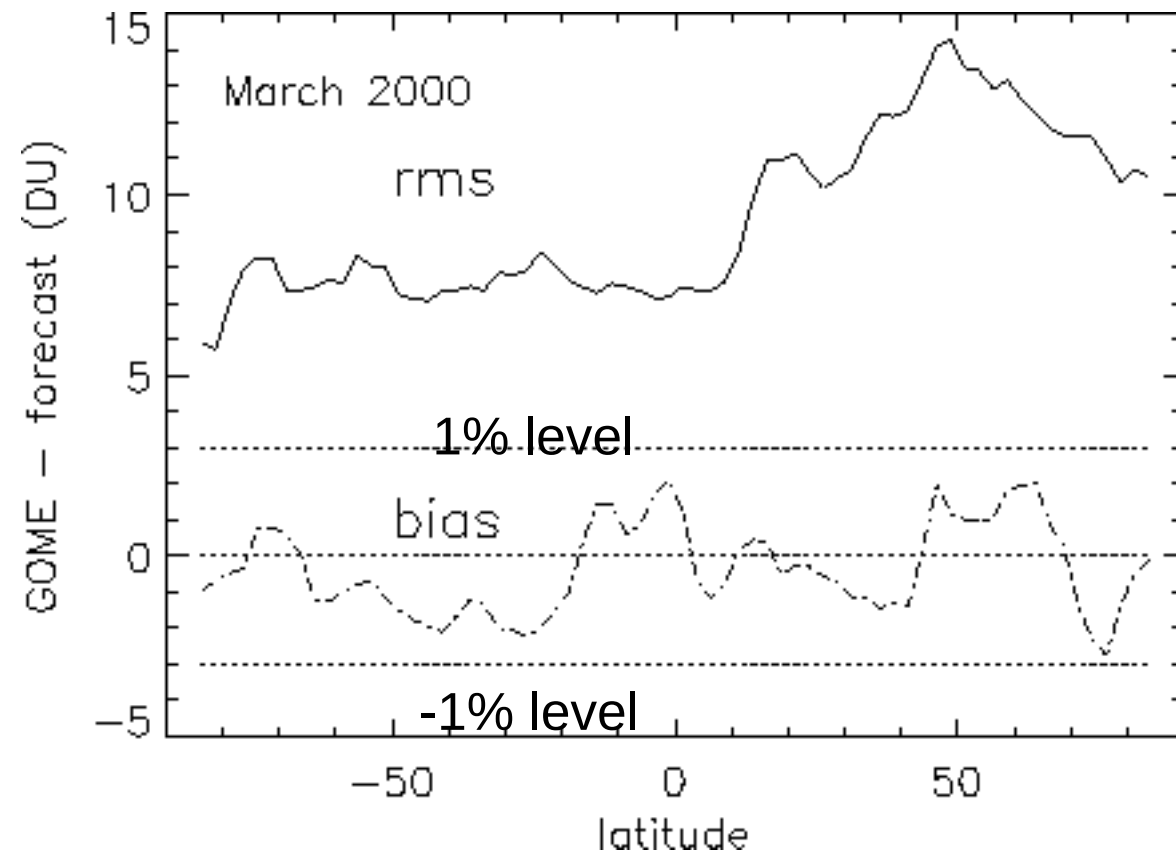
*Eskes et al. Q. J. R. Meteorol. Soc., **129**, 1663-1681, 2003*

