

Advanced Sounder Working Group

Andrew Collard (co-chair), Bill Smith (co-chair), Allen Huang, Paolo Antonelli, Zhaohui Cheng, David Crain, Allen Larar, Jun Li, Nikita Pougatchev, Filomena Romano, Stephen Tjemkes, Alexander Uspensky, Banghua Yan, Jonathan Taylor, James Cameron, Bill Blackwell, Marc Schwarz, Arlindo Arriaga, Yanni Qu, Lihang Zhou, Haibing Sun, John Le Marshall, Min Jeong-Kim, Jie Zhang, Daniel Zhou, Stephen Mango, Kenneth Holmlund, Denis Blumstein, Cyril Crevoisier, Hal Bloom, Filipe Aires, John Eyre, David Tobin, Jean Pla, Steve English.

Colour Key:

Recommendations **Action Items** **Results of Action Items**

Advanced IR Sounders in Geostationary Orbit (1)

Recommendation AS-1 to the space agencies:

In reaction to user requirements by the global and regional scale NWP community for more frequent observations of lower tropospheric moisture and temperature profiles, and for additional frequent monitoring of atmospheric dynamics, it is recognised that high spectral resolution imaging radiometers on geostationary platforms would be an important part of the future global observing system. It is therefore strongly recommended that operational missions, like MTG-IRS, be flown as soon as possible. Ideally, a demonstration mission should be conducted for risk reduction purposes, but should not delay the operational missions. GIFTS is the best current option for a demonstration mission.

Advanced IR Sounders in Geostationary Orbit (2)

Action AS-1 on ITWG co-chairs:

Co-ordinate recommendations from this conference with those from the Winds Workshop and communicate to Space Agencies.

It was determined that the means to influence MTG_IRS was through the national delegates of EUMETSAT. ITWG's statement of support for MTG-IRS was communicated to IWWW co-chairs. The MTG-IRS wind product will be a Day-02 deliverable.

IGeoLab

**Recommendation AS-2 to the space Agencies:
The WMO IGEOLAB concept should be supported.**

**Recommendation AS-3 to WMO:
GIFTS should be considered as a candidate hyperspectral imager for the IGEOLAB Molniya mission.**

Calibration and Validation of Advanced Sounder Data (1)

Recommendation AS-4 to data users:

The group encourages pre- and post-launch instrument characterisation and traceable calibration. Requirements for the parameters to be characterised and their required accuracy and stability should be communicated from the users (i.e., NWP, RT modellers, climate researchers) to the data providers.

Recommendation AS-5 to data providers:

To aid in early calibration and characterisation of new instruments data should be released as early as possible to NWP centres.

Calibration and Validation of Advanced Sounder Data (3)

Recommendation AS-6: to the space agencies and NWP centres:

Cal/Val for advanced sounders needs to be an activity which receives sufficient resources. High-altitude airborne sensors, such as those associated with the NAST, S-HIS, and ARIES airborne sensors, and upper air reference networks need to be added to complementary data sources in order to validate the radiances and derived products to the very high accuracy and precision specified by the users. These campaigns should be co-ordinated with new satellite launches.

Calibration and Validation of Advanced Sounder Data (4)

Recommendation AS-7 to space agencies, NWP centres and researchers:

Case study data sets should be prepared and made freely available from these campaigns and the scientific community which is encouraged to use these data to determine instrument and forward model spectral characteristics and to improve retrieval and data assimilation procedures, with a workshop focused on case study applications of the data taking place after a couple of years.

Action AS-2 on Jonathan Taylor:

E-mail details of Joint Airborne IASI Validation Experiment (JAIVEx) data to the ITSC conference.

The action was completed and further DVDs of Jaivex data were distributed as a result.

Experience with IASI calibration

Recommendation AS-8 to Space Agencies:

Future instruments should be carefully calibrated before launch. In particular, care must be taken to accurately establish the instrument field of view, as this procedure is far more accurate when performed on the ground rather than in orbit

Correlated Noise from advanced infrared sounders

Recommendation AS-10 to Space Agencies and NWP Centres:
Encourage studies to evaluate the full error covariance matrix of advanced sounder measurements and error introduced by forward models.

