The variability in sunphotometer retrieved total ozone over Indian Astronomical Observatory, Mt. Sarswati, Hanle

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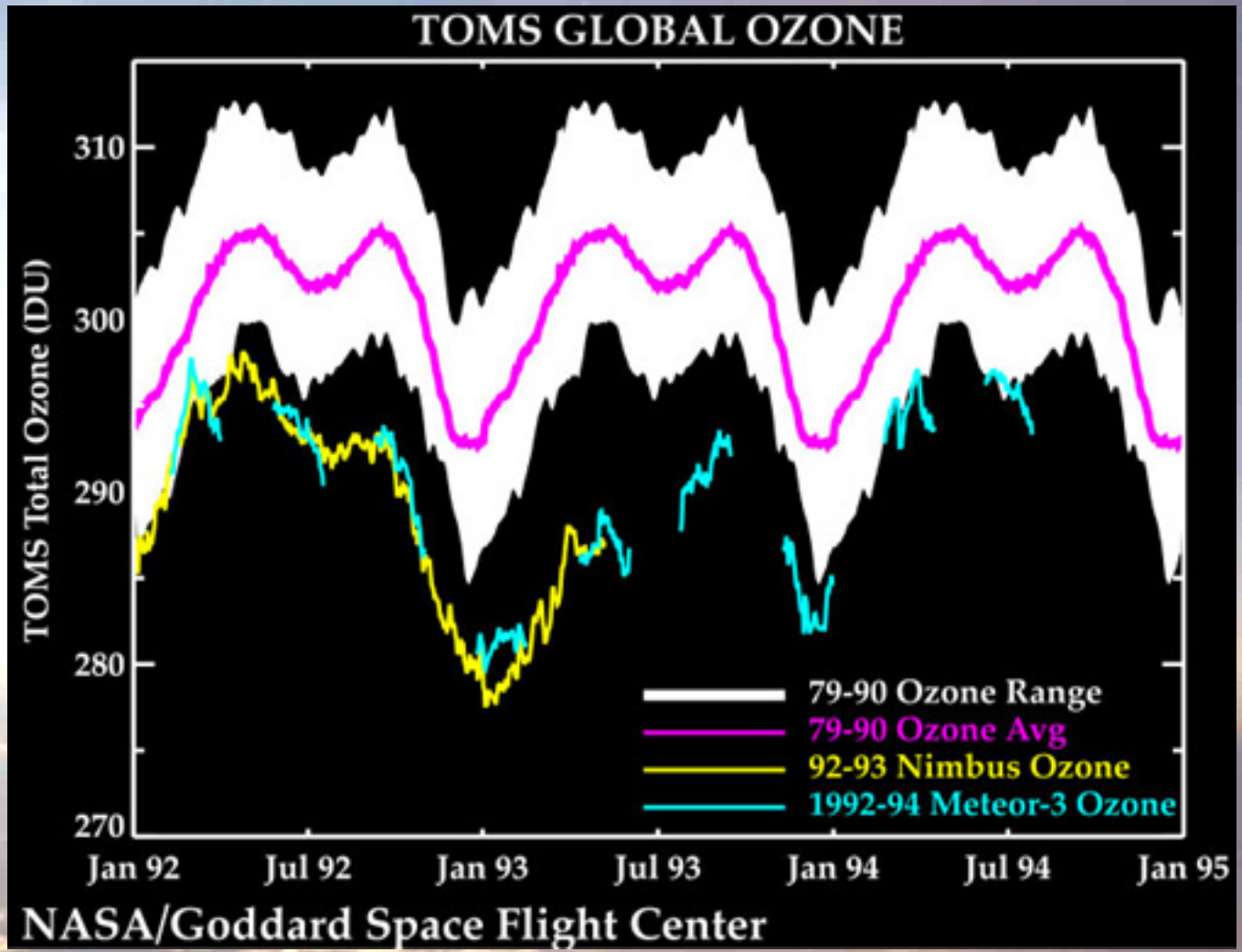
Importance of trace gases:

- The trace gases such as carbon dioxide, water vapour, ozone, and methane as well as the manmade chlorofluorocarbon (C F Cs), are all categorized as “greenhouse gases”.
- This is because each one of them has the ability to affect the Earth’s energy balance and changes the temperature at the surface and in the atmosphere.
- To - day the above trace gases are increasing rapidly.
- The C F C’s are playing a big role in stratospheric ozone destruction process.

