UNCERTAINTY IN THE TOTAL OZONE DATA: IMPLICATIONS FOR UV RECONSTRUCTIONS

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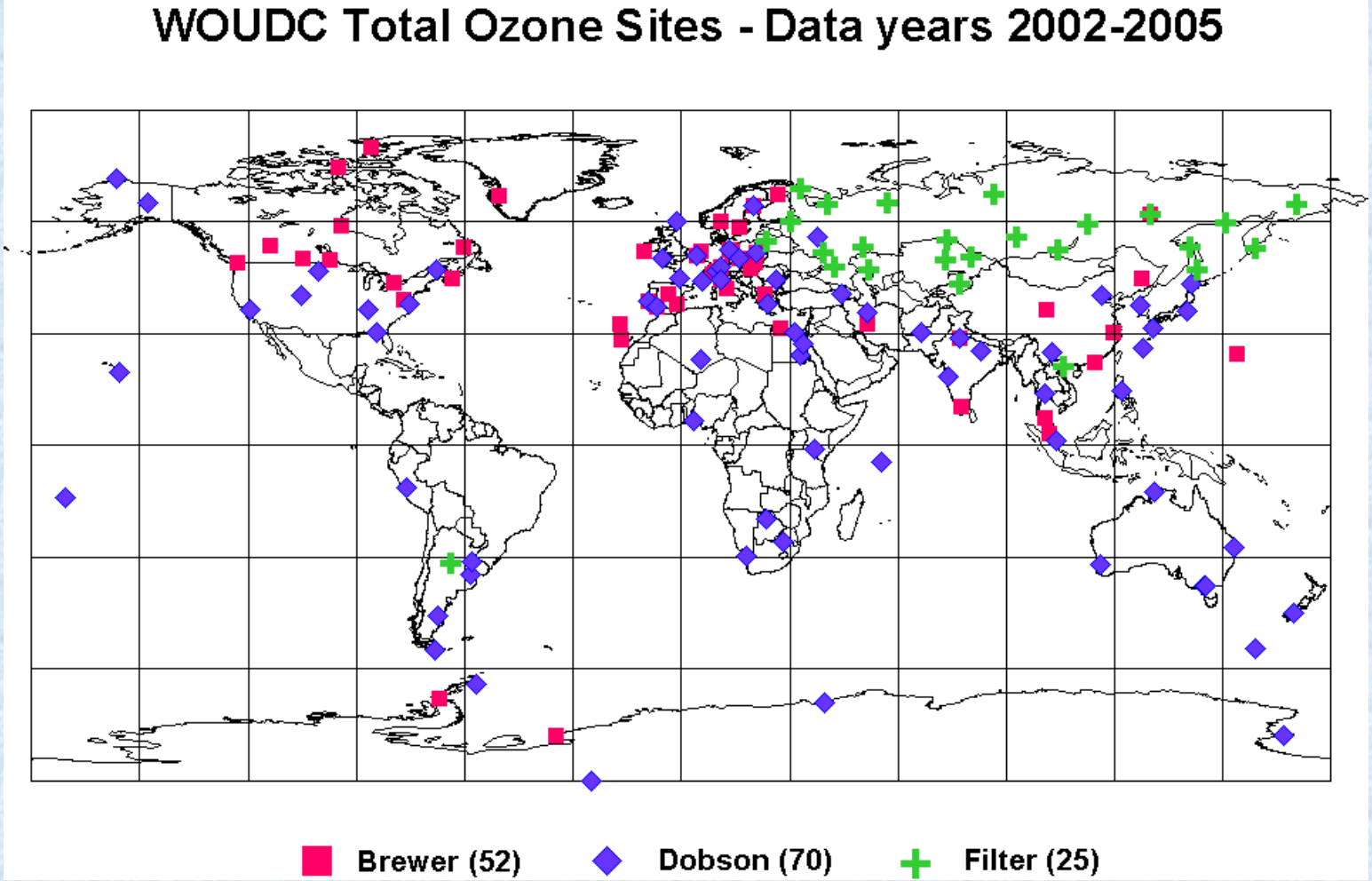
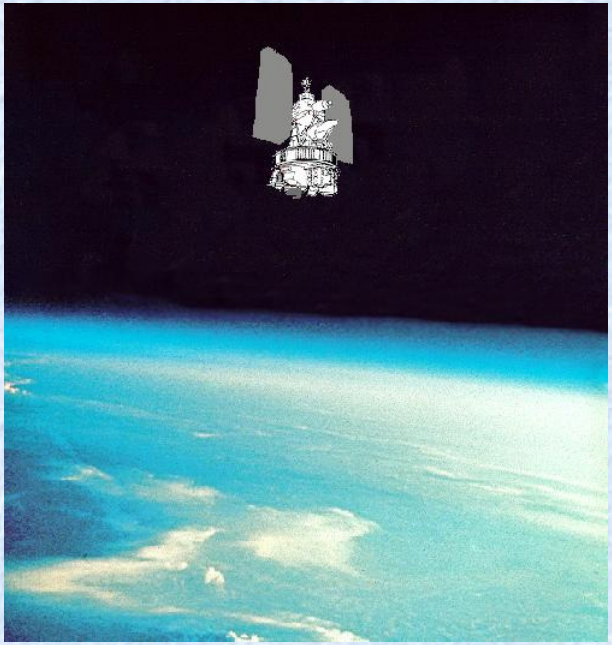
MCM X COST 726; EL ARENOSILLO, SPAIN , 10-11.04.2008

