CGMS-34, NOAA-WP-11
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Agenda Item: II/2
Discussed in WG2

REPORT FROM THE GLOBAL SATELLITE-BASED INTERCALIBRATION SYSTEM (GSICS) EXECUTIVE PANEL

NOAA-WP-11 provides a report from the Global Satellite-based Intercalibration System (GSICS) Executive Panel.

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1 INTRODUCTION

The first session of the Global Space-based Inter-calibration System (GSICS) Executive Panel was held in WMO headquarter, in Geneva, Switzerland on 11-13 October 2006. The GSICS Executive Panel is chaired by Dr Mitch Goldberg of NOAA/NESDIS. NOAA, EUMETSAT, JMA, CNES and WMO participated to this meeting. The list of participants is enclosed as Annex II.

The session was opened at 10:00 on Wednesday 11 October 2006, by Dr Donald Hinsman, Director of the WMO Space Programme. Dr Hinsman welcomed the participants in Geneva and asserted his confidence in the fact that GSICS will become an essential component of the WWW Global Observing System. He described the organization of GSICS and then reminded the main objectives of the Executive Panel. Dr Hinsman thanked the participants in the meeting and wished them a pleasant stay in Geneva.

Dr Mitch Goldberg thanked Dr Hinsman and the participants and underlined the importance of GSICS both for climate products and for Numerical Weather Prediction.

2 OVERVIEW OF GSICS

The session began with an overview of GSICS provided by Dr Goldberg. He emphasized the importance of GSICS in the international context of the Global Earth Observation System of Systems. He recalled GSICS objectives, benefits and outcome in order meet climate and weather requirements. He detailed the Organizational Chart of GSICS and the role of its different components. He finished with a presentation of cal/val activities performed by NESDIS.

In the following discussion, the Executive Panel agreed that the initial focus of GSICS should be operational satellites but that Research and Development space agencies participation to GSICS and its Executive Panel is essential.

2.1 AGENCIES STATUS REPORT

The session continued with the agencies report on Meteorological Satellite Programme, cal/val activities and GSICS related priorities and contributions.

Dr Johannes Schmetz described satellite inter-calibration work in EUMETSAT. He described the inter-calibration between NOAA/HIRS and Meteosat and the operational vicarious calibration of the solar channels of Meteosat performed by EUMETSAT. He

underlined the benefits of hyper-spectral sounders (AIRS and IASI) and the importance of characterization of spectral response for inter-calibration. He emphasized the value of such data for NWP but also for climate research and presented the priorities of EUMETSAT for the coming year, which are: operational inter-calibration with HIRS, use of IASI-AIRS and better understanding of current biases in satellite inter-calibration.

Then, Dr Toshiyuki Kurino introduced the cal/val activities of JMA. He described the procedure of comparisons of brightness temperature (TB) between MTSAT-1R and NOAA satellites. JMA performed two types of comparisons: 'higher' TB over clear sky and ocean and 'lower' TB over smooth cloud top. Then, Dr Kurino detailed the navigation status of MTSAT-1R and its monitoring web page. To finish, he explained the JMA project for re-calibration of the VIS channel data using, especially reference target as moon.

Dr Fuzhong Weng from NOAA reported on GSICS Coordination Centre (GCC) plan. First, he presented the NOAA Integrated Calibration and Validation system (ICVS), giving examples of satellite to satellite matching, noise and telemetry trending and radiance validation using reference sites. Then, he described the GCC plan essentially based on the ICVS. He emphasized the need for detailing technical specifications, software tools developments, key requirements and deliverables for each of the participating agencies. He stressed the need to share software tools among GSICS participants.

The Executive Panel agreed upon the importance of ICVS that would be a core contribution for LEO to LEO calibration in particular.

Dr Patrice Henry reported on the system of inter-calibration in CNES. It consists of using vicarious calibration on 20 desert sites over North Africa and Arabia. Many satellite data for these sites have been stored since 1985 allowing the inter-calibration of numerous satellite instruments (AVHRR, POLDER, SeaWIFS, HRV, VEGETATION, HRS, MERIS, AATSR, MISR, MODIS). He concluded with the future plans for this system, which are site characterization and atmospheric correction improvement, extension of the data base and availability of the latter to users.