Among the few examples of ozone hole phenomenon are the Antarctica ozone hole. The following figures are the ozone hole areas in million sq.km observed at Antarctica.

- 1980 October 27 > Area 3.27
- 1984 September 24 > Area 14.65
- 2001 September 19 > Area 21.74
- 2005 September 24 > Area 26.77

About 90 % of the total ozone resides at the stratosphere and the remaining 10 % resides at the troposphere.


TOMS GLOBAL OZONE
TOMS Total Ozone (DU)
310
300
290
280
270
Jan 92
Jul 92
Jan 93
Jul 93
Jan 94
Jul 94
Jan 95
79-90 Ozone Range
79-90 Ozone Avg
92-93 Nimbus Ozone
1992-94 Meteor-3 Ozone
NASA/Goddard Space Flight Center

How to determine Ozone ?

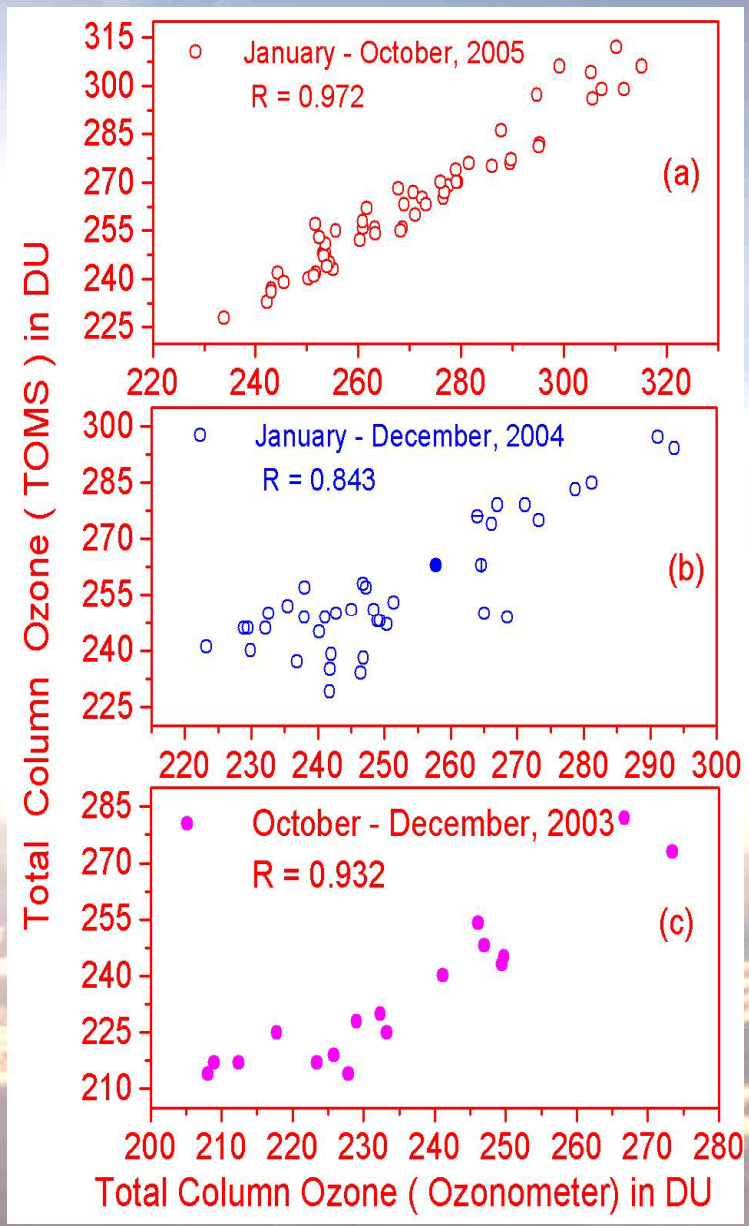
The columnar unit of ozone is measured in Dobson unit (DU). It represents the height of a stack of ozone molecules at the surface of the Earth at 0^0 C and 760 mm of Hg ,collected from a column of air above the stack.

