

# ICWG Matters: Report from the International Clouds Working Group

Presented to CGMS-46 Working Group II session, Agenda item WGII/5

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Coordination Group for  
Meteorological Satellites

CGMS-47, Russia, May 2019



## OUTLINE

- **Outcomes of the 2<sup>nd</sup> International Clouds Workshop (ICWG2)**
- **Status of CGMS-46 Recommendations**
- **Other Items of Relevance to CGMS**

## 2<sup>nd</sup> International Clouds Workshop

- University of Wisconsin, Madison, Wisconsin (23 April - 27 April 2018)

**Local Coordinator:** Ralf Bennartz (UW-AOS/Vanderbilt)

- **Sponsored by:** NOAA/NESDIS, EUMETSAT,
- **Co-chaired by:** Andrew Heidinger (NOAA/NESDIS) and Karl-Goran Karlsson (Swedish Hydro and Met Inst. /SMHI)
- 80-85 participants
- **Working Groups / Sessions:**
  - Algorithms
  - Assessments
  - Climate Applications
  - Weather Applications
  - International Collaboration



- **Topical Groups that Convened in ICWG-2**
  - Cloud Height for AMV (shared with IWWG)
  - Cloud Detection
  - Retrieval methods, models and uncertainty
  - Microwave Retrievals
  - Cloud Product Intercomparison
  - Severe Weather

## ICWG Organization: Sub-Working and Topical Groups

- **Algorithms**
  - Retrieval Methods (Phil Watts & Bryan Baum)
  - Cloud Masking (Karl-Goran Karlsson)
  - Microwave (Ralf Bennartz)
- **Assessments**
  - Cloud Product Intercomparisons (Andi Walther)
- **Climate Applications**
  - Climate Applications (Mike Foster)
- **Weather Applications**
  - Severe Weather (Mike Pavolonis)
  - Winds (Steve Wanzong, Dong Wu)
- **International Collaboration**
  - International Collaboration (Dong Wu, Andrew Heidinger)

*Sub-Working Groups are permanent*

*Topical Groups can be modified based on ICWG feedback*

## 2<sup>nd</sup> International Clouds Workshop, main outcomes (1/4)

### Weather Applications Summary:

- IWWG collaboration with ICWG remains productive. A topical group was created to facilitate this collaboration and multiple members of the IWWG attend this meeting.
- Optimal Wind Target heights are usually below the true top height of the cloud being tracked. There remains a physical disconnect between the retrieved heights and the target heights for each wavelength used. ICWG requests guidance from IWWG on future development of cloud heights.
- Members of the solar energy community attended and briefed ICWG on the use of cloud properties for solar energy applications.
- Use of cloud properties for data and/or radiance assimilation is growing and we should form a topical group to focus on this, perhaps coordinating with ITWG.

### Weather Applications Recommendations:

- The ICWG should invite a lightning expert(s) to next ICWG meeting
- IWWG community would like height errors expressed in hPa and we should encourage height providers to include CTP uncertainty in their data.
- IWWG suggests that they conduct studies to see if AMV errors correlate with CTP uncertainties.
  - OE cost and other metrics should also be considered.
- Recommend a new Golden Day for IWWG and ICWG comparisons when Aeolus is available.
- The next ICWG inter-comparison exercise will include analysis of time series of cloud properties for pre-defined cloud objects that capture the life cycle of severe and non-severe mid-latitude convection.

## 2<sup>nd</sup> International Clouds Workshop, main outcomes (2/4)

### Climate Applications Working Group Summary

- The Climate Working Group is continuing to coordinate its work with the GEWEX Cloud Assessment Project led by Claudia Stubenrauch. One group decided to add their data for the first time.
- The ICWG climate group is extending these analyses beyond what was done in GEWEX but the mechanism is still to be determined.
- What is the connection between CGMS and IPCC, and should we be working towards satellite cloud climate records playing a larger role in the IPCC reports?
- Inter-sensor consistency/calibration particularly when sensors are very different and necessary for continuity among climate records (e.g., AVHRR->VIIRS)

### Climate Applications Working Group Recommendations

- Satellite Data Providers generate subsampled versions of level-1B products for recent and future launches to facilitate CDR reprocessing, for example, MODIS MYD02SSH and GAC-format versions of VIIRS data.
- Climate product developers should add uncertainties in a standard way to facilitate meaningful comparisons.

