INTERCOMPARISON OF MIPAS NEAR REAL TIME AND OFFLINE DATA PRODUCTS

Alastair Burgess, Anu Dudhia, and Chiara Piccolo

Atmospheric, Oceanic and Planetary Physics, Department of Physics, University of Oxford,
Oxford, OX1 3PU, UK
aburgess@atm.ox.ac.uk

ABSTRACT

There are two level 2 data resources provided by ESA for MIPAS users. These are the Near Real Time (NRT) and Offline data sets. We investigate the differences observed between these products over a large number of profiles, to assist in validating their mutual consistency and determining the effect of the differing data processing routes.

Key words: Envisat,MIPAS,Offline,Level2.

1. INTRODUCTION

The Near Real Time and Offline data sets are two level 2 data resources provided by ESA for MIPAS users, *ESA* (2000a,b). To date, NRT data has been commonly used within the MIPAS validation community. The NRT data was primarily designed for use in situations where accuracy could be traded for fast turnaround and data receipt, such as volcanic monitoring, data assimilation and field campaigns.

The Offline product uses consolidated level 1B spectra which consists of complete orbits that start and end at a fixed geolocation. A more accurate gain calibration has also been applied to this spectral data. Very similar microwindows – small spectral regions designed to maximize sensitivity to the target species whilst minimizing systematic errors – are used in both the NRT and Offline processors. The differences in altitude coverage are highlighted in Figure 1. Their selection is discussed in *Dudhia et al.* (2002). The retrieval in the Offline case is permitted to iterate to convergence, and contains more levels (down to 6km instead of 12km for NRT data). A consequence of the increased retrieval range is greater susceptibility to cloud contamination within the field of view. A simple cloud detection routine, based on work by *Spang et al.* (2003), has been implemented to enable the processor to discount cloudy levels. Other small differences exist, such as a more accurate orbital state vector and corresponding geolocation, but these are not expected to be of significance to the retrieval.

2. DISCUSSION

One of the key differences between the NRT and Offline data sets, as previously mentioned, is shown in Figure 1. The effect of these extra levels can be seen as increased scatter for top and bottom levels in Figure 3, which gives an overview of the mean differences, averaged over the month of November 2003, between the Offline and NRT data. The second of the pair of plots shows the NRT monthly mean for the same species as a reference. November 2003 was chosen because of the availability of Offline data. Most months are lacking in good coverage. Indeed, even within this month, some days have no data and some have only NRT data. This is highlighted in Figure 2.

For individual species, the main observed differences between NRT and Offline values were:

- 'PRE' – Pressure (3(b)).
  The Latitude band 75N (90N-60N) shows an unusual deviation. One would expect for November that this atmosphere would be perturbed (i.e. Figure 3(b)right is reasonable), however the effect would be expected to be the same for the two retrieval schemes, leaving a smaller difference than is observed.
- 'H2O' – Water Vapour (3(d)).
  The 60 km level is still problematic in Offline L2 data - large percentage deviations are observed at this topmost level.
- 'CH4' – Methane (3(e)).
  The bottom levels show improvements for Offline L2 data, but overall there is little change above the effect of the increased retrieval range.
- 'N2O' – Nitrous Oxide (3(f)).
  Again discrepancies with 75N showing high nighttime mean profile in both L2 data. The influence of the pressure anomaly observed above may be responsible for the problems propagating through to the retrieved species.
- 'NO2' – Nitrogen Dioxide (3(g) & 3(h)).
  Large top level excursion (day and night) observed.

