

2.4 ADVANCED SOUNDERS

Working Group members: William L. Smith (Co-Chair), Peter Schliüssel (Co-Chair), Thomas August, Reima Eresmaa, Francois Fajan, Robin Faulwetter, Evan Fishbein, Kevin Garrett, Mitch Goldberg, Hyo-Jin Han, Sylvain Heilliette, Allen Huang, Brian Kahn, Allen Larar, Chris Lietzke, Will McCarty, Laura Stewart, Thibaud Thonat, Bernard Tournier, Peter Weston, Vladimir Zavyalov, Daniel Zhou

2.4.1 Introduction

This working group focuses on scientific issues affecting the optimal performance of advanced satellite sounder systems. The working group reviews the status of the development of advanced sounder systems and recommends changes pertaining to instrument specification, performance, data processing, and utilisation. For the purpose of this group, “Advanced Sounders” are defined as instruments that present significant new scientific and technological challenges and which require new methods for data processing and utilization. Thus, Advanced Sounders currently include high spectral/spatial resolution passive infrared and microwave sounders and active sensors.

2.4.2 Potential Observation Gaps in Geostationary IR Sounding

The WMO vision of the GOS in 2025 asks for a complete coverage of infrared sounders in geostationary orbit; current implementation plans of space agencies only partially consider an implementation. The group recognises a growing concern of potential observation gaps, particularly over America and the Pacific Ocean.

Recommendation AS-1 to space agencies (e.g., NOAA, JAXA)

Devise plans to fill gaps in geostationary coverage with infrared soundings.

Action AS-1

ITWG Co-Chairs to present the concern of this group to CGMS.

Closed

Presented to CGMS-40 (Report of CGMS-40, 66-67 and WG-II report, 104-131)

2.4.3 High Spectral Resolution MW Sounding

Vertical resolution of temperature and water vapour soundings in the microwave region has been limited through noisy receivers. Recent advancements in microwave receiver technology enable high spectral resolution measurements in the microwave regions between 118 and 183 GHz with low noise.

Recommendation AS-2 to space agencies

3. Pursue the development of advanced microwave sounders with high spectral resolution and reduced noise in order to enhance vertical resolution of temperature and moisture soundings under partial and non-precipitating cloud conditions.

4. Extend developments of microwave receiver technology to enable high spectral resolution measurements with lower noise in the 50-60 GHz region.

Action AS-2

ITWG Co-Chairs to present the recommendation of this group to relevant space agencies (e.g., NASA, ESA, JAXA).

Closed

Presented to CGMS-40 (Report of CGMS-40, 66-67 and WG-II report, 104-131)

2.4.4 Infrared FOV Size

Along with high radiometric and spectral resolution, the user communities need infrared sounders with higher spatial resolution and denser spatial sampling to increase the likelihood of clear soundings, commensurate with finer grid size of future NWP models. With new technological developments the employment of infrared detector arrays, which allow for higher spatial resolution at reasonable noise increase, seems feasible. Increasing horizontal resolution will also demand an increase in vertical resolution. Significantly higher vertical resolution can only be obtained by utilising active techniques such as lidar, radar, and GPS.

Recommendation AS-3 to space agencies

3. Conduct studies to trade off benefits of spectral, radiometric, and spatial resolutions of infrared sounders.

4. Consider the development of active techniques for future systems (lidar, radar, GPS).

Action AS-3

ITWG Co-Chairs to present the concerns of this group to space agencies.

Closed

Presented to CGMS-40 (Report of CGMS-40, 66-67 and WG-II report, 104-131)

Recommendation AS-4 to NOAA

3. Develop plans for the next generation infrared sounders (evolution of CrIS) for the JPSS-2 and follow-on satellites.

4. Pursue the development of next generation sounders, which support higher spatial resolution and denser spatial sampling, complementary to the high spectral and high radiometric resolution of IASI-NG; this includes the highest spectral resolution being maintained in all bands and the elimination of band gaps.

Action AS-4

ITWG Co-Chairs to present the recommendation of this group to NOAA.