TOTAL OZONE MEASUREMENTS
GROUND-BASED SPECTROPHOTOMETERS

DOBSON (AROSA - 1926), BREWER (ITALY-1986), FILTER INSTRUMENT (M83/M124, RUSSIA ~ 1970)



TOTAL OZONE MEASUREMENTS
SATELLITE- BORNE SPECTROPHOTOMETERS



Nimbus 7 Platform

TOMS : (since October 1978)

NIMBUS 7 - 1978-1993

METEOR 3 – 1991-1994

Earth Probe – 1996-2005

SBUV : (operational monitoring since 1985)

NOAA-9, 11, 14, and 16

TOVS: (operational monitoring 1995-2005)

NOAA satelitte

GOME: (1995 - present) – ERS-2 platform

SCIAMACHY: (2002 - present) – ENVISAT platform

OMI: (2004 – present) -AURA platform

SELECTED TOTAL OZONE DATA BASES

NIWA - GLOBAL TOTAL OZONE DATA 1978-2004:

National Institute of Water and Atmosphere Research (NIWA), Lauder, New Zealand,
Assimilated Total Ozone Data Base 1979-2004 (Bodeker et al., 2005)

Version 8 Nimbus 7 and Earth Probe TOMS
GOME version 3.1
KNMI TOGOMI
Version 8 SBUV from NIMBUS 7, NOAA9, NOAA 11, and NOAA 16

ERA- 40 (1958-2002)- GLOBAL DATA
3-D GCM SIMULATIONS

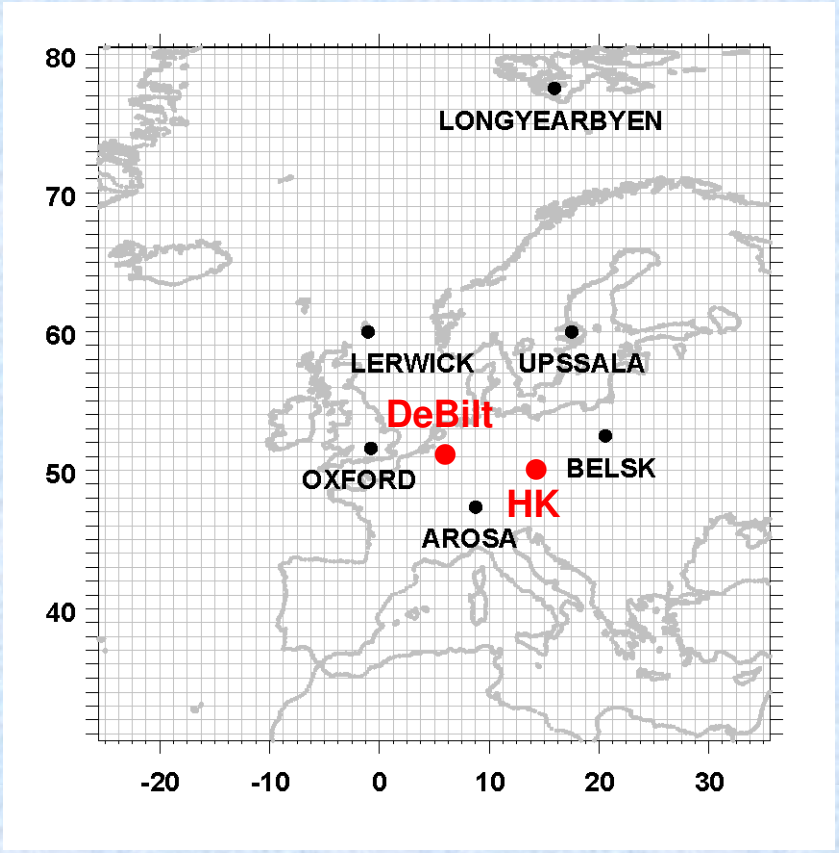
COST-726 : (1950-2004) EUROPE DATA
STATISTCAL MODEL TRAINED ON NIWA DATA

IN BSCW DATA :
COST MODEL DATA 1950-2004: NIWA DATA 1979-2004

MCM DECISION IN 2006 - USE THE BEST AVAILABLE DATA

SOFTWARE (READY TO BE ADDED) CALCULATES O3 SERIES FOR ANY SITE IN THE AREA
1950-1978 - MODEL + 1979-2004 – NIWA + 1979-2004 (HOLES - NO NIWA) - MODEL

COST-726 DATA BASE



The area with reconstructed daily total ozone values for the period 1950-2004 and ground-based stations used for the validation of the model.

Grid resolution:

$\Delta\varphi=1°, \Delta\lambda=1.25°$ (IGFPAS)

$\Delta\varphi=1°, \Delta\lambda=1°$ (BSCW)

HOW LARGE ARE DIFFERENCES BETWEEN VARIOUS OZONE DATA?