Recommendation AS-11 on members of the research community:

Use the information from dedicated validation campaigns to better understand the full error covariance matrix of advanced sounder measurements and error introduced by forward models.

Objectives and Desirable System Requirements of Advanced Sounders (1)

Action AS-3 on Bill Smith:

Review and re-create this table with particular emphasis on establishing a link between instrument and geophysical measurement criteria (particularly WMO requirements).

Not completed at present

Recommendation AS-12 to the space agencies:

In order to ensure consistency of objectives and adequacy of the capabilities of various international contributions to the global observing system, it is recommended that space agencies follow the ITWG guidance on desirable radiometric measurement requirements to be met or exceeded for advanced IR sounders to be carried on future polar and geostationary orbiting satellites.

Objectives and Desirable System Requirements of Advanced Sounders (2)

Recommendation AS-13 to the research community and space agencies:

It is recommended that relevant organizations conduct studies to identify the capabilities of microwave sounders and develop consensus user measurement requirements for future systems. This should be done for LEO as well as GEO. It is recommended that this information be consolidated in a table similar to that presented above for the IR sounder.

Objectives and Desirable System Requirements of Advanced Sounders (3)

Action AS-4 on Bjorn Lambrigsten and Bill Blackwell:
Prepare a draft table summarising the requirements for microwave sounding systems between instrument and geophysical measurement criteria (particularly WMO requirements). This should be communicated to the frequency-protection community.

In progress

Action AS-5 on the Advanced Sounders Working Group:
Review the tables produced by Actions AS-3 and AS-4.

Awaiting completion of AS-3 and AS-4

Advanced Sounder Field-of-View Size and sampling interval

Recommendation AS-14 to the scientific community:
Further studies on optimisation of the size of advanced sounder fields-of-view and spatial contiguity need to be pursued, taking into account probable future advances in sounding techniques.

CrIS Spectral Performance

Recommendation AS-15 to IPO:

CrIS measurements should be communicated from the satellite at full (as measured) spectral resolution.

Recommendation AS-16 to IPO:

Further investigate communication of the full (as measured) CrIS full spectrum.

On the performance of Conically-Scanning Microwave Instruments

Recommendation AS-17 further study to Space Agencies/IPO: Further study the ability of conical sounders, using on-orbit data from new conical imager/sounders as it becomes available as well as data from existing sensors, to deliver sufficiently accurate observations for NWP in the light of the most recent results.

Recommendation AS-18 further study to Space Agencies/IPO: Future conical sounding missions should take full account of the experience gained in the post-launch analyses of existing operational conical imagers and sounders (including SSMIS, Windsat, TMI and AMSR) in the specification and design of instruments.

MW Sounder Deployment with Future Infrared Sounders

Recommendation AS-19 to the space agencies:

Microwave sounders should be considered to always be flown with future advanced IR sounders, to provide simultaneous observations at the same time and at the same location.

Imagers with Sounding Channels to Support Future IR Sounders

Recommendation AS-20 to the space agencies:

Future high spatial resolution imaging radiometers to be flown with advanced IR sounding instruments should possess channels primarily sensitive to lower tropospheric emission to support the interpretation and enhance the use of advanced IR sounding spectrometer observations obtained for cloudy sky scene conditions.

Spacing of satellites when during MetOp overlap periods.

Recommendation AS-21 to EUMETSAT:

All MetOp level-1 and level-2 data should be distributed in near-real time from both satellites.

Recommendation AS-22 to NWP centres:

Preferences for separation between the two satellites should be communicated to EUMETSAT.

Recommendation AS-23 to ITSC:

Investigate the implications on developing innovative products from two METOP satellites with 20-50 minute

On the continuation of the global GPSRO constellation

Recommendation AS-24 to Space Agencies:
A fully operational constellation of GPS radio-occultation receivers provides useful calibration information for satellite sounders and thus the group recommends a follow-on from the current COSMIC constellation to be flown.