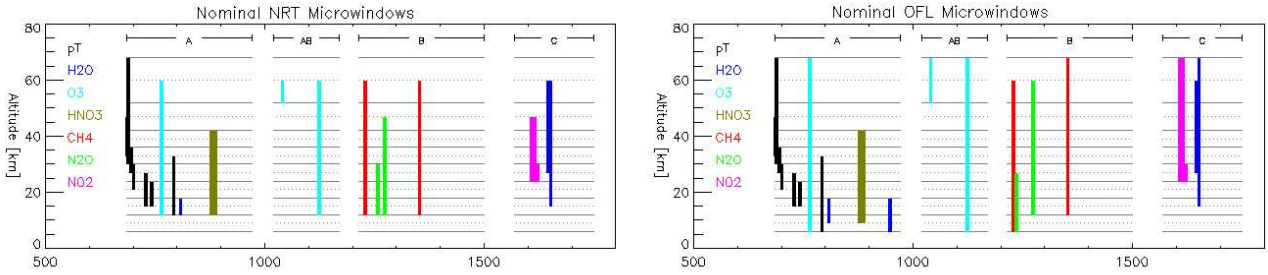


Figure 1. Differences in microwindow ranges for the NRT (left) and Offline retrievals.

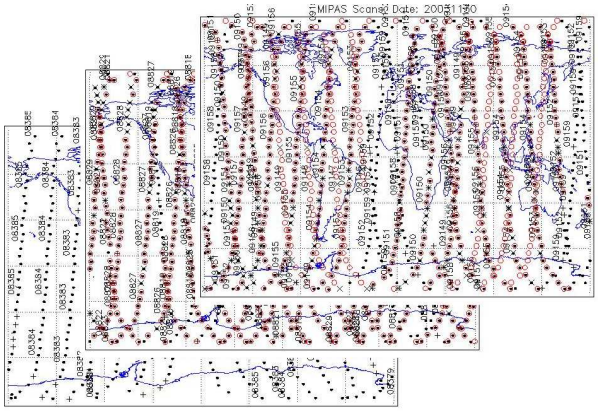


Figure 2. Sucessful NRT retrievals (black dots) and Offline retrievals (red rings) for single days. Many months have no Offline data available (lowermost plot), some have excellent coverage. Crosses mark failed PT retrievals.

- 'HNO3' – Nitric Acid (3(i)).
  An unusual feature at 75N around 20km is observed. However it is not so large or misplaced as to be instantly discounted as nonphysical.

2.1. Coverage

Figure 2 shows the variability observed in the coverage over the month of interest (November 2003). Some orbits have neither NRT nor Offline data, others have only NRT data. However, an increasing number now have both data sets, making comparisons easier.

3. FURTHER INFORMATION

The Oxford group group performs a variety of MIPAS data health-monitoring. A large amount of diagnostic information together with information for other months is available from our website, `http://www.atm.ox.ac.uk/group/mipas/`.

4. CONCLUSIONS

These initial findings show reasonable agreement between the two product types, but considering the relationship between the input data, it is surprising that the disagreement is so large.

The differences observed at the uppermost and lowermost levels should be attributable to differing convergence criteria and the extended altitude range of the Offline retrieval. Interestingly, the NRT data seems more stable but has been under scrutiny since launch, unlike the Offline processor.

