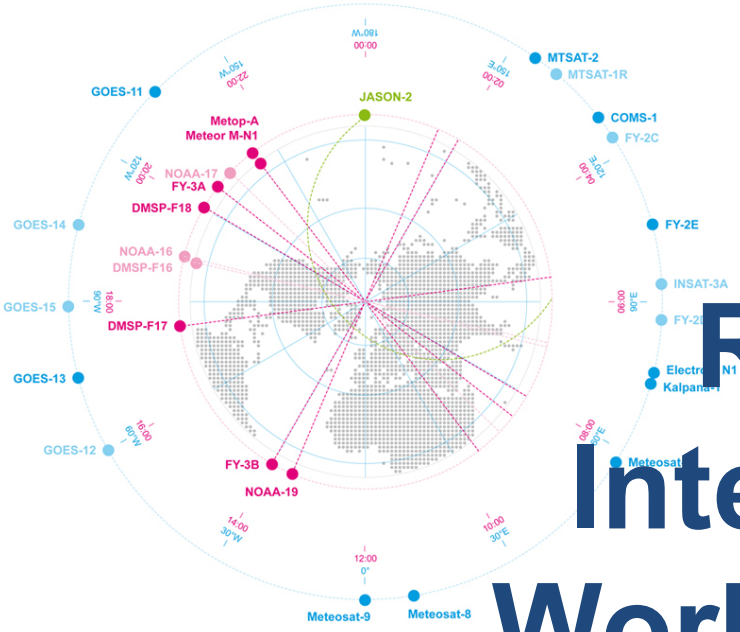


Report from the International Clouds Working Group (ICWG)

Presented to IWWG-13

Rapporteur: Dong Wu (NASA/GSFC)

Co-Chairs: Rob Roebeling (EUMETSAT)
Bryan Baum (U. Wisc, SSEC) (retired 06/16)