Typical forecast performance: OmF

total ozone

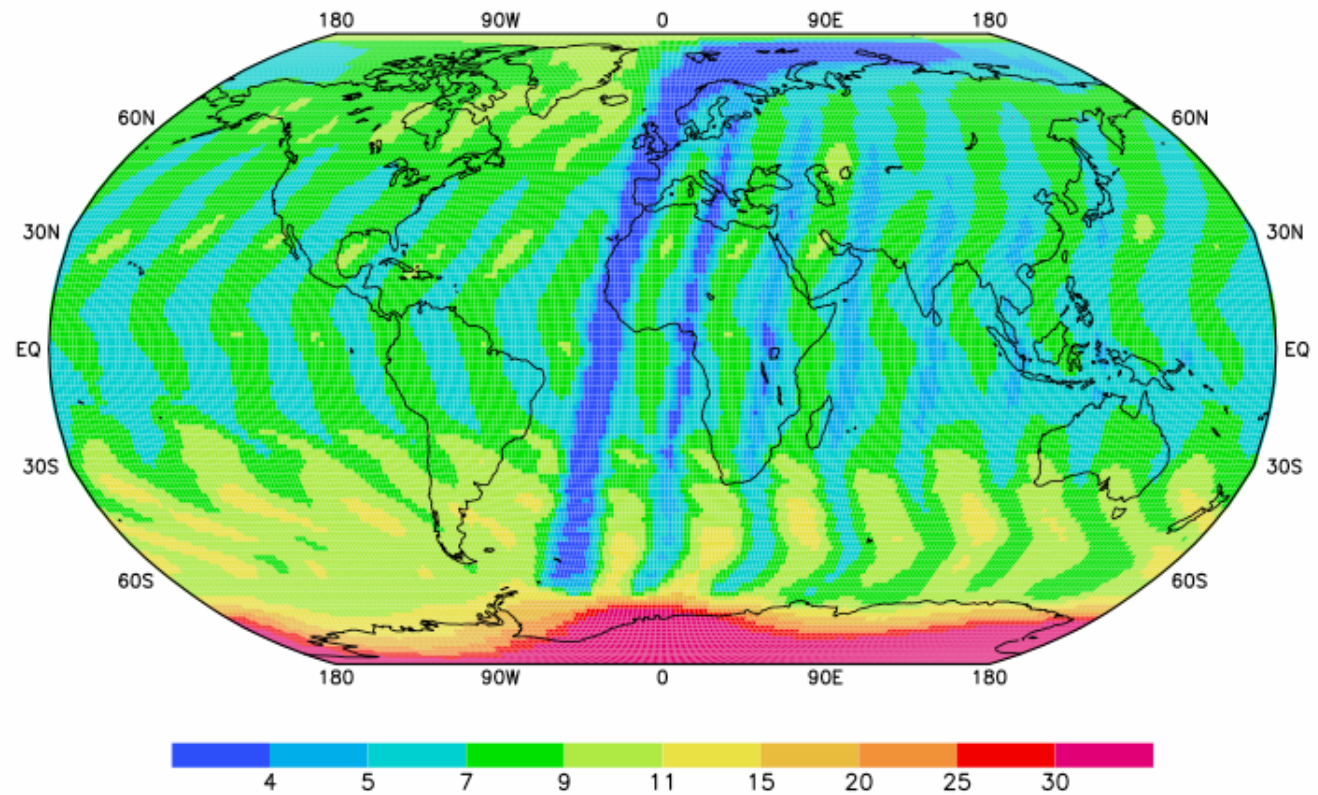
rms(OmF)
typically 3%

bias within 1%

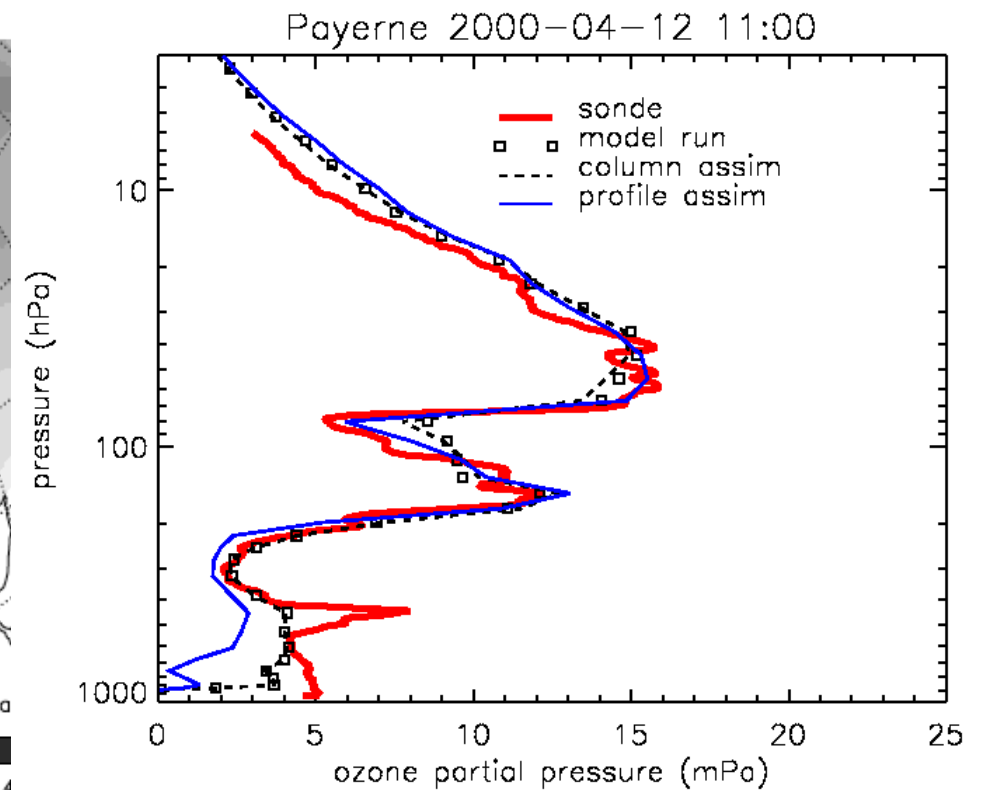
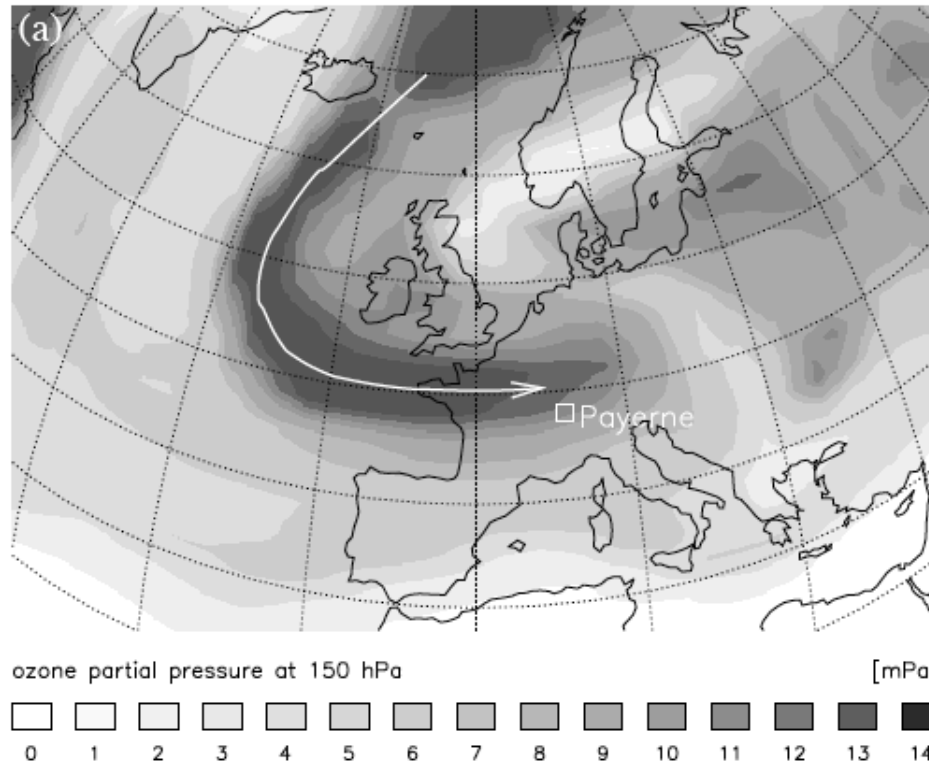


