



CGMS-36, NOAA-WP-18  
Prepared by Stephen English,  
Allen Huang  
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### Report from the International TOVS Working Group (ITWG)

NOAA WP-18 reports that the Sixteenth International TOVS Study Conference (ITSC-XVI) was held at the Hotel do Frade near Angra dos Reis from 6-13 May 2008. With about 137 participants representing 18 countries, this conference report summarizes the scientific exchanges and outcomes of the meeting. A companion document, *The Technical Proceedings of the Sixteenth International TOVS Study Conference*, contains the complete text of ITSC-XVI scientific presentations. The ITWG Web site (<http://cimss.ssec.wisc.edu/itwg/>) contains electronic versions of the conference presentations and publications. Together, these documents and Web pages reflect the conduct of a highly successful meeting in Angra dos Reis. An active and mature community of TOVS and ATOVS data users exists, and considerable progress and positive results were reported at ITSC-XVI in a number of areas, including many related to the ATOVS system, use of IASI measurements, and to the other current and impending advanced sounders.

## FOREWORD

The International TOVS Working Group (ITWG) is convened as a sub-group of the International Radiation Commission (IRC) of the International Association of Meteorology and Atmospheric Physics (IAMAP). The ITWG continues to organise International TOVS Study Conferences (ITSCs) which have met approximately every 18 months since 1983. Through this forum, operational and research users of TIROS Operational Vertical Sounder (TOVS), Advanced TOVS (ATOVS) and other atmospheric sounding data have exchanged information on data processing methods, derived products, and the impacts of radiances and inferred atmospheric temperature, moisture, and cloud fields on numerical weather prediction (NWP) and climate studies.

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ITSC-XVI was sponsored by industry, government agencies and a university, including, VCS Engineering, CNES, Kongsberg Spacotec AS, ABB, ITT Industries, the Met Office, the University of Wisconsin-Madison Space Science and Engineering Center, EUMETSAT, NOAA/NESDIS, CPTEC, Sea Space, NASA, NPOESS and the NSMC. The support of these groups is gratefully acknowledged. We wish to thank the local organising committee from the Centro de Previsão de Tempo e Estudos Climáticos, National Institute of space Research (INPE/CPTEC), located in Cachoeira Paulista, SP, Brazil, especially to Dr. Dirceu Herdies, Dr. Rodrigo Souza and Dr. Simone Costa for their exceptional effort and talent in leading the local organization and to Carine Previatti and Marcelo Acquaviva of Acquaviva Produções e Promoções for their enthusiastic support to the CPTEC team. Finally, appreciation is given to the local sponsors, including Petrobras and SBMET.

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Stephen English  
Co-Chair ITWG  
Met Office (U.K.)

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Allen Huang  
Co-Chair ITWG  
University of Wisconsin-Madison

## 1. EXECUTIVE SUMMARY

### 1.1 INTRODUCTION

The Sixteenth International TOVS Study Conference, ITSC-XVI, was held near the town of Angra in Brazil from 6-13 May 2008. Around one hundred and thirty seven participants attended the Conference and provided scientific contributions. Eighteen countries, and three international organizations were represented: Australia, Brazil, Argentina, Canada, China, Taiwan, France, Germany, Hungary, India, Italy, Japan, Norway, Poland, Russia, Sweden, United Kingdom, United States, ECMWF, EUMETSAT and WMO. The number of attendees was the highest ever. The Working Groups had very useful discussions and it was again encouraging to see a large number of new younger scientists participating. This was the first opportunity for the conference to discuss the use of new data from Metop-A, which was launched just after ITSC-XV and it was exciting to see the substantial progress already achieved by several centres.

Most of the meeting was occupied with oral presentations and three poster sessions, one of which had short oral poster introductions, on a range of issues which included the following:

- Radiative transfer and surface modelling
- Climate applications
- ATOVS cloud studies
- Direct broadcast software, pre-processing and calibration and frequency protection (again dedicated to Guy Rochard)
- IASI
- Operational use of ATOVS
- Developments in use of ATOVS in NWP
- International Issues and Agency Status Reports
- Products from ATOVS
- Future sensors

There were 95 oral presentations, including 14 poster introductions, 16 working group and technical sub group presentations and 86 posters presented during the conference; the agenda is given in Appendix A. All of the talks and many of the posters can be viewed at the ITWG Web site, located at <http://cimss.ssec.wisc.edu/itwg>.

Working Groups were formed to consider six key areas of interest to the ITWG, including Radiative Transfer and Surface Property Modelling; Use of ATOVS in Numerical Weather Prediction; Use of TOVS and ATOVS for Climate Studies; Advanced Sounders; International Issues; and Satellite Sounder Science and Products. The Working Groups reviewed recent progress in these areas, made recommendations on key areas of concern and identified items for action. Working Group reviews and recommendations comprise an important part of the ITSC-XV Working Group Report. A summary of the key points arising from the conference are listed below.

