

# Validation of Total Ozone Analysis from SBUV/2 and TOVS (TOAST)

S. Kondragunta<sup>1\*</sup>, Q. Zhao<sup>2</sup>, D. McNamara<sup>1#</sup>, A. Neuendorffer<sup>1</sup>, and L. E. Flynn<sup>1</sup>

<sup>1</sup> NOAA/NESDIS, Camp Springs, Maryland

<sup>2</sup>STG, Inc., Rockville, Maryland

\* Email contact for scientific questions: Shobha.Kondragunta@noaa.gov

# Email contact for product questions: Donna.McNamara@noaa.gov

## Introduction

NOAA/NESDIS has developed an improved TOVS total ozone product that combines TOVS upper tropospheric and lower stratospheric ozone (LOZ) and SBUV/2 middle-to-upper stratospheric ozone (UOZ). The algorithm for the new product has the following steps:

- (1) Create a gridded 1° X 1° SBUV/2 UOZ (32 mb and above) analysis fields from SBUV/2 soundings,
- (2) Create a gridded 1° X 1° TOVS LOZ (surface to 32 mb) analysis fields from TOVS soundings,
- (3) Combine UOZ and LOZ fields to create a new total ozone map product.

This map product has been running at NOAA/NESDIS in a pre-operational mode since 2001 and is available to users via the internet at <http://140.90.208.66/>. The TOAST product is expected to become operational in late 2005.

## Purpose of this Study

TOVS algorithm uses a latitude dependent but seasonally independent UOZ climatology. This assumption leads to large errors in TOVS total ozone when day-to-day ozone variations deviate from climatology. In the TOAST algorithm, we replaced TOVS UOZ climatology with measurements from SBUV/2. In this study, we compare the TOAST total ozone product with ground-based observations to determine that its accuracy is better than TOVS.

## Data

Two years of satellite (NOAA-16 TOVS and SBUV/2) and ground observations (Dobson and ozonesonde network).

## Analysis

Time series of monthly mean offsets between:

TOAST vs Dobson – TOAST validation

SBUV/2 UOZ vs POAM UOZ – SBUV/2 UOZ validation

TOVS LOZ vs ozonesonde LOZ – TOVS LOZ validation

Figure 1: TOAST Algorithm Schematic

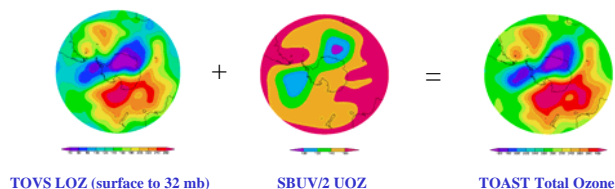


Figure 2: Validation of NOAA-16 TOAST Total Ozone Product

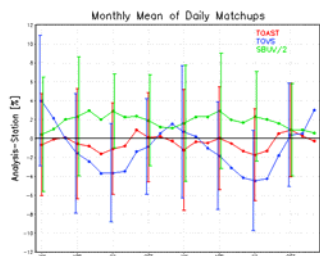


Figure 2: Time series of monthly mean (Analysis – Dobson) total ozone (%). For matchups, a 4-point linear interpolation from 1° x 1° degree daily analysis fields were made to observation spots. TOAST shows an improvement over TOVS and its accuracy is at the 2% level. Vertical bars are 1-sigma standard deviations.

Figure 3: Validation of NOAA-16 SBUV/2 UOZ

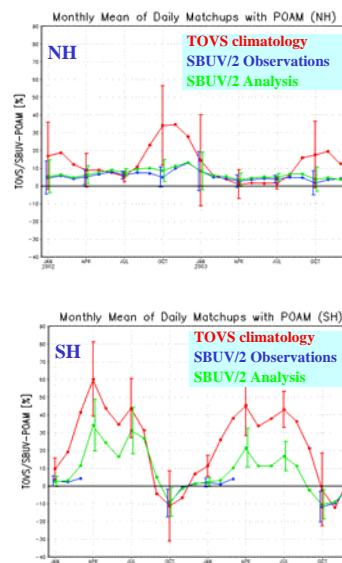


Figure 3: Time series of monthly ((TOVS/SBUV2) – POAM) integrated profile ozone (UOZ) (%) in the Northern Hemisphere (top panel) and in the Southern Hemisphere (bottom panel). Matchups were obtained for coincident measurements within 4° latitude and 12° longitude. Climatological TOVS UOZs have large offsets compared to POAM observations (red curve). UOZs from SBUV/2 measurements and analysis have smaller offsets (green and blue curves). In the SH, for SBUV/2 vs POAM comparisons, gaps in matchups are due to differences in coverage between POAM and SBUV/2; POAM latitude coverage is different between SH and NH. Vertical bars are 1-sigma standard deviations.

Figure 4: Validation of NOAA-16 TOVS LOZ

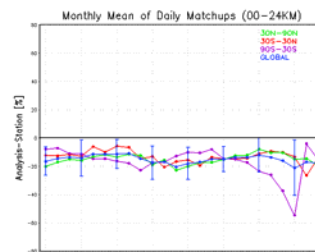


Figure 4: Time series of monthly ((TOVS analysis – ozonesonde) LOZ (%). For matchups, a 4-point linear interpolation from the 1° x 1° degree daily analysis fields were made to the observation spots. Offsets between TOVS and ozonesonde LOZs are between 10 and 20%, with offsets being larger at higher southern latitudes. Vertical bars are 1-sigma standard deviations.

## Conclusions

- Accuracy of TOAST total ozone is at the 2% level. Amplitude of the annual cycle in the offsets between TOAST vs Dobson is much less compared to TOVS vs Dobson.
- Replacing TOVS UOZ climatology with SBUV/2 UOZ retrievals in the TOAST algorithm improves total ozone retrievals. Comparisons of SBUV/2 UOZ retrievals/analysis with coincident POAM observations show that they agree within 10%. TOVS climatological UOZ values on the other hand have offsets as large as 60%.
- Comparisons of TOVS LOZ values with ozonesonde data show that they agree within 20% except at the southern high latitudes for which the discrepancies are larger (~ 40%). This is possibly due to uncertainties in TOVS LOZ retrievals over cold Antarctic surface.

## Acknowledgements

The POAM data were obtained from NRL via anonymous ftp site at [poamb.nrl.navy.mil](http://poamb.nrl.navy.mil). Dobson and ozonesonde data were obtained from WouDC at <http://wouDC.org/>