

# Intercomparison of MIPAS-IMK product with balloon measurements from the StraPoIEte 2009 Kiruna campaign

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# Outline

- StraPoIEte reminder
- Climatology
- Intercomparisons

# StraPolEte campaign

Goal of the campaign : to gain a detailed knowledge of the polar stratosphere in summer

- **WP2 Dynamical investigations**

Coordinators: N. Huret and F. Lefèvre

- **WP3 Stratospheric aerosol characterization**

Coordinator: J.-B. Renard

- **WP4 Bromine budget investigations**

Coordinator: G. Berthet

- **WP5 Reference state determination before the settling of the winter polar conditions**

Coordinator: S. Payan

# StraPolEte : Balloon-borne instruments

Instrument	Measurement technique	Measurements used	Retrieval altitudes provided & vertical resolution
SPIRALE (Partner 1)	In situ Direct Infra-red absorption	O <sub>3</sub> , CH <sub>4</sub> , N <sub>2</sub> O, HCl, CO, HNO <sub>3</sub> , NO <sub>2</sub> , OCS	10km-35km 5m
IASI-Balloon (Partner 2)	Remote sensing Infra-red, nadir and limb	CO, CH <sub>4</sub> , CO <sub>2</sub> , OCS	Partial columns
LPMA (Partner 2)	Remote sensing Infra-red solar Occultation	O <sub>3</sub> , HNO <sub>3</sub> , NO, NO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O, HCl	15km-35km 1km
DOAS (Partner 2)	Remote sensing UV Solar occultation	BrO	15km-35km 1km
SALOMON-N2 (Partner 1)	Remote sensing UV-visible solar pointing	O <sub>3</sub> , NO <sub>2</sub> , BrO, aerosol extinction	15km-35km 1 km
STAC (Partner 1)	In situ aerosol counter	Size distribution of aerosols	10km-35km 10m
MicroRADIBAL (Partner 3)	Remote sensing Scattering and polarization by photopolarimetry	Nature (liquid, solid), size distribution of aerosols	15km-35km 1km

# StraPolEete reminder : Satellite instruments

Instrument	Measurement technique	Measurements used	Approximate retrieval altitudes provided & Vertical resolution
GOMOS (ENVISAT satellite)	Stellar occultation UV-visible and near-Infra-red	O <sub>3</sub> , NO <sub>2</sub> , aerosol extinction	18km-40km 2-3km
MIPAS (ENVISAT satellite)	Infra-Red atmospheric emission	O <sub>3</sub> , N <sub>2</sub> O, CH <sub>4</sub> , CO , NO <sub>2</sub> , HNO <sub>3</sub> , N <sub>2</sub> O <sub>5</sub>	18km-40km 3km
IASI (MetOp satellite)	Infra-Red Nadir pointing	O <sub>3</sub> , CO, CH <sub>4</sub> , N <sub>2</sub> O, O <sub>3</sub>	Column and partial column
MLS (EOS Aura satellite)	Microwaves	H <sub>2</sub> O, N <sub>2</sub> O, O <sub>3</sub> , CO, HNO <sub>3</sub> , HCl	18km–40km

# StraPoIEte reminder : Models

MODEL	Type	Scale	Characteristics	Outputs
FLEXPART (ECMWF)	Trajectories calculations	Global & synoptic	ECMWF fields	Air mass origin
REPROBUS (Partner 4)	Tridimensional chemical transport	Global	Comprehensive chemistry	Chemical species maps and vertical profiles
MIMOSA (ETHER data base)	Tridimensional dynamics	Global & synoptic	High resolution PV advection	Potential vorticity maps
MIMOSA_CHIM (Partner 4)	Tridimensional chemical transport	Global & synoptic	Advection on isentropic surfaces + Comprehensive Chemistry	Tracers (N <sub>2</sub> O, CH <sub>4</sub> ) maps and vertical profiles

# Climatology

- Aim : to determine a reference state of the polar stratosphere
- MIPAS-IMK, MLS measurement, Reprobus output were used to compute zonal statistics of several species : CO, O<sub>3</sub>, N<sub>2</sub>O, H<sub>2</sub>O, HNO<sub>3</sub> and temperature
- Measurements were gathered in (pressure x latitude) boxes, 2° wide, centered on MLS pressure levels
- Statistics were made over summer of 2007, 2008 and 2009 (1 month, three months of one year, all summer of three years)
- Statistics : mean, stdev, min/max, median, number of points, basic test of « gaussianity »

