INTRODUCTION

The Michelson Interferometer for Passive Atmospheric Sounding (MIPAS) is a limb-viewing infrared Fourier transform interferometers on the ESA Envisat satellite launched in 2002.

MIPAS makes global measurements of infrared spectra in the range 4-15μm at tangent heights from the mesosphere down to the mid-troposphere. From these spectra, vertical profiles of atmospheric temperature and composition, including stratospheric NO2, are routinely retrieved by ESA and several other groups, including Oxford.

Here we examine the feasibility of retrieving NO2 concentrations in the upper troposphere from MIPAS spectra.

THE MIPAS INSTRUMENT

In normal operation MIPAS views rearward along the orbit track giving pole-to-pole coverage and approximately 14 orbits per day. However it also has the ability to view sideways, and such observations are occasionally scheduled to view east-west along the North Atlantic flight corridor as a special mode dedicated to detection of aircraft emissions. Such observations are not yet routinely processed.

The plot below shows the coverage on 2nd January 2008, a day when such ‘AE mode’ observations can be seen as breaks from the normal observations following the orbit track.

ATMOSPHERIC NO2

NO2 (and other NOx species) occur naturally in the atmosphere, and have maximum concentrations (measured in ppbv) in the mid-stratosphere.

CONCLUSIONS

Assuming that the full NO2 band is used and the above viewing geometry, a linear least-squares-fit analysis suggests that the NO2 at 12km can be retrieved with a precision of 3% (i.e. that an aircraft-induced enhancement of 3% above background levels should be detectable).

However there are some important caveats:

- No other errors, e.g. in temperature or interfering species (primarily H2O)
- The ‘shape’ of the stratospheric NO2 is assumed fixed and known
- In practice, using the entire NO2 band would be computationally prohibitive. (Operational retrievals tend to concentrate on a few ‘microwindows’ totalling 10-20cm⁻¹ in bandwidth).