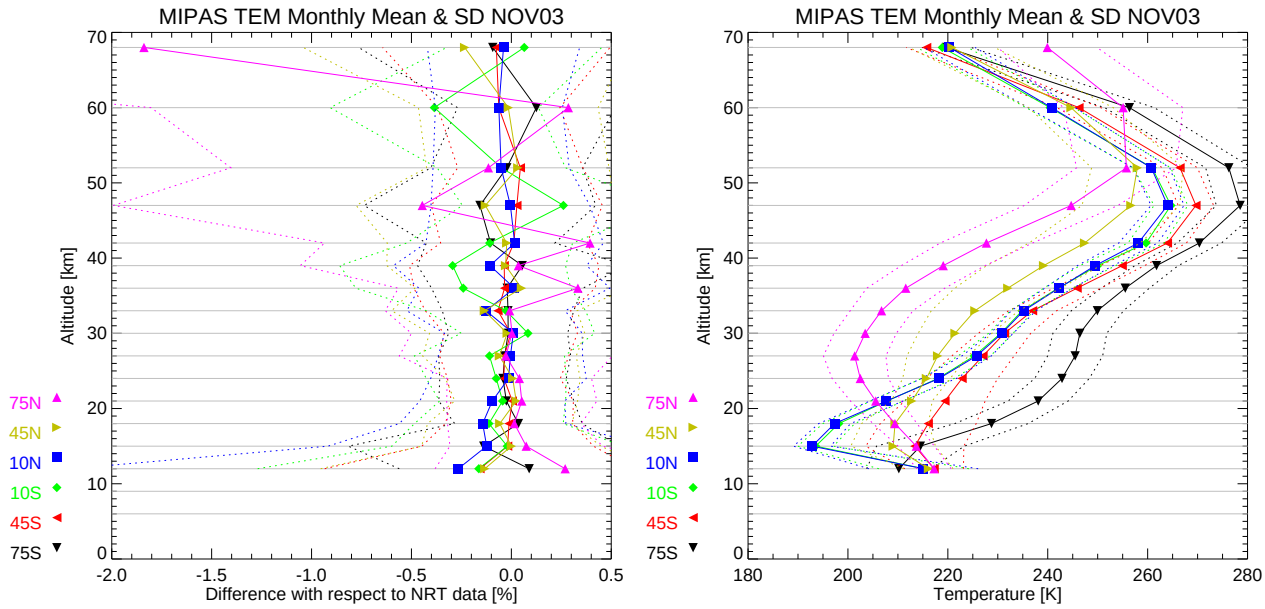
REFERENCES

Dudhia, A., V. Jay, and C. Rodgers, Microwindow selection for high spectral resolution sounders, *Applied Optics*, *41*, 3665–3673, 2002.

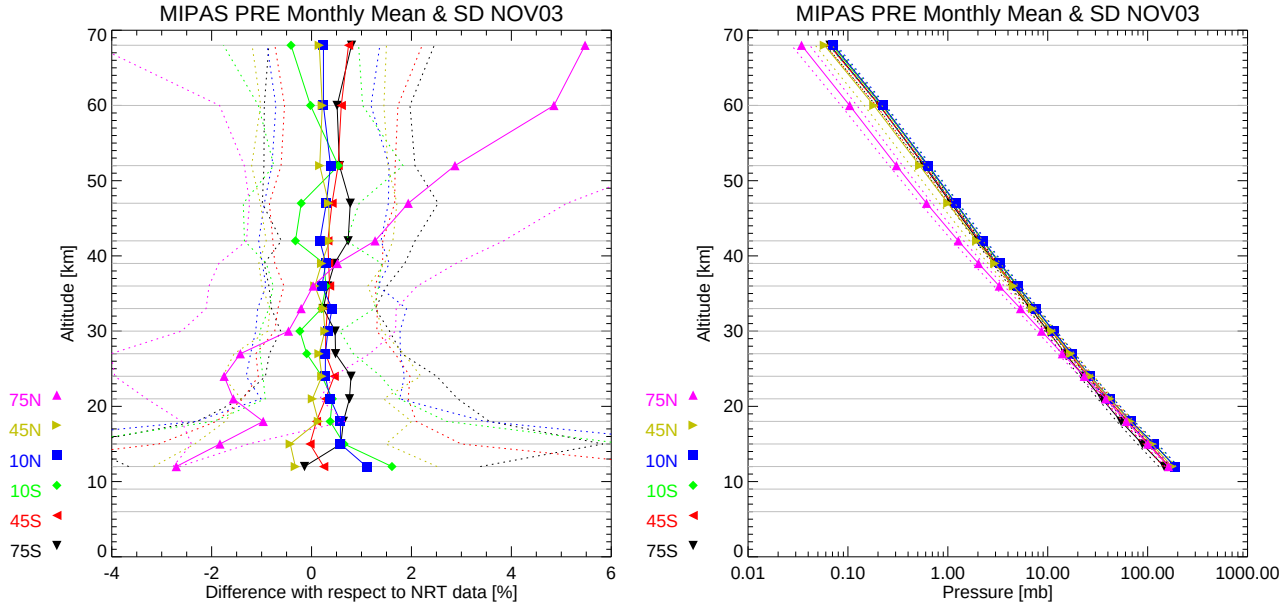
ESA, Envisat-1: Mission and system summary, *Tech. rep.*, European Space Agency, Dornier Satellitensysteme GmbH, Matra Marconi Space, Thompson-CSF, 2000a, ESA/SP-1229.