2<sup>nd</sup> International Clouds Workshop, main outcomes (3/4)

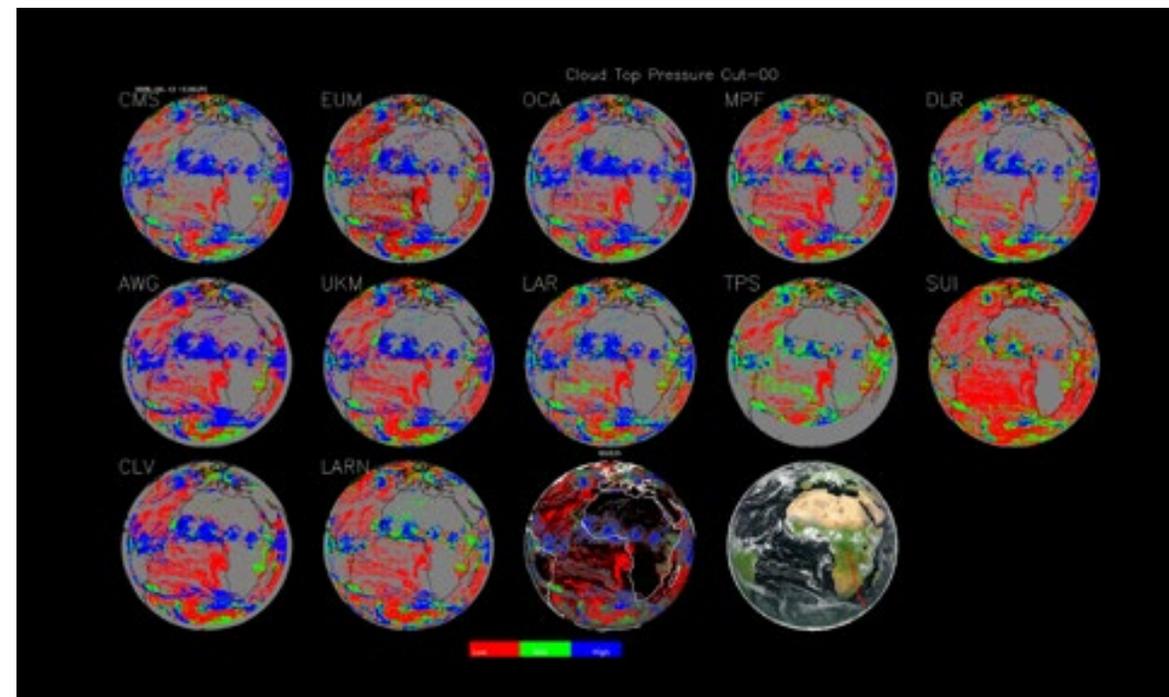
**Intercomparison Working Group Summary**

- Intercomparison group continues to support a set of IDL tools and data hosted by the University of Lille, France.
- The golden day data grew to include a day suggested by the IWWG (HIMAWARI-8: June 21, 2018).
- A standard set of analyses was completed for all data-sets submitted.
- The data policy was discussed and we agreed that publications will require approval from individual algorithm owners.
- A best-fit cloud-top pressure analysis was also shown.

**Intercomparison Working Group Recommendations**

- GOES-16/GOES-17 will be chosen in concert in IWWG.
- Support for a dedicated person to conduct analysis and generate reports as needed.

Example of the “CREW”-like analysis from ICWG IDL Tools



## 2<sup>nd</sup> International Clouds Workshop, main outcomes (3/4)

### Algorithm Working Group Summary

- Active instruments are playing a larger role in serving as training data for physical and machine learning approaches. Access to them in the long-term is a concern for cloud algorithm developers.
- This topical group identified the following prioritised modelling topics for further research in the cloud remote sensing community:
  - *Multi-layered clouds, Ice particle optical properties, Harmonization of Cloud Type Products*
- For the first time, microwave cloud retrievals were discussed and a dedicated topical group formed. They discussed modelling, continuity of conical scanning imager record, upcoming sub-mm missions and issues with the validation of cloud properties.
- This topical group has suggested forming three new sub-working groups as listed below:
  - sub-working group on ice models
  - sub-working group to refine the cloud type definitions
  - sub-working group on uncertainties across the retrieval process

### Algorithm Working Group Recommendations:

- We recommend the establishment of common definitions for 4-level cloud masks and for cloud type products.
- We recommend discussing the impact of machine learning and artificial intelligence approaches.