Forecast error modelling

- Analysis
- Advection
- Model error



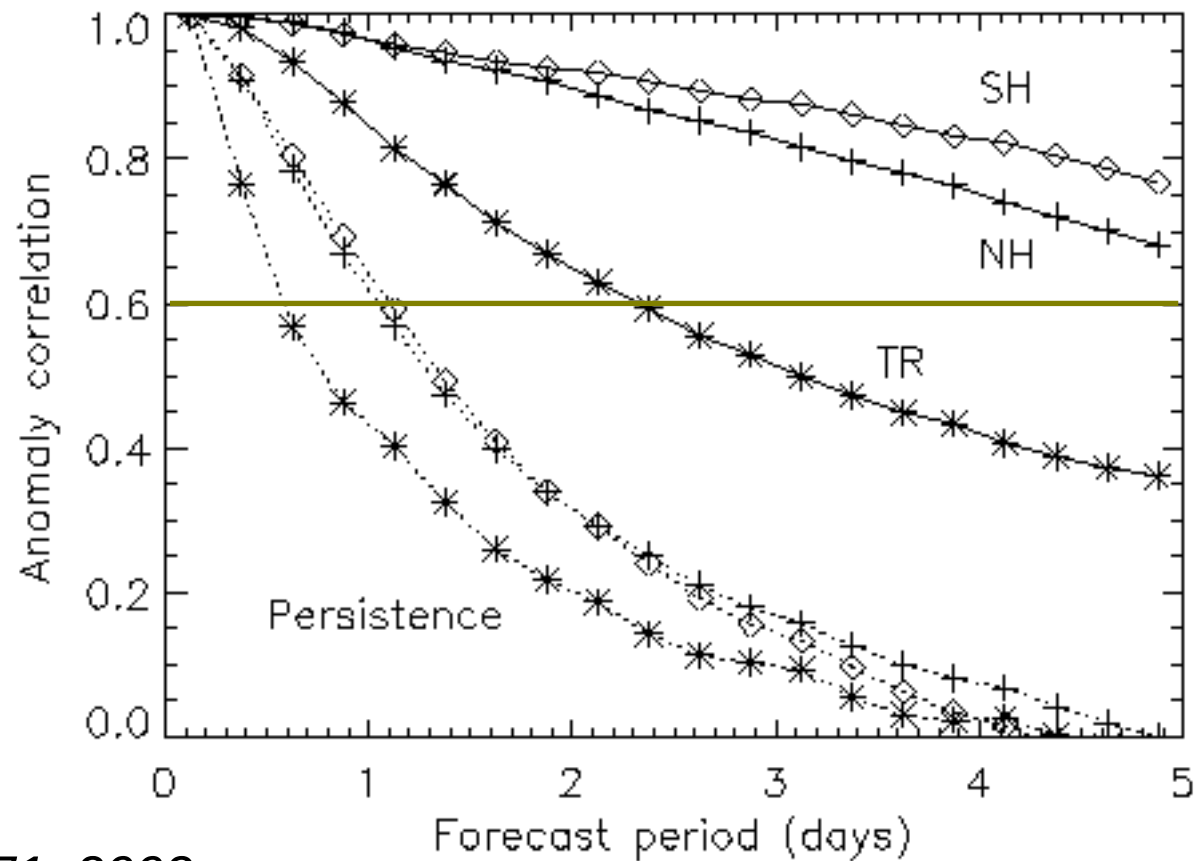
GOME nadir profile assimilation



Segers et al., Q.J.R. Meteorol. Soc., 131, 477-502, 2005

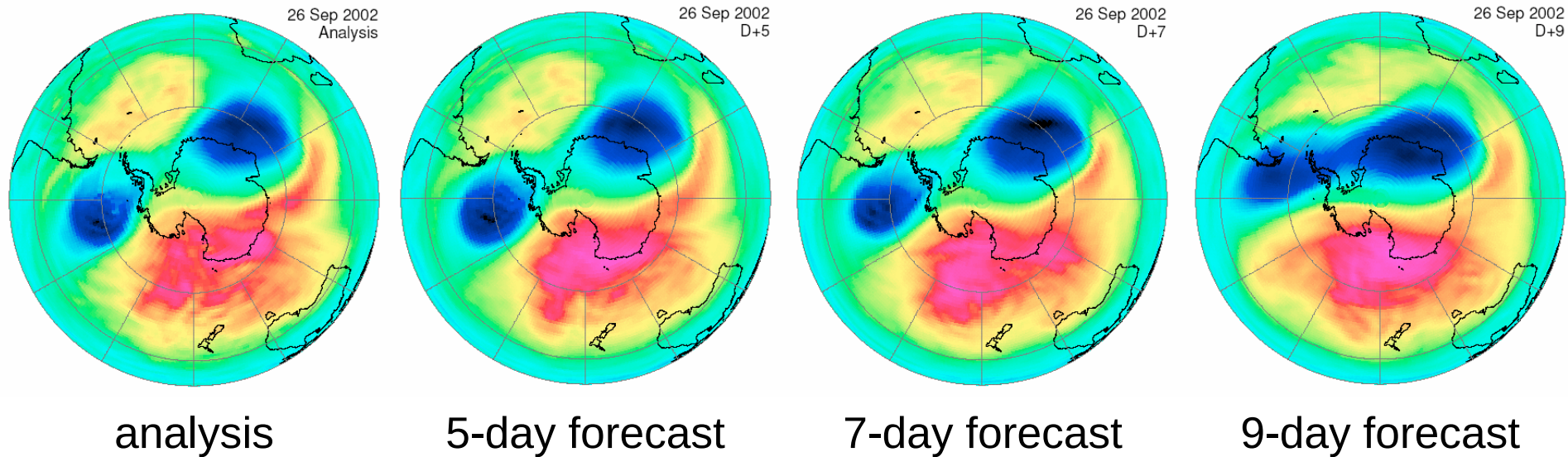
Total ozone anomaly correlation

meaningful
forecasts up to
7 days
(outside the tropics)



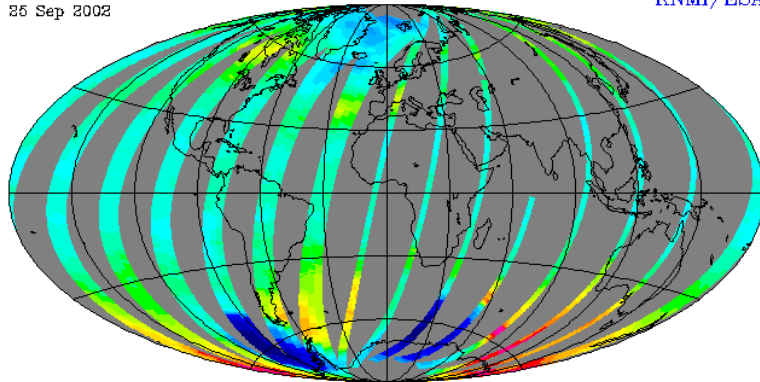
Eskes et al., ACP, 2, 271, 2002

Vortex breakup, 26 September 2002



FD TOTAL OZONE VALUES
26 Sep 2002

KNMI/ESA



<150 175 200 225 250 275 300 325 350 375 400 425 450 475 >500 DU

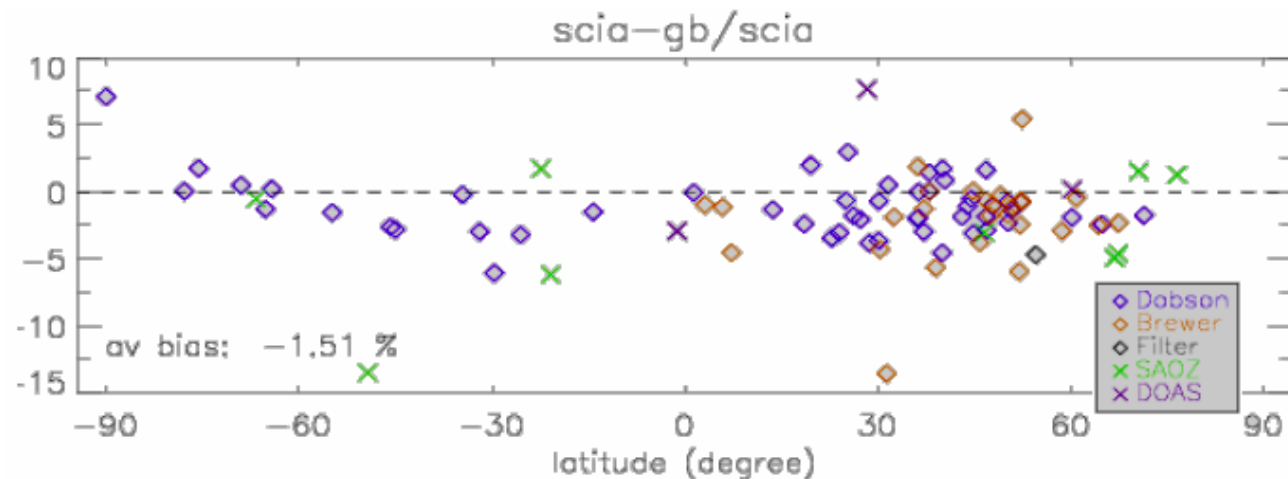
26 September 2002
based on GOME

H. Eskes et al, J.Atmos.Sci. 62, 812, 2005

Tosomi vs Brewer, Dobson ...



