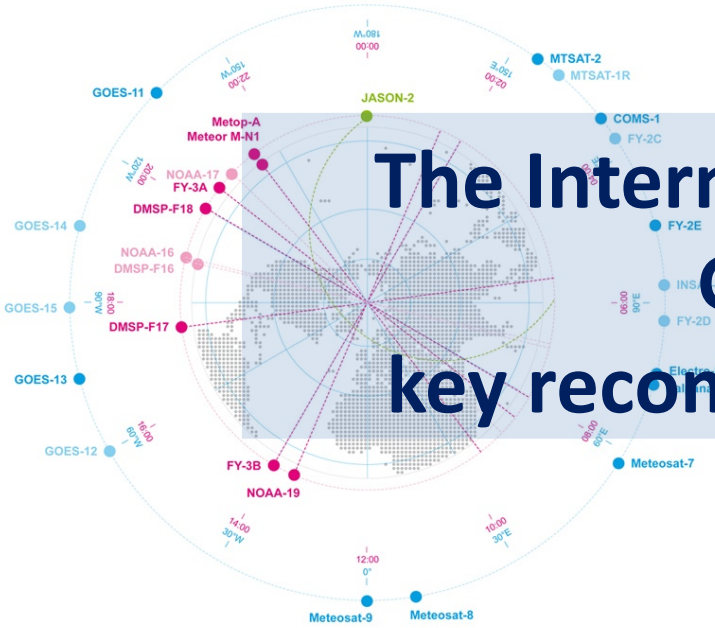


The International TOVS Working Group (ITWG) key recommendations to CGMS

Presented to CGMS-50 Plenary Meeting
June 16, 2022

Vincent Guidard (CNRM, Météo-France & CNRS)
Liam Gumley (CIMSS/SSEC/UW-Madison)

ITWG Co-Chairs

Coordination Group for Meteorological Satellites

INTERNATIONAL ATOVS WORKING GROUP

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 providers and users of atmospheric infrared and microwave sounder data exchange information on:
  - Satellite and sensor status
  - Processing methods and derived products
  - Data use in Numerical Weather Prediction
  - Radiative transfer developments
  - Climate studies
  - Real-time satellite data reception and processing

Working Groups

Radiative Transfer and Surface Property Modeling: Marco Matricardi (ECMWF; retiring) and Benjamin Johnson (NOAA)

Climate: Nathalie Selbach (DWD) and Cheng-Zhi Zou (NOAA; retiring) / Bill Bell (ECMWF)

Data Assimilation and Numerical Weather Prediction: Fiona Smith (BoM) and Brett Candy (Met Office)

Advanced Sounders: Dorothee Coppens (EUMETSAT) and David Tobin (UW-Madison)

International and Future Systems: Peng Zhang (CMA) and Niels Bormann (ECMWF)

Products and Software: Nigel Atkinson (Met Office) and Graeme Martin (UW-Madison)

RT-TOV and CRTM Technical Sub-group: James Hocking (Met Office) and Benjamin Johnson (NOAA)

Radio Frequency Interference Technical Sub-group: Stephen English (ECMWF), Nancy Baker (NRL), Rich Kelley (NOAA), Jean Pla (CNES)

Selected Recommendations from ITSC-23

Evolution of the Observing System

Climate-1

Create intercalibration time series from overlapping satellites to allow a continuation of climate time series (including trend analysis) when transitioning from older to newer satellites.

Climate-3

Consider climate requirements in terms of stability and length of life cycle when designing small satellite sensors.

DA/NWP-5

Following the success of the Megha-Tropiques SAPHIR instrument, future microwave sensors operating in a similar low inclination orbit are recommended.

AS-4

Continue to employ the traditional longwave infrared spectral radiance measurement band on all future hyperspectral infrared satellite sensors.

IIFS-5

Providers of data from constellations of smaller satellites should work towards standardization of data downlink frequencies and protocols to ease provision of near real-time (NRT) data.

International Issues

Climate-12

Support the further development of Essential Climate Variables (ECVs) and Greenhouse Gas CDRs to enrich the ECV inventory for climate change monitoring.

IIFS-2

Explicitly consider instrument capabilities, data quality, and data provision in future updates of the CGMS baseline, particularly for the 3-orbit backbone system of LEO passive sounders which plays an important role as a reference-style system.

DA/NWP-S7

The overlap period where one satellite resource is replacing another should be chosen after consultation with the user community and should follow WMO guidelines.

IIFS-S3

If a mission expects engagement from application areas with an NRT data requirement, budget should be allocated from the start to provide the required technical infrastructure.

IIFS-S5

Note that the benefits of Satellite Missions to the ITWG community are increased when early evaluation is undertaken by many independent centres (NWP centres in particular).

Data Dissemination

Climate-5

Climate Data Records (CDRs) should be citable by Digital Object Identifier (DOI) reference and all data records should be accompanied by metadata that follows WIGOS standards.

