Potential New Cloud Assessment and Link to CGMS ICWG

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Outline

- ICWG Review
- Report from ICWG Climate Topical Group
- Thoughts on Future Cloud Assessments

ICWG REVIEW

ICWG Biennial workshop

The 1st biennial workshop of the ICWG, or ICWG-1, was held in Lille, France from 17 to 20 May 2016, with ~85 attendees. The workshop covered a wide range of topics concerning cloud parameter retrievals, its applications and related issues.

Key issues of the ICWG-1 are:

- Cloud Modelling
- Cloud Parameter Retrievals from
 Combined Sensors
- Aggregation Methods for Climate
 Applications
- Assessment of Cloud Parameter Retrievals and their Uncertainty Estimates [LINK WITH IWWG]
- Cloud Parameters in Weather and Climate Applications



ICWG-1 17-20 May 2016, Lille, France, Europe

Organized by Université de Lille 1 - Sciences & Technologies, France Financially supported by EUMETSAT

Website:

http://www.icare.univ-lille1.fr/crew/ index.php/Welcome_ICWG.

ICWG Interactions with Other WGs.

CGMS Action (R43.11) is for ICWG and IWWG to liaise as appropriate on the provision of further information characterising the AMV derivation for enhanced QC and error characterisation

ICWG-IWWG interactions:

Andy Heidinger from ICWG will be the liaison to IWWG. He and Dong Wu will
participate in IWW-13 to be held in Monterey, CA, in June 2016. Regis Borde from
IWWG attended ICWG-1 in Lille, France, in May 2016.

ICWG-IPWG interactions:

 Cloud-precipitation connection is also recognized in ICWG-1 and highlighted in a number of presentation papers. Rémy Roca and Ralf Bennartz, who plan to attend IPWG-8 meeting in October 2016 in Bologna, Italy, will help to facilitate further cooperation between the two groups.

Recalling Actions and Recommendations from CGMS-43 (May 2015)

In Nov 2015 Co-chair R Roebling drafted white paper to be circulated within ICWG. The common cloud parameters discussed at ICWG-1 include: cloud mask (CM), cloud top temperature (CTT), cloud emissivity, effective radius (Re), and cloud optical thickness (COT).

ICWG	WGII/8	R43.14	ICWG should put focus on investigating data from the new-
			generations instruments on Himawari-8 and if available GOES-
			R for the retrieval of cloud parameters.

In Nov 2015 ICWG established a TG titled "Assessment of level-2 Passive Imager Cloud Parameter Retrievals", to assess the differences in Cloud Parameter Retrievals over the Asian region, applying existing retrieval algorithms to Himawari-8 measurements on 19 August 2015 (as the golden day for intercomparison).

Example ICWG Analysis: Cloud top temperature (CTT)



Taylor Plot of AHI CTT Comparisons

One standard ICWG analysis is the making Taylor plots for cloud height (CTT) using CALIPSO as a reference.

- Unfortunately, not all data have CTH, CTT and CTP. So a single Taylor never has all participants.
- Colored ovals show groupings for 3 cloud types.
- All algorithm suffer as clouds become thin and vertical structures become more complex.
- Inter-algorithm deviation is largest for multi-layer.



Suggested Action Items to CGMS from ICWG-1

(From Cloud Inter-Comparison Group)

• CGMS members to submit their data to the ICWG intercomparison. Fulldisk data at 10 minute temporal resolution, 2 km spatial resolution in the native AHI projection is preferred. The data should be submitted by September 1, 2016.

Recommendation to CGMS

- CGMS members to budget a baseline funding for the intercomparison study, given its importance and impacts on global cloud products. Currently, ICWG helps to facilitate to collect the data (e.g., level-3 climate data record in TG Climate Product, level-2 retrieval assessment in TG Intercomparison), but many teams carried out the efforts on a volunteer basis. Lack of funding limited the scope and prohibited a definitive analysis of the new HIMAWARI-8 data set.
- EUMETSAT is funding a Visiting Scientist Project to develop open-source software. (Anke Thoss SMHI is the Sponsor)

Notes and Recommendations from the Climate Products Topical Group

ICWG 2016 – Lille, France

GEWEX Cloud Assessment Discussion at IWCG

• The Climate Product Topical Group discussed the value of the GEWEX Cloud Assessment as an archive for level3 cloud climatologies in a shared format. To this end six of the participants present agreed to either add or extend their data holdings in the GEWEX archive (climserv.ipsl.polytechnique.fr/gewexca/):

SATCorps	PATMOS-x	CLARA-A2
HIRS CMSAF	Cloud_CCI	CALIPSO

- Questions raised regarding the current GEWEX format included whether:
 - The current level3 spatial resolution (1°x1°) would be sufficient for current and future model needs (perhaps add 0.5°x0.5° when possible)
 - We need to add or change included variables (CDNC, radiative properties)
 - Given the increase in AVHRR- and HIRS-derived records a method for satellite drift should be included;
 - Averaging standards should be developed to account for visible saturation for optical retrievals
 - Uncertainty estimates should be integrated into the averaging process.
 - Recommendation to ICWG and GEWEX DAP
 - The Climate Product Topical Group expressed interest in extending and expanding GEWEX Cloud Assessment activities in the ICWG framework.