## 2<sup>nd</sup> International Clouds Workshop, main outcomes (3/4)

### International Collaboration Working Group Discussions:

- Members of the IWWG, IPWG and GSICS participated in ICWG-2.
- The Cloud-Height / AMV group met and the idea of sharing a topical group among the CGMS Working Groups is a good one.
- There is a lot of overlap in the issues facing cloud retrievals and modelling and the issues with precipitation retrievals and modelling.
- ICWG is concerned about variation in calibration from current sensors with on-board solar calibration systems. GSICS (Dave Doelling) gave a very appreciated review of GSICS activity in this and other areas.

### International Collaboration Working Group Recommendations:

- ICWG continues to work closely with IWWG
- **ICWG sends representation to IPWG and ITWG and invites them to ICWG-3.**

## Other items of relevance to CGMS

**R44.05: CGMS members to budget a baseline funding for the cloud intercomparison study, given its importance and impacts on global cloud products.**

- Answer: ICWG thanks the agencies for providing data for ICWG-2 and we hope to have similar participation in ICWG-3. ICWG would like to seek support like other WGs for publishing the intercomparison report.

**A44.06: To enhance coordination, ISWGs to discuss with ICWG co-chairs key items for collaboration.**

- Answer: ICWG-2 had in-person participation from IWWG and IPWG and remote participation from GSICS. ICWG has a standing topical group focused on collaboration with the IWWG and this been successful and ICWG would like to try the same with IPWG.
- ICWG would also like to connect with ITWG on the use of cloud products in radiance assimilation applications.

**ICWG-3 to be hosted at EUMETSAT (TBD) late Summer or Fall 2020.**

**IWW15 to be hosted by ESA/KNMI in Utrecht, Netherlands, April 2020.**

- ICWG recommendations slides follow, but not presented here today

## ICWG2 Recommendations

### **ICWG Rec 1 to cloud product generators: Agencies should contribute their cloud products for the GOES-16 Golden Day**

- IWWG will select a day with optimal Aeolus coverage and provide to ICWG.
- We encourage agencies to update their data from existing golden days in the ICWG database.
- ICWG seeks support for assisting in publishing the intercomparison results after ICWG-3.
- The tentative Golden Day date selected by IWWG is 21 September 2018.

## ICWG2 Recommendations

**ICWG Rec 2 to cloud height generators: Agencies should provide Cloud-Top Pressure uncertainty and additional data for upcoming ICWG/IWWG intercomparisons.**

- Agencies should contribute their cloud products for the GOES-16 Golden Day to be selected in coordination with the IWWG.
- We request agencies provide cloud top pressure uncertainty in hPa in their level-2 data stream.
- If possible, this collaboration would like to extend to the analysis of cloud base and multilayer flag information.
- We continue to request support for ICWG and IWWG members to collaborate.

## ICWG2 Recommendations

**ICWG Rec 3 to cloud climate data record producers: Agencies should provide uncertainties in the cloud climate data records and continue to support the GEWEX Cloud Assessment.**

- The ICWG CTG wants to continue its relationship with the GEWEX DAP Cloud Climate Assessment.
- The WG requests data providers include uncertainties and make clear any constraints and/or limitations on use. We also solicit best practices for aggregation of uncertainties.
- The WG highlighted the usefulness of the A-train satellite constellation and express our support for similar missions

## ICWG2 Recommendations

### **ICWG Rec 4 to cloud product producers: Agencies should support analysis of their products in the context of severe convection.**

- The next ICWG inter-comparison exercise should include analysis of time series of cloud properties for pre-defined cloud objects that capture the life cycle of severe and non-severe mid-latitude convection. Either 5 minute SEVIRI, 2.5 minute Himawari-8, or 1 minute GOES-16 data should be utilized. A mechanism for supporting such an analysis has not yet been identified.
- The ICWG should utilize the results of the WMO SCOPE-Nowcasting survey to help develop consensus standards for satellite metrics that characterize the evolution of convection.
- The ICWG should invite a lightning expert(s) to next ICWG meeting
- We recommend that CGMS agencies consider introducing multi-sensor (satellite and ground-based measurements) applications for convective nowcasting when developing/updating product requirements. Satellite products that quantitatively identify robust storm top features (overshooting tops, above anvil cirrus, gravity waves) should also be considered when formulating or updating requirements.