World-wide validation for 2 years of SCIA-Tosomi ozone columns
(Ellen Brinksma)



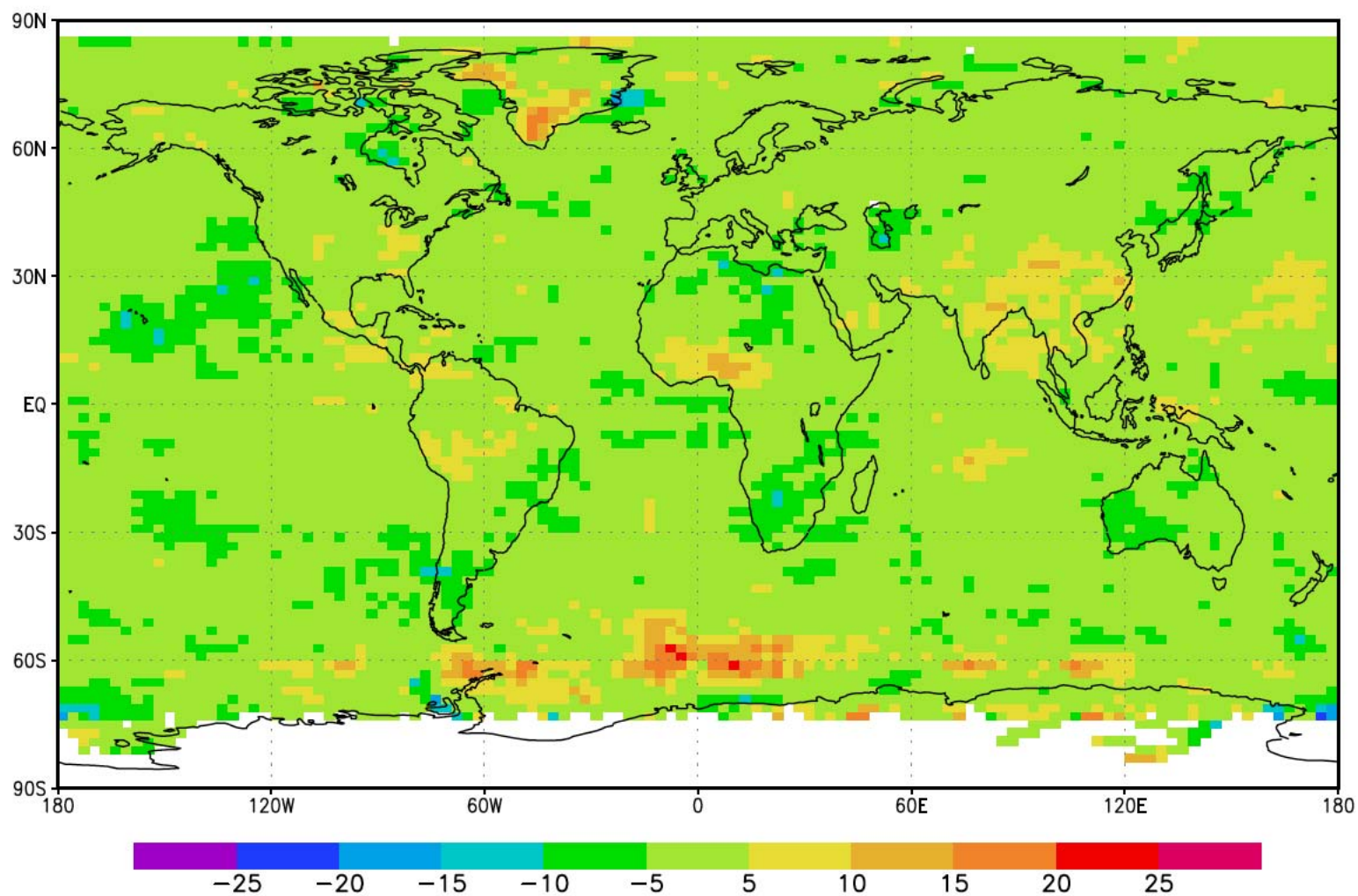
Main conclusions:

- Tosomi 1.5% lower than ground based
- RMS about 5%
- No clear geographical location or seasonal dependence !
- Stable product

....

Eskes et al., ACPD, 5, 4429-4475, 2005

Tosomi vs assimilation



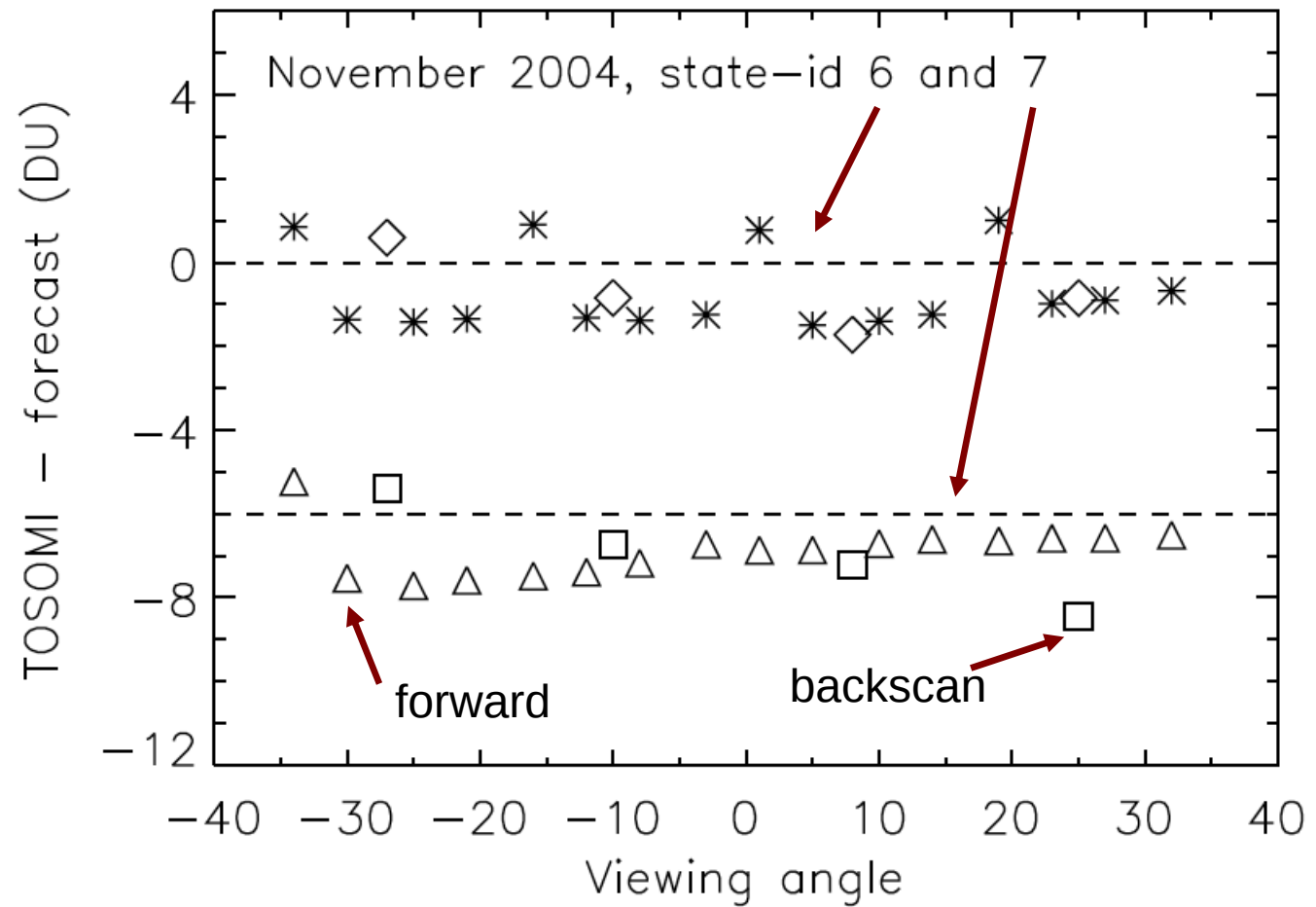
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Eskes et al., ACPD, 5, 4429-4475, 2005