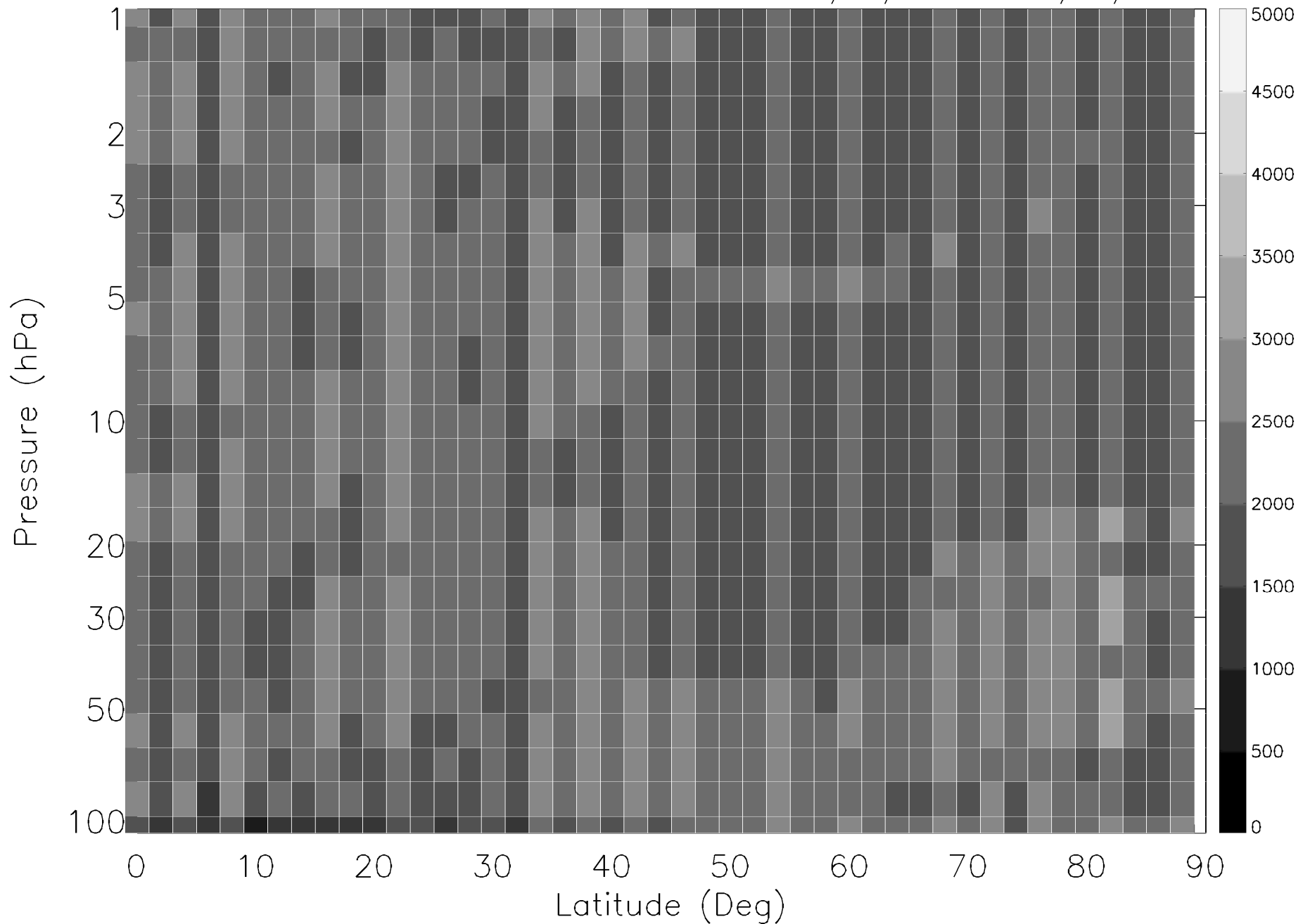






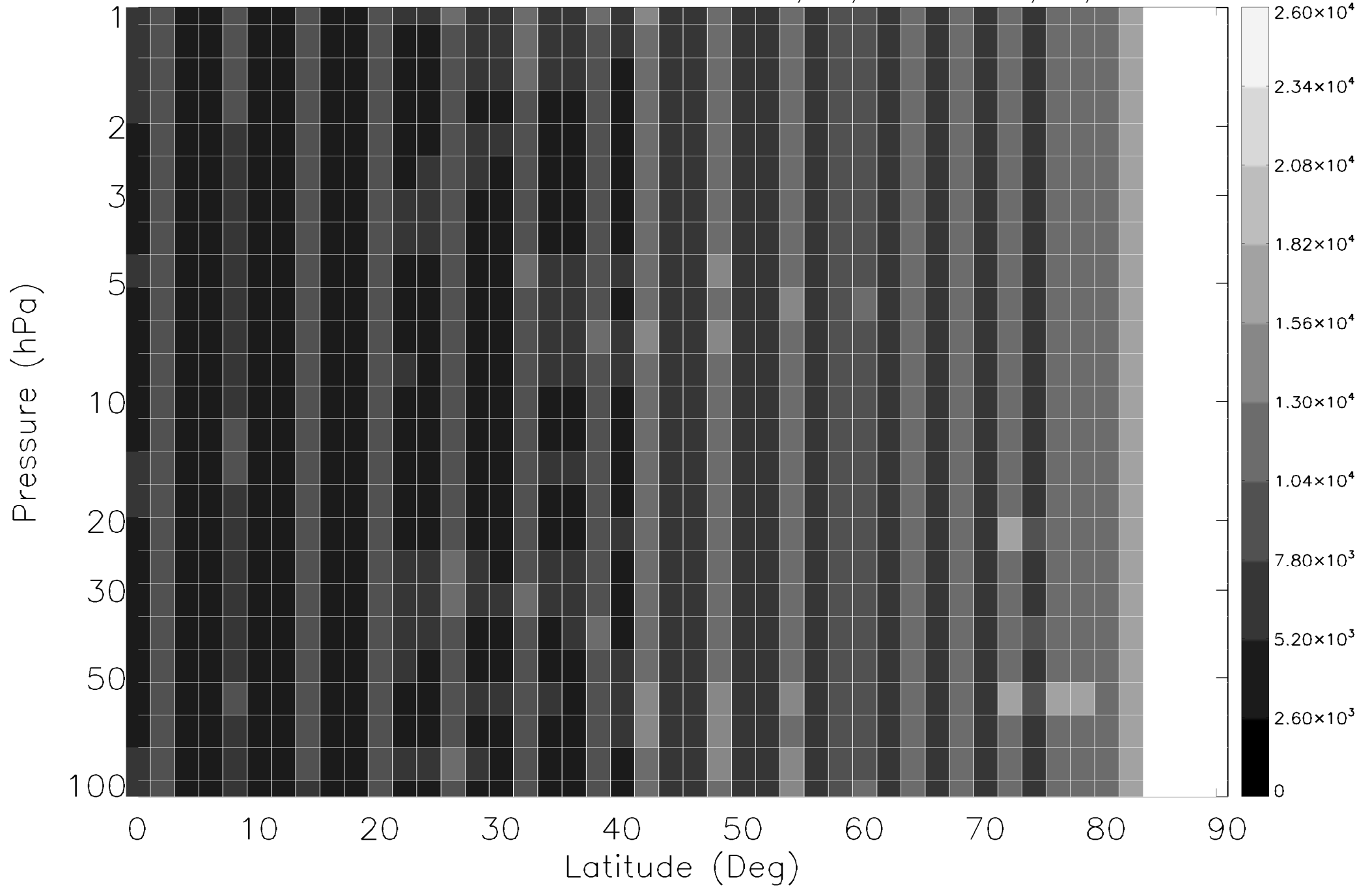
# Climatology : O<sub>3</sub>

MIPAS-IMK I data number of O<sub>3</sub> : Global