Climate-6

CDR development and stewardship should follow guidance similar to NOAA National Centers for Environmental Information (NCEI) data stewardship maturity matrix or the Copernicus Climate Change (C3S) convention (including recommendations for metadata).

DA/NWP-1

NOAA should continue to produce POES Level 1 sounder products for near-real time dissemination.

DA/NWP-S4

When designing new or modified BUFR formats, circulate drafts to the NWP community via the NWP Working Group for feedback prior to submission to WMO.

DA/NWP-S11

Develop and maintain public instrument status monitoring web pages similar to the Integrated Calibration and Validation System (ICVS) from NOAA/NESDIS.

Selected Highlights from ITSC-23

1. Small satellite constellations
2. Preparing to assimilate MTG-IRS
3. Impact of all-sky microwave

"Investigating the optimal design for a future constellation of microwave sounding instruments on small satellites using the Ensemble of Data Assimilations method"

Katie Lean, Niels Bormann, Sean Healy (ECMWF) and Dirk Schűttemeyer (ESA)

Choosing potential constellations

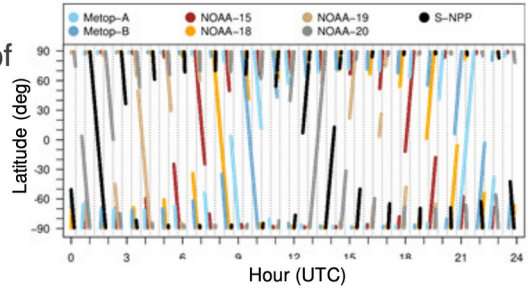
10 different scenarios will be tested. Choice of different scenarios motivated by 2 key areas:

What is the optimal number/orbit type?

To better increase sampling frequency:

- Different orbital planes?
- Mixture of polar/low inclination (particularly for better tropical/mid-latitude coverage)?

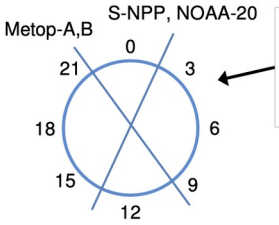
Temporal coverage over 500 km stripe around 0º meridian (15 July 2018)



7 satellite polar constellation coverage sparser in tropics/mid-lat

Humidity (~183GHz) only or with additional temperature (~55GHz) sounding channels?

- Improved dynamical information due to higher temporal sampling
- Increased sampling reduces effective noise for temperature sounding



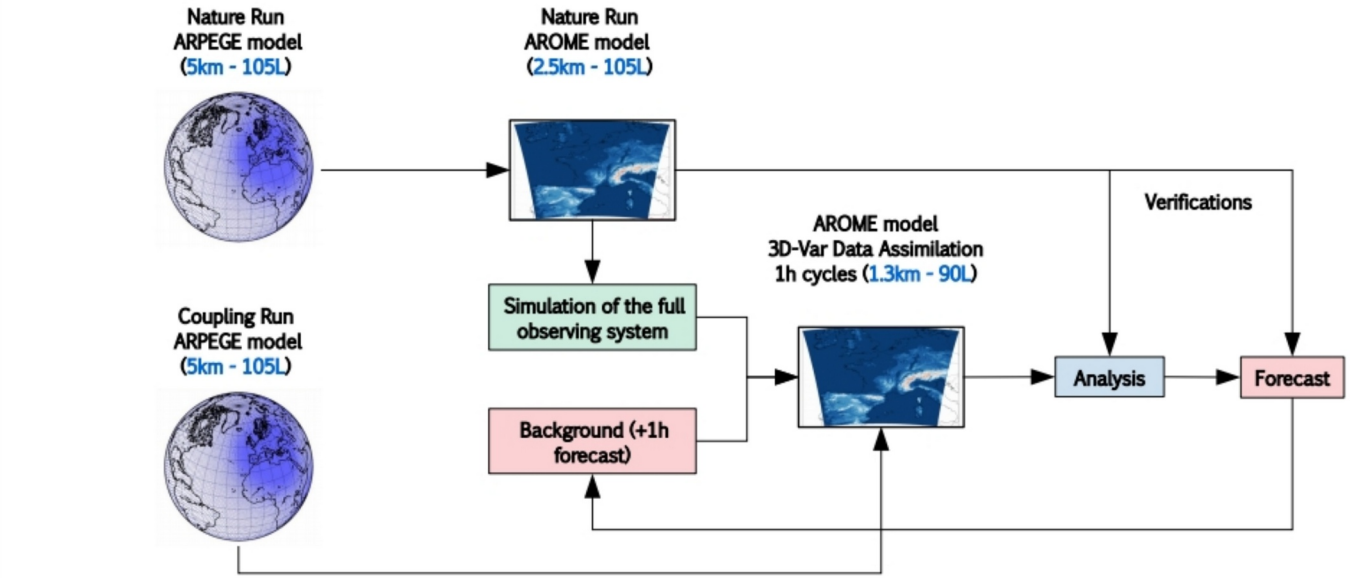
Orbital planes of JPSS and Metop programs provide baseline representing complementary backbone for testing optimal constellation of small satellite MW data.