Tosomi vs assimilation

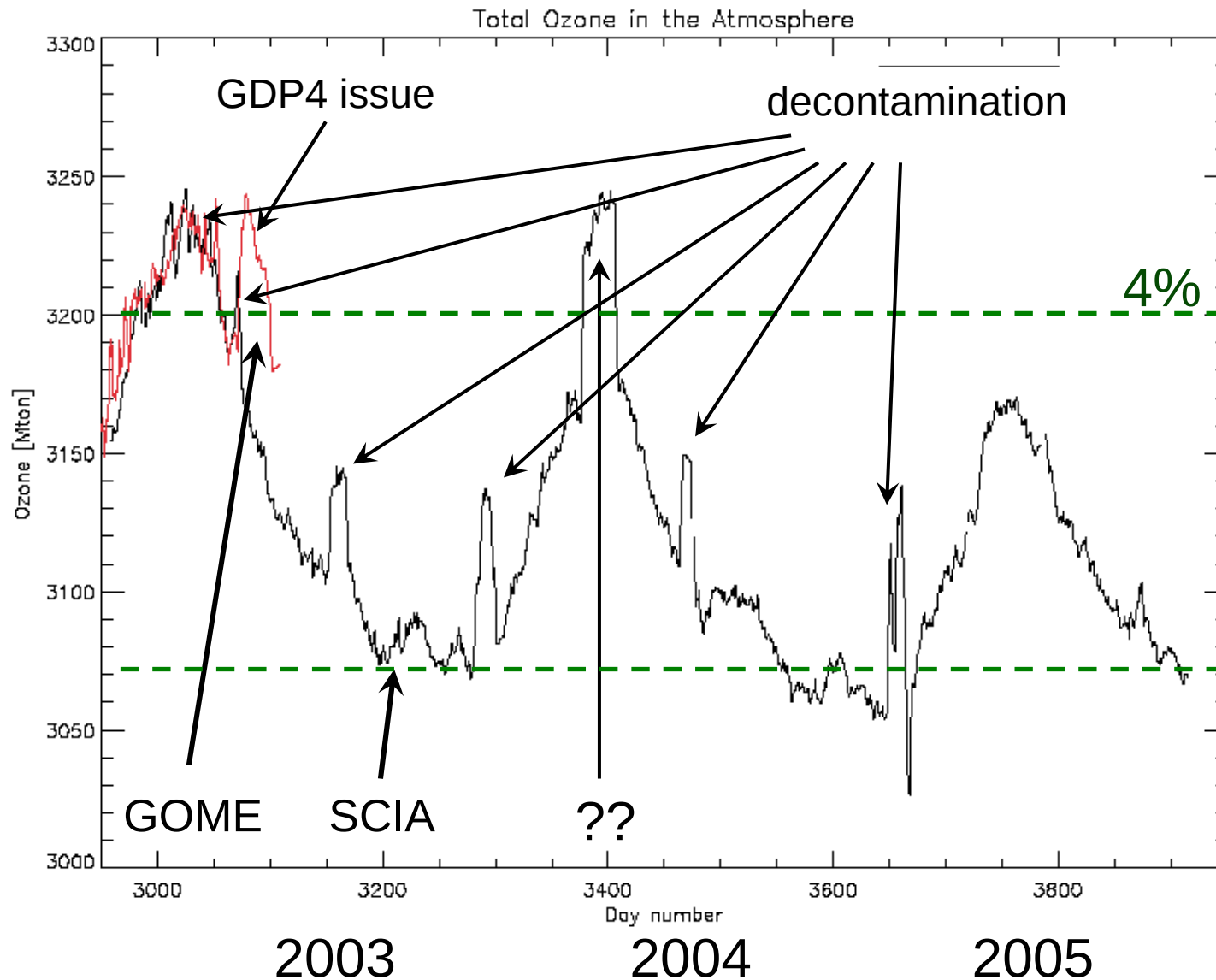
Several
features
< 1%

partly
understood



••••

Total ozone mass

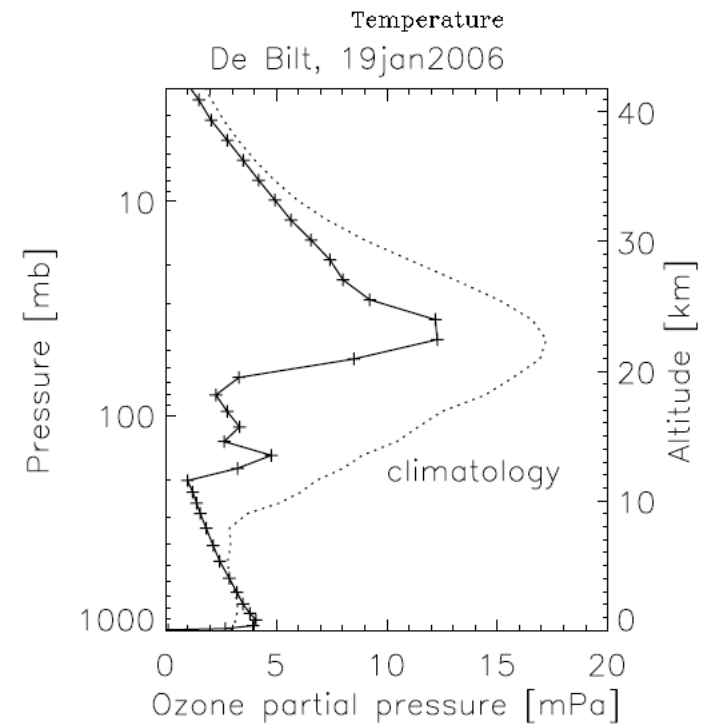
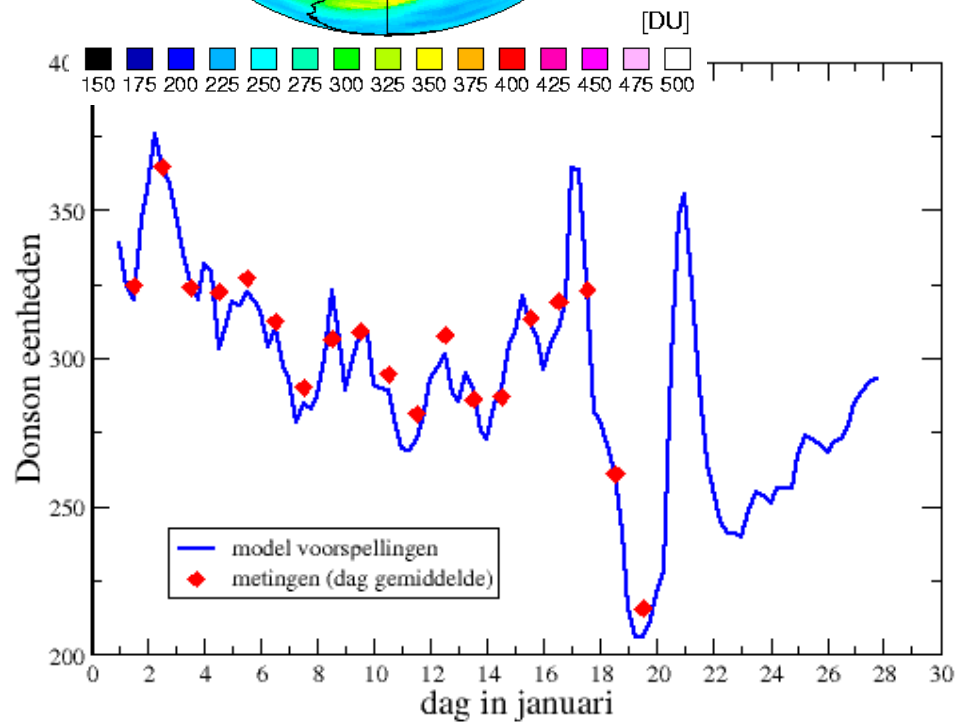
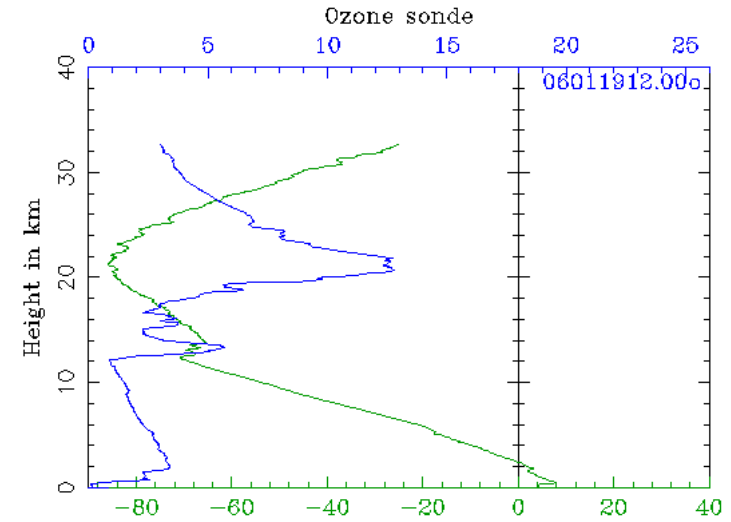
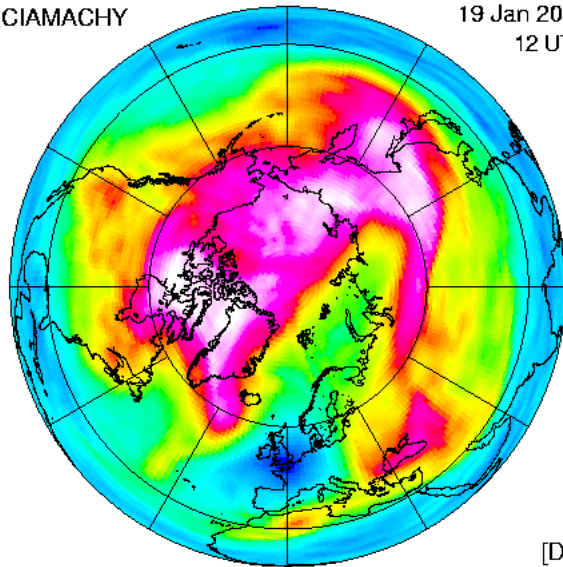