ESA, Envisat MIPAS - an instrument for atmospheric chemistry and climate research, *Tech. rep.*, European Space Agency, 2000b, ESA Bulletin No. 101, ISSN 0276-4265.

Spang, R., J. Remedios, and M. Barkley, Colour indices for the detection and differentiation of cloud types in infra-red limb emission spectra, *Advances in Space Research*, 2003.

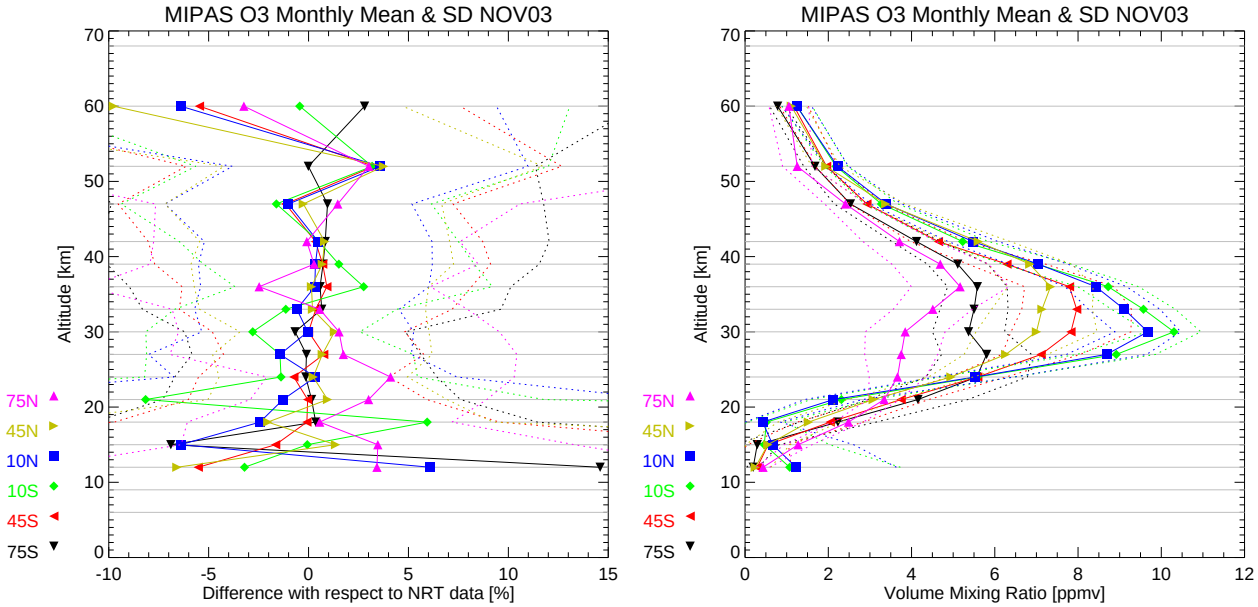


(a) Temperature.