Optimal use of community state-of-art algorithms and systems within prime contractor operational processing for satellite programs

Recommendation AS-25 to Space Agencies:

Environmental satellite systems should be developed by a partnership of government, industry and university science communities under the leadership and responsibility of government agencies.

Distribution and Optimal Use of Advanced Sounder Radiance Data in NWP (1)

Recommendation AS-26 to NWP Centres:

It is recognised that more efficient use of the full advanced IR sounder spectrum is desirable within NWP data assimilation. NWP centres are encouraged to consider research into the direct use of principal components and/or retrievals from advanced IR sounders in assimilation systems.

Recommendation AS-27 to retrieval providers:

Provide full characterisation of retrieval schemes including observation error covariance matrix, averaging kernels, quality control, and cloud detection. This characterisation should be both theoretically derived and independently validated. Data should be available in suitable and timely format.

Distribution and Optimal Use of Advanced Sounder Radiance Data in NWP (2)

Recommendation AS-28 to the ITSC:

Where possible, retrieval studies should be presented with averaging kernel and full error covariance estimates and validation.

Recommendation AS-29 to data providers:

It is noted that the use of principal components to represent advanced sounder spectra carries the danger of the loss of signals that are not properly represented in the training set. Care must be taken to ensure that data compression methods used for archiving of satellite data be lossless. Lossy compression of advanced sounder data for transmission may be acceptable for certain users. This question has become particularly pertinent in the context of continued distribution of IASI data in near real time.

Distribution and Optimal Use of Advanced Sounder Radiance Data in NWP (3)

Action AS-6 on Ken Holmlund and the ASWG co-chairs: Produce a table documenting the timeliness required (i.e., type of distribution) and the required fidelity of advanced sounder data as a function of user type (e.g., NWP, trace gas retrieval, climate applications) as a guide to space agencies on the most efficient strategy for data dissemination.

The action was completed by Ken Holmlund (*EUM/STG-OPSWG/24/08/DOC/12*) and e-mailed to the Advanced Sounders Working Group on 28th August 2008.

Action AS-7 on ASWG and other working groups: Critically review the table produced by AS-6.

No replies as yet. To be further discussed at ITSC-XVII

Distribution and Optimal Use of Advanced Sounder Radiance Data in NWP (4)

Recommendation AS-30 to researchers:

Consider possibilities for spatial compression at the data source.

Recommendation AS-31 to Space Agencies:

Encourage further investigation of truly lossless data compression techniques.

Land Surface Infrared Emissivity

Recommendation AS-32 to the research community:

Continue work on infrared land surface emissivity databases including validation and intercomparison between techniques.

Recommendation AS-33 to the research community:

Continue work on infrared land surface emissivity retrieval algorithms including validation, intercomparison between techniques and investigation of robustness to cloud in the instrument field-of-view.

Recommendation AS-34 to the research community:

Databases of global infrared land surface emissivities should be represented in spectral resolution fine enough to resolve spectral feature of earth surface. The use of EOF as an efficient way to model the spectral databases is encouraged but further verification study is recommended.

Interaction with Other Bodies

Recommendation AS-35 to the relevant chairpersons:

It is recommended that there be co-ordination between the Advanced Sounders Working Group, the Hyperspectral Workshop, the IASI Conference and the AIRS science team.

Action AS-8 on the Advanced Sounder Working Group co-chairs:

Co-ordinate with the IASI conference chairs, the AIRS science team and Paolo Antonelli to suggest possible topics that should be covered at future workshops and conferences.

There was discussion between the ITWG co-chairs and Thierry Phulpin on the content of the IASI conference which had some influence on the programmes for both.

Pedantry

And Finally....

Action on ITWG members: Check your presentations to ensure that you are using Principal (adjective) and not Principle (noun) Components.

Questions?