Validation of Met. Office Mesospheric Analyses

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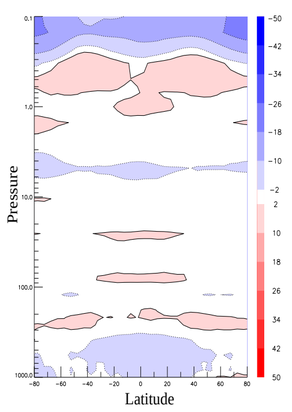
1 Introduction

Met. Office middle atmosphere analyses are widely used by the stratospheric and mesospheric community. The aim of this project will be to supply the first proper assessment of the quality of Met. Office mesospheric temperature analyses. The independent temperature profiles used to perform the validation were obtained from the Earth observation satellite micro-wave limb sounder (EOS MLS). The temperature analyses being validated are from the Met. Office stratospheric assimilated data-set.

For each day in the EOS MLS dataset range, analyses sub-grid temperature values on each model pressure level are averaged horizontally to each EOS MLS location. Subsequently each of these values were then interpolated vertically to the nearest EOS MLS pressure level and the difference was recorded in Kelvins.

The temperature differences for each pressure level were then zonally averaged for each month in latitude bins of 5^o ranging from -80^o South to 80^o North. The associated pressure levels range from 1000 hPa to 0.1 hPa. The Met. Office middle atmosphere analyses are available from 1991 to the present. However here we focus on the August 2004 - June 2008 period, when both Met. Office analyses and EOS MLS data are available.

2 Total Zonal Mean Temperature Difference



This section displays the total zonal mean temperature difference of all monthly means in section 6.

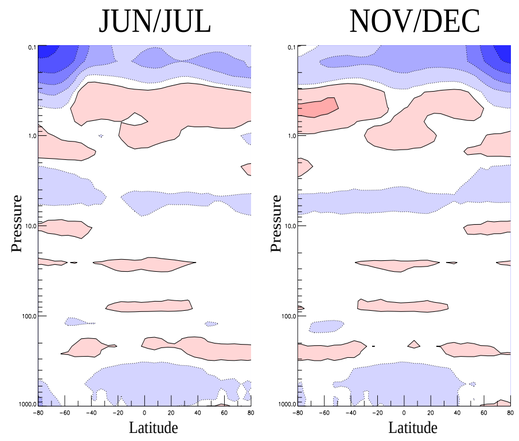
The major temperature biases occur over 2 regions in the lower mesosphere.

- Warm bias between 2 and 10 K. from $\sim 1.0 \rightarrow 0.3$ hPa. .
- Cold bias between -2 and -26 K. from $\sim 0.3 \rightarrow 0.1$ hPa.

The maximum difference is a cold bias between -18 and -26 K. located at high Southern and Northern latitudes in the middle mesosphere, $\sim 0.2 \rightarrow 0.1$ hPa.

Note: For ALL results. Differences below ~ 300 hPa. should be ignored as EOS MLS data is not recommended for scientific use.

3 Seasonal Dependance

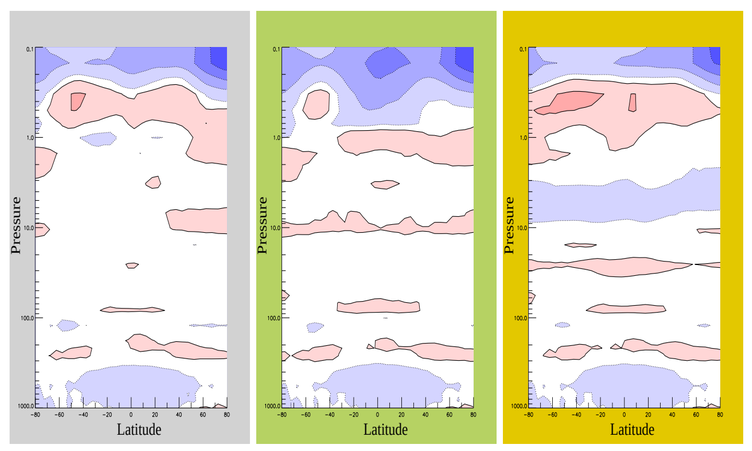


This section displays the total zonal mean temperature differences over the years 2005,2006 and 2007 for the seasons (June/July) and (November/December) in both the Northern and Southern hemispheres.

In general all biases below ~ 0.3 hPa. are not heavily dependent on season. The exception being the warm bias in the region from $\sim 1.0 \rightarrow 0.3$ hPa. which tends to be more extreme at high latitudes in the Southern summer.

The cold bias in the region from $\sim 0.3 \rightarrow 0.1$ hPa. is however heavily dependent on season. Clearly shown by the maximum cold bias occuring at high latitudes in both the Southern and Northern winters.