Andrew Heidinger (NOAA) (since 06/16)

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.

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

Action:

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.

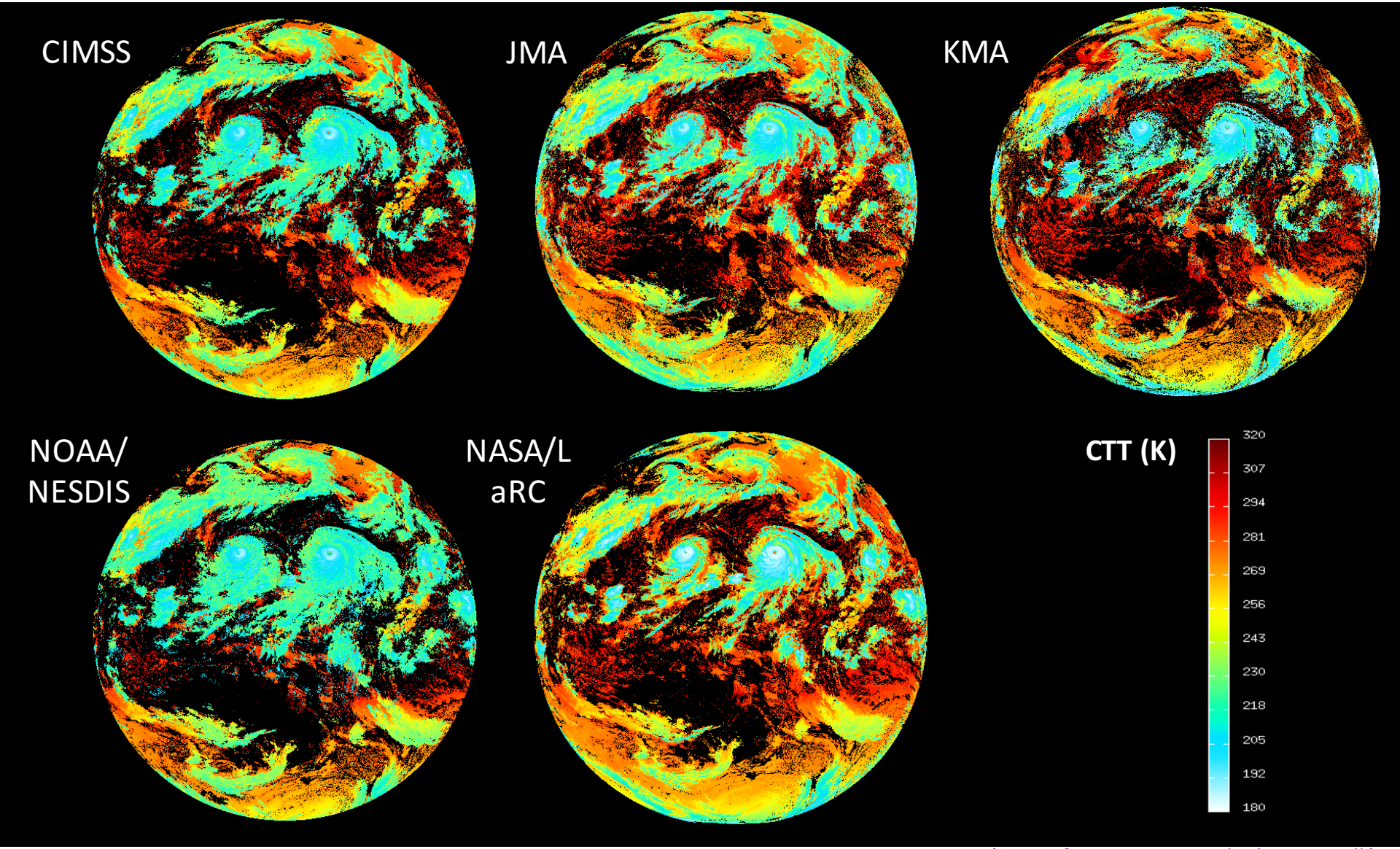
Response:

- 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 inter-comparison).
- Participants at the time of the meeting: NOAA, JMA, CMA*, KMA, PATMOS-x, NASA GSFC and NASA LARC
- EUMETSAT NWCSAF and UK Met Office have contributed data since the meeting.
- CMA and CCI are coming. (CMA delivered FY-3 data)

Standard ICWG (aka CREW) Analysis

- We select golden days. Several for MSG/SEVIRI and new one for HIMARI-8/AHI. Polar analysis lags geo.
- The common cloud parameters discussed at ICWG-1 include: cloud mask (CM), cloud top temperature, height and pressure (CTT,CTH & CTP), cloud emissivity, effective radius (Re), and cloud optical thickness (COT).
- Scatterplots among the participants are used to look for outliers.
- Colocations with the EOS A-Train (CALIPSO, CloudSat) for quantitative evaluation.
- Taylor plots to summarize performance for selected parameters (CTP, CTH, CTT).
- Images showing areas of largest deviations among the participants are used to find sub regions of interest.

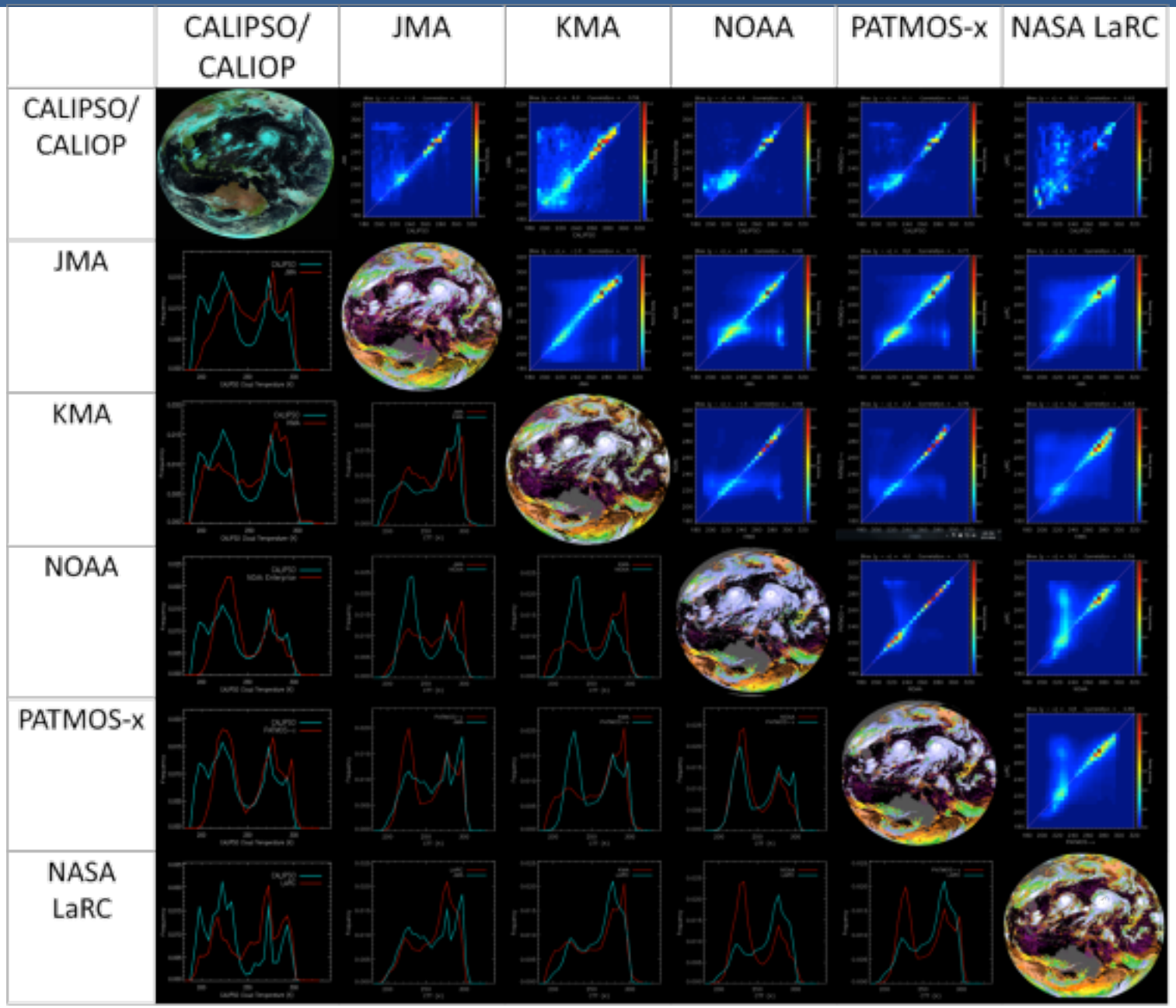
Cloud top temperature (CTT)



(image from Yong-Sang Choi's ICWG talk)