Low ozone, 19 January 2006



KNMI / ESA
SCIAMACHY

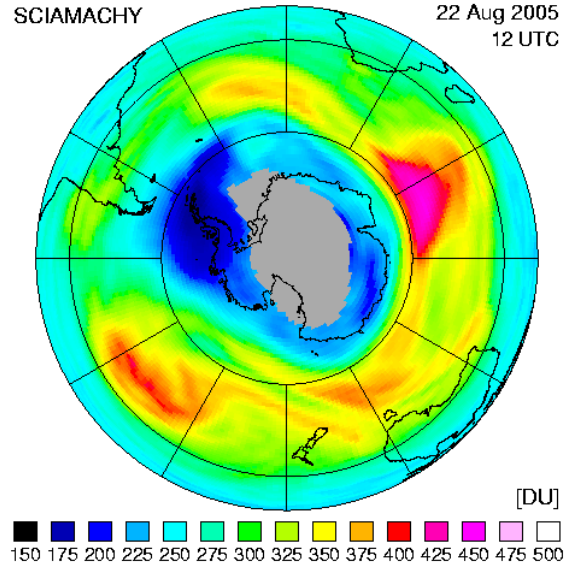
Assimilated total ozone
19 Jan 2006
12 UTC



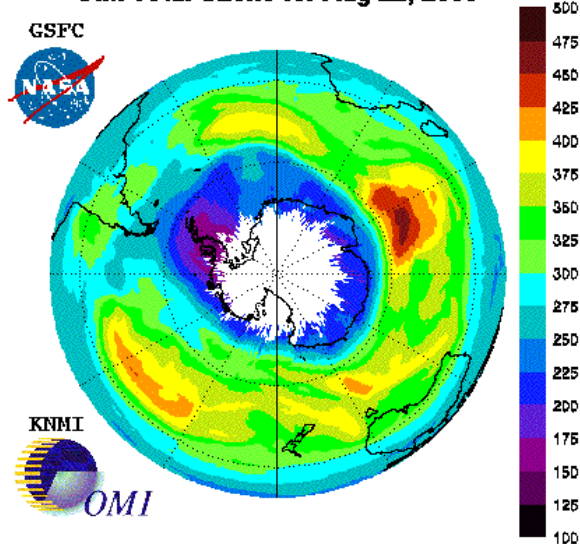
August 2005: very early start of ozone hole



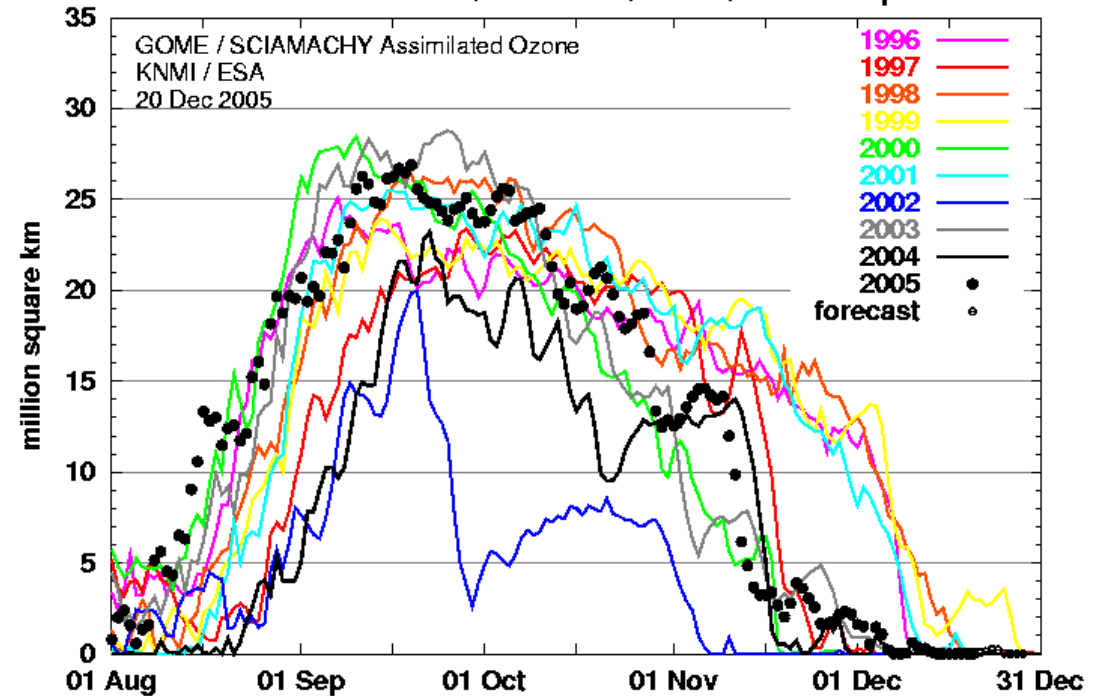
KNMI / ESA
SCIAMACHY
Assimilated total ozone
22 Aug 2005
12 UTC