Closed

Presented to CGMS-40 (Report of CGMS-40, 66-67 and WG-II report, 104-131)

2.4.5 Apodisation of CrIS Data

While CrIS provides a spectral resolution that is closely adapted to the CO₂ line spacing, the apodisation of the spectra reduces the resolution to an extent that information is lost in radiances of single spectral samples which in turn has a damaging effect on the vertical resolution. Most NWP users today make use of a sub-set of spectral samples and therefore will suffer from lost vertical resolution if they select apodised radiances. Users must be enabled to access the full hyperspectral resolution information content of the CrIS data.

Recommendation AS-5 to users

4. Preserve hyperspectral information in CrIS data by utilising either full CrIS spectra or unapodised radiances if a sub-set of spectral samples is utilised.

5. Develop radiative transfer codes for the use with unapodised radiances.

6. Develop radiative transfer codes in PC space and educate users to make use of these in data assimilation (and retrieval).

Or 4. Ensure apodised radiance channel sub-set is representative, i.e. channel subset sufficiently covers spectral band(s) of interest and noise representation includes apodisation and inter-channel correlations.

Recommendation AS-6 to EUMETSAT

Preserve hyperspectral resolution information in CrIS data from EARS by either distributing full CrIS spectra or disseminating unapodised spectral samples if a sub-set needs to be distributed.

Action AS-5

ITWG Co-Chairs to present the concern of this group to EUMETSAT.

Closed

Presented to CGMS-40 (Report of CGMS-40, 66-67 and WG-II report, 104-131)

2.4.6 Full Resolution CrIS Data

While CrIS data are measured at high spectral resolution only spectrally sub-sampled data in mid and short-wave bands are down-linked from the Suomi NPP satellite and distributed to users. The users desire full-resolution spectra in all three bands to fully exploit the data.

Recommendation AS-7 to NOAA

Down-link full resolution data from the CrIS instrument and distribute it to users.

Action AS-6

ITWG Co-Chairs to present the concern of this group to NOAA.

Closed

Presented to CGMS-40 (Report of CGMS-40, 66-67 and WG-II report, 104-131)

2.4.7 Data compression

Future high-resolution sounders will provide data volumes that demand data compression for space-to-ground links as well as for ground transportation. Compression techniques must be exploited to reduce data transmission costs.

Action AS-7 to ITWG

Report current state of compression techniques.

Closed

NWP SAF Workshop on the subject held at ECMWF 5-7 Nov. 2013

Presentations made available to ITSC mailing list.

Recommendation AS-8 to space agencies

Pursue advancement of loss-less compression techniques for hyperspectral sounders.

Dear colleagues,

The recommendations to space agencies are delivered via CGMS. ITWG reports to this body (usually a few weeks after ITSC, though for ITSC-18 it was very soon afterwards).

I do not have to hand the presentation given to CGMS, but a short report for CGMS is always prepared which is more or less the executive summary plus main outcomes / actions.

I think the AS WG actions fall into one of three types:

1. Technical

e.g. AS-6 disseminate unapodised CrIS where sub samples are used

2. Strategic e.g. AS-4 provide hyperspectral in several orbital planes

3. Internal (to ITWG) e.g. AS-7 report on compression techniques

The first type of action should really be placed on a WG member to discuss with the relevant technical expert in the agency, not the ITWG co-chairs.

The second type should always be directed to CGMS and can be placed on the ITWG co-chairs. In recent years Mitch has reported ITWG outcomes to CGMS on our behalf with a version of the executive summary and main outcomes and, I believe, a short presentation of key points (see CGMS-40 report for a flavour of this). ITWG should be very grateful to Mitch for being our rapporteur at CGMS for many meetings, its a crucial role.

AS-1 to 4, 6, and 8 are all in the strategic category and hence closed after CGMS-40. AS-5 is more technical but would also have been communicated through the report to CGMS but may have had more impact if it had been placed on a WG member, perhaps someone from EUMETSAT. However in my opinion it can be closed. AS-7 is in the 3rd category and there has clearly been activity.