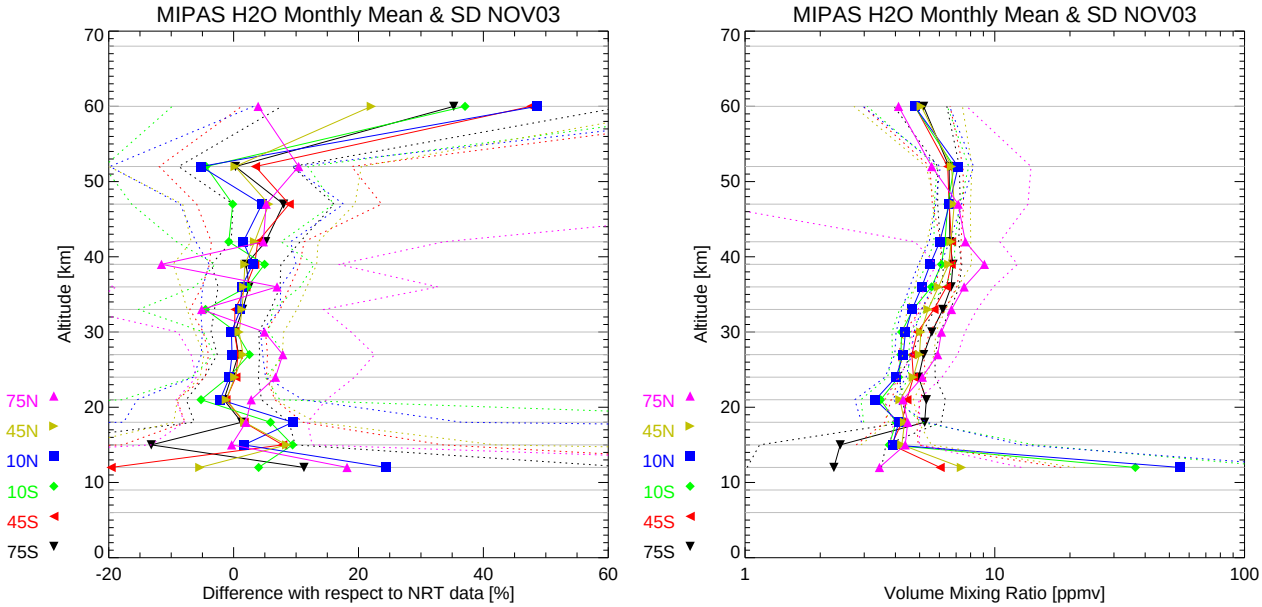


(b) Pressure.

Figure 3. Plots showing mean of the differences between NRT and Offline L2 data products. November 2003 (approx. 30 days 25,000 profiles). Different colours represent the different latitude bands over which the averaging was performed. The difference taken was Offline-NRT. Adjacent to each difference is the mean NRT profile over the same latitude bands, for comparison.