OMI Total Ozone for Aug 22, 2005



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



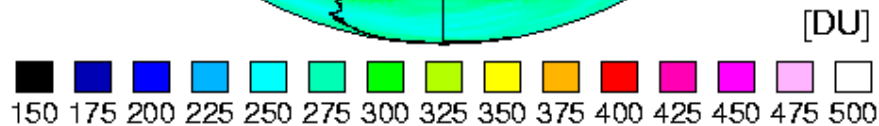
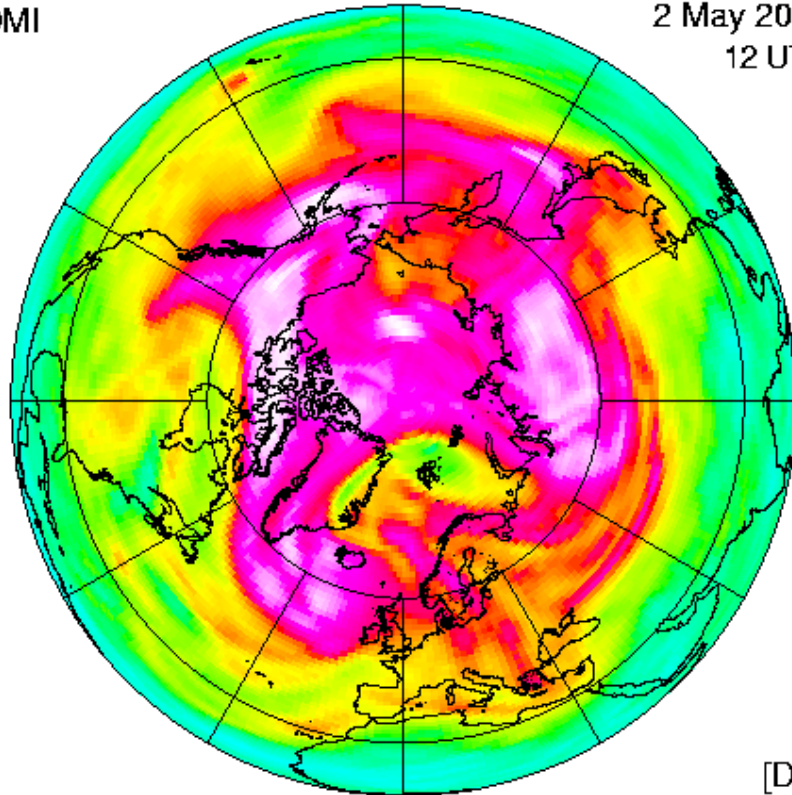
Ozone hole size

Assimilation of OMI vs SCIAMACHY



KNMI / NASA
OMI

Forecast total ozone (D+1)
2 May 2006
12 UTC

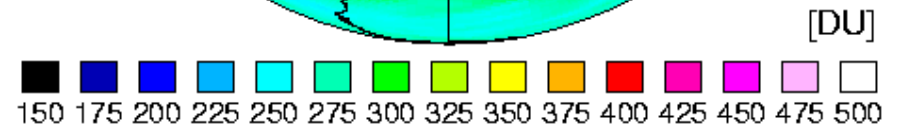
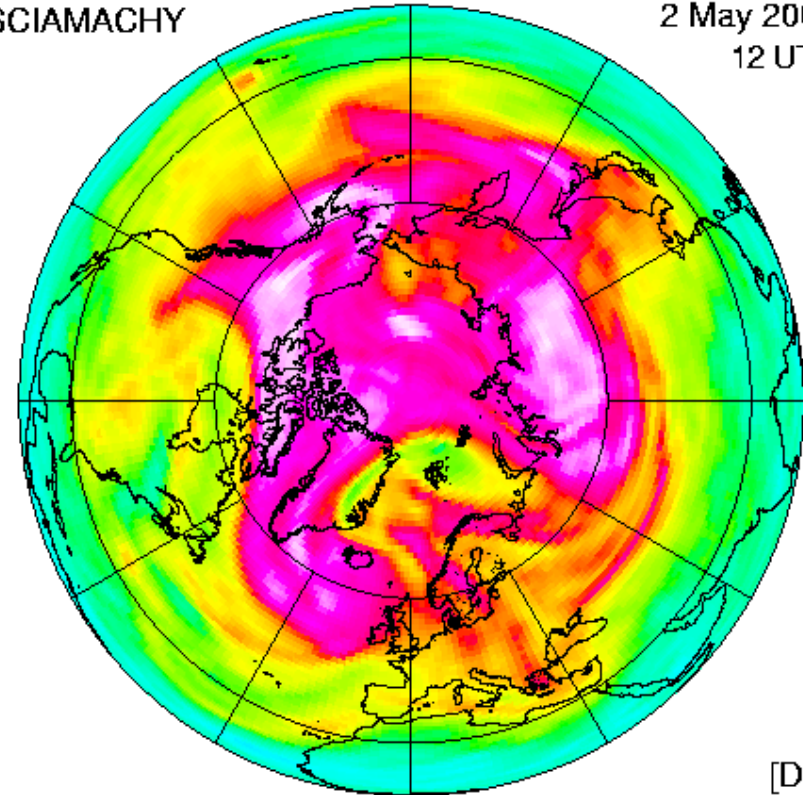


OMI operational analysis



KNMI / ESA
SCIAMACHY

Forecast total ozone (D+1)
2 May 2006
12 UTC



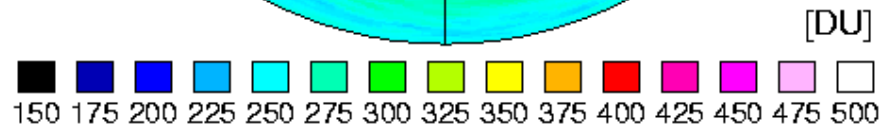
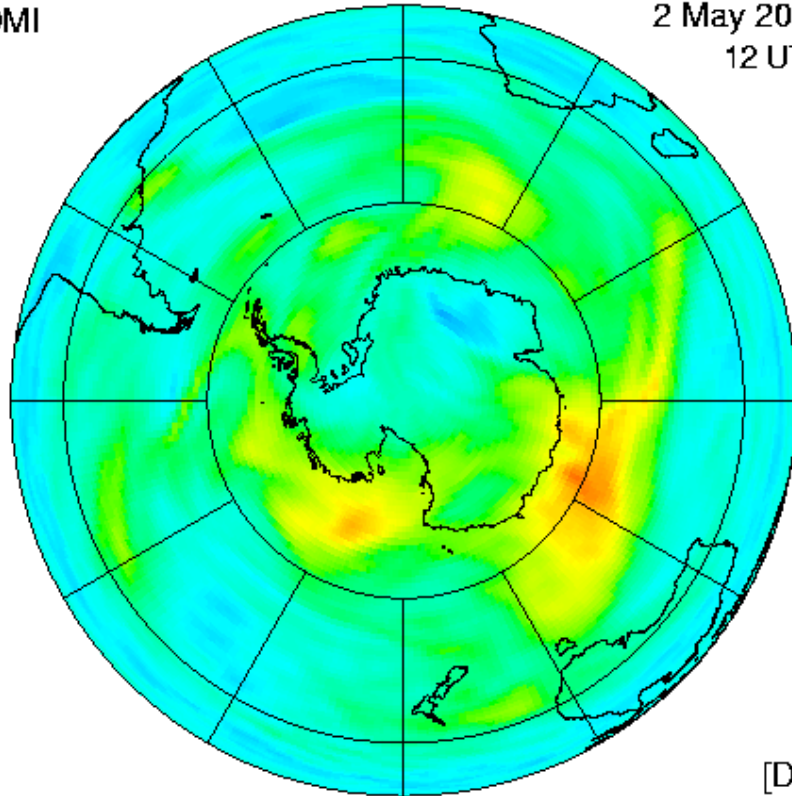
SCIA operational analysis