Steve

----- Original Message -----

From: "Niels Bormann" <Niels.Bormann@ecmwf.int>

To: "Stephen English" <Stephen.English@ecmwf.int>, "Allen Huang" <allenh@ssec.wisc.edu>

Cc: "Dieter Klaes" <Dieter.Klaes@eumetsat.int>, "Mitch Goldberg" <mitch.goldberg@noaa.gov>, "Bill Smith" <bill.l.smith@cox.net>

Sent: Wednesday, 29 January, 2014 10:27:24 AM

Subject: Re: ITSC Working Groups

Hi Steve and Allen,

Please see the email below from Dieter regarding the status of some actions from the Advanced Sounders WG which were on ITWG co-chairs (ie you for ITSC-18 as agreed earlier). Could you respond to Dieter please?

Thanks,

Niels

On 29/01/14 10:14, Dieter Klaes wrote:

> Dear Niels and Mitch,

>
> I just want to iterate again on the actions of the Advanced Sounder Working Group, and kindly ask for some feedback.
>
> Many thanks and
>
> Best Regards
> Dieter
>
> -----Original Message-----
> From: Peter Schluessel
> Sent: Friday, November 01, 2013 7:50 AM
> To: 'Niels.Bormann@ecmwf.int'; Mitch Goldberg; Bill Smith
> Cc: Dieter Klaes
> Subject: RE: ITSC Working Groups
>
> Dear All,
>
> I will not be attending the ITSC-19. Dieter Klaes is volunteering to co-chair the Advanced Sounder WG.
>
> As for the actions(see below), they are mostly on the ITWG co-chairs, I did not receive any feedback so far.
>
> Regarding AS-7 on compression, this is covered by the NWP SAF workshop that takes place next week at ECMWF.
>
> Kind regards,
> Peter
>
>
>
> Recommendations and actions from Advanced Sounder WG:
>
> Recommendation AS-1 to space agencies (e.g., NOAA, JAXA) Devise plans to fill gaps in geostationary coverage with infrared soundings.
> Action AS-1
> ITWG Co-Chairs to present the concern of this group to CGMS.
>
> Recommendation AS-2 to space agencies
> 1. Pursue the development of advanced microwave sounders with high spectral resolution and reduced noise in order to enhance vertical resolution of temperature and moisture soundings under partial and non-precipitating cloud conditions.
> 2. Extend developments of microwave receiver technology to enable high spectral resolution measurements with lower noise in the 50-60 GHz region.
> 13
>
> Action AS-2
> ITWG Co-Chairs to present the recommendation of this group to relevant space agencies (e.g., NASA, ESA, JAXA).
>
> Recommendation AS-3 to space agencies
> 1. Conduct studies to trade off benefits of spectral, radiometric, and spatial resolutions of infrared sounders.

- > 2. Consider the development of active techniques for future systems (lidar, radar, GPS).
- >
- > Action AS-3
- > ITWG Co-Chairs to present the concerns of this group to space agencies.
- >
- > Recommendation AS-4 to NOAA
- > 1. Develop plans for the next generation infrared sounders (evolution of CrIS) for the JPSS-2 and follow-on satellites.
- > 2. Pursue the development of next generation sounders, which support higher spatial resolution and denser spatial sampling, complementary to the high spectral and high radiometric resolution of IASI-NG; this includes the highest spectral resolution being maintained in all bands and the elimination of band gaps.
- >
- > Action AS-4
- > ITWG Co-Chairs to present the recommendation of this group to NOAA.
- >
- > Recommendation AS-5 to users
- > 1. Preserve hyperspectral information in CrIS data by utilising either full CrIS spectra or unapodised radiances if a sub-set of spectral samples is utilised.
- > 2. Develop radiative transfer codes for the use with unapodised radiances.
- > 3. Develop radiative transfer codes in PC space and educate users to make use of these in data assimilation (and retrieval).
- > Or 4. Ensure apodised radiance channel sub-set is representative, i.e. channel subset sufficiently covers spectral band(s) of interest and noise representation includes apodisation and interchannel correlations.
- >
- > Recommendation AS-6 to EUMETSAT
- > Preserve hyperspectral resolution information in CrIS data from EARS by either distributing full CrIS spectra or disseminating unapodised spectral samples if a sub-set needs to be distributed.
- >
- > Action AS-5
- > ITWG Co-Chairs to present the concern of this group to EUMETSAT.
- >
- > Recommendation AS-7 to NOAA
- > Down-link full resolution data from the CrIS instrument and distribute it to users.
- >
- > Action AS-6
- > ITWG Co-Chairs to present the concern of this group to NOAA.
- >
- > Action AS-7 to ITWG
- > Report current state of compression techniques.
- >
- > Recommendation AS-8 to space agencies
- > Pursue advancement of loss-less compression techniques for hyperspectral sounders.
- >
- >
- > --
- > Peter Schluessel
- > EUMETSAT