HK- Hradec Kralove - Dobson\Brewer mark III and IV\Satelitte\COST 726

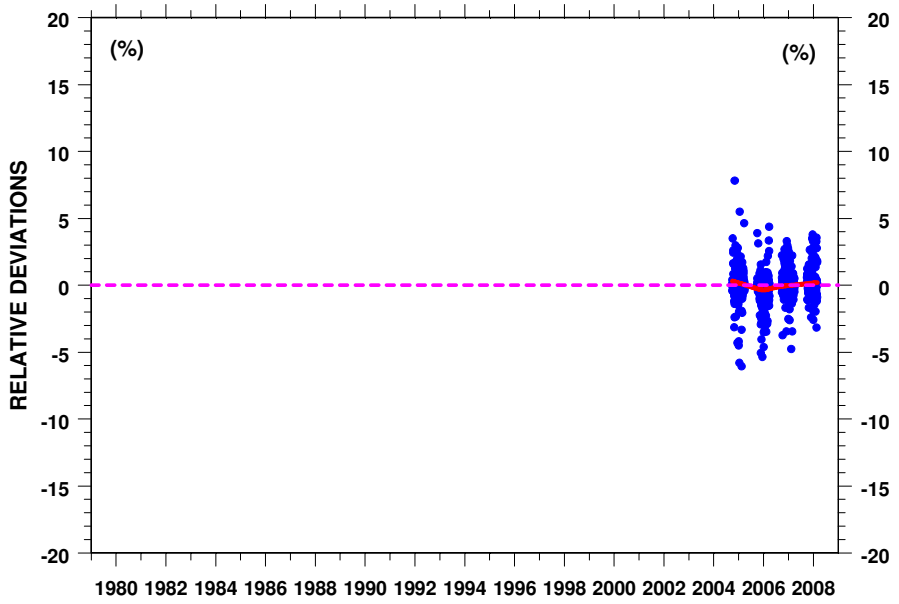
DeBilt – (large differences?-Peter den Outer) – Brewer mark III\Satelitte\COST726