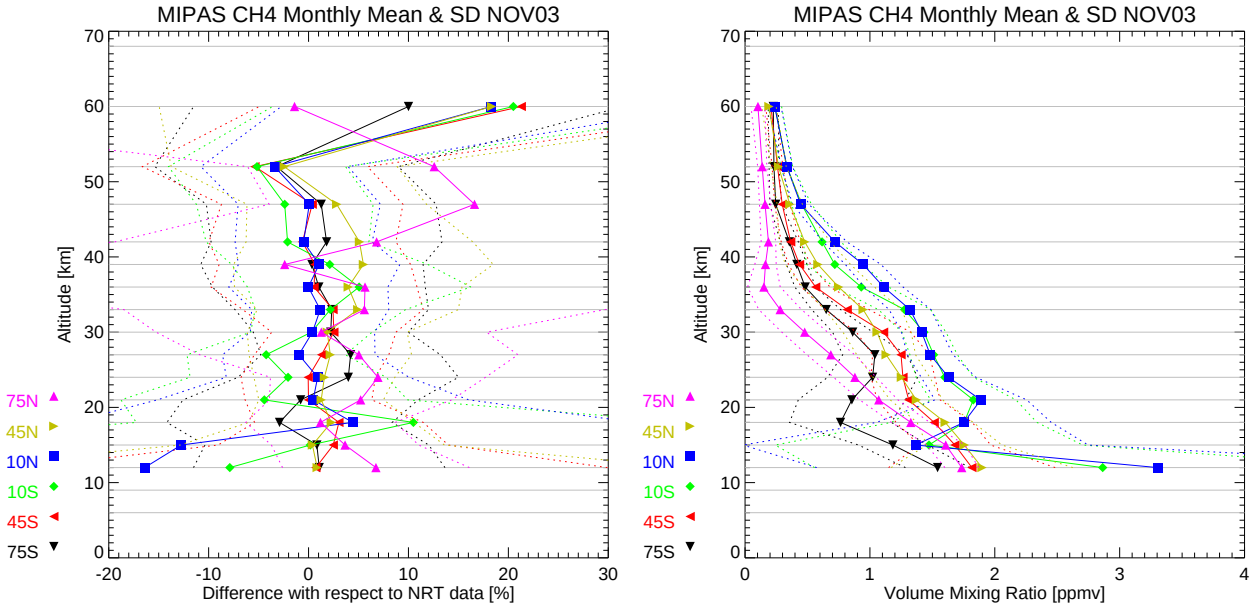


(c) Ozone (O_3).

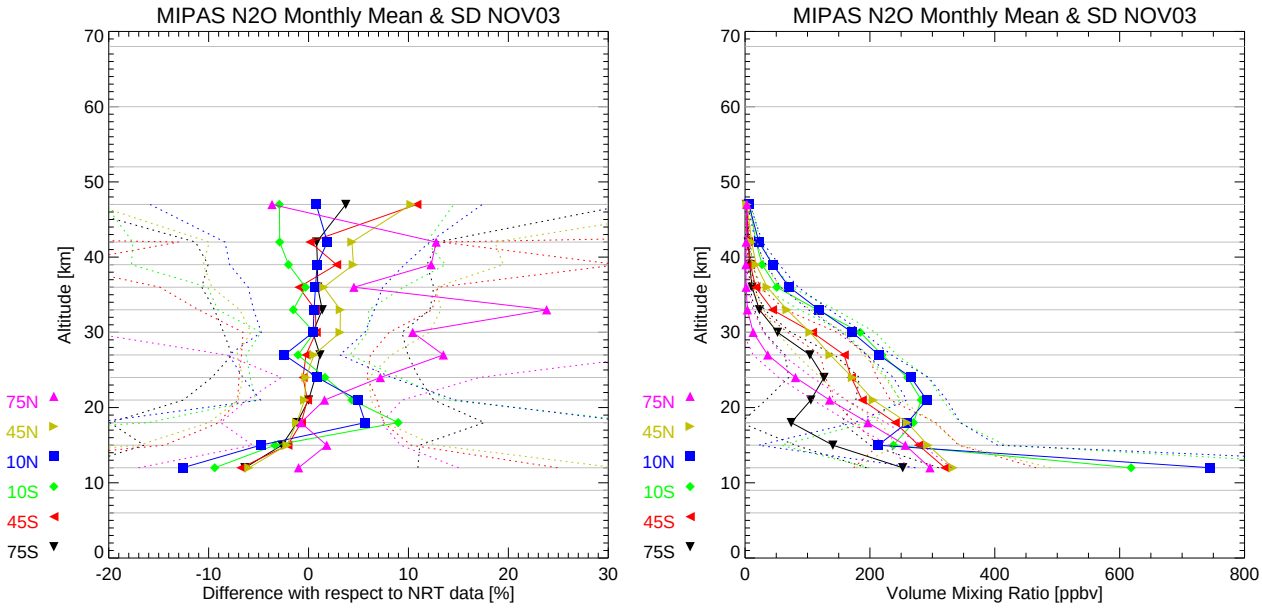


(d) Water Vapor (H_2O).

Figure 3. (Continued).