## ICWG2 Recommendations

### **ICWG Rec 4 to cloud product producers: Agencies should harmonize their cloud products.**

- Many agencies make cloud type products but there is a wide range in the number and meaning of the cloud types.
- Many agencies make 4-level cloud masks but definitions of the various mask classification differ and this makes comparisons challenging.
- ICWG recommends agencies pursue a harmonization in the generation of these two products.

## Status of CGMS-45 Recommendations

**A44.02- to CGMS space agencies : CGMS members to submit data to the ICWG intercomparison: full-disk data at 10 minute temporal resolution, 2 km spatial resolution in the native AHI projection is preferred. The data should be submitted by 1 September 2016.**

- Propose to close A44.02.
- Future ICWG intercomparison studies should be funded in a similar manner to CREW (ICWG predecessor) and IWWG studies. ICWG seeks guidance on this.

## Status of CGMS-45 Recommendations

**R45.01- to ICWG : ICWG to liaise with IPWG to explore common interests in the area of cloud microphysics and scattering libraries of hydrometeors (liquid, ice).**

- Ben Johnson (IPWG) attended ICWG-2 and gave a briefing on the IPWG and areas of collaboration.
- ICWG would like to establish a topical group to meet on this collaboration and include membership from IPWG. This group could meet at both meetings as warranted. The areas of collaboration would include cloud modeling and use of cloud microphysical products in precipitation retrievals.

## Status of HLPP Relevant to ICWG

### 4.2.4: Develop best practices for retrieving cloud properties, using the converging capabilities of next -generation geostationary imagers

- ICWG continued to run an intercomparison of cloud properties for the existing golden days (SEVIRI/AHI) and a new golden day for AHI chosen in collaboration with IWWG (July 21, 2016).
- Agencies submitted data ahead of the meeting and a standard analysis was conducted and discussed in the intercomparison group. The ICWG continues to support publicly available tools and data library hosted by the University of Lille.
- The ICWG/IWWG collaboration is also developing analyses relevant to the use of heights for the AMV application.
- The IWWG has chosen 21 September 2018 as a Golden Day for GOES-16 and Aeolus comparisons (preliminary).
- The ICWG intercomparison group is planning on automating data submission and analysis in the future.
- ICWG will participate in the comparison of techniques for generating the International Satellite Cloud Climatology Project Next Generation (ISCCP-NG) under the direction of the GEWEX Data and Analysis Panel.

## Status of HLPP Relevant to ICWG

**4.2.5: Using current and future geostationary imagers and sounders, generate and disseminate consistent basic nowcasting products, initially in pilot areas, as identified in SCOPE -Nowcasting.**

- With the adoption of 10-minute full-disk scans by GOES16 and GOES17, all full-disk scans from all advanced geostationary imagers are available at 10 minutes.
- ICWG data submissions include full temporal resolution and this data is available to interrogate the use of cloud properties for nowcasting applications.
- ICWG welcomes the opportunity to collaborate with the community on use of the submitted cloud products for use with non-satellite information.
- ICWG weather applications group intends to compare products over severe weather including through the life-time of storms.

**Recommendations from ICWG for the attention of CGMS 47**

**Recommendation 1 to CGMS: Agencies should contribute their cloud products for the GOES-16 Golden Day**

**Recommendation 2 to CGMS: Agencies should provide Cloud-Top Pressure uncertainty and additional data for upcoming ICWG/IWWG intercomparisons.**

**Recommendation 3 to CGMS: Agencies should provide uncertainties in the cloud climate data records and continue to support the GEWEX Cloud Assessment.**

**Recommendation 4 to CGMS: Agencies should support analysis of their products in the context of severe convection.**

## Further Information

Please visit ICWG Page

<http://www.icare.univ-lille1.fr/crew/index.php/Welcome>

Please visit the ICWG-2 Web page:

<https://cimss.ssec.wisc.edu/icwg/program.html>

ICWG-3 Planned in Late Summer/Early Fall 2020 in Europe.