HRADEC KRALOVE DAILY TOTAL OZONE

(BREWER_III – BREWER_IV) / BREWER_IV *100%

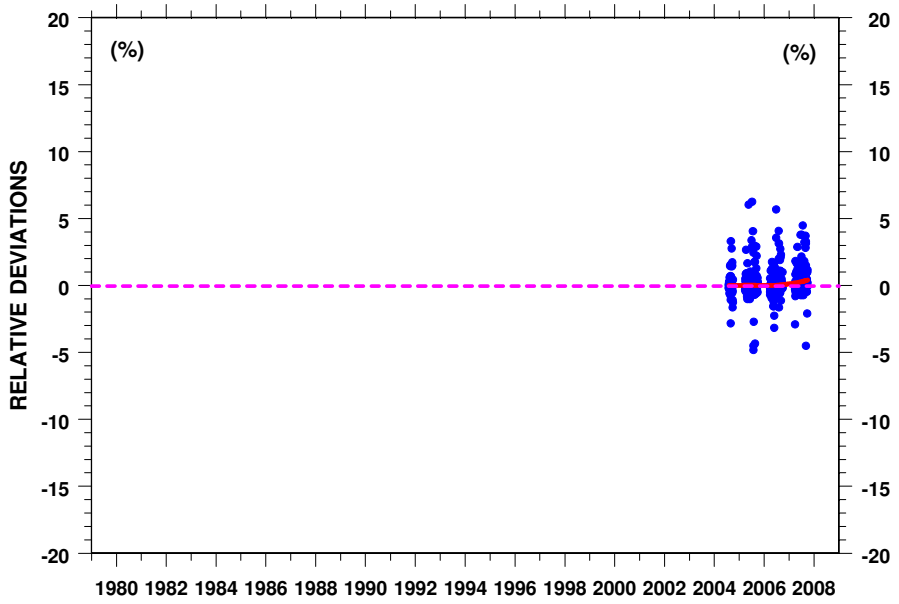
2004-2008

OCTOBER-MARCH



MEAN RELATIVE DEV.= -0.02% ± 1.42%

APRIL - SEPTEMBER



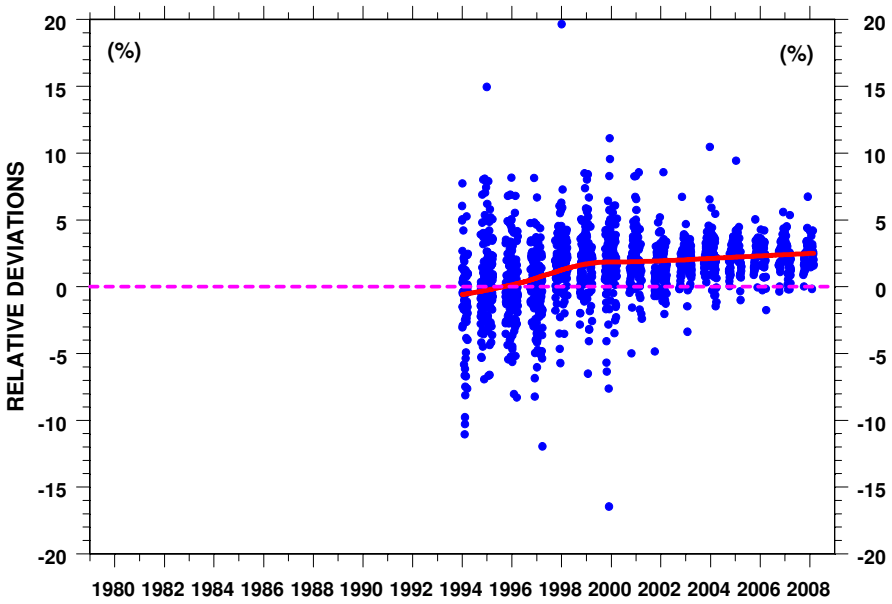
MEAN RELATIVE DEV.= 0.23% ± 1.03%

HRADEC KRALOVE DAILY TOTAL OZONE

(BREWER_IV – DOBSON) / DOBSON*100%

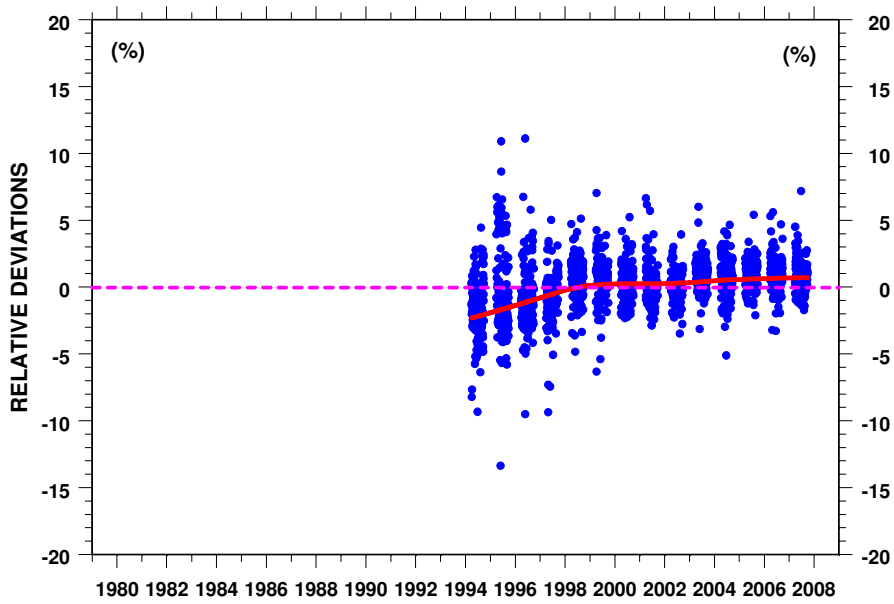
1994-2008

OCTOBER - MARCH



MEAN RELATIVE DEV.= 1.32% ± 2.64%

APRIL - SEPTEMBER



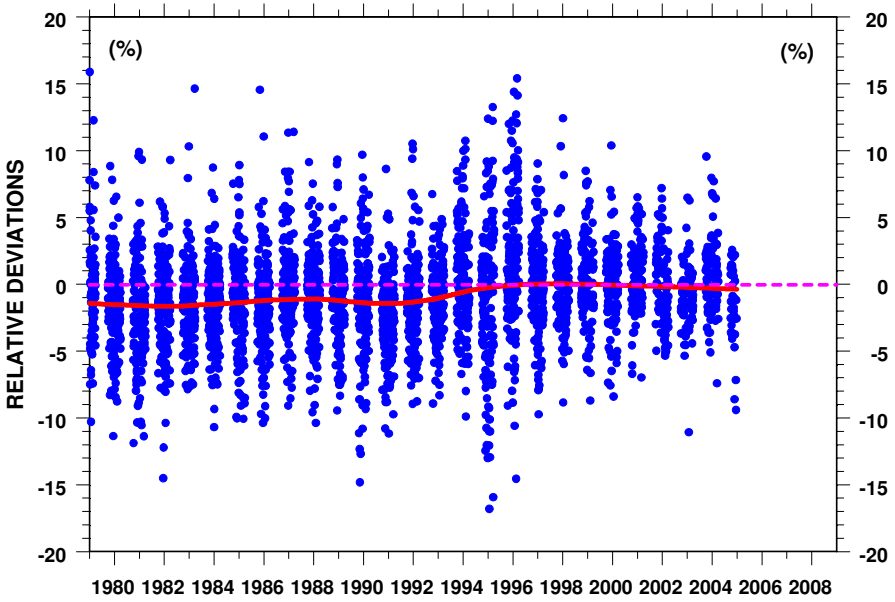
MEAN RELATIVE DEV.= 0.00% ± 1.97%

HRADEC KRALOVE DAILY TOTAL OZONE