from 16/06/2007 to 15/09/2009



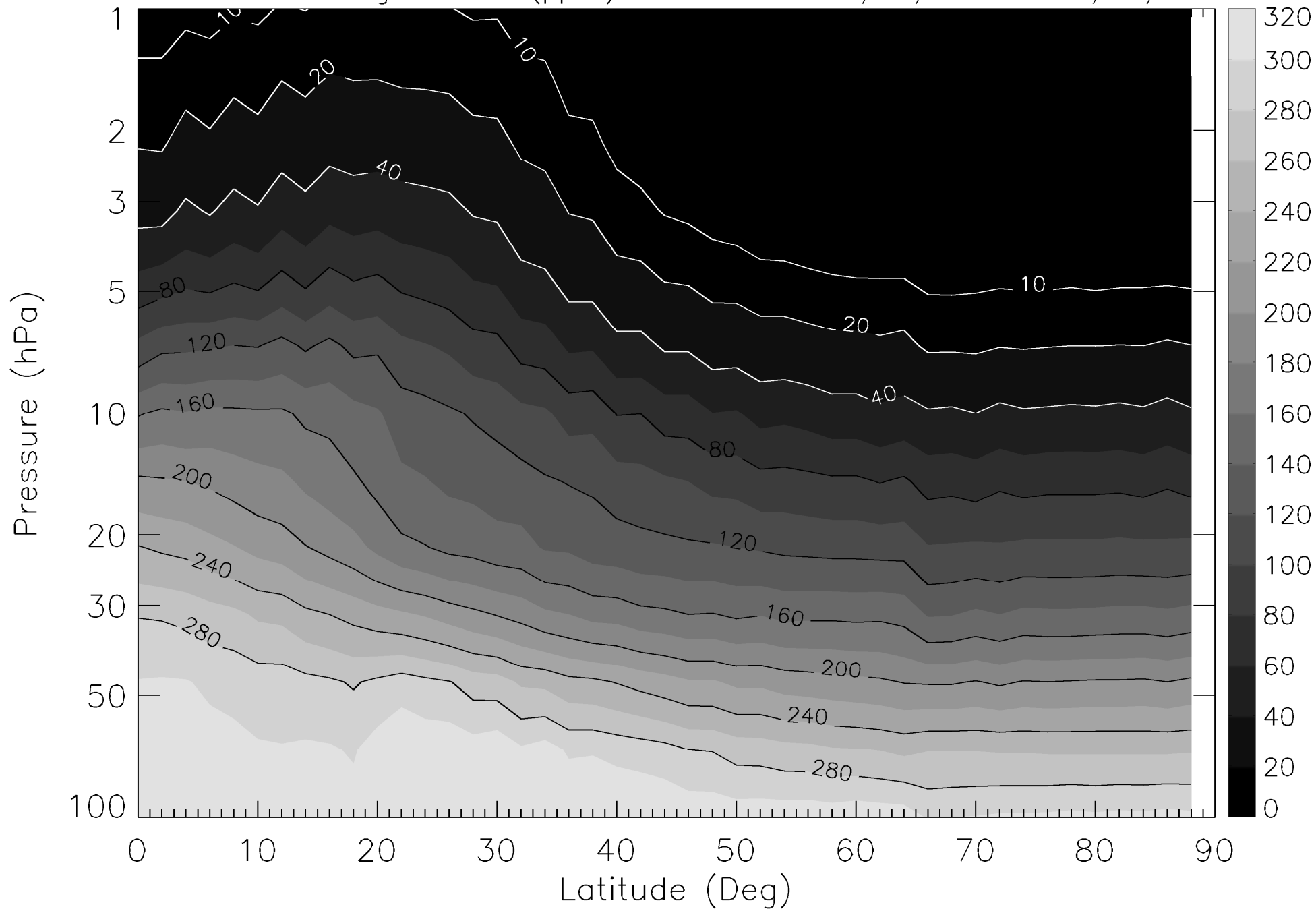
# Climatology : O<sub>3</sub>

MLS | data number of O<sub>3</sub> : Global from 16/06/2007 to 15/09/2009