The Executive Panel noted that the opening of the data base would be of great interest for users.

Dr George Ohring briefly introduced the Challenges of Global Climate Change and Numerical Prediction and described the outcome of the workshop on Achieving Satellite Inter-Calibration for Climate Change (ASIC3). The workshop emphasized the need for a better evaluation of the magnitude and impact of climate change, which drives requirements for high accuracy climate observing systems. He reported on the recommendations of the workshop: implementation of satellite benchmark missions to create irrefutable record and calibrate other satellite sensors, creation of a U.S. Joint Center for Satellite Inter-Calibration (JCSIC), establishment of a global network of reliable in situ sites for sea level, as well as additional recommendations for UV, VIS, NIR, IR, microwave and broadband radiometers and use of active sensors for benchmark measurements.

2.2 EXPECTED OUTCOME AND OVERVIEW OF GSICS ACTIVITIES

The Panel reviewed the expected outcome of GSICS activities and the related deliverables. This should determine tasks to be conducted by the GCC, GPRCs and other entities.

The expected outcome is:

- To provide quantitative reports on the performance of the space-based component of the Global Observing System
- To provide satellite instrument intercomparison statistics and adjustments
- To deliver normalized calibration with respect to agreed references
- To provide comparison of space-based measurements with numerical simulations and in situ reference measurements
- To analyze this information in order to improve calibration practices

2.3 STEPWISE IMPLEMENTATION

The Panel recognized that the comprehensive set of 62 tasks included in the Implementation Plan should be all ultimately carried out, but should be implemented in a stepwise mode. It was agreed to identify priority tasks for the implementation and initial operations of GSICS. A schematic diagram of initial GSICS implementation in enclosed in Annex III.

In a first step, GSICS will compile and provide visibility on current relevant activities of GSICS participating organizations. GSICS will evaluate these practices, agree on a harmonized methodology for future GSICS activities, undertake pilot actions and identify needs for further research and development.

The GRWG shall provide scientific assessments on the critical issues including priorities of importance, review the requirements through appropriate user consultation, define methodologies, identify research and development needs, and provide scientific guidance.

New GSICS operations shall be initiated and validated on off-line data sets, which are easily accessible. After validation, the GDWG shall then determine the appropriate data circulation and management scheme to perform these operationally on real-time data.

2.2 PRIORITY ACTIVITIES

The Panel identified priority activities in the following areas:

Category of task	Activities	Reference in IP

Executive Panel	Establish the GRWG and GDWG	1.4
GCC	Coordinate definition of technical specifications	2.01
	Guidance on calibration methodology	2.08
	Website information	2.10
GPRC	Operational LEO to LEO co-location	3.1 to 3.7
	Operational GEO to LEO co-location	3.1 to 3.7
	Overlap of LEO time series	4.1 to 4.4
GCC-CSS	Ancillary datasets	8 and 9
Research	Research	5.1 to 5.5

These activities are detailed below.

Establish the GRWG and GDWG

1st GRWG meting

- To be convened in December 2006, in USA
- Shall involve GRWG designated members plus external experts from R&D agencies, ISCCP, GDWG
- GRWG 1 shall focus on infrared measurements and address in priority:
    - Review of co-location methodologies currently applied by JMA (MTSAT-AVHRR), EUMETSAT (Meteosat-HIRS), and ISCCP (all GEOs – AVHRR)
    - Define an agreed GEO to LEO collocation methodology for IR sensors
        - collocation criteria (viewing angle, time window)
        - sampling strategy (target size and numbers, geographical coverage, target selection bright/dark clear/cloudy, temporal frequency)
        - matching technique to account for different fields of views and spectral response
        - statistical processing (bias, or regression, spectral shift, quality index)
    - methodology for spectral convolution (comparison of IR band radiances with hyperspectral measurements)
    - consultation of representative users for climate and NWP
    - take into account current work of IASI cal/val projects
- Expected output is:
    - Agreed initial GEO-LEO methodology,
    - Refined user requirements from NWP and climate monitoring
    - Identification of software tools to be exchanged
    - Definition of a methodology to compare GEO IR radiances with AIRS and IASI radiances