(COST – DOBSON) / DOBSON*100%

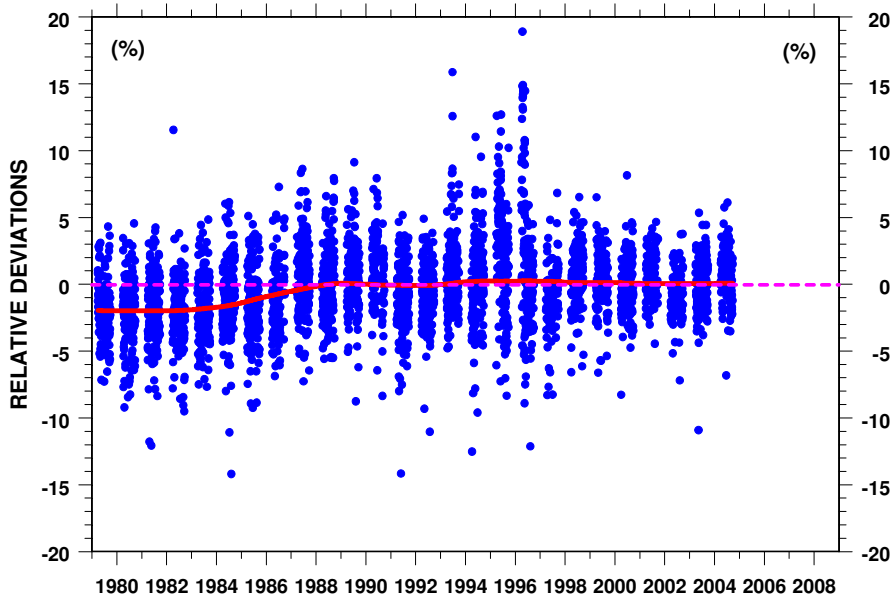
1979-2004

OCTOBER - MARCH



MEAN RELATIVE DEV.= -0.79% ± 3.77%

APRIL - SEPTEMBER



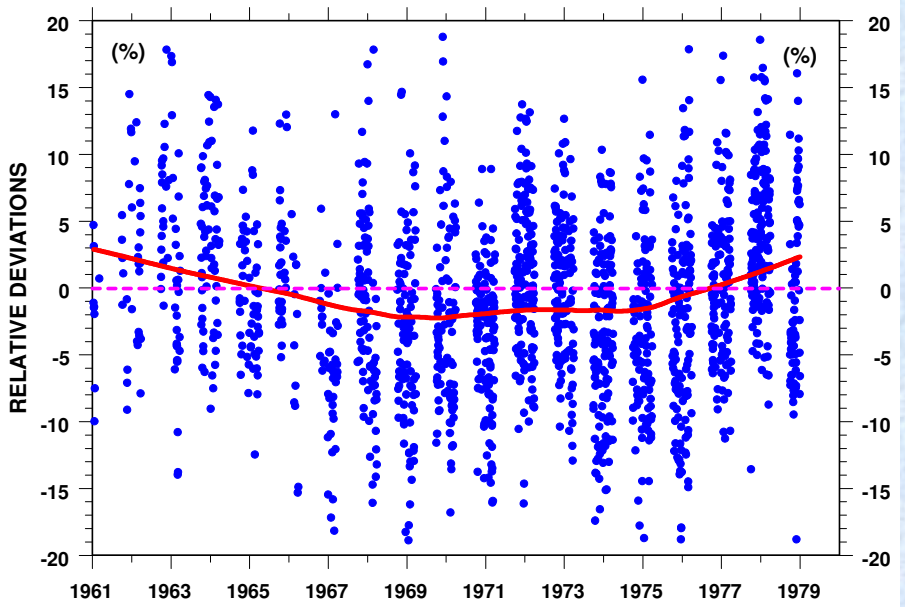
MEAN RELATIVE DEV.= -0.35% ± 3.05%

HRADEC KRALOVE DAILY TOTAL OZONE

(COST – DOBSON) / DOBSON*100%

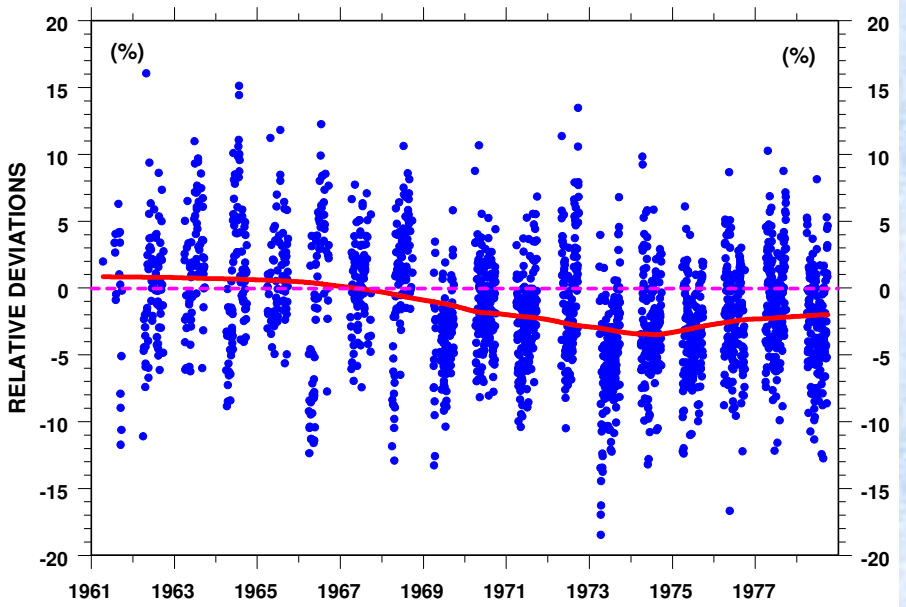
1961-1978

OCTOBER - MARCH



MEAN RELATIVE DEV.= -0.77% ± 6.71%

APRIL - SEPTEMBER

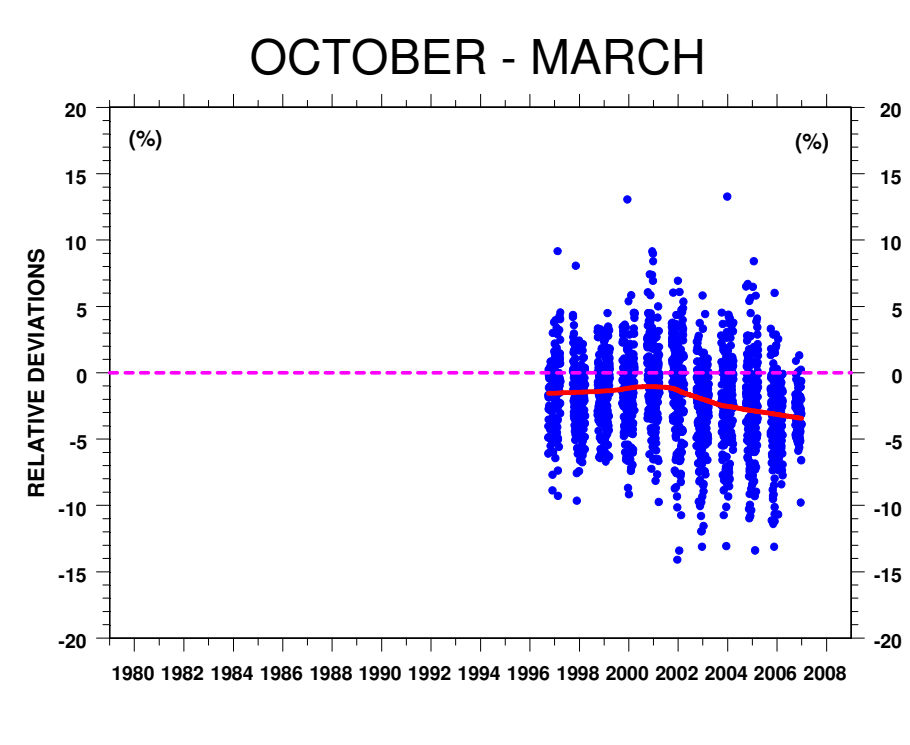


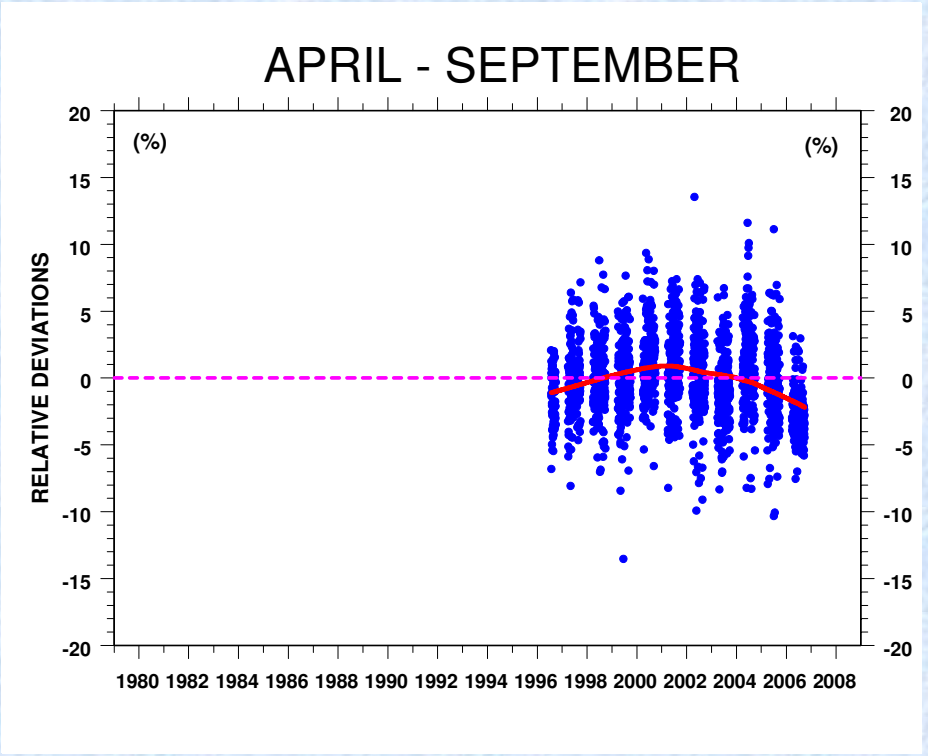
MEAN RELATIVE DEV.= -1.66% ± 4.47%

DeBilt DAILY TOTAL OZONE

(SATELITTE – BREWER III) / BREWER III *100%

