

The International TOVS (Soundings) Working Group (ITWG)

Summary of highlights and request for guidance from ITSC-21

Presented to CGMS-46, Plenary

Niels Bormann (ECMWF) and Mitch Goldberg (NOAA/NESDIS)

ITWG Co-Chairs



CGMS

International TOVS Working Group (ITWG)

- Established in 1983 as a working group of the International Radiation Commission (IRC) of the International Association of Meteorology and Atmospheric Physics (IAMAP)
- Formally adopted as sub-group of CGMS in 2012
- Provides a forum where operational and research users of atmospheric infrared and microwave sounders exchange information on:
 - Sensor status
 - Processing methods and derived products
 - Data use in Numerical Weather Prediction
 - Radiative transfer developments
 - Climate studies
 - etc

ITSC-21

Hosted by EUMETSAT in Darmstadt, Germany

- 29 November – 5 December 2017
- 180 participants
- 63 oral, 132 poster presentations
- <http://cimss.ssec.wisc.edu/itwg/itsc/itsc21>



Topics Covered:

- Current, new and future observing systems
- Reports from space agencies and NWP Centres
- Data assimilation applications
- Climate applications
- Processing software systems
- Advanced sounder science
- Radiative transfer models
- Cloud and precipitation applications
- Retrieval Science

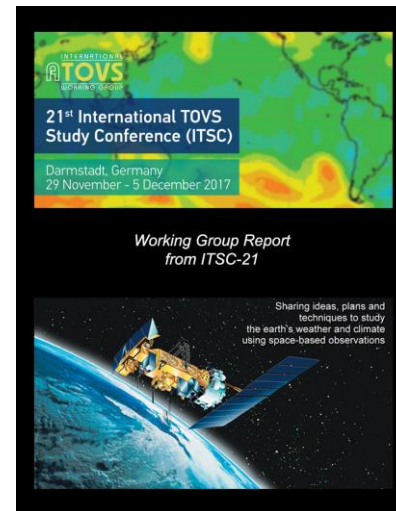
Working Groups

Six Working Groups

- Radiative Transfer and Surface Property Modelling
- Climate
- Data Assimilation and NWP
- Advanced Sounders
- International Issues and Future Systems
- Products and Software

Technical Sub-Groups

- RTTOV
- CRTM
- RARS/DBNET and direct broadcast packages



Leadership in ITWG

Radiative Transfer and Surface Property Modeling(Marco Matricardi, ECMWF and Benjamin Johnson, JCSDA/NCEP)

Climate (Nathalie Selbach, DWD/Climate SAF and Cheng-Zhi Zou, NOAA)

NWP (Andrew Collard, NCEP and Fiona Smith, BOM/UMKO)

Advanced Sounders (Dieter Klaes, EUMETSAT and Bill Smith, UW/Hampton)

International and Future Systems (Stephen English, ECMWF and Peng Zhang, CMA)

Products and Software (Liam Gumley, UW and Nigel Atkinson, UKMO)

RARS/DBNet and Direct broadcast packages (Mikael Rattenborg, WMO and Liam Gumley, UW)

**Coordination Group for
Meteorological Satellites**



1966-2016

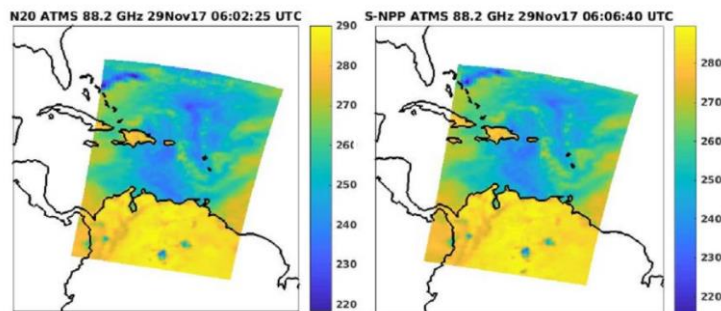
https://cimss.ssec.wisc.edu/itwg/news/paul_van_delst/index.html



CGMS

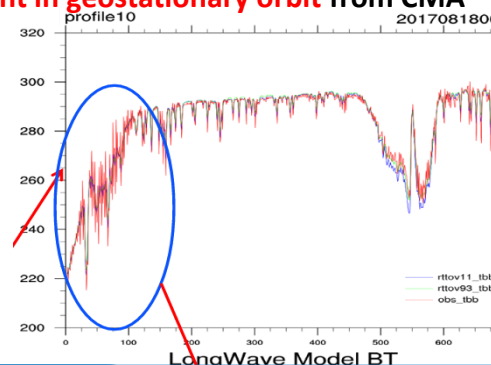
Highlights

- First results from **NOAA-20 ATMS** (almost live)