Climate Topics Discussed at ICWG Not Directly Related to GEWEX

- The Climate Product Topical Group pointed out the *importance of CALIPSO and the upcoming EarthCare mission* for validation of satellite cloud properties. The availability of satellite-derived lidar cloud measurements is essential for validation of long-term cloud records.
 - The Climate Product Topical Group discussed prominent issues facing those groups developing climate data sets (CDRs) from heritage sensors like HIRS and AVHRR. In recent years the number of cloud climate records developed from these sensors has steadily grown. Three issues identified as being priorities for this group include: 1) calibration; 2) reliance on reanalysis products as ancillary data; 3) Aliasing effects caused by orbital drift. These are issues that specifically affect stability of these records over time, limiting their usefulness for certain climate applications such as trend detection.
 - The Climate Product Topical Group **discussed the challenges of re-processing modern satellites for CDR purposes** as the amount of data produced by these satellites rapidly increases. The amount of data produced by Suomi NPP, Himawari and others and future launches (e.g. GOES-R series) is large enough to make it difficult to re-process.

One Issue: Pre- versus Post-2000 Record Stability

- In BAMS SotC 2008 we had 4 data sets for the time series, 3 of which were from satellite records (ISCCP, HIRS and PATMOS-x).
- In BAMS SotC 2015 we included 8 satellites records. We would like to continue to grow this number.
- Over that period we went from one AVHRR-derived record (PATMOS-x) to at least four (PATMOS-x, CLARA-A2, SATCorp, Cloud_CCI)
- Discussion topic:
 - Is it time to discuss collaborations on addressing known issues with this record?





Another Issue: Effect of ENSO on Climate Record Stability

multivariate enso index

- Focus of 2015: largest El Niño event since before the NASA EOS era
- Records, including those derived from AVHRR, were still in agreement.
- This weakens the case that earlyrecord variability can be attributed to ENSO events



ICWG climate topical group could serve as a platform for studying areas identified as weaknesses or outstanding questions that apply to all or many of the GEWEX CA cloud climate records

THOUGHTS ON NEW ASSESSMENTS

GEWEX Cloud Assessment Improvements

- Many of the GEWEX data sets are improving.
- Work continues to improve their stability.
- For example, CLARA-A2 is much more stable than CLARA-A1.
- PATMOS-x will fix its error in IWP in the GEWEX CA library where the annual cycle was off.
- In summary, the GEWEX CA data is getting better over time.
- GEWEX CA report has helped identify many issues that have been unnoticed.

Example of improvement in the GEWEX CA (PATMOS-x IWP) The error was in generation of the averages,, not the algorithm

Cloud Ice Water Path



New Geostationary Imagers

- We are in period where the geo constellation is being updated and unified.
- MODIS-like spatial and spectral information
- Temporal sampling is 10 minutes for full disk and it will be synchronized (imho).
- Common channels in 1980 were 0.65 & 11 micron
- New common channels (AHI, ABI, AMI, FY-4, MTG): 0.45, 0.65, 0.86, 1.6, 3.75, 6.2, 7.2, 8.5, 11, 12, 13.3 micron
- Except for MTG, all of the imagers made by ITT

 perhaps leads to commonality in calibration
 and navigation quality.



True Color at 10 minutes from AHI



Opportunities with New Geostationary Imagers

What can future climatologies do with this vast volume of data?

- Do nothing and continue to make standard level-3
- New parameters like growth or glaciation rates?
- Treat clouds as objects and store their mean properties?



GOES 1 minute data

A PATMOS-x Library of DCC Objects

We have constructed a library of Deep Convective Cloud (DCC) Objects.

- 1. Detect DCC's using previous criteria (clouds that near the Tropopause)
- 2. If DCC pixels are contiguous (i.e. they touch) combine into a single DCC object.

3. For each DCC object, we record the following: location

- local and UTC Time
- size
- minimum 11 micron B.T.
- surface temperature*
- tropopause temperature*
- total precipitable water*
- K Index*
- particle effective radius
- surface type*
- * ancillary data including CFSR

NOAA-19 AVHRR 11 µm BT Day 340, Year 2012 (night) DCC detections are colored ref





Example DCC Object Info.

Object id = 1883297 Year = 2012 Doy = 340 Lat = -5 N Lon = -10 E Sensor = AVHRR Local Time = 2.43



Min T11 = 202 K Trop Temp = 195 K Sfc Temp = 300 K TPW = 4 g/m^2 K Index = 35 K Size = 3450 km^2

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Conclusions

ICWG Conclusions

- What is the role of ICWG climate topical group?
 - Is it a supplement to GEWEX CA Meetings?
 - Does it focus only on climate products from operational agencies and their coordination?
 - GEWEX CA library is still very relevant and most ICWG participants are updating their data in the GEWEX CA library.
 - ICWG can form new topical groups to investigate issues relevant to GEWEX.
- ICWG is a natural voice for the cloud climate community to express their needs to the operational agencies via CGMS actions.
 - common spatial and temporal sampling
 - generation of thinned level1b to facilitate reprocessing (similar to MODIS MYD02SSH)
 - operational agencies seem very open to any user request.

New Geostationary Conclusions

- Global geostationary observing system is rapidly evolving but in a common way that will provide synchronized sub-hourly data with MODIS like spatial and spectral resolution.
- The data records are short but the commonality makes them appealing for climate-relevant process studies.
- At least for the geostationary imager CDRs, some thought is needed on how to grapple with observations
 - Maybe storing clouds as data objects
 - ICWG offers a voice to the operational agencies to request climate-specific actions.
- Definitely offers a potential for a new GEWEX analysis

Thoughts on New Cloud Assessment

- We have established there is broad interest in extending and ۲ improving the GEWEX CA Library.
- What other activities could we do? ۲
 - a. Redo the first assessment (new products, new resolution)
 - b. Spawn off focused assessments (i.e. cloud water path)
 - c. Apply the GEWEX CA library to some interesting questions using uniform analysis.
 - k-means cluster analysis is possible with this data
 - Library is applicable to some of the grand challenge questions
 - d. Something entirely different (Obs4Mips, ISCCP-centric ?)
- I vote for "c" and we poll the community for the questions that ۲ interest them enough to continue to participate. 24

The End, Thank You!