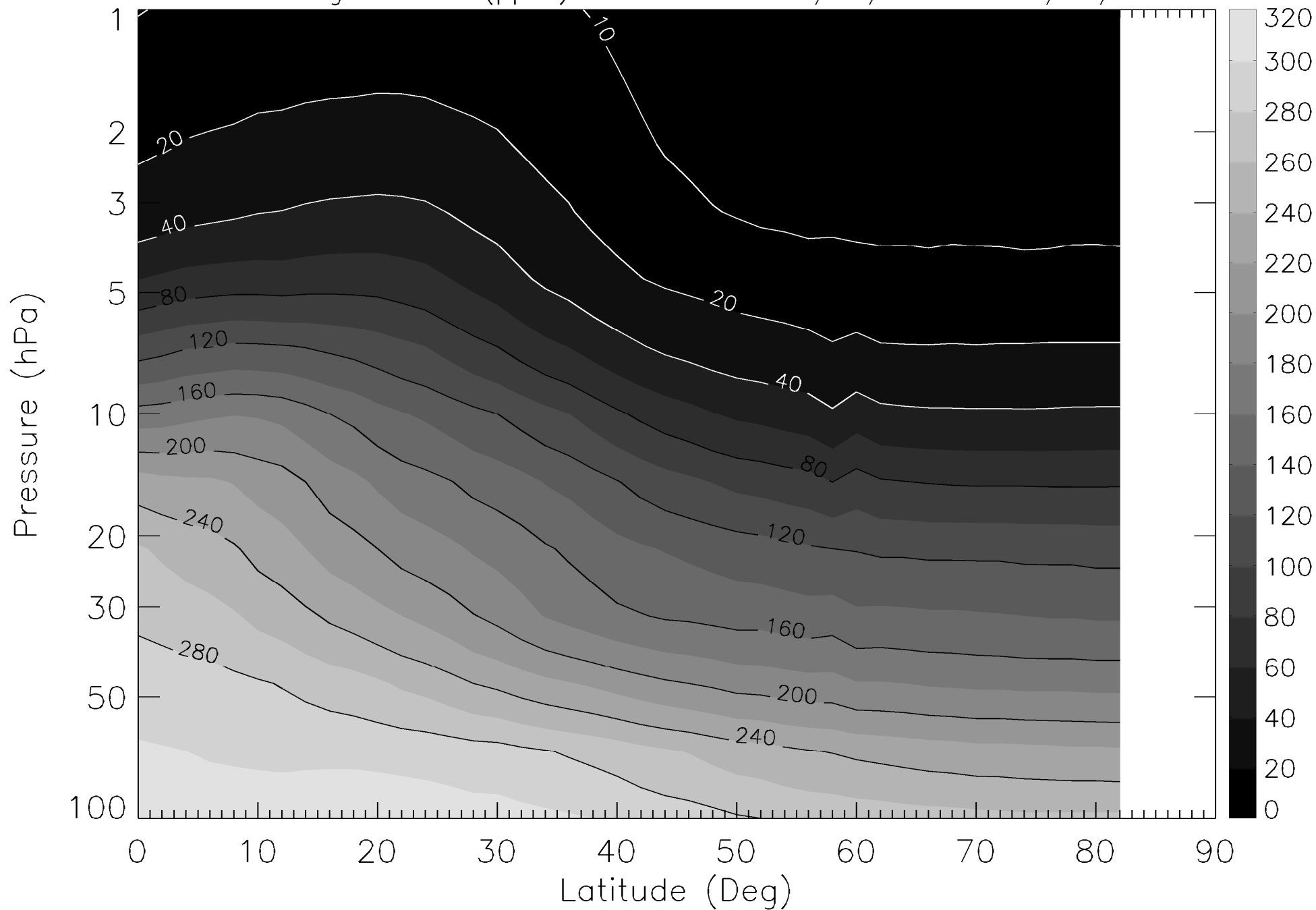
# Climatology:N<sub>2</sub>O

MIPAS-IMK | Average of N<sub>2</sub>O (ppbv) : Global from 16/06/2007 to 15/09/2009