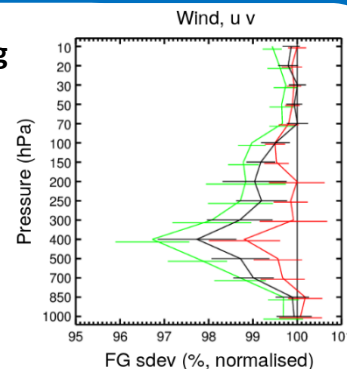
(curtesy Mitch Goldberg et al)

- Initial results from GIIRS – the **first hyperspectral IR instrument in geostationary orbit** from CMA



(curtesy Wei Han et al)

- Good NWP impact** of sounding instruments confirmed, including on wind in 4d-Var

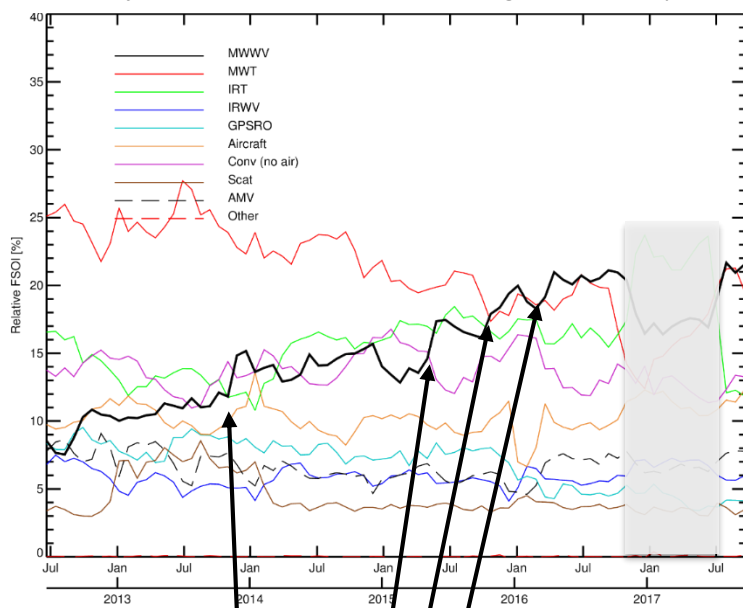


(curtesy Kirsti Salonen)

Highlights

- Significant progress in **all-sky assimilation of radiances**

Relative FSOI in ECMWF system
(= adjoint-based measure of short-range forecast impact)

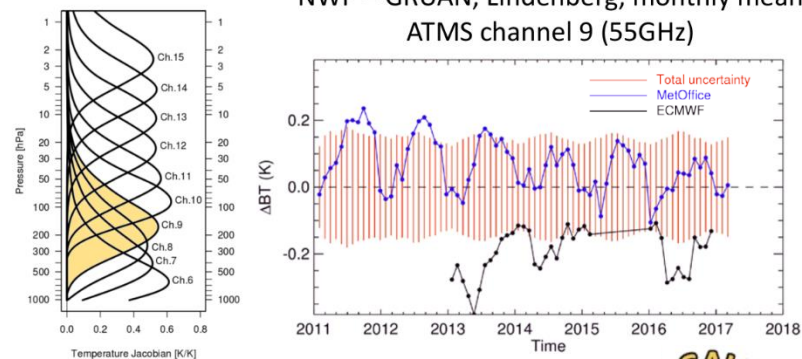


Addition of more all-sky data

(courtesy Alan Geer et al)

- Significant progress in **uncertainty characterisation/ cal-val for climate applications and NWP**

NWP – GRUAN, Lindenberg, monthly mean
ATMS channel 9 (55GHz)



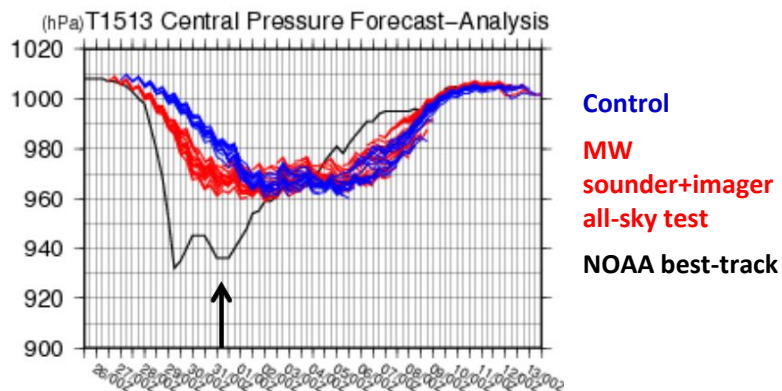
(courtesy Fabien
Carminati et al)