4 Dependance on Data Assimilation Scheme / Model



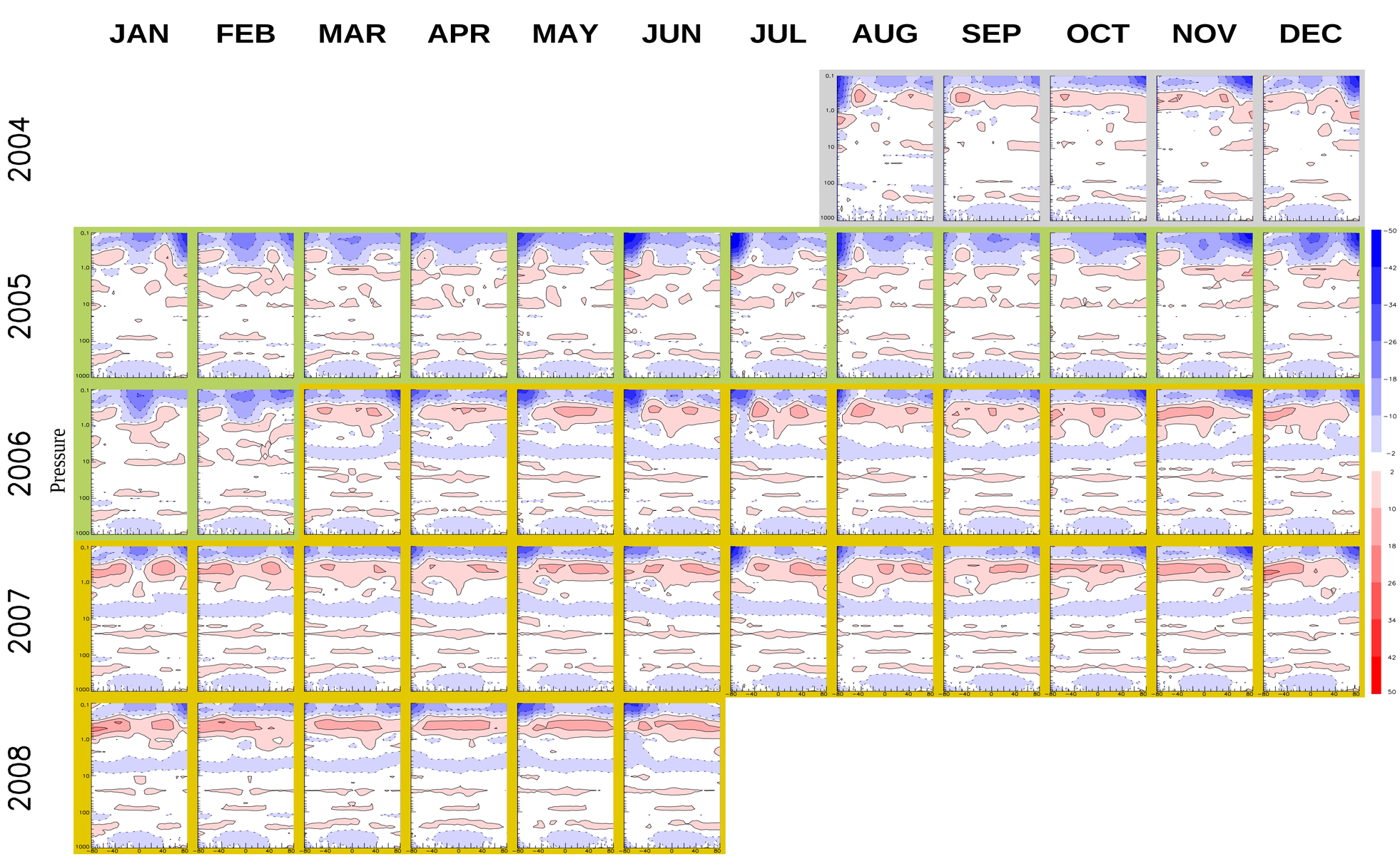
This section displays the total zonal mean temperature differences from August→December for the 3 different data assimilation schemes / models discussed in section 6.

Note in comparison the green scheme has an increased cold bias at low latitudes in the lower mesosphere. Also in comparison the orange, currently operational, scheme has an additional cold bias for all latitudes over $\sim 10.0 \rightarrow 5$ hPa.

5 Conclusions

- The relationship between the cold bias and season, shown in section 3, would suggest that there is not enough descent in the model at these locations and the representation of the middle atmosphere mean meridional flow is inaccurate. A strong possible reason for this would be errors in how gravity waves are parametrized in the mesosphere.
- From all results displayed we find several bias regions, both hot and cold, which occur at constant pressure levels for large ranges of latitude. This would suggest that there are possible errors in the radiation scheme of the model at these pressure levels.

6 Zonal Monthly Average Temperature Differences from August 2004 to June 2008



Model N48L50

D.A. Scheme: 3D-Var

Latitude Resolution: 2.5^o
Longitude Resolution: 3.75^o

Model N48L50

D.A. Scheme: 3D-Var + Bugged Assimilation of Atmospheric Infrared Sounder (AIRS) Data

Latitude Resolution: 2.5^o
Longitude Resolution: 3.75^o

Model N320L50

D.A. Scheme: 3D-Var + Un-bugged Assimilation of Atmospheric Infrared Sounder (AIRS) Data

Latitude Resolution: 0.375^o
Longitude Resolution: 0.5625^o

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