ICWG Scatterplot Example

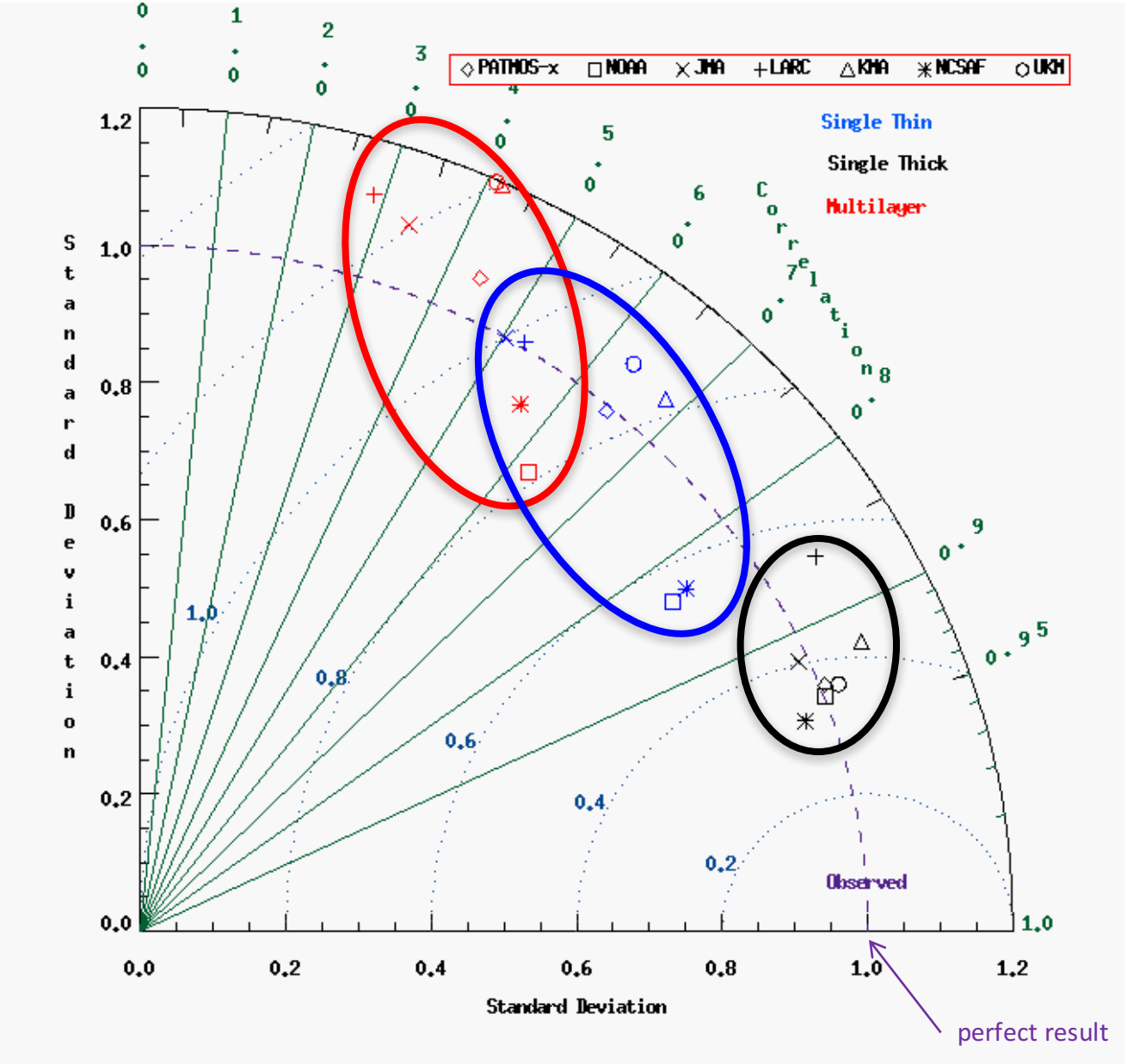
- Comparisons of CTT for August 19, 2015
- Diagonal shows CTT images or false color (CALIPSO).
- Upper half shows scatterplots
- Lower half shows histograms.
- CALIPSO shown in first row and column.