FIduceo



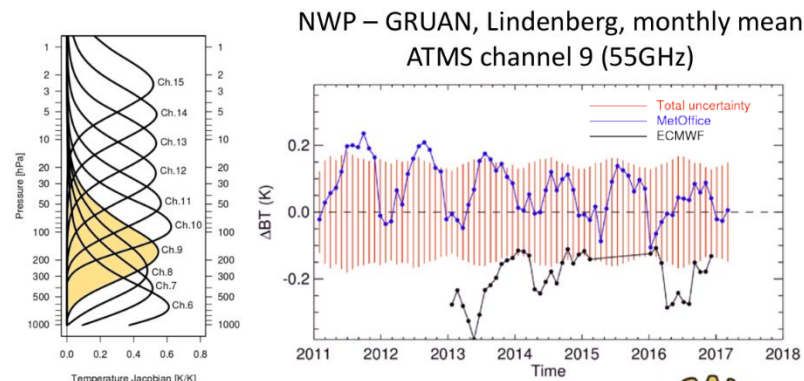
Highlights

- Significant progress in **all-sky assimilation of radiances**



Better intensity forecast for tropical cyclones.
(curtesy Masahiro Kazumori et al)

- Significant progress in **uncertainty characterisation/ cal-val** for **climate applications** and NWP



(curtesy Fabien
Carminati et al)

FIduceo



Top Recommendations from ITSC-21

Evolution of the observing system

1. **To CGMS and other satellite agencies:** The constellation of at least three polar orbits (early morning, morning, and afternoon), each with full sounding capabilities (IR and MW), should be maintained. The overpass times of operational satellites with sounding capability (IR and MW) should be coordinated between agencies to maximize their value.
2. **To CGMS and other satellite agencies:** Noting the growing evidence of likely benefits from hyperspectral geostationary soundings, ITWG recommends where possible to work towards the provision of such instruments in plans for future geostationary systems.
3. **To CGMS, other satellite agencies, and users:** ITWG recognises the opportunities arising from the provision of sounder data from small satellites as supplements to the global observing system, particularly for better temporal sampling. ITWG recommends the evaluation of such missions by appropriate agencies, including already planned missions (e.g., TROPICS).
4. **To CGMS and other satellite agencies:** Instrumentation to allow continued sounding of the temperature of the upper stratosphere and mesosphere (as for the SSMIS UAS channels) should be explored, in support of maintaining a robust global satellite observing system.
5. **To CGMS and other satellite agencies:** ITWG recommends to develop, test, and implement an SI-traceable radiometric standard in space as soon as feasible.
6. **To satellite agencies:** Consider implementing high spatial resolution and contiguous sampling detector arrays in future hyperspectral infrared sounding instruments.
7. **To CGMS and other satellite agencies:** Climate applications should be appropriately represented during the planning for new meteorological satellite missions.
8. **To space agencies and all agencies involved in GRUAN/ARM:** ITWG recommends to expand the provision of GRUAN and ARM sites, noting the continued need for and scarcity of ground-based reference measurements.

Top Recommendations from ITSC-21

International coordination, DBNet, frequency protection

9. **To WMO/CGMS and other satellite agencies:** ITWG recommends to further maintain OSCAR and SATURN, noting the strong positive feedback from ITWG Members. ITWG strongly encourages all agencies to actively contribute information to this portal.
10. **To satellite agencies:** to ensure that provision of Spectral Response Functions for MW instruments is routine practice, particularly for future instruments. This is required to facilitate RFI investigations when needed, and to allow optimal radiative transfer calculations. SRFs should be provided on the SATURN portal, including for current and old sensors.
11. **To the NWP community and other relevant agencies:** in support of continued efforts for frequency protection, national meteorological services should attempt to provide an assessment of the economic value of bands based on an impact assessment, as was done by the Met Office in 2005.
12. **To WMO/stations participating in DBNet:** ITWG continues to support low-cost fast delivery initiatives such as DBNet and welcomes recent extensions to further sensors. ITWG recommends more stations to consider contributing FY-3 sounder data.
13. **To Roshydromet:** Roshydromet are encouraged to release a direct broadcast processing package for the Meteor-M N2 series, including level 1 processing for the MTVZA-GY microwave imager.

