



Improving the representation of ozone in the Met Office Unified Model

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Contents

This presentation covers the following areas

- Motivation for assimilating ozone
- Ozone in the Met Office Variational Assimilation system
- 4 Methods tested for improving ozone in the Unified Model
- Results, conclusions and future plans
- Questions and answers



Motivation for assimilating ozone

- Ozone is a key trace element
- Ozone could improve certain aspects of NWP
 - Improved radiative heating rates.
 - Better forecasts of surface UV.
 - Possible impact on UTLS winds.
 - Improved radiance assimilation.
- Assimilating ozone allows the exploitation of new and improved satellite data
 - MIPAS (ASSET project) (Geer et al, 2006a,b, 2007; Lahoz et al, 2007)
 - EOSMLS (Jackson, 2007)



Ozone assimilation in the Met Office Unified Model

- An N48 50 level 3D-Var system has been tested in a research environment.
- Plans for 4D-Var test system.
- The model ozone is from tracer transport plus chemistry (Cariolle parameterization)
- Assimilates satellite radiances – SBUV. Research satellites such as EOSMLS and MIPAS can also be assimilated.
- **B** is from ECMWF



Observations assimilated

- **SBUV**

- Nadir viewing, low vertical resolution (1000-16, 16-8, 8-4, 4-2, 2-1 and 1-0.1 hPa layers)
- Horizontal resolution ~ 200 km. No obs in polar night

- **EOSMLS**

- Profiles from 215-0.46 hPa with vertical resolution ~ 3km along track resolution of 165km. Global coverage
- Flies on NASA Aura research satellite – not (yet) available in near real time.

- **Future Operational Data**

- GOME II – onboard METOP similar to EOSMLS
- OMPS – onboard NPOESS
 - Total column and vertical profile ozone data
 - Continuation of SBUV and TOMS data



Methods for Improving ozone

5 experiments were run

- Control
- Alternative climatology – SPARC
- Inclusion of ECMWF ozone field
 - ECMWF already assimilate ozone in their model
 - Cheaper to use their field than to carry out the assimilation in the Unified model
 - The ECMWF ozone field might be better
 - One thing less to have to find resources to develop
- Assimilation of EOSMLS and SBUV observations into 3D-Var system
- Assimilation of SBUV observations into 3D-Var System.



