



Assimilation of Multiple Ozone Products into the NCEP Operational Forecast Model

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NCEP GFS Information

Global Data Assimilation System:

-GSI: Gridpoint Statistical Interpolation

- Co-developed & used with NASA/GMAO
- T382L64: ~50 km,
- top layer is at 0.3 hPa,
- 21 layers above 100 hPa

-Currently assimilating SBUV/2 v6 data from N16 and N17.

-Testing assimilation of SBUV/2 v8 from N16, N17, and N18

Forecast mode:

-Use Naval Research Lab (NRL) CHEM2D Ozone Photochemistry Parameterization (McCormack, 2004)

Impacts of Assimilation of Ozone

•Using NCEP skill assessment package (AC & RMS):

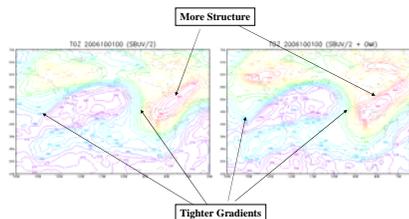
- At operational resolution (T382) noticeable improvement of skill of 200 and 850 hPa v winds in tropics.
- Neutral (N) or slight improvements of
 - 1000 and 500 hPa Z AC
 - 850 and 200 hPa u component RMS.

•Ozone hole forecasts are more accurate.

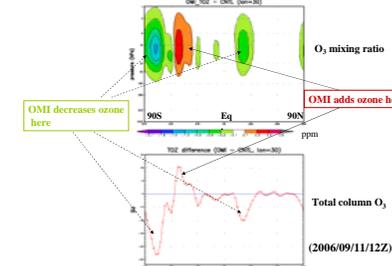
•Assimilation of NESDIS OMPRO (ozone profile) modifies Cntl similarly to how MLS modifies it.

-Expect similar results from OMO3PRO

Total Ozone Analysis Improvements



How GSI distributes total ozone changes in vertical profile



Profile ozone changes are proportionately distributed throughout the entire profile.

Assimilation of Ozone into Operational Wx Model

Why assimilate ozone

•Ozone forecasts

- UV Index Forecasts
- Air Quality Forecasts

-Needed for assimilating radiances from IR instruments (eg. HIRS, AIRS) where ozone influences the accuracy of determining temperatures.

Why OMI total ozone

-GFS currently assimilating only SBUV/2 (nadir obs)

•OMI offers greater horizontal and latitudinal coverage

-Preparation for assimilation of:

•OMPS (NP and NPOESS) - Limb Sounder un-demonstrated

•GOME-2 (MetOp)

-Available in NRT

-NCEP no longer require data to come from operational satellites.

•Instruments of opportunity

OMI Impact on Forecast Skill Scores (AC)

Wave #	Variable	1 - 3	4 - 9	10 - 20	1 - 20
1	NH 500 Z	N	N	N	N
2	NH 1000 Z	N	N	⊕	N
3	SH 500 Z	N	N	⊕	N
4	SH 1000 Z	N	N	N	N
5	TR 200 U	⊕	⊕	⊕	⊕
6	TR 200 V	⊕	⊕	⊕	⊕
7	TR 200 S	N	N	⊕	N
8	TR 850 U	N	⊕	⊕	⊕
9	TR 850 V	⊕	⊕	⊕	⊕
10	TR 850 S	⊕	⊕	⊕	⊕

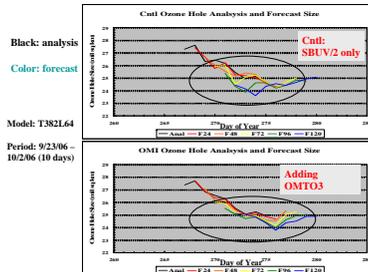
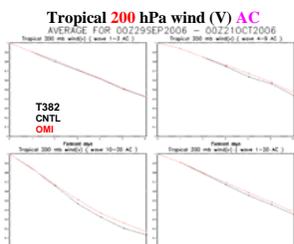
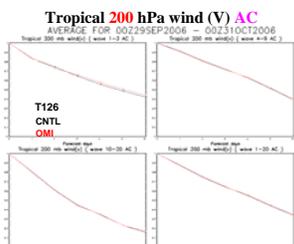
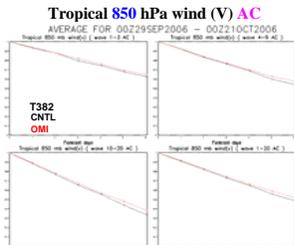
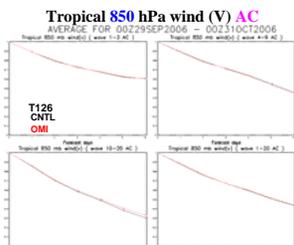
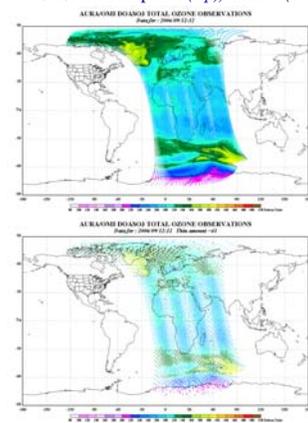
Issues: Thinning

•OMI provides 60x13 more obs per single SBUV/2 nadir obs
-~80,000 obs per orbit

•Using every 41st observation still produces ~20 times more obs than SBUV/2

- Reduction has no impact upon ozone analysis.
- Differences between OMT03 and OMDOAS decrease as forecast time increase.

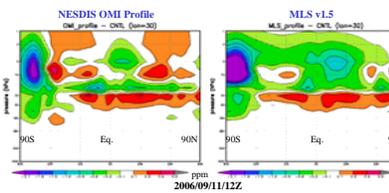
OMI DOAS: All data points (top), thinned (bottom)



Improved ozone hole forecasts, especially for Day 4 and 5 forecasts.

Assimilated ozone mixing ratio differences

OMI and MLS profiles have more ozone in lower stratosphere. Assimilation produces lowering of ozone max below 30 hPa and decrease of ozone above 30 hPa



MLS has coverage in polar night where as OMI does not. SBUV/2 v8 will produce similar differences from CNTL (SBUV/2 v6) as OMI profile

What's Next

- Complete OMI total ozone tests, look for additional impacts, and prepare for operational assimilation in Fall 2007.
 - Run additional tests at T382
 - QC data better
 - Validation
- Complete SBUV/2 v8 profile tests and prepare for operational assimilation in Fall 2007.
- Conduct tests using MLS NRT ozone product.
- Utilize MLS (v2.2) as ozone validation dataset along with ozonesonde and lidar (NDACC).
- Provide feedback to HIRDLS Science Team as new versions of ozone profiles become available.
- Begin tests with MetOp GOME-2 total ozone product.
- Work with KNMI OMI profile ozone product when available.
 - NESDIS SBUV version available.