Taylor Plot of AHI CTT Comparisons

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

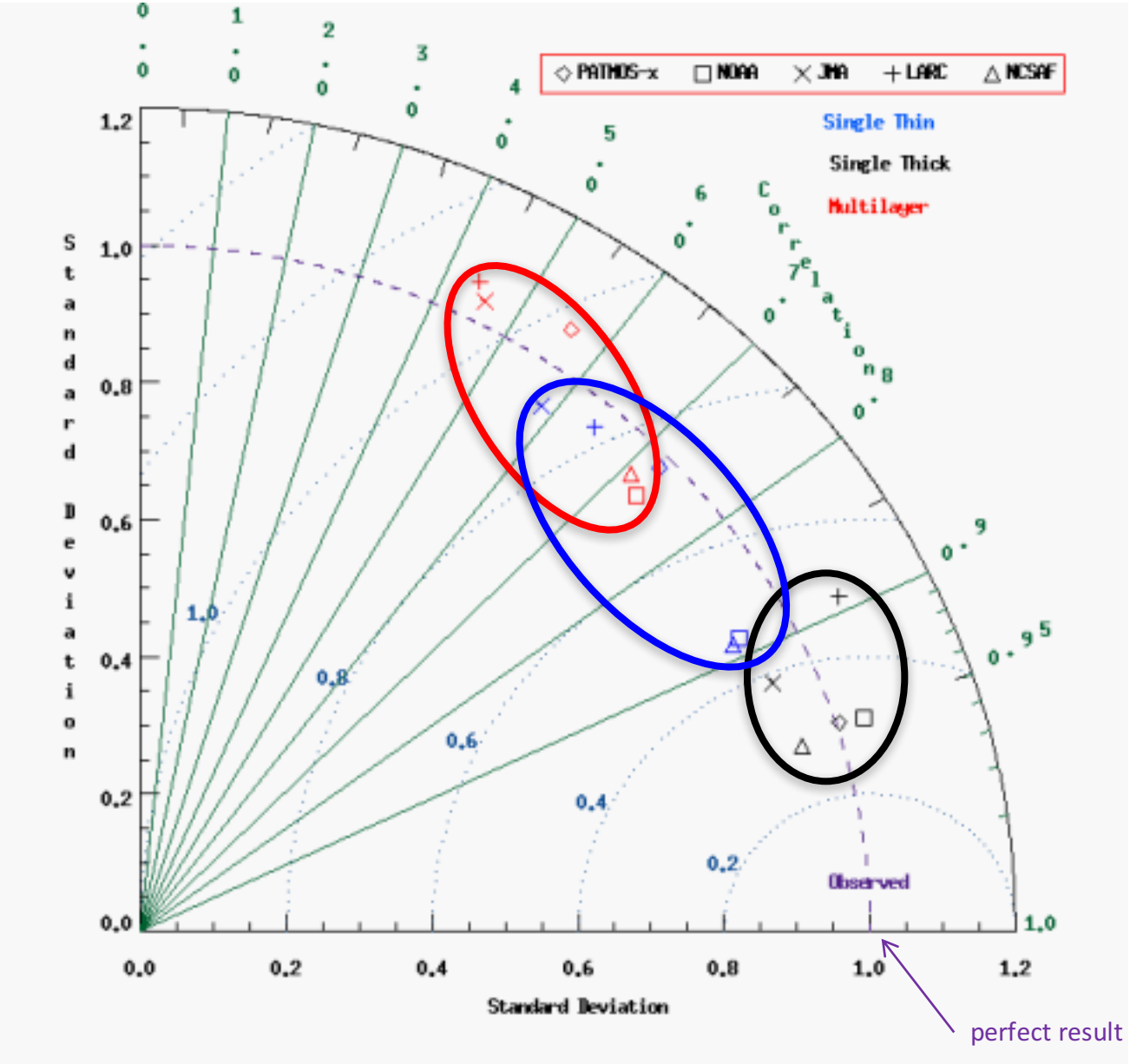
- Unfortunately, not all data have CTH, CTT and CTP. So a single Taylor never has all participants.
- Colored ovals show groupings for 3 cloud types.
- All algorithm suffer as clouds become thin and vertical structures become more complex.
- Inter-algorithm deviation is largest for multi-layer.