The ground based total columnar ozone can be determined by :

1. Differential absorption technique in the UV region of the solar spectrum
2. Spectral extinction measurements in the Chappuis absorption band (440 -1180 nm)

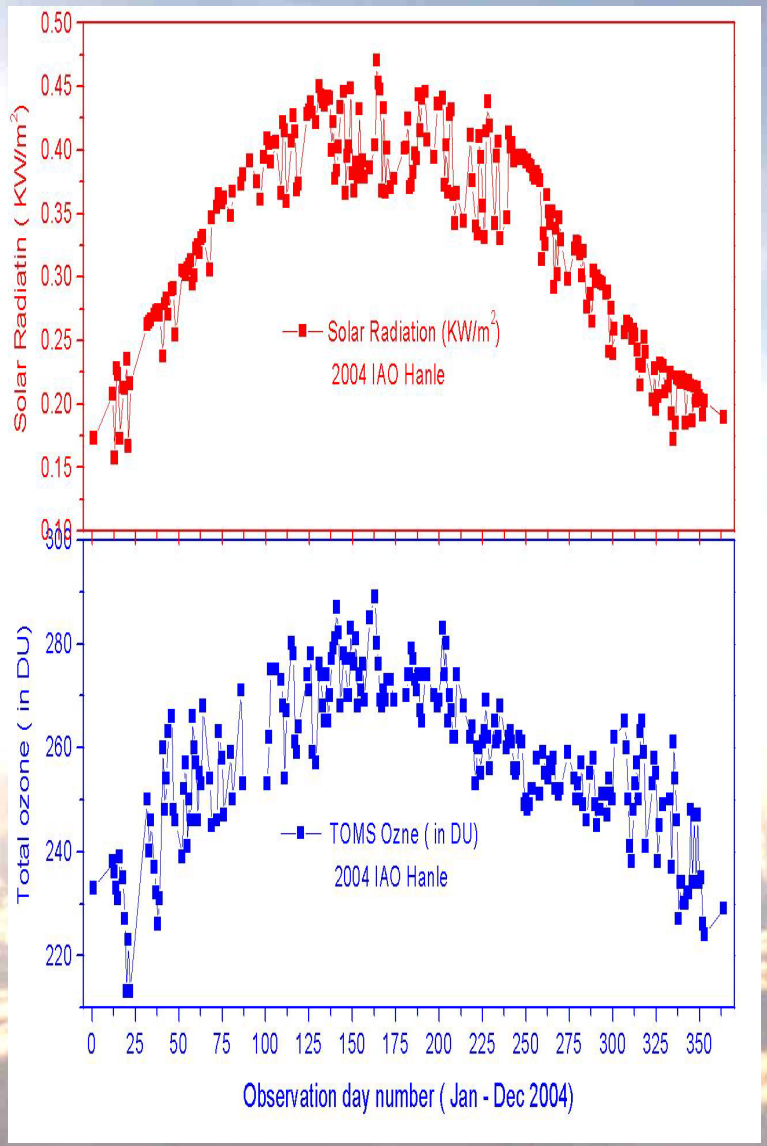
In both the methods applied the well known Lambert Bouger – law