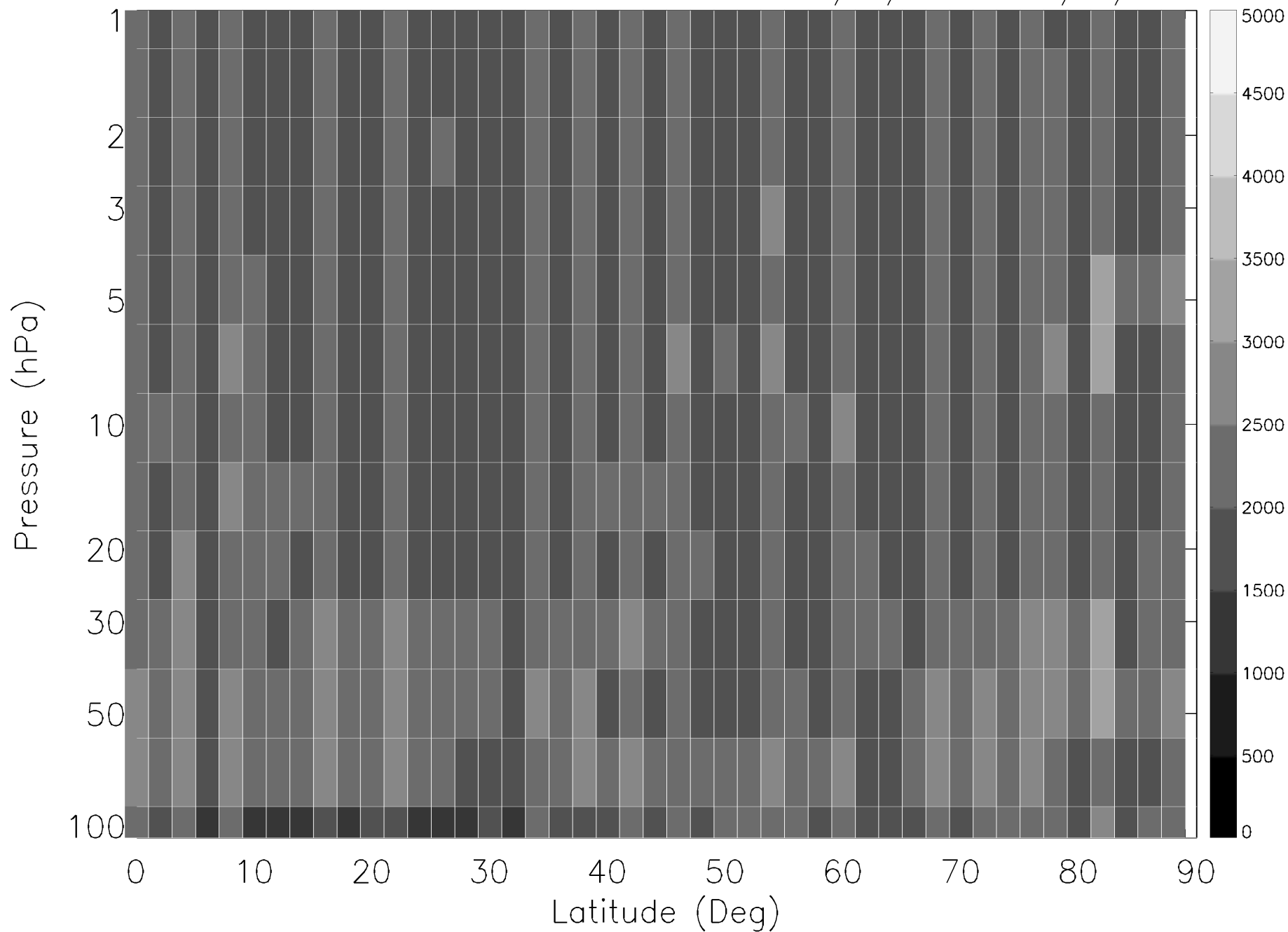
# Climatology:N<sub>2</sub>O

MLS | Average of N2O (ppbv) : Global from 16/06/2007 to 15/09/2009



# Climatology:N<sub>2</sub>O

MIPAS-IMK I data number of N<sub>2</sub>O : Global from 16/06/2007 to 15/09/2009





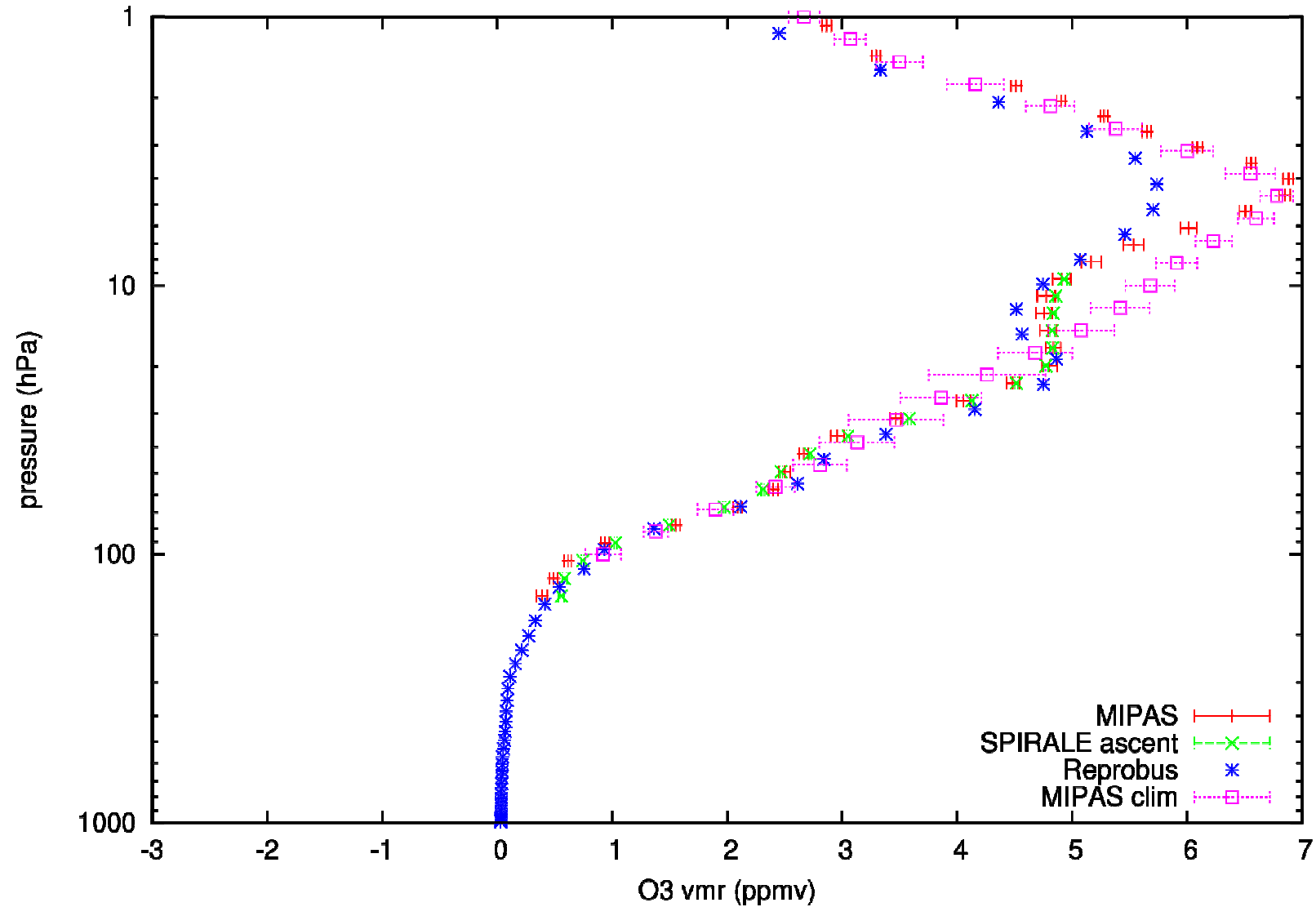
# Intercomparisons

- Measurements made during the campaign by balloon borne instruments, (*in situ* or remote) were compared to satellites measurements, model outputs



