MIPAS vM21 temperatures: Comparison of version vM21 with ACE-FTS, MLS, OSIRIS, SABER, SOFIE and lidar measurements

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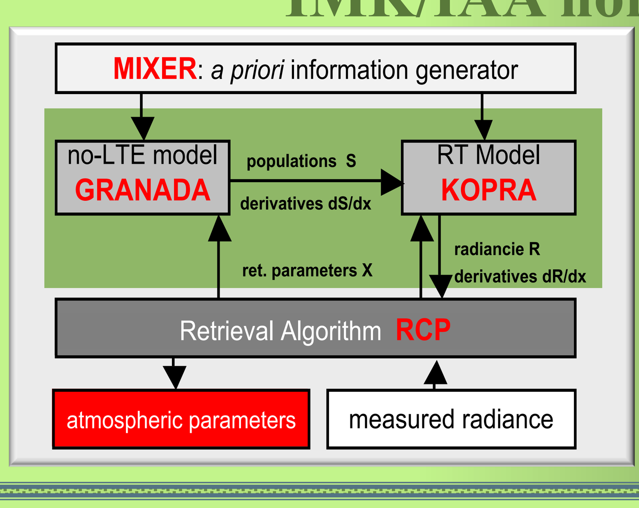
Introduction

We present the recently released version vM21 of MIPAS temperatures and line of sight information from the lower stratosphere to the lower thermosphere, which cover measurements performed by MIPAS in its **MA, UA and NLC modes** from **January 2005 to March 2012**. We will present the main upgrades with respect to the previous version (vM11) and their effect on retrieved temperature fields. The MIPAS vM21 temperatures correct the main systematic biases of previous versions, leading to a remarkable improvement of their comparisons with ACE-FTS, MLS, OSIRIS, SABER, SOFIE and the two Rayleigh lidars at Mauna Loa and Table Mountain. We show comparisons for the whole data set with these instruments as a function of season and latitude.

IMK/IAA non-LTE retrievals

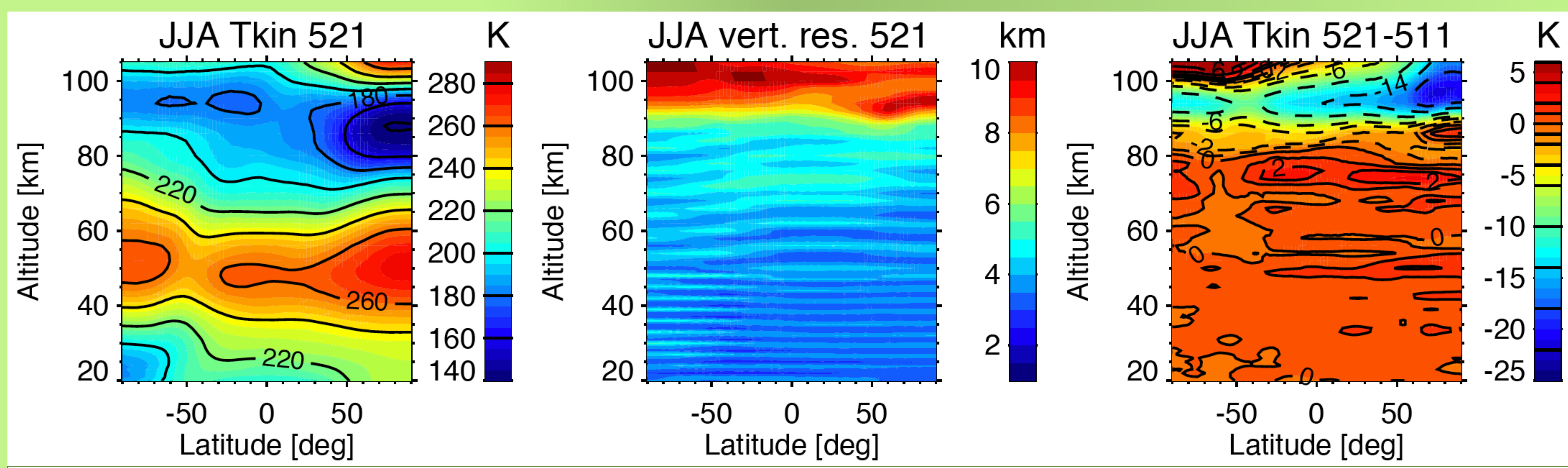


- Developed by IAA/IMK; mainly applied to MIPAS measurements
- Allows for consideration of non-LTE emissions
- Used for temperature, LOS, abundances, non-LTE parameters
- May be easily adapted for retrieval of data from other instruments

Comparison of vM21 temperatures with the previous version vM11

The main upgrades with respect to the previous version of MIPAS temperatures (vM11) are:

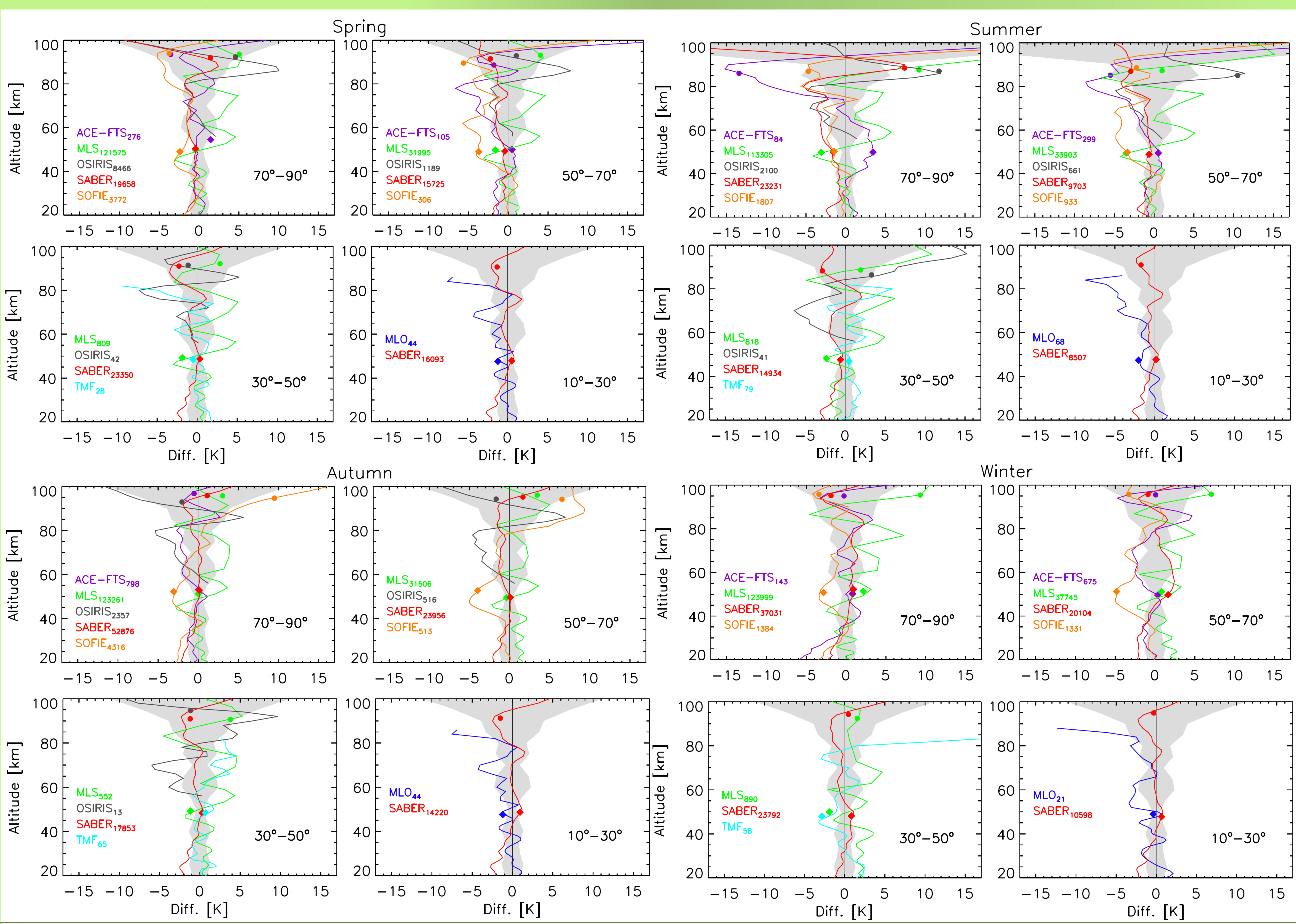
- update of the spectroscopic database
- use of a different climatology of atomic oxygen and carbon dioxide
- Improvement temperature gradient LOS & offset regularizations and apodization accuracy
- updated version of ESA calibrated L1b spectra (5.02/5.06) is used.



Latitude-altitude cross sections of v521 zonal means of MIPAS MA kinetic temperature (left), its vertical resolution (center) and its difference with version v511 for austral winter (June-July-August; JJA). Only measurements from 2005 to 2009 are included allowing for comparison with results in Garcia-Comas2012 et al. (2012).