Top Recommendations from ITSC-21

Data Provision

14. **To satellite agencies:** For new sensors, pre-launch test datasets should be provided well before launch, in order to allow software development teams (e.g., AAPP, OPS-LRS, CSPP) and other operational users (e.g., NWP centres) to test processing software before satellite launch. New operational data dissemination infrastructure should be tested at an early stage (well before launch) with simulated data.
15. **To satellite data providers:** The overlap period where one satellite resource is replacing another should be chosen after consultation with the user community and should follow WMO guidelines.
16. **To satellite agencies:** ITWG recommends open access to new satellite data during the calibration/validation phase (particularly for all NWP centres) to help with calibration and validation.
17. **To CMA:** Consider making available as soon as possible the GIIRS hyperspectral data on FY-4A and of HIRAS on FY-3D to the international user community.
18. **To WMO/CGMS/space agencies:** ITWG supports initiatives to make data from R&D and pre-operational missions available, with a timeliness suitable for operational near-realtime applications. We re-emphasize best practise is to consider timeliness requirements early in the planning stage of new missions, including for research and pre-operational missions, and note that high reliability levels (e.g. >95%) do not need to be a requirement at the pre-operational stage or for short-term research missions.
19. **To CGMS satellite agencies and other data providers:** Advance notifications of processing changes should be an integral component of data provision. If a planned change to data processing results in a change in brightness temperature of 0.1K or 20% of NEdT (whichever is smaller), this should be made clear in notifications to users. These notifications should be made no later than 8 weeks before the change and test data should be provided if possible.
20. **To CMA:** Consider implementing a subscription-based anomaly/event notification service, similar to that provided by NOAA and EUMETSAT.

Rec. #19 >> CGMS radiance processing change notification procedure proposal

- From Stephen English's paper presented at COMMISSION FOR BASIC SYSTEMS OPEN PROGRAMME AREA GROUP ON INTEGRATED OBSERVING SYSTEMS INTER-PROGRAMME EXPERT TEAM ON SATELLITE UTILIZATION AND PRODUCTS FOURTH SESSION, GENEVA, SWITZERLAND, 26 FEBRUARY – 1 MARCH 2018
- The guiding principle is that users are, in general, sensitive to changes smaller than the specification of the instrument accuracy. So, for example, the specification of the absolute calibration of a radiance dataset may be 1K. Users expect to have to make corrections (e.g. bias correction) of up to 1K prior to operational use of the data. However once operational an unexpected change of, say, 0.1K may cause detrimental impact.
- An example of this was the recent changes introduced by EUMETSAT for IASI, where advance warning was given to users only a short time before the change, because the expected change of 0.1K was well below specification. However it caused severe problems to operational users of IASI, who had to either accept a degraded system or blacklist the data and quickly revise operational bias corrections to allow for the change
- Therefore the guiding principle proposed by the ITWG is if the expected maximum change (temporally, geographically) in the observed brightness temperature of any channel of the instrument exceeds 0.1K or 20% of NEdT (whichever is smaller) this should be made clear in notifications to users. Users need these notifications to be made no later than 8 weeks before the change and with test data (at least a few orbits, ideally more) provided if possible.

Top Recommendations from ITSC-21

Radiative transfer, optimizing return on investments

21. **To IRC and agencies involved in radiative transfer developments:** ITWG strongly recommends continuous efforts in radiative transfer modelling developments, especially regarding:
 - Line-by-line model development as a fundamental basis for accurate radiative transfer calculations in fast RT models.
 - Development of reference-quality ocean-surface emissivity modeling, specifically Infrared, Microwave, for both active and passive simulations.
 - Extension of the frequency range of scattering models to cover the ranges of current and upcoming sensors, from visible to microwave (i.e., ICI channels).
22. **To IRC and agencies involved in spectroscopy research and radiative transfer development:** ITWG strongly recommends continuous support of theoretical and laboratory spectroscopic studies to improve the accuracy of fundamental parameters required for radiative transfer calculations (e.g., research into spectroscopy of higher frequency microwave channels up to 1000 GHz), as well as efforts to map uncertainties in spectroscopy into radiance uncertainties.
23. **To funding bodies of NWP centres and satellite agencies:** consider, as part of the cost of satellite programs, providing computational and personnel resources targeted at operational NWP centres to optimise the public's return on investment from these expensive measurement systems.

ITSC-22

In 2019

Welcome our new co-chairs:

Liam Gumley (UW/SSEC) and Vincent Guidard (Météo France)