1996-2008





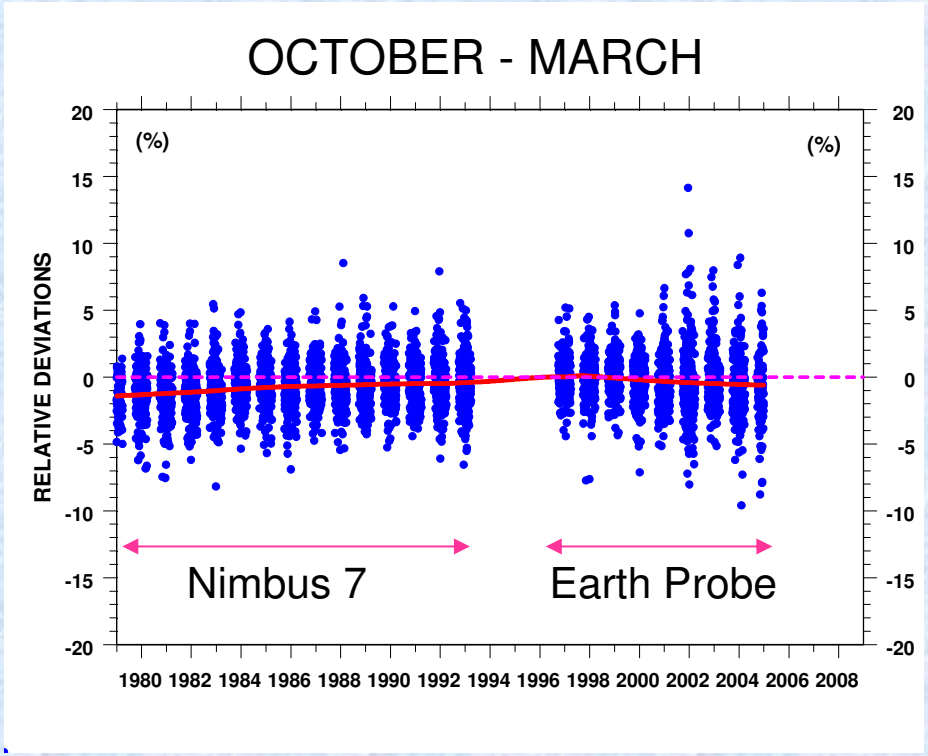
MEAN RELATIVE DEV.= -1.96% ± 3.34%

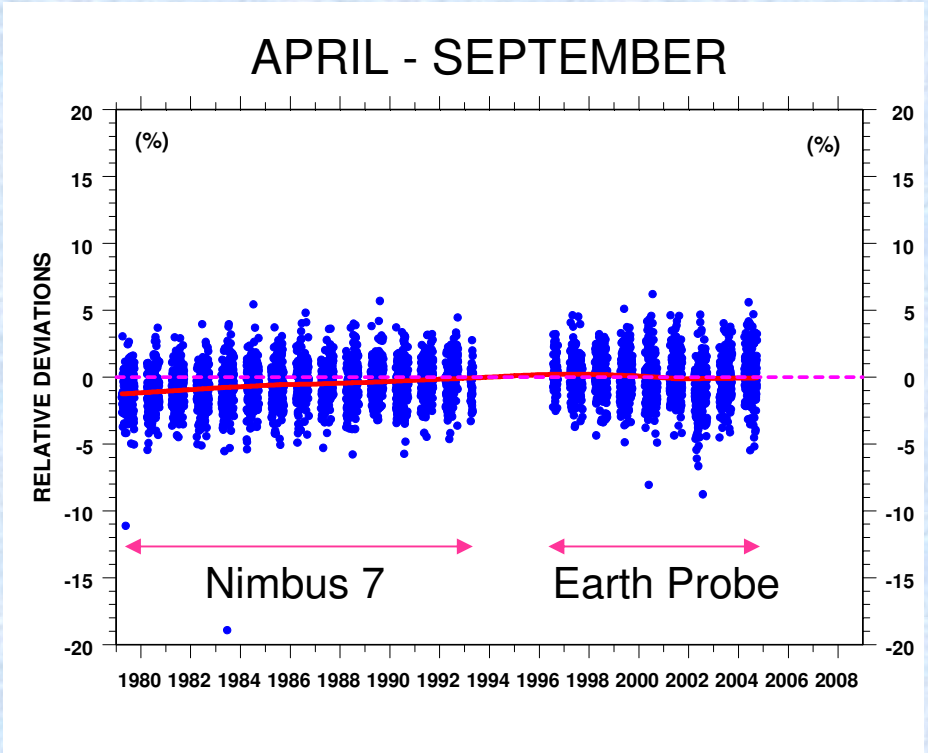
MEAN RELATIVE DEV.= 0.01% ± 2.96%

DeBilt DAILY TOTAL OZONE

(COST – SATELITTE)/ SATELITTE *100%

1979-2004





MEAN RELATIVE DEV.= -0.54% ± 2.02%

MEAN RELATIVE DEV.= -0.38% ± 1.66%

General Comments

HOW TO CALCULATE THE TRUE TOTAL OZONE VALUE?

* LONG-TERM BIAS BETWEEN VARIOUS OZONE SOURCES WITHIN ±2% RANGE

* STANDARD DEVIATION OF THE SATELLITE/GROUND O3 AND COST/GROUND O3 DAILY DIFFERENCES 2-5% (APRIL-SEPTEMBER)

  ~2-3% STANDARD DEVIATION FOR THE SATELITTE ERA T>1979
  ~5% STANDARD DEVIATION FOR THE PRE-SATELLITE ERA

* FOR RECONSTRUCTION OF UV USE:

  COST O3 BASE BEFORE 1979
  REGRIDDED NIWA BASE (WITH HOLES FILLED BY COST MODEL) AFTER 1978

* BSCW DATA CONTAINS:

  BOTH DATA SOURCES (COST726-NEW, NIWA-NEW)
  PROCEDURE TO CALCULATE TIME SERIES FOR ANY SITE IN EUROPE
  (USER SELECTS ONLY φ AND λ)

  - FORTRAN 77 SOURCE + .EXE VERSION READY – TO BE COPIED SOON
  - TIME SERIES 1950-2004 FOR HRADEC KRALOVE AND DEBILT - TO BE COPIED SOON

* TECHNICAL COMMENT:

CHECK CORRECTNESS OF YOUR OZONE READING PROCEDURE USING THESE TIME SERIES!

