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International Clouds Working Group

(Submitted by Bryan Baum and Rob Roebeling)

Summary and Purpose of Document

This document provides a short overview of the current status of the International Clouds Working Group within CGMS. It informs the Team about the establishment of the International Cloud Working Group that was endorsed at the 42nd CGMS meeting in Guangzhou, China, 19-23 May 2014. Moreover, it informs the Team about the current membership, objectives, work plan and activities of the ICWG. Finally, it presents the results and main recommendations of the 4th Cloud Retrieval Evaluation Workshop (CREW-4) held in March 2014 in Grainau, Germany.

International Clouds Working Group

Endorsement of the International Clouds Working Group

The International Clouds Working Group (ICWG) was endorsed at the 42nd CGMS meeting in Guangzhou, China, 19-23 May 2014. Within WG-II of this meeting the nominated ICWG representatives presented the Terms of References (ToRs) for the proposed ICWG, which are describe in CGMS paper: CGMS-42 EUM-WP-25. The CGMS-42 plenary endorsed the ICWG as CGMS science working group.

Membership

The ICWG includes representatives nominated by the satellite operators of the CGMS, other members of CGMS and relevant research satellite operators. The Working Group is widely open to participation from any representative of the user community expressing interest and/or willing to contribute to cloud retrieval science and its applications. Currently, the ICWG is co-chaired by Bryan Baum (University of Wisconsin-Madison) and Rob Roebeling (EUMETSAT), whereas Dong Wu (NASA) is the CGMS rapporteur.

Terms of Reference

The goal of the ICWG is to enhance our knowledge on quantitative cloud parameter retrievals from state-of-art algorithms, and to pave the path towards optimizing their retrieval algorithms for near-term (on the order of hours; now-casting), short-term (1-5 days; weather forecasting), medium-term (months to years; regional monitoring), and decadal (climatological cloud analyses), as well for potential improvements in the cloud and convection parameterizations adopted in weather and climate models. Users of cloud products want assurances that the products are well characterised, meaning that there is a well-defined assessment of the strengths and weaknesses of the various cloud parameters. An over-arching goal of the Group is for the community to reach harmony on the best practices for characterising each cloud data set. The ICWG builds upon the expertise of scientists who are involved in atmospheric radiative transfer and the retrieval of cloud parameters from satellite observations.

The overarching objectives of the ICWG are to:

1. foster commonality for level-2 and level-3 operational cloud parameter retrievals and/or products;
2. contribute to the assessment of differences between level-2 cloud parameter retrievals;
3. contribute to the validation of both level-2 cloud parameter retrievals and their error estimates;
4. identify and address research questions on level-2 cloud parameter retrieval algorithms and level-3 aggregation methods;
5. contribute to process studies of clouds and/or convection;
6. contribute to the definition of new space borne observation capabilities for cloud parameter retrievals and validation;
7. support and stimulate training of the operational and scientific community;
8. enhance the communication in this field and develop international partnerships.

In addressing these objectives, and to underpin the value of cloud parameter retrievals in weather and climate applications, the Working Group proposes to promote the:

- sharing of approaches among algorithm developers;
- performing of regular cloud parameter retrieval assessments;
- further improvement of level-2/level-3 cloud parameter retrievals;
- characterization of level-2/level-3 cloud parameter retrieval uncertainties at different space/time scales;

- adoption of standards for validation procedures and describing error estimates;
- adoption of self-describing data formats for level-2 cloud parameter products;
- use of common ancillary data;
- use of a common set of forward simulators to analyse algorithm differences;
- more efficient process for addressing the research questions identified by space agencies and WMO programmes (e.g. GEWEX);
- establishment and coordination of sub-working groups addressing specific research topics.

To achieve its objectives, ICWG needs a structure that provides:

- Biennial workshops;
- Training towards retrieving and interpreting cloud parameter products;
- Advice to CGMS member agencies at CGMS plenary;
- A forum to initiate and support validation efforts;
- Opportunities to participate in joint research projects;
- Outreach to users in the weather and climate communities.

Results and Recommendations of CREW-4

The 4th Cloud Retrieval Evaluation Workshop (CREW-4) is the precursor for the biennial workshops that shall be organized by the ICWG. During the CREW-4 (March 2014, Grainau, Germany) the developments on the latest status of research on cloud parameter retrievals were presented and discussed. A noticeable finding of CREW-4 was the increased number of research groups that now implement optimal estimation methods in their operational retrievals. In addition, some research groups have started to combine observations from both passive and active instruments. While the active sensors provide information for only a very small portion of the imager swath, these observations are critical for improving global cloud parameter retrievals. Moreover, the preliminary results presented on the assessments of error estimates produced by some of the retrieval schemes were an important step towards quantifying these estimates in a more systematic manner. These assessments reveal that error estimates compare reasonably well in multiple algorithm ensembles or against the true uncertainty between retrieved and observed cloud parameters. Finally, the evaluation of aggregation methods and filtering rules revealed that the manner of aggregating or filtering level-2 data creates systematic differences in level-3 products that tend to vary regionally depending on climate regions and/or surface conditions. Although the differences are smaller than those between level-2 retrievals they are not negligible.

The main recommendations of the workshop towards future cloud retrieval research are:

- Improve cloud models used in retrievals to more accurately reflect reality, in particular ice crystal models, vertical in-homogeneity, and multiple layers;
- Explore the potential of combining different types of observations in level-2 cloud retrievals methods;
- Explore the definition of a set of essential filtering rules in level-3 aggregation methods for different cloud parameters;
- Work toward the characterization of uncertainties in level-2 and level-3 products;
- Explore production of multi-algorithm ensembles to assess uncertainty/sensitivity;
- Explore the production of long-term datasets aimed at stability and accurate assessment of product strengths and weaknesses;
- Use common ancillary data and validation procedures for level-2 and level-3 data;
- Establish sub-working groups to make progress on a variety of outstanding issues, for example multi-layered clouds, severe weather applications, and aggregation methods.

Next Workshop

The first workshop of the ICWG is planned to be held in Lille, France from 17 till 20 May 2016. This workshop is organized by Université des Sciences et Technologies de Lille.