> Eumetsat-Allee 1
> 64295 Darmstadt
> Germany
> T +49 6151 807 6990
> F +49 6151 807 8380
>
> -----Original Message-----
> From: Niels Bormann [<mailto:Niels.Bormann@ecmwf.int>]
> Sent: Wednesday, October 23, 2013 5:37 PM
> To: Paul van Delst; stm; Joerg Schulz; Phulpin Thierry; Andrew
> Collard; Fiona Smith; Bill Smith; Peter Schluessel; John Eyre; Jerome
> Lafeuille; Liam Gumley; Nathalie Selbach; Atkinson, Nigel; Christelle
> Ponsard; Hocking, James; Ruston, Dr. Ben; KARBOU Fatima; Fuzhong Weng
> Cc: Mitch Goldberg
> Subject: ITSC Working Groups
>
> Dear WG-Co-chairs,
>
> In about 5 months we'll be meeting again for ITSC-19, so it's a good time to
> start thinking about our working groups.
>
> - Could you please provide us with an update on the status of the action
> items of your working group/subgroups? Also, if there is anything you would
> like us to consider or raise at ITSC-19, please let us know.
>
> - We are very much hoping that you will continue your great work as co-
> chairs of your working group. For our planning, it would be useful if you
> could indicate whether you intend to attend ITSC-19. As at previous meetings,
> we expect that one co-chair per working group will report on the status of the
> actions of their group, and we will schedule working group meetings over the
> weekend.
>
> All the best,
> Niels and Mitch
>
> --
> -----
> Niels Bormann (Dr.)
> Satellite Section
> ECMWF, Shinfield Park, Reading, Berkshire RG2 9AX, U.K.
> Ph: +44 118 949 9652 Fax: +44 118 986 9450
> Email: n.bormann@ecmwf.int WWW: <http://www.ecmwf.int>
>
> -----Original Message-----
> From: Niels Bormann [<mailto:Niels.Bormann@ecmwf.int>]
> Sent: Wednesday, October 23, 2013 5:37 PM
> To: Paul van Delst; stm; Joerg Schulz; Phulpin Thierry; Andrew
> Collard; Fiona Smith; Bill Smith; Peter Schluessel; John Eyre; Jerome
> Lafeuille; Liam Gumley; Nathalie Selbach; Atkinson, Nigel; Christelle
> Ponsard; Hocking, James; Ruston, Dr. Ben; KARBOU Fatima; Fuzhong Weng
> Cc: Mitch Goldberg
> Subject: ITSC Working Groups
>
> Dear WG-Co-chairs,
>

> In about 5 months we'll be meeting again for ITSC-19, so it's a good time to start thinking about our working groups.

>

> - Could you please provide us with an update on the status of the action items of your working group/subgroups? Also, if there is anything you would like us to consider or raise at ITSC-19, please let us know.

>

> - We are very much hoping that you will continue your great work as co-chairs of your working group. For our planning, it would be useful if you could indicate whether you intend to attend ITSC-19. As at previous meetings, we expect that one co-chair per working group will report on the status of the actions of their group, and we will schedule working group meetings over the weekend.

>

> All the best,
> Niels and Mitch

>

> --

> -----

> Niels Bormann (Dr.)
> Satellite Section
> ECMWF, Shinfield Park, Reading, Berkshire RG2 9AX, U.K.
> Ph: +44 118 949 9652 Fax: +44 118 986 9450
> Email: n.bormann@ecmwf.int WWW: <http://www.ecmwf.int>

>

--

Niels Bormann (Dr.)
Satellite Section
ECMWF, Shinfield Park, Reading, Berkshire RG2 9AX, U.K.
Ph: +44 118 949 9652 Fax: +44 118 986 9450
Email: n.bormann@ecmwf.int WWW: <http://www.ecmwf.int>