FINAL COMMENTS

The extreme difference between the modelled and measured daily total ozone is ~ 20% that induces ~ 20% overestimation or underestimation of UV erythemally weighted radiation reaching the ground-level under clear-sky conditions.

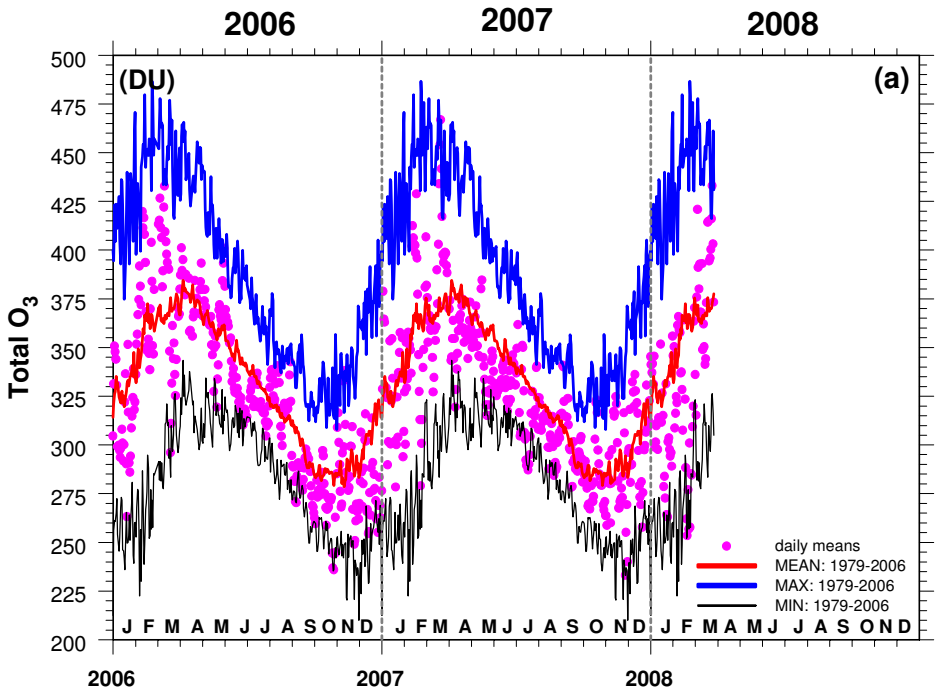
The total ozone data base is proper for examination of long-term variability ($| \Delta O3 | > 2\%$) rather than for analyses of extreme ozone cases.

All statistics concerning UV radiation should be built by averaging modelled daily UV data. Monthly mean UV doses seem to be unreliable if inferred from the monthly mean ozone and monthly mean cloudiness.

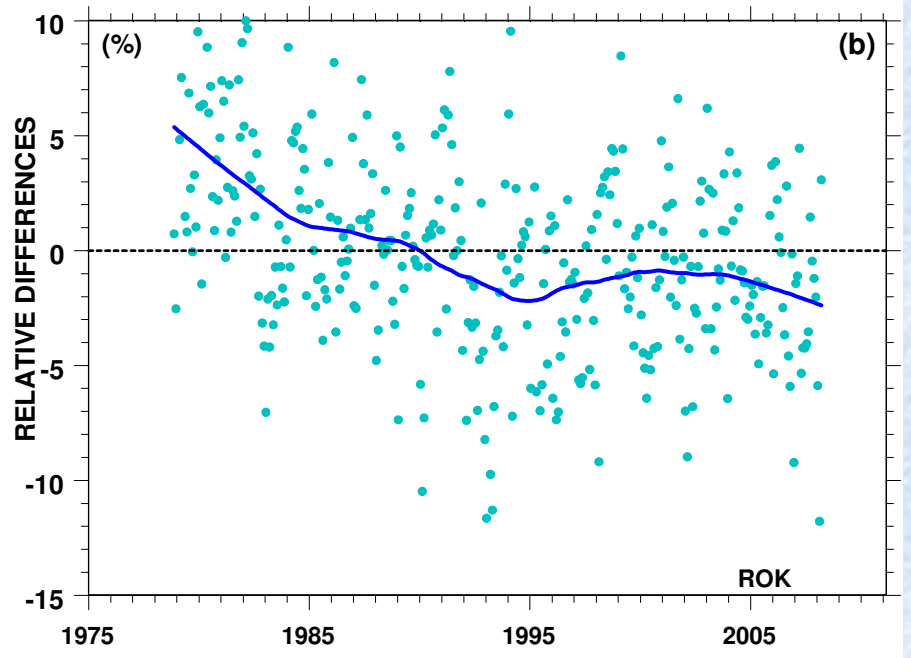
Various comparisons with the ground-based and satellite data lead to conclusion that the statistical total ozone data base over Europe will provide valuable input values for the surface UV reconstructions there.

SATELLITE DATA AVERAGED OVER CENTRAL EUROPE

DAILY MEANS



MONTHLY MEANS



UNEXPECTED OZONE BEHAVIOUR – OZONE IS DECRESING !