Results

A brief summary of the key results



NWP Index

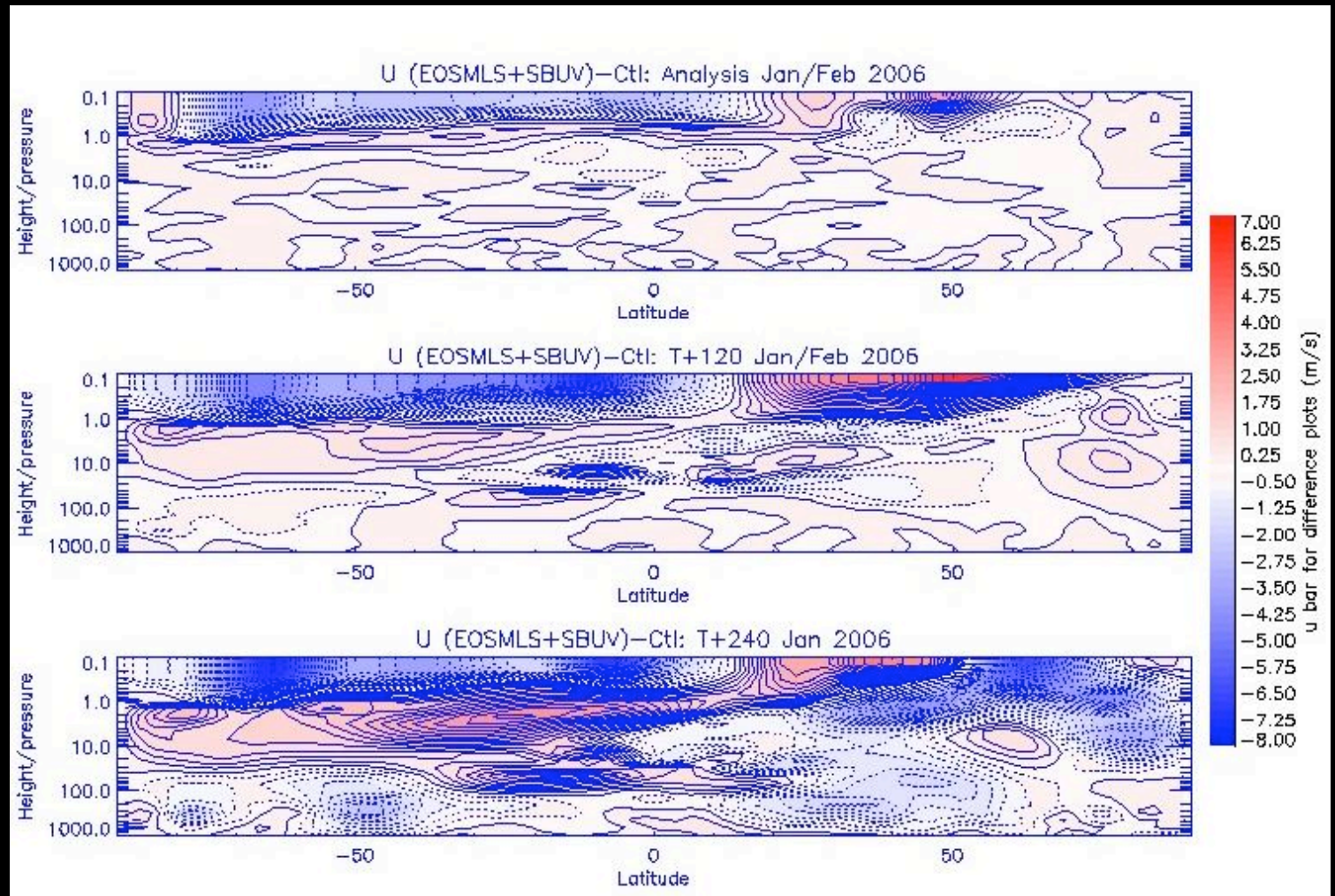
– A tropospheric measure of performance

	Alternative Ozone Climatology	ECMWF full ozone field	Full Met Office 3D- Var (EOSMLS + SBUV)	Full Met Office 3D-Var (SBUV only)
Global index (compared with analysis)	+0.314	-0.027	+0.413	+0.112
Global index (compared with observations)	+0.051	-0.216	+0.182	+0.289



