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

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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

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%. 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.
- 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

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