Correlation between TO M S & Microtops data



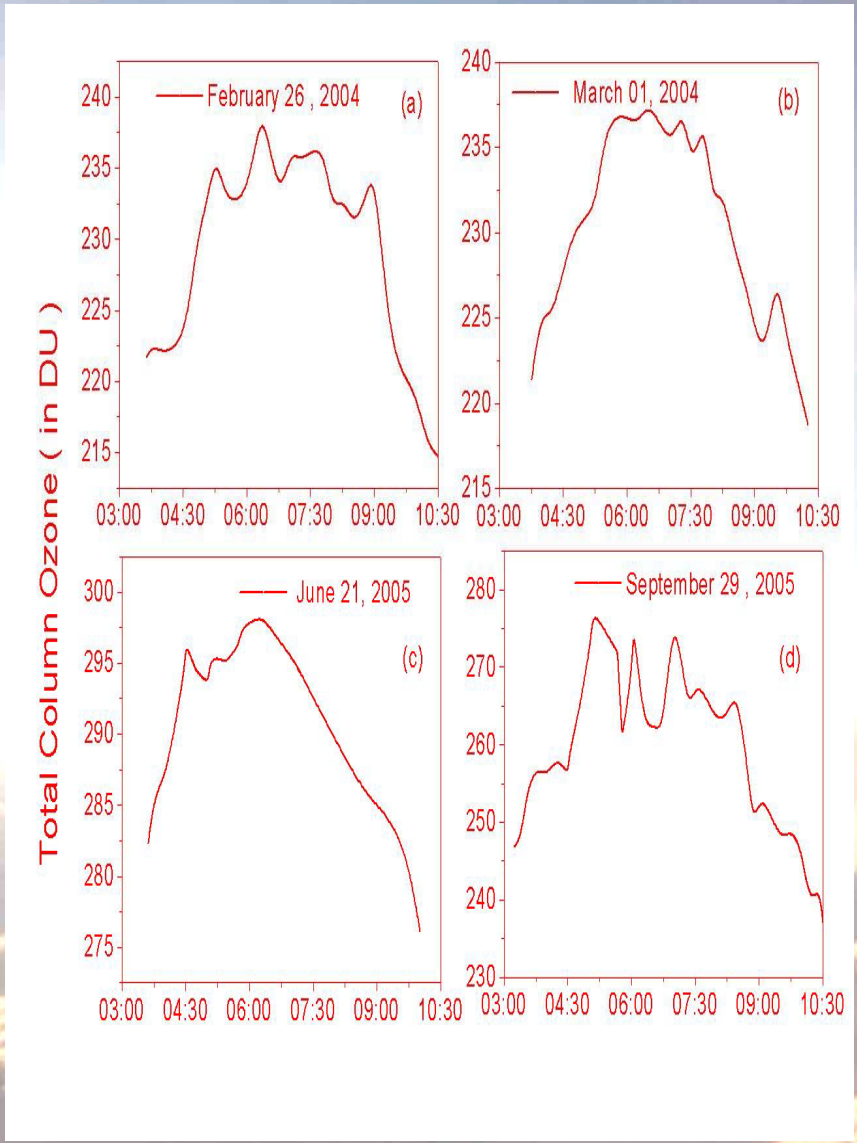
- The figures show the correlation between TOMS and Micro tops ozone data for IAO Hanle.
- The correlation between T O M S and Microtops ozone for 2005 is 0.97.
- The correlation is 0.84 for the year 2004 during January – December.
- For the year 2003 (Oct – Dec), the correlation is 0.93.

Variation of Solar Radiation & Ozone at I A O



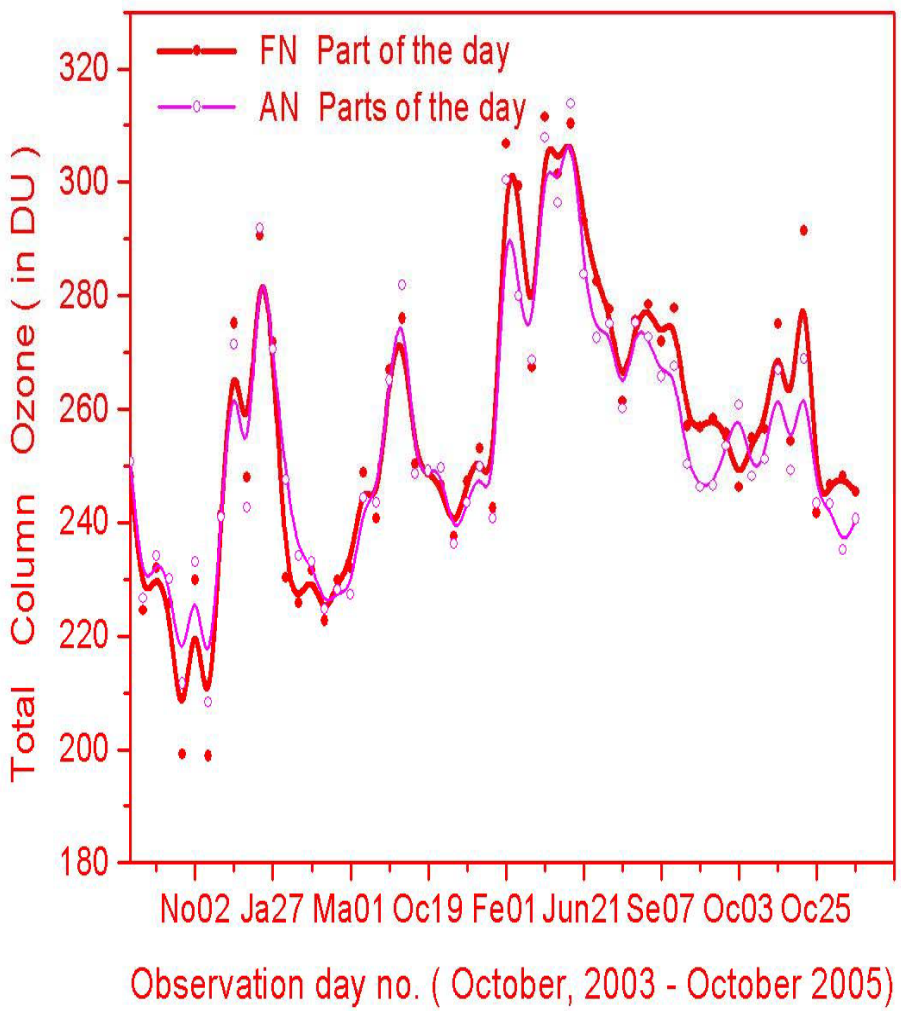
- The figure shows the variability of solar radiation measured at I A O Hanle and the corresponding T O M S ozone.
- The seasonal peak oscillations occurred during May – July of the year 2004.
- There is a good correlation (0.76) between the two observed parameters.