Assimilation of OMI vs SCIAMACHY



KNMI / NASA
OMI

Forecast total ozone (D+1)
2 May 2006
12 UTC

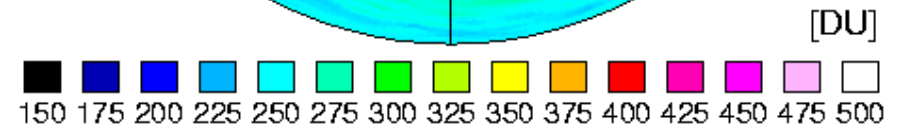
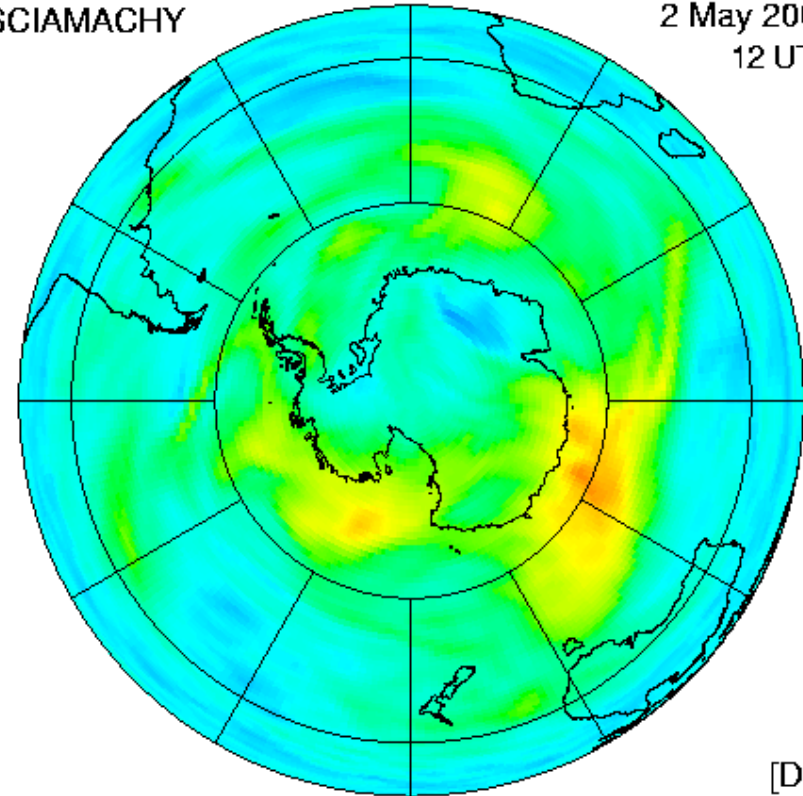


OMI operational analysis



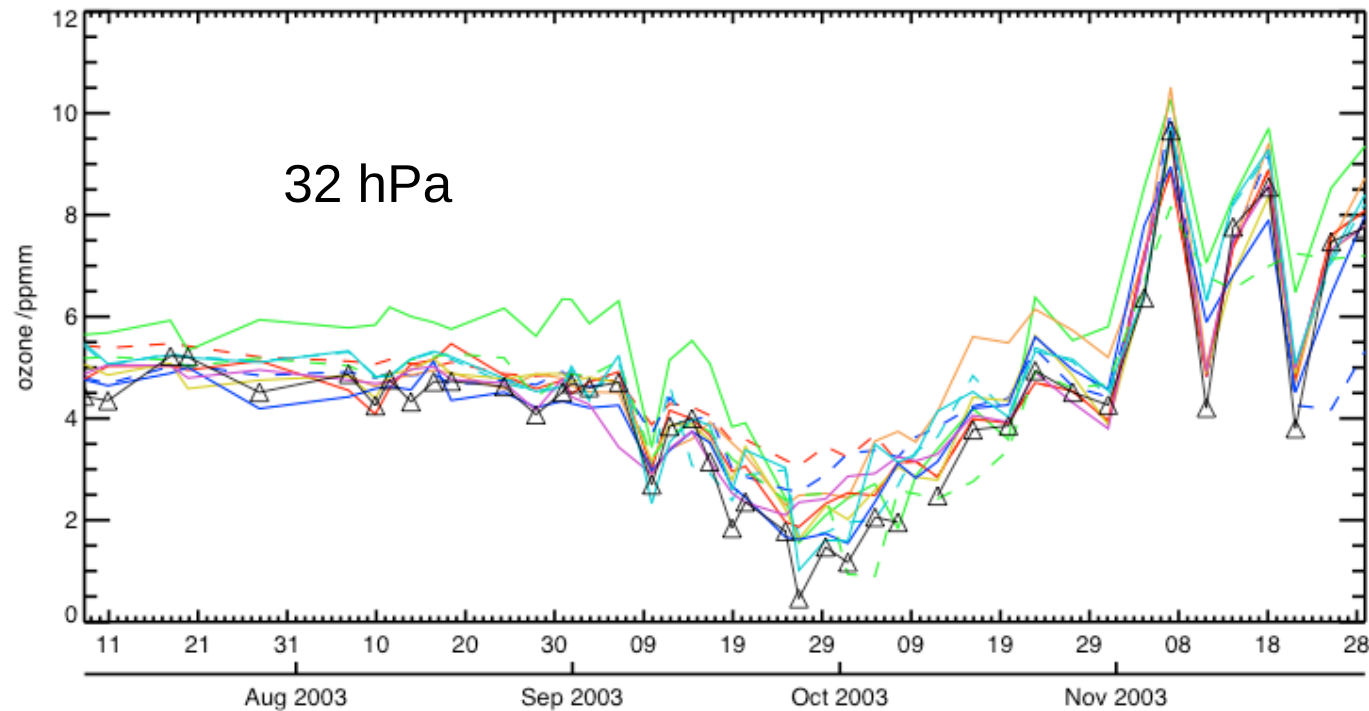
KNMI / ESA
SCIAMACHY

Forecast total ozone (D+1)
2 May 2006
12 UTC



SCIA operational analysis

ASSET ozone assimilation intercomparison



Green solid: KNMI SCIAMACHY ozone column analysis

Green dash: KNMI SCIAMACHY ozone profile analysis



A. Geer et al, ACPD 2006

Conclusions of ASSET intercomparison

KNMI SCIA ozone column assimilation:

- shows best comparison with TOMS total ozone
- reasonable profiles, comparable with others (based on MIPAS profiles)
profile biases found in upper stratosphere (due to chemistry param)
and at South Pole ozone hole

KNMI SCIA ozone limb profile assimilation:

- Improves profile shape at South Pole (compared to column assimilation)

Conclusions

GOME/SCIA/OMI ozone column assimilation:

- Forecast operational since 2000 (www.temis.nl)
- OmF bias < 1%, rms ~ 3%
- Meaningful forecasts up to 7 days at mid/high latitudes
- Reasonable profile shape e.g. low-ozone events

GOME/SCIA ozone profile assimilation:

- Some hints of improvement in profile shape
- Under development

Outlook:

- Long-term assimilated ozone reanalysis
from TOMS/GOME/SCIA/OMI (PROMOTE)