Investigating the response in the troposphere

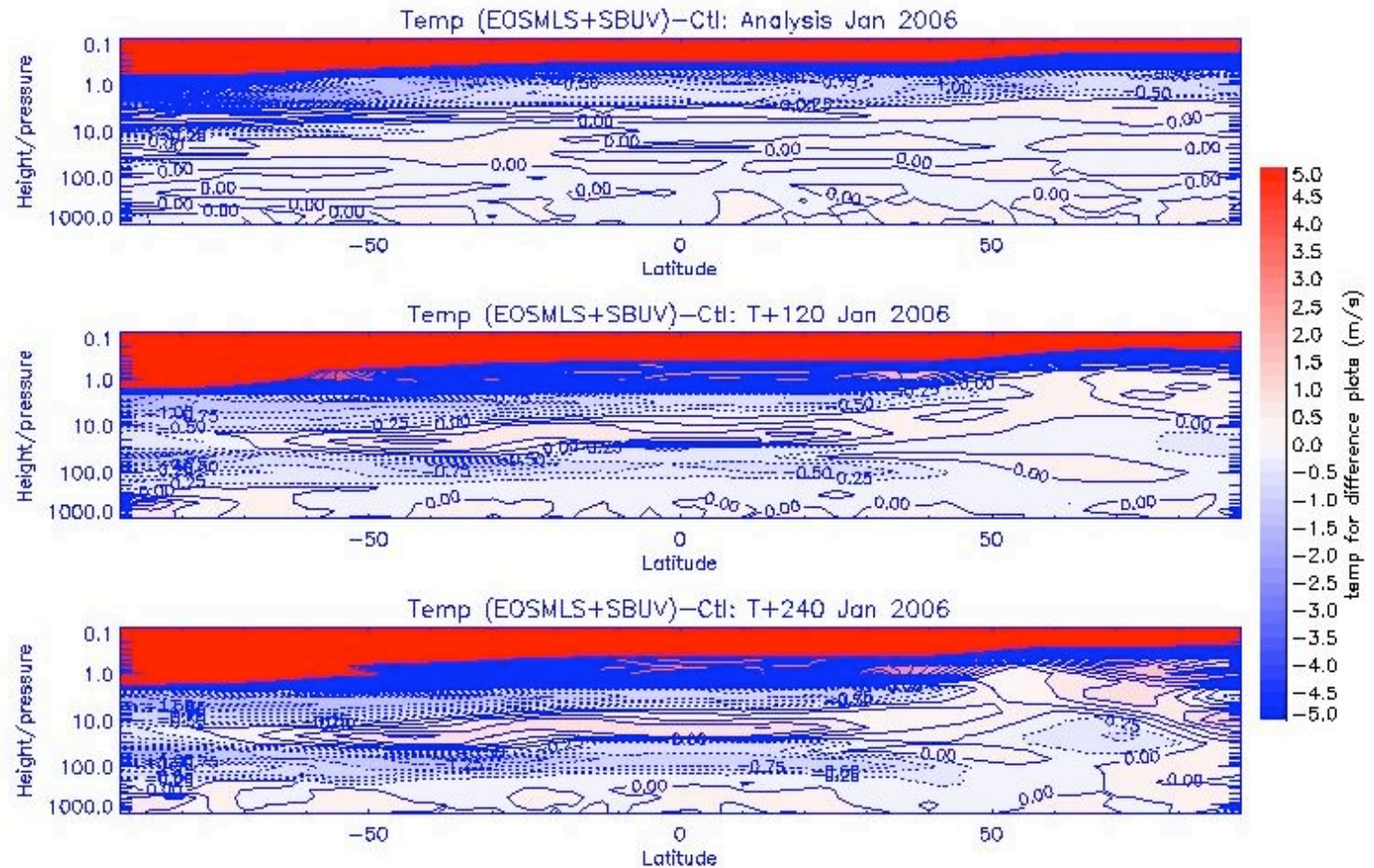
Winds





Investigating the response in the troposphere

Temperature





Conclusions

- **Importing ECMWF ozone field into the UM – disappointing results.**
- **Changing climatology to SPARC had a favourable impact**
 - SPARC climatology has more data over a longer period and includes a transport model.
- **Ozone analyses is improved by assimilating ozone**
 - High resolution data.
 - Mechanisms are being investigated.
 - **Currently developing this system into a viable operational system within 4D-Var.**

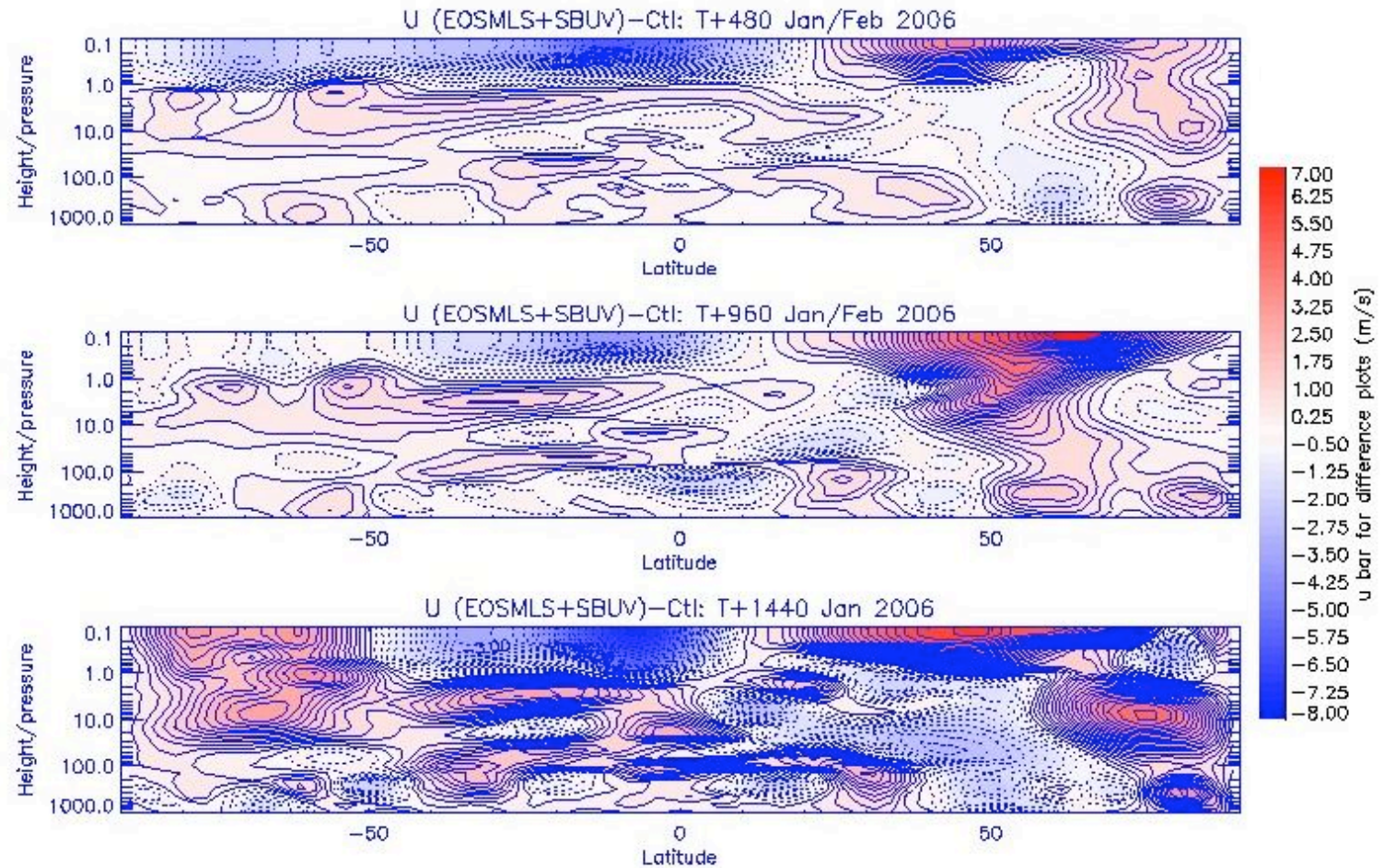


Questions & answers



Investigating the response in the troposphere

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