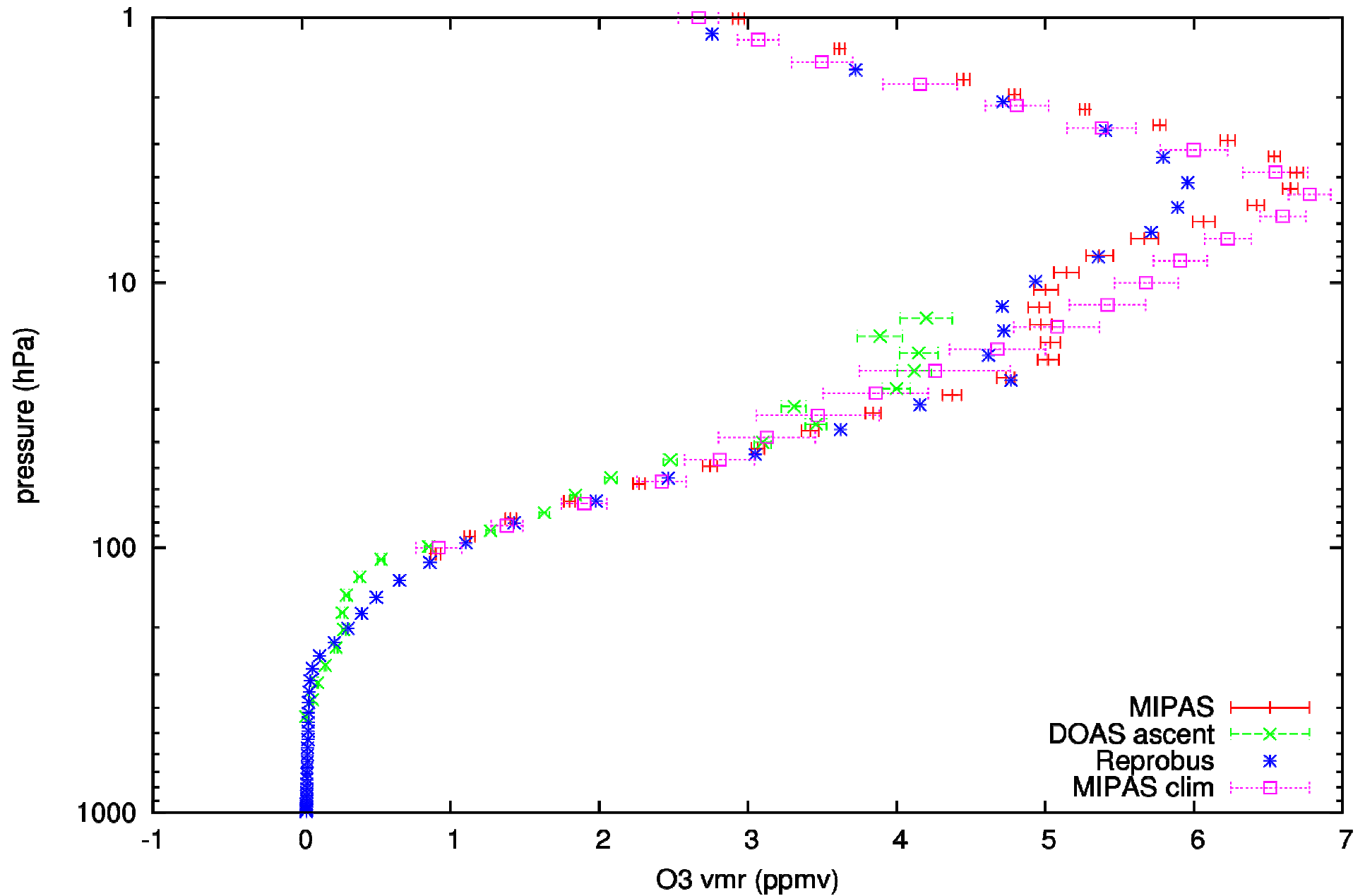
# Intercomparisons : O<sub>3</sub>

O3 MIPAS-IMK (20090824 - delta t=1h - dist = 200 km)

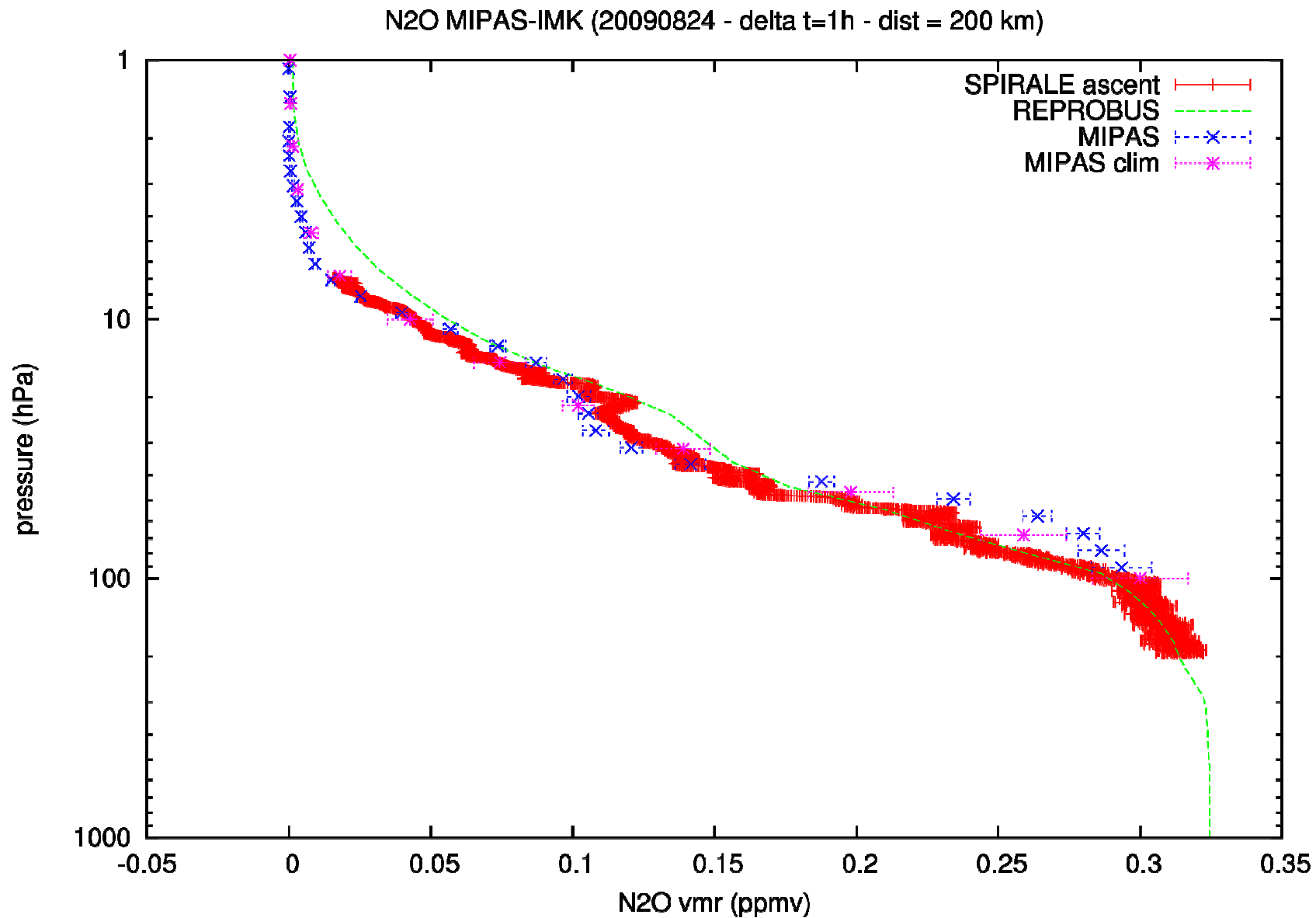


# Intercomparisons : O<sub>3</sub>

O3 MIPAS-IMK (20090907 - delta t= $\sim$ 4h - dist = 400 km)