Diurnal variation of ozone at I A O



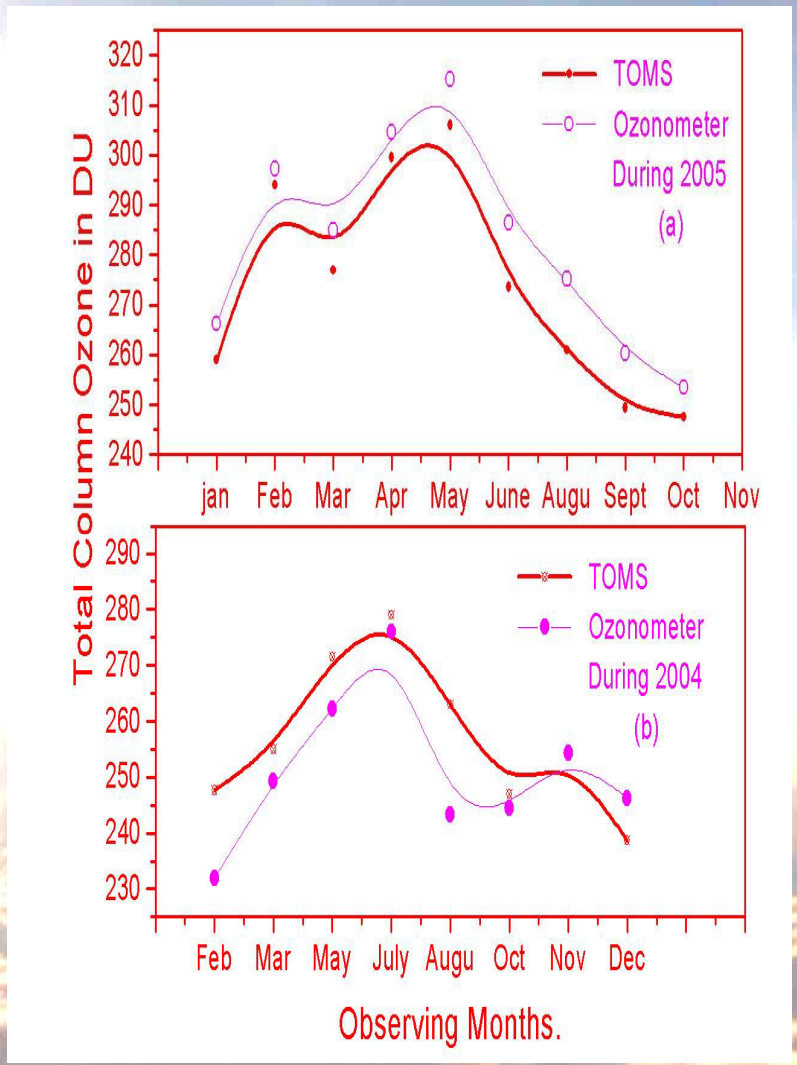
- The figures show the diurnal variation of Microtops Ozone data for I A O Hanle.
- During the local noon, the ozone production is maximum.