During the Conference, a session on Working Group status reports considered activities that had taken place since ITSC-XV in Maratea. This session also reviewed progress on the Action Items and Recommendations identified by the ITSC-XV Working Groups. Many of these items formed the basis for further discussion by the Working Groups at ITSC-XVI. Several technical sub-groups also met during ITSC-XVI to discuss developments and plans concerning specific software packages, shared and in common use and microwave frequency protection. Brief reports on these sub-group meetings are provided in section 3.

The conference also paid tribute to Izabela Dyras, an active member of the group, who died in 2007. During the conference banquet on Itanhanga island Bozena Lapeta, Paolo Antonelli and Tom Achtor recalled Isabella's life and her contribution both to ITWG and to the development of use of satellite data in Poland. She will be sadly missed by the ITWG.

## 1.2 SUMMARY OF MAJOR CONCLUSIONS

The ITSC-XVI presentations, posters, Working Group meetings and discussions documented significant issues in many areas and noted areas for future activity. In particular, it noted that:

1. The group noted that LEO IR and MW sounding capability on 3 orbital planes is essential to proper sampling of atmospheric temperature and humidity vertical profiles. At present there is no IR sounding capability planned for the early morning orbit and the performance of the MIS sounding channels is yet to be assessed. The group recommended WMO, CGMS and CEOS investigate scenarios for sounding instruments in the early morning orbit.
2. The results of new observing system experiments presented at ITSC-XVI demonstrate that satellite data have a large impact on weather forecast accuracy and promising new results suggest the potential for future enhancements in the use of satellite sounder and imager data. It is crucial that future instruments as a baseline maintain, and if cost effective, improve upon the quality of AMSU and IASI.
3. Many NWP centres are now assimilating radiances operationally or experimentally from the Infrared Atmospheric Sounding Interferometer, IASI, and getting significant positive forecast impacts. The experience with AIRS was crucial to the rapid implementation of IASI.
4. The Regional ATOVS Retransmission Service, RARS, has continued to develop since ITSC-XV. The Asia-Pacific RARS service has continued to expand and more NWP centres are using the RARS data. RARS networks in S. America and Africa are now available. The group encouraged WMO and the space agencies to continue to develop this ATOVS retransmission service as a low cost means of providing more timely ATOVS data for 90% of the globe. The Southern Ocean and North Pacific were identified by one study as particularly needing RARS.
5. The group continues to strongly support the SafetyNet concept, which will allow rapid dissemination of global NPOESS data products, identifying it as one of the most attractive features of NPOESS. WMO and the RARS Implementation Group were invited to consider an expansion of RARS for NPP and NPOESS-C1 as SafetyNet will become fully operational only from NPOESS-C2 onwards.
6. An important issue for consideration is that when MODIS is retired, according to current plans, there will not be an imager in polar orbit with a channel in the water vapour band. This will degrade the accuracy of any polar satellite derived winds. Space agencies are urged to consider the best means for providing a polar orbiting imager with water vapour channels along with the conventional VIS and IR channels.
7. Further progress in the pre-processing of SSMIS data has been made with the development of the unified preprocessor, jointly developed by several centres with a strong interest in SSMIS data quality. More NWP centres are now able to use the DMSP-

F16 SSMIS sounding channels operationally and progress is being made with DMSP-F17 SSMIS. The group encouraged the SSMIS cal/val team to make the data available from DMSP-F18 as early as possible after the launch to expedite their use in operational systems.

8. The group urged space agencies to use expertise from NWP centres throughout the cal/val phase for new instruments, as proved particularly successful for SSMIS and IASI.
9. The group encouraged the careful characterization of new satellite instruments, notable promoting the use of pre- and post-launch traceable calibration standards for future sounders.
10. The group noted that lossy datasets for advanced sounders may not be suitable for all applications and consequently recommended techniques for spatial as well as spectral thinning to be studied for distribution of advanced sounder data, notably IASI.
11. The community software packages (i.e. AAPP, IAPP, IMAPP) have been essential in the use of ATOVS, IASI, AIRS and MODIS data by the meteorological community. The group encouraged satellite agencies to continue to support these packages for existing missions and to develop and release pre-processing software packages (e.g. IPOPP) as soon as practical before launch.
12. The group urged space agencies to provide documentation on data formats well before launch to allow similar community software packages to be developed for planned new satellites (e.g. FY-3 and NPP).
13. The group noted the increasing threat of RF interference in microwave imager channels. All members were urged to lobby their respective radio communication authorities to support protection of the imager and sounder bands and specifically to identify useful bands between 275 and 3000 GHz and to undertake more detailed studies in support of 52.6-59.3 GHz and 86-92 GHz.
14. Satellite agencies were again encouraged to continue and expand their support for education and training of the next generation of remote sensing scientists
15. It was also noted that research into truly lossless compression techniques continues in the wider scientific community. It is recommended that space agencies investigate both lossless and lossy data compression techniques which may be used to aid dissemination of advanced sounder observations.
16. Optimal use of community state-of-art software packages within the central operational processing for satellite programs has been raised again and the group is continuing to recommend to the space agencies to promote partnership in building environmental satellite systems where government, industry and university science communities share their expertise.
17. The time series of (A)TOVS now exceeds 29 years and the quality and number of climate products continues to grow. It was recognized that the fundamental instrument parameters of all the (A)TOVS sensors should be retained for future reprocessing efforts.
18. The group supported the continuing efforts to develop the GCOS Reference Upper Atmospheric Network (GRUAN) for climate with the primary objective of creating long