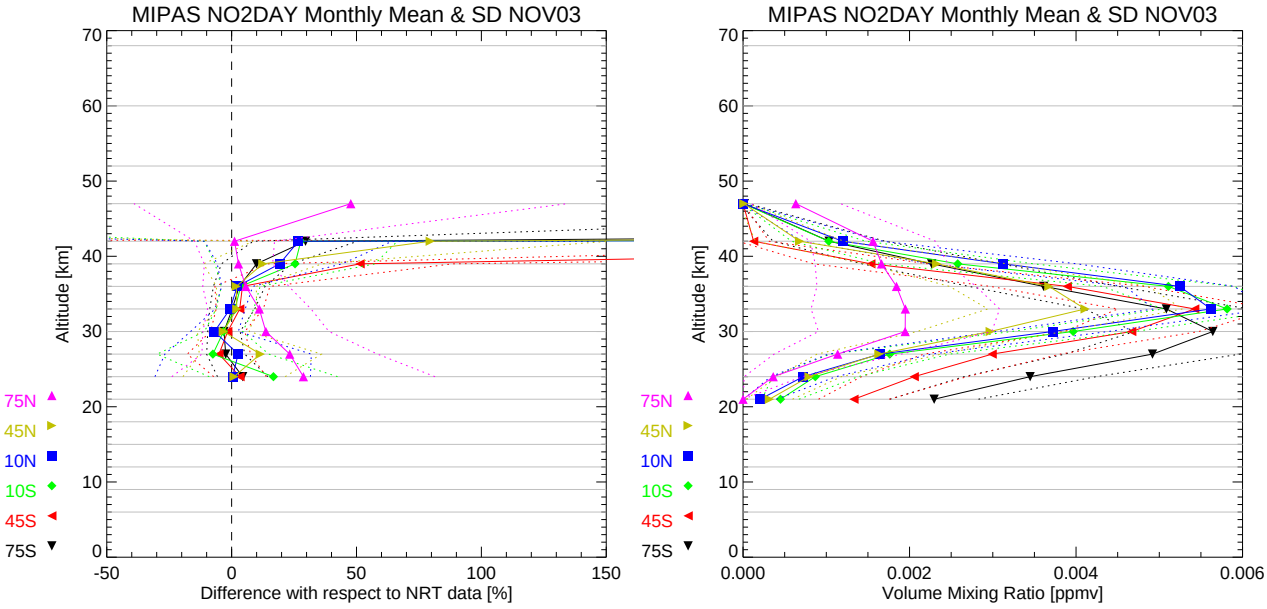


(e) Methane (CH_4).