2nd GRWG meeting

- To be convened in June 2007, place TBD

- Main focus on calibration of reflective channels, noting that the co-location criteria won't be the same as for IR because of directional effects, aerosols, atmospheric backscattering, and hot spots.
- Expected output :
    - Methodology for GEO-MODIS comparison for visible channels
    - Radiative transfer requirements for simulations from reference sites

1st GDWG meeting

- To be convened in June 2007, (co-located with GRWG)
- Expected output:
    - Definition of best practices for data management
    - Definition of formats and operational procedures for data exchange

3rd GRWG meeting

- To be convened tentatively December 2007, place TBD
- Shall address calibration support segments, and namely GSICS requirements for Upper Air Network

Coordinate definition of technical specifications

This will be based on the outcome of GRWG and GDWG.

Guidance on calibration methodology

In consolidating user requirements from different application areas with respect to calibration, GSICS will issue guidance regarding

- Pre-launch characterization
- Reference sites
- In-orbit calibration procedures
- Cal/Val activities
- Benchmark measurements
- Sensor performance

Website information

The website will be established by the GCC (NOAA) and include:

- overall presentation of GSICS goals, organization, reference documents
- description of NOAA activities on LEO-LEO calibration
- links to EUMETSAT and JMA information on GEO-LEO calibration
- calibration results, NWP simulations, "cardiograms"
- quarterly reports, notes on methodology
- reference datasets, or links to such information
- (e.g. CNES SADE database of VIS sensor calibration on desert sites)
- information on future meetings and workshops

The website should be completed by June 2007.

Operational LEO-LEO collocation and LEO-LEO time series overlap

In an initial phase, the only GPRC involved in these activities will be NOAA, through its ICVS,

dealing with following inter-comparison:

"Historical" time series overlap	Instrument collocation
	2.2.1.1.1.1.1 Current satellites
HIRS/HIRS	HIRS/AIRS
MSU/MSU	AVHRR/AIRS
AMSU/AMSU	AIRS/MODIS
SSMI/SSMI	SSMIS/AMSU
	TMI/AMSU
	Future satellites
	AIRS/IASI
	AMSR/FY-3

Subject to further review by the GRWG the following instruments will be taken as references:

- VIS: MODIS
- IR: AIRS (then probably IASI)
- MW: still TBD

Operational GEO to LEO calibration

This will rely on each GEO operator with the support of the GCC to provide collocation details.

A first step is to provide information on, and results from, current GEO-LEO comparison activities conducted by JMA, EUMETSAT and ISCCP. This should be made available through the website.

In 2007, once a proper methodology is agreed, calibration of GEO against AIRS shall be implemented, initially as a demonstration. This shall be carried out routinely on real-time data once validated. This shall be then extended to GEO against MODIS (for Visible channels) and against IASI.

Ancillary datasets

The GCC will collect or generate, and maintain, the following datasets:

- SNO/SCO for LEO to LEO collocations
- Opportunities for GEO to LEO collocations
- Campaign data : NAST-I, ARIES
- ARM sites
- Balloon flights
- Radiosondes:
  - Routine Radiosondes with match-up details
  - Special observing periods

- Special high-quality Upper Air Network

Research

Research topics shall include in priority:

- IASI validation
- Review methodology for LEO to LEO collocations
- Review methodology for GEO to LEO collocations
- Review methodology to use desert sites for visible calibration
- Review methodology to use tropical rain forest for microwave calibration
- Use of AIRS and/or IASI for interpretation of spectral response from low spectral resolution IR sounders or imagers, and possible correction by shifting the spectral response curve
- Normalization of thermal radiances at reference wavelengths(infrared and microwave)
- Reduce measurement uncertainties for climate trends detection
- Assess sources of inter-calibration discrepancies

The output of these research activities shall be:

- Capability to normalize radiances from multiple sensors to a recognized reference
- Corrected spectral response functions
- Recommendations on most appropriate radiative transfer algorithm

2.3 TERMS OF REFERENCE

The meeting drafted Terms of Reference for the Executive Panel and the two working groups, as enclosed below in Annex I.

