

MIPAS Exploitation Plan

John Remedios, Angelika Dehn
with inputs from the team

From 2012 to infinity!

Science areas

1. Chemistry at the ozone minimum and recovery of the ozone layer. **ClO, BrONO₂, CH₃Cl, phosgene**
2. Lifetimes of ozone depleting (and greenhouse gas) substances: **CFC-11**
3. General circulation and dynamical/physical changes in time, **SF₆, C₂H₂, C₂H₆**
4. Energetic particle impacts on the mesosphere and stratosphere.
5. Profiles of radiative gases (including non-LTE): **UTLS O₃, H₂O**
6. Chemistry and dynamics in the tropopause and extended UTLS
7. Upper tropospheric chemistry and clouds: **Organics etc.**
8. Aerosols and their evolution in the stratosphere: **aerosol profiles and type**
9. Climatology and trends of the atmosphere in the 2000s
10. Expected performance of MIPAS products
11. Spectroscopy requirements for MIPAS data (**Jean-Marie's presentation**)
12. Future missions

Organisation of Expert meeting



Attendees (key players only):

Europe: MIPAS, GOMOS, SCIAMACHY, ODIN

Canada: ACE, ODIN

USA: MLS, TES, HIRDLS, OMPS, (SAGE?)

JAPAN: JEM/SMILES instrument (JAXA)

Invited speakers

B. Carli, M. Schoeberl (NASA/UARS retired), N. Livesey (JPL/MLS), J. Worden (JPL/TES)

Objective current existing missions and data sets – how to improve these further in a new implementation scheme (e.g. Recalibration, new species, spectroscopy)

- Format**
- Key note presentations (invited speakers) + discussions
 - Breakout / splinter sessions
 - Breakout reporting + way forward recommendations (*for position paper*)
- Output**
- Recommendations for a way forward for limb ESA / other space agencies
 - Characterisation and understanding of differences
 - Prioritisation of issues/species
 - ESA: open to all instruments (not only ENVISAT)

Timeline

<u>Web announcement:</u>	by 10 November 2015
<u>Confirmation:</u>	ca. 15 December 2015
<u>Agenda:</u>	ca. 31 January 2016 (Feb 10 th , 2016)
<u>Meeting:</u>	7-8 March 2016
<u>Position paper:</u>	ca April/May 2016

Still on the web!

<https://earth.esa.int/web/sppa/meetings-workshops/expert-meetings/limb>

1. This Expert Meeting on limb sounding and occultation measurements is organised by the European Space Agency through its ENVISAT/MIPAS Quality Working Group. The consultation meeting is intended to provide a scientific forum to discuss the evolution of data from the golden decade (2000's) for atmospheric composition profile measurements from missions such as ENVISAT, ODIN, ACE, EOS-Aura and SNPP/OMPS.
2. Much science has already been undertaken and published but a focus is needed on future research and processing activities using improved satellite data sets which are suited to meet the challenges of atmospheric research in the next decade. For ESA, this is particularly relevant, as it is the process of defining the implementation of the new ESA EO framework on data improvement and R&D, which will start in 2017.
3. CNR Congress Centre, Bologna

Meeting Objectives



Objectives

- To review scientific priorities for improvements to data sets from existing limb sounding and occultation missions, including from ENVISAT, ODIN, ACE, EOS-Aura, SNPP/OMPS, etc.;
- To understand better the quality of data, including intercomparisons with other data sets and models;
- To develop priorities for improvements to existing limb retrievals and to define new reprocessing requirements, including the identification of the remaining challenges for instrument (inter-)calibrations and (inter-)characterisations;
- To strengthen the spectroscopic aspects to the missions;
- To recommend R&D activities with a strong emphasis on instrument synergies and the generation of merged data sets

Organisation committee:

John Remedios (NERC), Bojan Bojkov (ESA), Angelika Dehn (ESA), Piera Raspollini (IFAC-CNR), Bianca Dinelli (ISAC-CNR)



European Space Agency



Recommendations 1



Level 1 products and Spectroscopy

LSEM01-01	Keep Level 0 and Level 1 data, together with the processors (including software source code). Curation should include on-ground calibration documentation.
LSEM01-02	Pay particular attention to radiance calibration (all instrument families), and straylight/polarisation (visible).
LSEM01-03	Review of existing spectroscopic studies before starting a new project.
LSEM01-04	Keep precise track of changes in spectroscopic database; extensive documentation is essential.
LSEM01-05	Use laboratory spectra (absolute intensities) and/or atmospheric spectra (consistency between different spectral regions).
LSEM01-06	Simulate the whole MIPAS spectrum to check spectroscopic errors and/or missing species. Create a unified test data set of MIPAS and ACE spectra.

Recommendations 2



Level 2 products	
LSEM01-07	Improve water vapour and ozone in key regions (i.e. UTLS and above 40 km) with good stability (2-5%/decade), with focus on adding value from MLS (lower uncertainties).
LSEM01-08	Make the most of info on tracers in the MIPAS record compared to ACE and SMR. Ensure the connexion to ACE .
LSEM01-09	Focus on key species in the upper troposphere and UTLS: organics and NO _y , aerosols and precursors (chlorine and bromine source gases).
LSEM01-10	A new activity on CO ₂ retrieval (in both stratosphere and troposphere) would be excellent.
LSEM01-11	For mesosphere studies, ensure that all instruments (but particularly MIPAS bands C and D) are well calibrated.
LSEM01-12	Examine carefully new products in mesosphere that could make a difference, e.g. metals, OH airglow estimates.
LSEM01-13	Encourage a synthesis on NLCs between GOMOS, SCIAMACHY, MIPAS, ACE and OSIRIS.

Recommendations 3



Intrinsic products	
LSEM01-14	Temperatures are very good, better than re-analyses but we need to understand the real agreement. Strong efforts are needed to validate and intercompare data; identify reanalysis efforts.
LSEM01-15	Water vapour validation, particularly in UTLS, requires significant effort but it is fundamental.
LSEM01-16	Focus on aerosol total extinctions, and separation between aerosols and clouds.
LSEM01-17	Aerosol parameters, particle size distribution.
LSEM01-18	Clouds e.g. NLCs.
LSEM01-19	Little combined work across sensors, about aerosol and clouds.

Recommendations 4



Users	
LSEM01-20	Look at traceable uncertainties (possible SPARC activity).
LSEM01-21	Provide simple, user-friendly estimates of stability (%/dec), accuracy and precision.
LSEM01-22	Make data easily accessible, e.g. web portal.
LSEM01-23	Provide consistent messaging in obvious places as to which data product to use.
Future	
LSEM01-24	ESA to encourage studies of new instruments and group to strongly promote next step instruments (low-cost?). Should be in context of international activities e.g. SPARC, NASA.
LSEM01-25	Maintain QWGs as much as possible in the framework of the new ESA activity.

Outlook

- New ESA V8 products
- New spectroscopic data
- Good MIPAS publications
- New “missions”

Good science basis for new chlorine, biomass burning products, transport studies
MIPAS spectroscopic database

Do we have a way to capture this?

GLORIA on HALO.

<https://journals.ametsoc.org/doi/pdf/10.1175/BAMS-D-18-0181.1>

Little progress on satellite limb sounding.

[https://public.wmo.int/en/resources/bulletin/status-of-global-observing-system-climate \(2015\):](https://public.wmo.int/en/resources/bulletin/status-of-global-observing-system-climate-(2015))

Exploitation of IASI

FORUM mission