term records of critical upper air measurements and associated error characteristics to support their continuing integration in climate applications and research.

19. The ITWG noted that the TOVS/ATOVS lower tropospheric climate data record is view geometry dependent and this product would be lost if there was a migration to a conical viewing geometry
20. It was recognised that hyperspectral resolution imaging radiometers on geostationary platforms are likely to be an important part of the future global observing system. The group supported plans for operational missions but would also welcome a preparatory mission earlier than 2015 if possible.
21. The group noted that GPSRO data has allowed better characterization of biases in passive sounding data from 20-40 km and consequently operational continuity for COSMIC is now important to maintaining good quality passive upper level sounding data.
22. The success of the JAIVEx campaign in support of cal/val for IASI was reported at ITSC-XVI both in support of assimilation of IASI observations in NWP and to improve characterization of climate data records. The group urged similar campaigns for future instruments.
23. Many centres are experiencing difficulty using moisture-sensitive channels and the group urged more focused effort in this area and encouraged more exchanges of experience between centres.
24. Since ITSC-XV several centres have made significant progress in understanding and using cloud-affected radiances, with progress in radiative transfer, data assimilation and more sophisticated cloud screening. As a result more satellite sounding data can be used.
25. The IASI and AIRS radiances assimilated are still a small fraction of those available but some efforts are underway to allow a more complete use of the data (e.g. through use of reconstructed radiances or principal components).
26. The number of NWP centres using level 1b ATOVS radiances in their variational data assimilation systems continues to grow but there are still centres which rely on the level 2 retrievals provided by NESDIS.
27. The group recommended further studies on the optimization of the size of the advanced sounder fields of view using experience with the Metop HIRS/4 and NOAA-17 HIRS/3 instruments.

### 1.3 FUTURE PLANS

The ITWG will continue to meet and inform the ATOVS community of the latest news and developments through its Web site currently maintained by the University of Wisconsin CIMSS and the email list also maintained by CIMSS. The 4<sup>th</sup> Hyperspectral Workshop to be held at EUMETSAT, Darmstadt, Germany 15-17<sup>th</sup> September 2008 was noted and ITWG undertook to assist coordination between this group, the AIRS science team, the IASI conference and the ITWG advanced sounder working group to ensure effective exchange of

information. The ITWG will also be holding the second workshop on remote sensing and modelling of surface properties prior to ITSC-17, tentatively scheduled for June 2009.

The website will continue to evolve to become an even more important tool for ITSC, with many new ideas proposed and endorsed at ITSC-16. This could include some interactive elements to the website (e.g. wiki).

The format of ITSC-16 was similar to previous meetings, but with a significant increase in numbers attending resulting significant time pressure on the agenda. If the recommendation of the climate working group to attract significantly more climate scientists to ITSC-17 is successfully carried out, the climate session will have to be significantly longer. Therefore ITWG has to consider options for continuing to deliver a successful meeting which may require changes in structure, length or number of oral presentations. At ITSC-16 a partially successful experiment was carried out with the operational NWP session using a format of a longer, invited summary presentation, followed by short 3 minute poster presentations, followed by the poster session. It has been suggested this format could be extended to other sessions e.g. the agency status reports and reports on software packages. The ITWG members expressed a strong preference to investigate this type of option before any move to parallel sessions is considered.

The ITSC-XVI Working Group Report, a Proceedings for ITSC-XVI from the papers submitted will be provided to attendees and other interested persons on CD-ROM. The oral and poster presentations from ITSC-XVI are already available as pdf files which can be downloaded from the ITWG Web site. The next meeting of the ITWG is scheduled to take place in February 2010, depending on final choice of venue. Topics of interest will include more extensive evaluation of MetOp data, initial assessment of FY-3 data and status of preparations for the NPP launch.