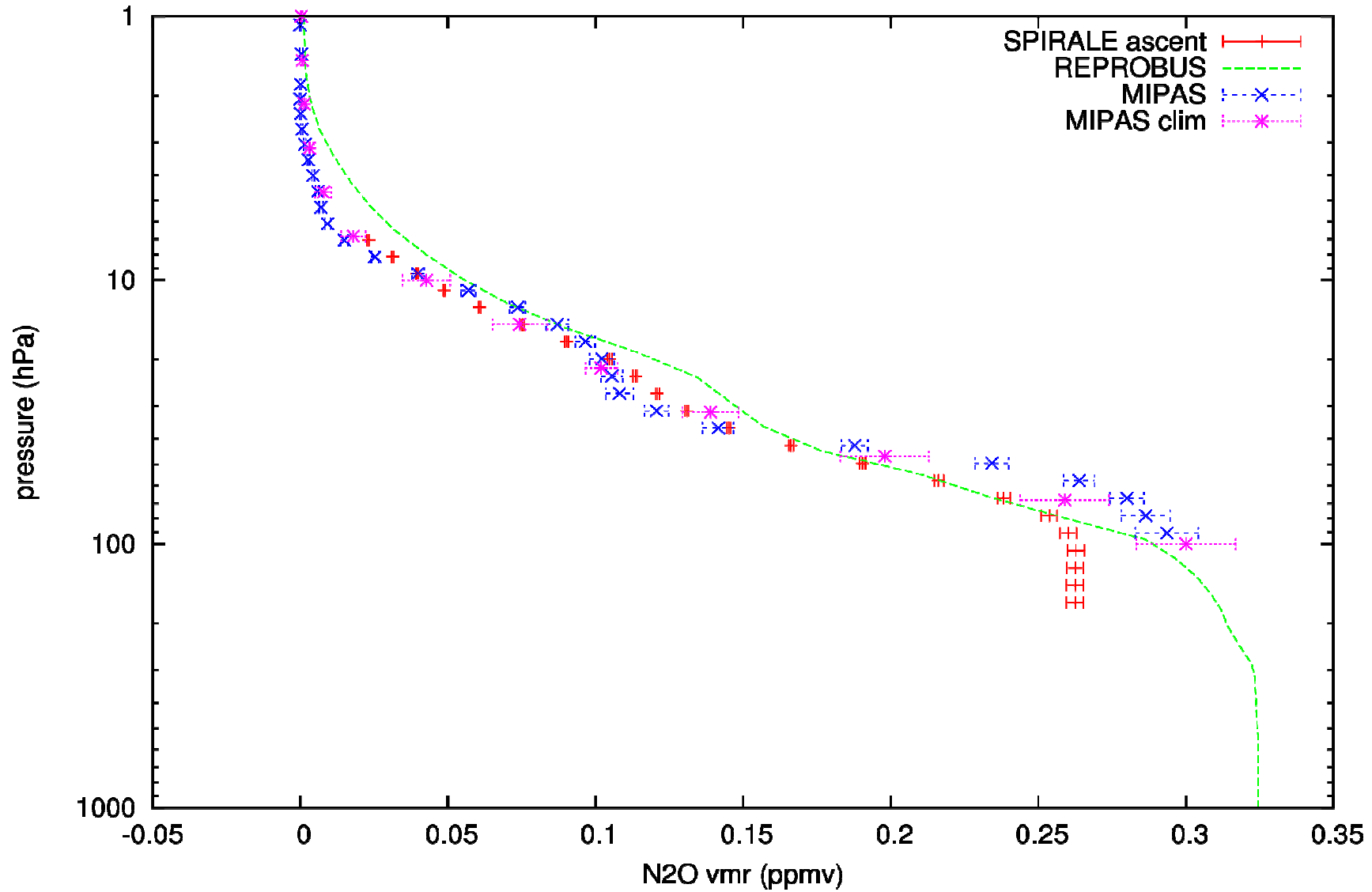


# Intercomparisons : N<sub>2</sub>O

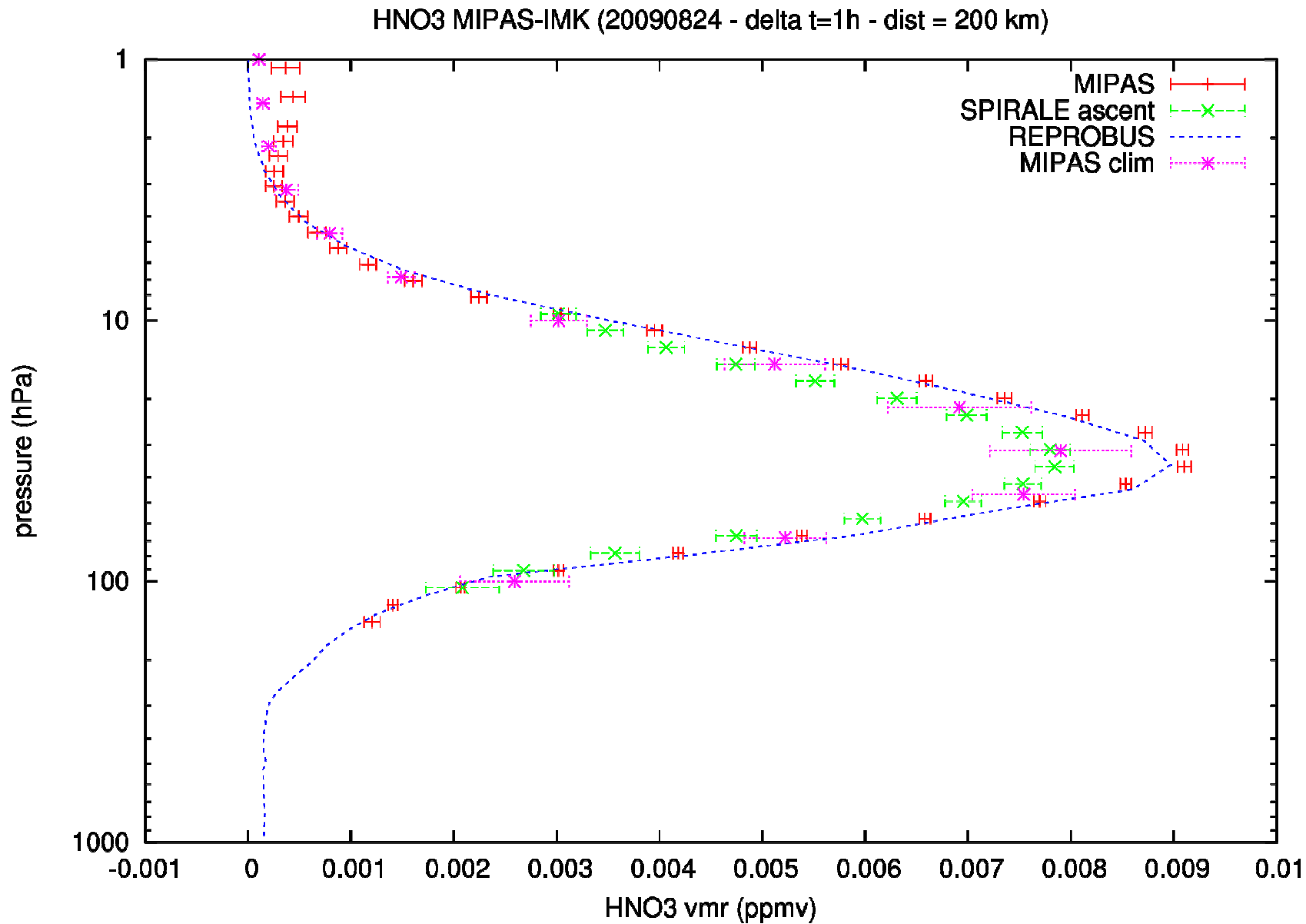


# Intercomparisons : N<sub>2</sub>O

N2O MIPAS-IMK (20090824 - delta t=1h - dist = 200 km)

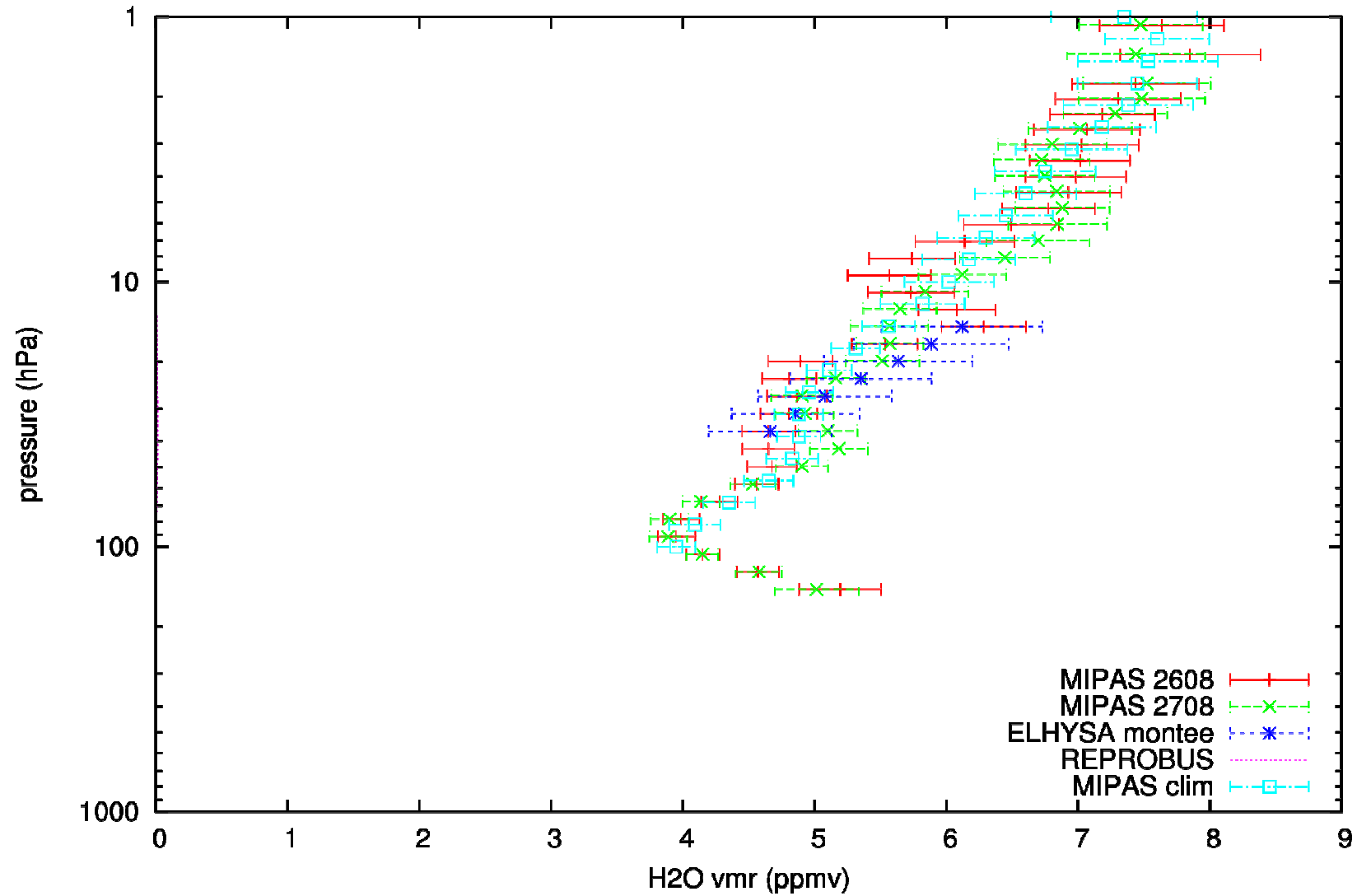


# Intercomparisons : HNO<sub>3</sub>



# Intercomparisons : H<sub>2</sub>O

MIPAS - ELHYSA 2608 22h (400 km and 140km-1 day)



# To do

- To go on with the intercomparison of profiles measured during the StraPoEte campaign with satellites measurements, soundings, ...
- To determine if august 2009 was a representative month
- Climatology : to compare the means over different period of time to get more information about time variability
- To look more carefully at the non-gaussian distributions, which can be caused by several modes.

# Thanks

- IMK for providing MIPAS profiles

M. Kiefer for help with averaging kernels

- F. Jegou for running the Reprobust model

- R. Thiéblemont for helping to generate graphs illustrating the climatology

- C. Camy-Peyret, S. Payan