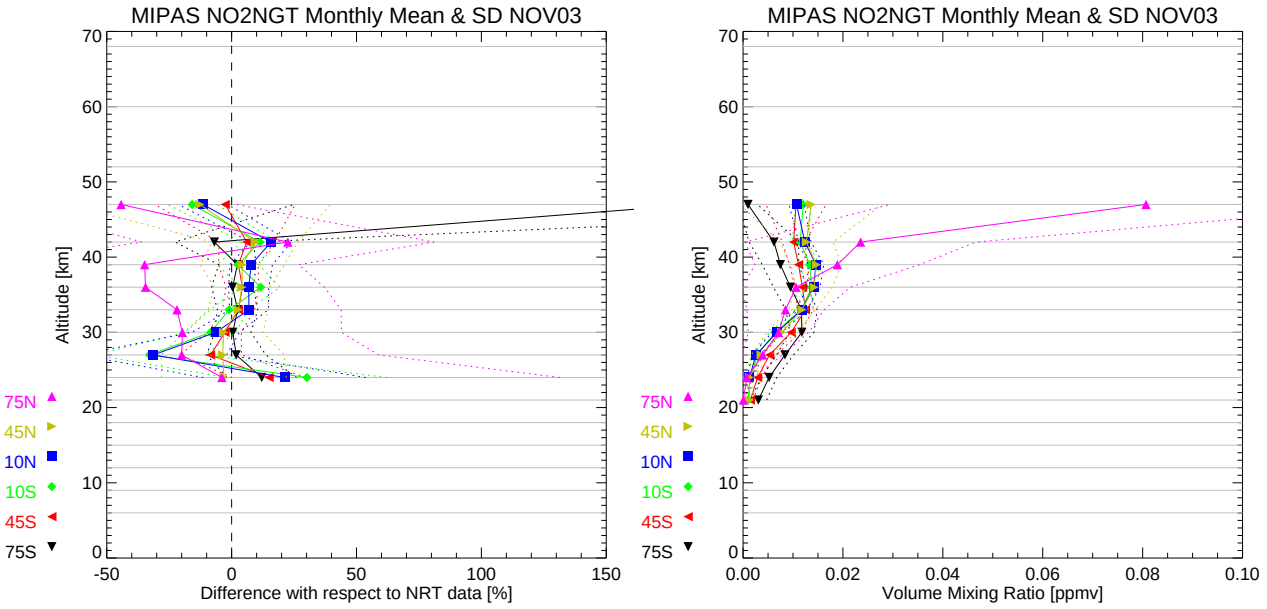


(f) Nitrous Oxide (N_2O).

Figure 3. (Continued).

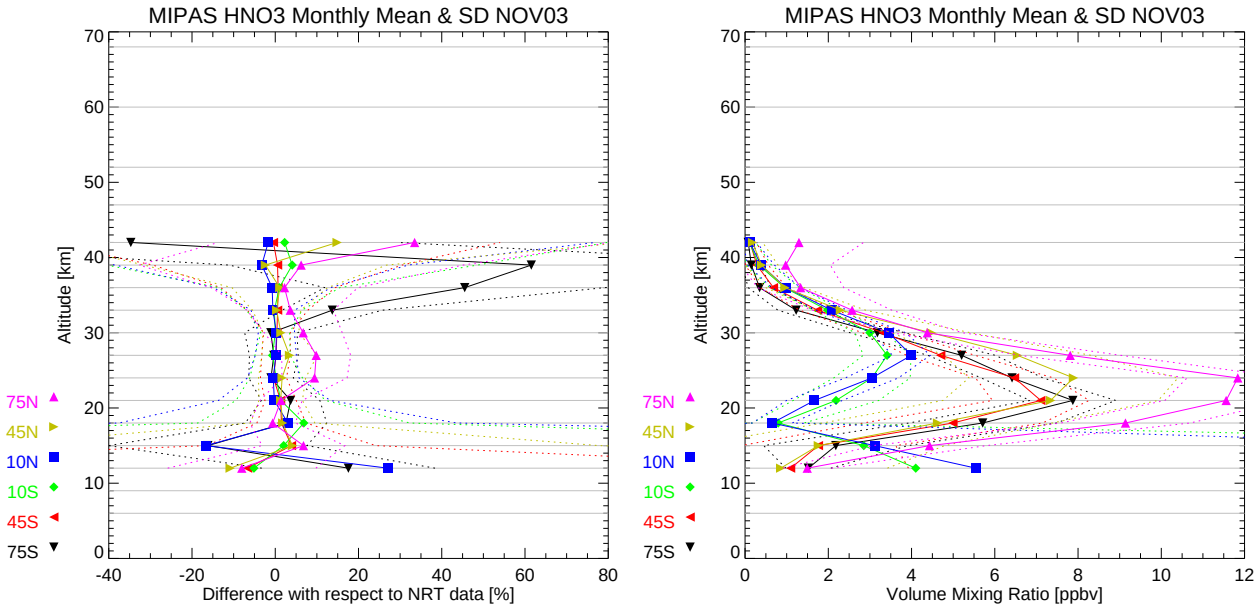


(g) Daytime Nitrogen Dioxide (NO_2).



(h) Nighttime Nitrogen Dioxide (NO_2).

Figure 3. (Continued).



(i) Nitric Acid (HNO_3).

Figure 3. (Continued).