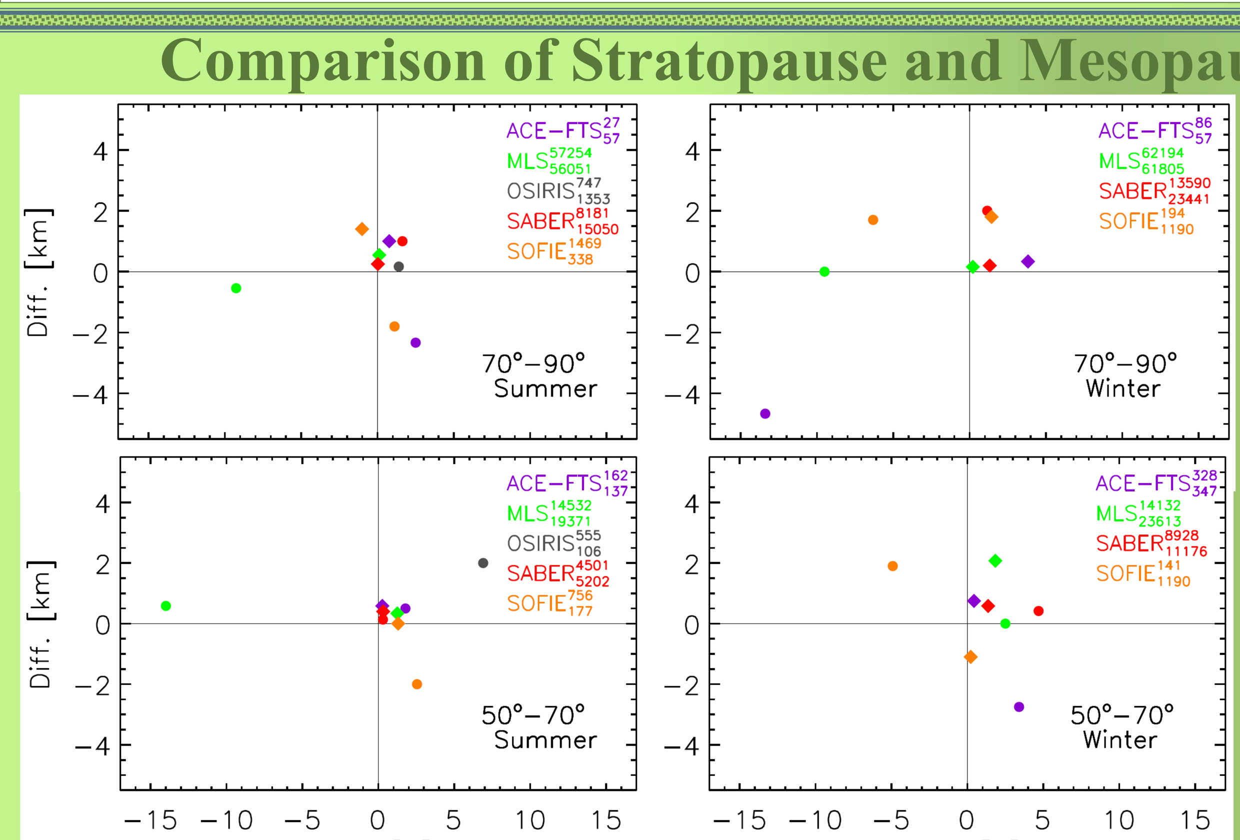
Temperature comparisons of MIPAS co-located measurements with other instruments

Coincidence criterium: 2 h and 1000 km. It minimizes differences coming from atmospheric variability without compromising the statistical significance. Decreasing the distance and the time difference barely changes the results. For a given pair, we use the averaging kernels and a priori of the coarser vertical resolution instrument to smooth the colocated profile of the finer-resolution one.



Spring (MAM for NH and SON for SH), autumn (SON for NH and MAM for SH), summer (JJA for NH and DJF for SH) and winter (DJF for NH and JJA for SH) mean temperature differences (MIPAS-instrument) between co-located pairs of measurements of MIPAS (MA mode) and ACE-FTS (purple), MLS (green), OSIRIS (grey), SABER (red), SOFIE (orange), and the Table Mountain (light blue) and Mauna Loa (dark blue) lidars. The number of coincidences is indicated in the corresponding subscript. Difference in the stratopause (diamond) and mesopause (circle) temperatures at the corresponding MIPAS average altitude is also plotted. Shaded areas include MIPAS-only systematic errors.

Comparison of Stratopause and Mesopause interhemispheric anomalies



Difference (in absolute value) between stratopause (diamonds) and mesopause (circles) interhemispheric temperature (x-axis) and altitude (y-axis) anomalies (NH-SH) measured by MIPAS and the satellite instruments indicated for summer (left) and winter (right) at 70°-90° (top) and 50°-70° (bottom) latitudes. A positive sign of the difference indicates that the NH-SH difference has the same sign in both instruments (and viceversa). The number of MIPAS coincidences with each instrument in the Northern and Southern hemispheres are shown in the superscripts and subscripts, respectively.

Summary of comparisons

The new vM21 temperatures correct the main systematic errors of the previous version (vM11) providing on average a 1-2K warmer stratopause and middle mesopause, and a 6-10K colder mesopause (except in polar summers) and lower thermosphere.

These lead to a remarkable improvement of MIPAS comparisons with other instruments, that typically exhibit differences:

- <1K below 50 km
- <2K at 50-80 km and <5K above 80 km, in **spring, autumn, winter at all latitudes, and summer at low to mid-latitudes**
- <2K at 50-65, 5K at 65-80 km, within 5-10K at mesopause (warmer than SABER, MLS & OSIRIS and colder than ACE-FTS & SOFIE) and exhibiting larger vertical gradients in the **high latitude summers**

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