F N and A N variability of ozone for I A O



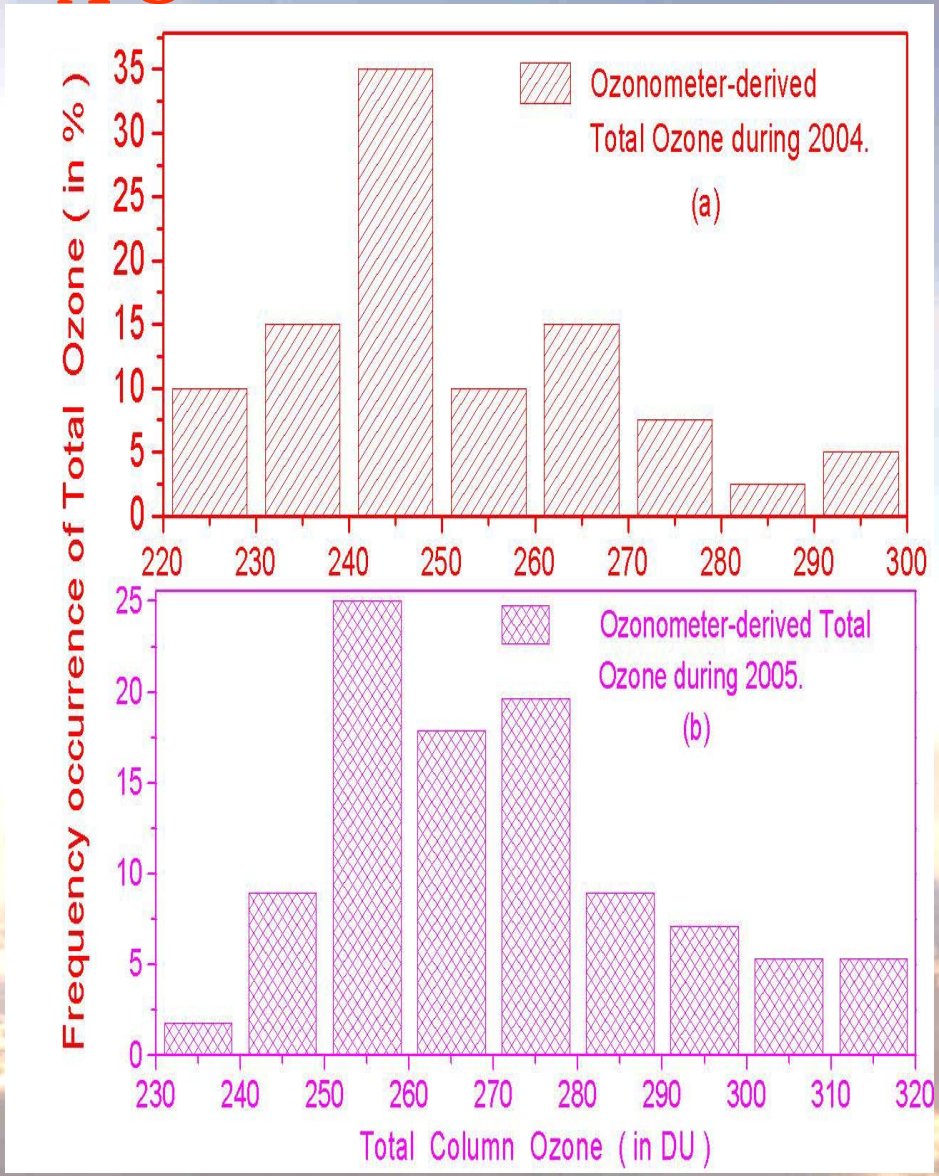
- The F N and A N variability of total zone for the I A O Hanle is very small (~2 D U). This data is taken by the Microtops during the year 2003 - 2005.
- It is noticed that the total ozone production around the local noon and afternoon time is about stable.

Seasonal variability of total ozone



The seasonal variation of ozone between maximum to minimum is the largest (80 D U) in northern hemisphere mid latitudes,where as in the southern hemisphere it ranges up to 60 D U. Near the equator, the seasonal cycle is about 30 D U. The seasonal cycle is smallest (10 D U) at 60^0 N - 60^0 S.

Frequency distribution of total ozone observed at I A O



- The maximum percentage frequency distribution is occurred in the range of 240 – 250 DU for 2004 and 250 – 260 DU for year 2005.