2.4 CONCLUSIONS

The panel agreed that its second meeting should be held through teleconference in March-April 2007 (TBC) to adopt the first GSICS Annual Operating Plan that will be drafted by GCC with the support of WMO Space Programme on the basis of the outcome of GRWG.

The Panel agreed that the WGRG would be chaired by Fred Wu (NOAA/NESDIS) and the GDWG will be chaired by Dr Volker Gaertner (EUMETSAT).

It was agreed that the Executive Panel Chairman would present the conclusions of this first meeting to CGMS XXXIV, in complement to the report from WMO introducing the GSICS Implementation Plan. The Panel recommended that this be discussed by CGMS in plenary session and that CGMS Members should secure appropriate resources to allow timely implementation and efficient operation of GSICS.

WMO underlined that the participation of CNES was an excellent illustration of the valuable contribution that R&D space agencies could make to GSICS.

The chairman closed the meeting by thanking all participants for their contribution to the significant accomplishments during this first Executive Panel session.

Annex I. DRAFT TERMS OF REFERENCE

Executive Panel of the Global Space-based Inter-Calibration System (GSICS)

Draft Terms of Reference

1. **Provide overall guidance for the GSICS**

2. **Monitor and evaluate the performance of the GSICS, including the activities of the GSICS Coordination Centre (GCC), GSICS Processing and Research Centers (GPRC), Calibration Support Segments (CSS), GSICS Research Working Group (GRWG) and the GSICS Data Working Group (GDWG)**

3. **Conduct annual progress reviews of the GSICS**

4. **Nominate the chairpersons of the WRWG and GDWG among the designated members of these groups**

5. **Prepare an annual report to the CGMS and the Director, WMO Space Programme, on the status and accomplishments of the GSICS**

6. **Organize workshops and sessions at scientific meetings to advance the objectives of GSICS and publicize the program's achievements**

7. **Develop and implement mechanisms for obtaining feedback from users of GSICS results**

8. **Prepare the GSICS Annual Operating Plan**

9. **Revise the GSICS Implementation Plan as necessary**

10. **The Executive Panel will agree on its Rules of procedure**

GSICS Data Working Group (GDWG)

Draft Terms of Reference

1. **Develop a detailed plan for implementing the data management activities of the GSICS**

2. **Specify formats and procedures for exchange of data between the satellite agencies, the GSICS Processing and Research Centers, and the GSICS Coordination Center**

3. **Develop specifications for GSICS data archive and access systems**

4. **Oversee and coordinate the data management activities of the GSICS**

5. **Establish and maintain cooperation with the research programs at the GSICS Processing and Research Centers and assist with their data management activities, as appropriate**

6. **Convene at least annually, and more frequently if appropriate.**

7. **Provide the GSICS Executive Panel with a report on GSICS data management activities including recommendations as appropriate. Submit report three weeks prior to the annual meeting of the GSICS Executive Panel, and present it to the Panel.**

GSICS Research Working Group (GRWG)

Draft Terms of Reference

1. **Coordinate the development of and publish the GSICS Research Plan to advance the GSICS Overarching Goal of ensuring the comparability of satellite measurements provided at different times, by different instruments under the responsibility of different satellite operators**

2. **In cooperation with, and with input from the GSICS Processing and Research Centres (GPRC) and other contributing parties, maintain a spreadsheet summarizing the status of research projects supported under the GSICS Distributed Research Component**

3. **Organize annual workshop to review the GSICS research programme.**

4. **Recommend to the GSICS Executive Panel topics for scientific workshops and sessions at scientific meetings to advance the objectives of GSICS**

5. **Provide the GSICS Executive Panel with a report on GSICS science programme status and accomplishments, including recommendations as appropriate. Submit report three weeks prior to the annual meeting of the GSICS Executive Panel, and present it to the Panel.**

Annex II. LIST OF PARTICIPANTS

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Annex III. Schematic diagram of the initial GSICS Implementation