Other considerations include instrument performance limitations e.g. higher instrument noise

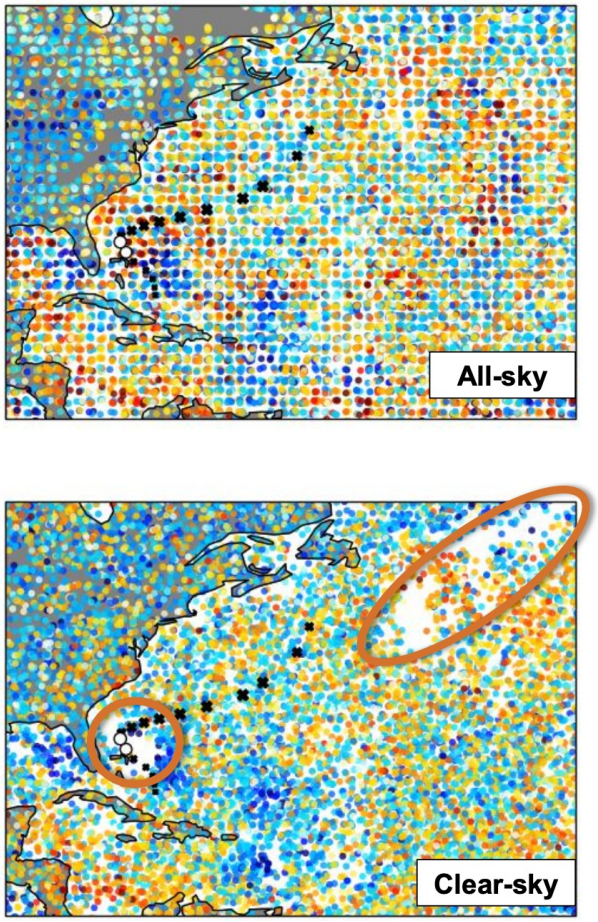
"First steps in the preparation for the assimilation of the future IRS sounder in NWP models"

Olivier COOPMANN (olivier.coopmann@meteo.fr), Nadia FOURRIÉ, Philippe CHAMBON, Pierre BROUSSEAU
CNRM, Université de Toulouse, Météo-France & CNRS

Creation of an **OSSE** to simulate the full observing system for AROME including IRS and to evaluate the impact of IRS in addition to radar observations in the 3D-Var NWP system on weather analysis and forecasts. Implementation of **ARPEGE Nature Run** (5 km horizontal resolution & 105 vertical levels up to 0.1 hPa) to initialise the boundary conditions of **AROME Nature Run** (2.5 km horizontal resolution & 90 vertical levels up to 10 hPa + 15 levels above up to 0.1 hPa from ARPEGE). Two study periods (4 months: **January and February** & **July and August**)



"Moving AMSU-A to all-sky assimilation at ECMWF"
David I. Duncan, Niels Bormann, Peter Weston, Alan Geer (ECMWF)



High-impact sampling

Tropical cyclones provide excellent example of the increase in sampling from all-sky

Here Hurricane Humberto makes a sharp turn to north Atlantic, better observed by AMSU-A

- In our experimentation, all-sky AMSU-A improved representation of Humberto's extratropical transition
- This helped mitigate a multi-day forecast bust over Europe

Conclusion

Full report from ITSC-23 available at

https://cimss.ssec.wisc.edu/itwg/itsc23/

ITWG interim working group virtual meetings were held March-April of 2022:

https://cimss.ssec.wisc.edu/itwg/itsc/2022interim/

ITSC-24 will be an in-person meeting in Tromsø, Norway, March 16-22, 2023.

ITSC-23 (2021)

June 24-30, 2021 via Webex (hosted by UW-Madison and Meteo France).

258 participants from 52 organizations across 19 countries.

Highlighted topics at ITSC-23:

Studies for future infrared and microwave sounders including small satellites

Evaluation of FY-4A GIIRS impact on NWP and preparations for MTG-IRS assimilation

Assimilation of all-sky observations and assimilation of surface-sensitive observations over land/snow/sea-ice surfaces

Preparations for sunset of current LEO satellites (e.g. NOAA-15, Metop-A, Aqua) and for use of future LEO satellites (e.g, Metop-SG; JPSS-2; FY-3E)

Applications of sounder data in climate monitoring and reanalysis

Processing software current status and preparations for future missions (Metop-SG; JPSS-2; FY-3E)

Data reception and dissemination services (DBNet, EUMETCAST) current status and future developments

INTERNATIONAL ATOVS WORKING GROUP

ITSC-23 virtual conference
24-30 June 2021