A O D variability with P W V at I A O

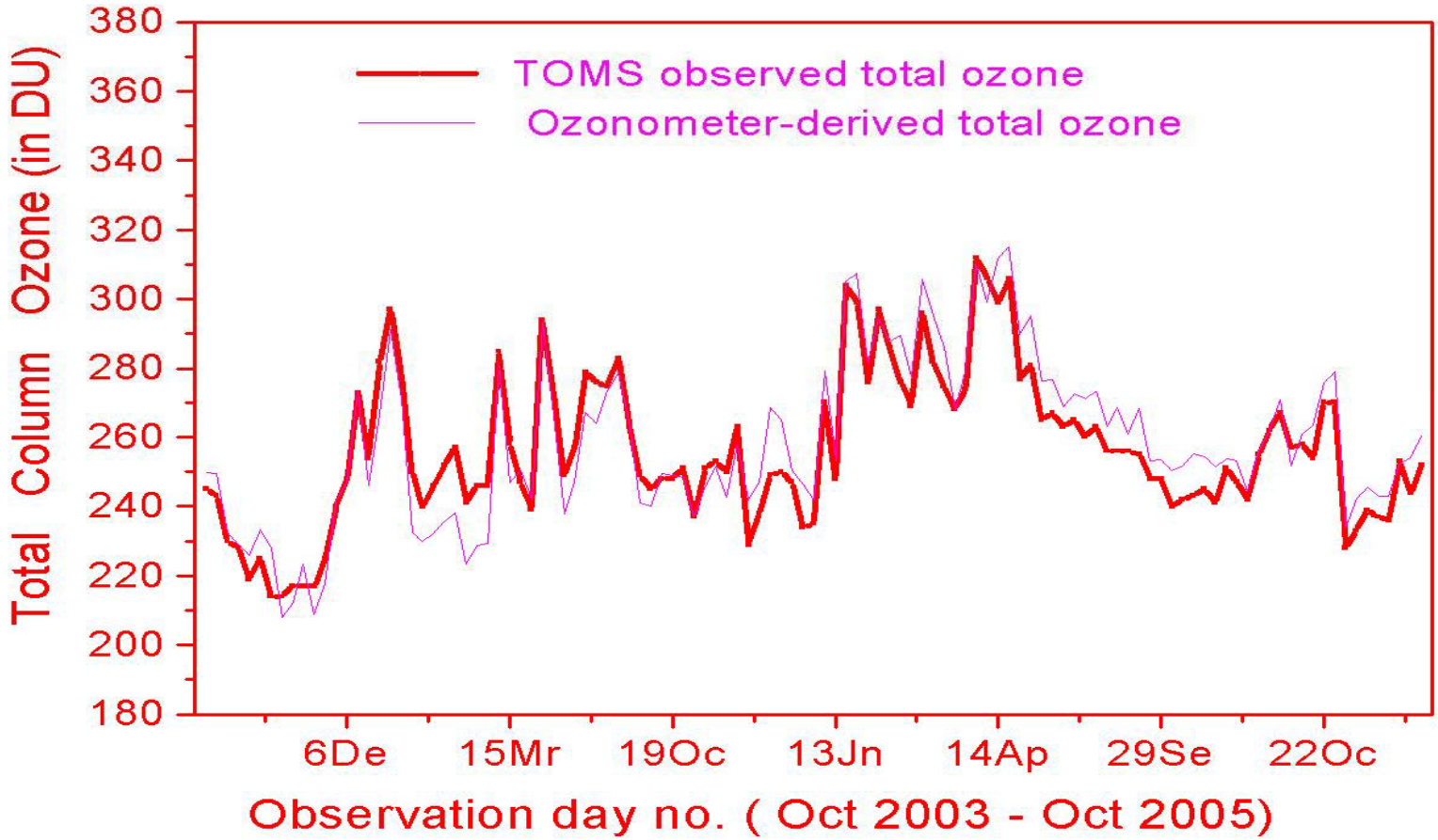
- The physical features of aerosols are changing with the increasing precipitable water vapour (Corr. coefficient 0.79). It indicates the dominance of hygroscopic aerosol particles are present at IAO Hanle.

- The aerosol optical depth observed at

  I A O Hanle is very small (0.111) and may be considered as the natural aerosols rather than anthropogenic origins.

- Due to dry and low water vapor content and aerosol optical depth, the IAO Hanle is becoming one of the best site in the world for setting up Astronomical observatories.

T O M S – Microtops ozone variability for I A O Hanle



Conclusions:

- It is noticed that there is a significant seasonal variation of total ozone at I A O Hanle.
- The seasonal oscillation is having maximum (~ 275 D U) during the Spring - summer and minimum during the winter months.
- The ground based total ozone values, measured by Microtops are matching well with the satellite T O M S data.
- In further prospect, the variability of ozone will study with Quasi - biennial oscillation (Q B O), Brewer- Dobson circulation and Solar cycle.