Taylor Plot of AHI CTH Comparisons

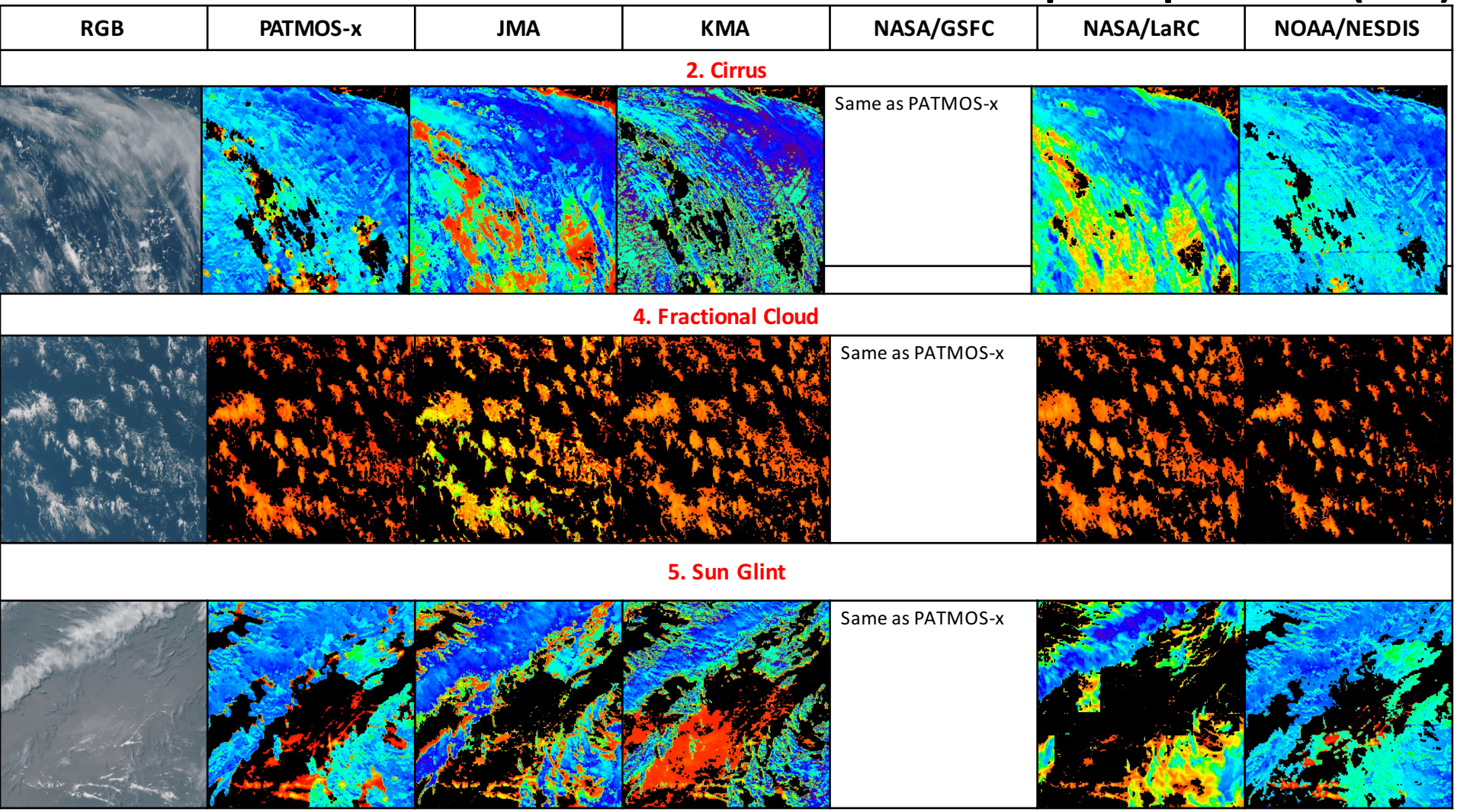
One standard ICWG analysis is the making Taylor plots for cloud height (CTH) using CALIPSO as a reference.

- KMA and UK Met Office did not provide CTH (yet).
- Performance is similar to scene with SEVIRI. (Harmann et al.)
- ***This plots are useful for tracking improvements between meetings***.



Examples of more detailed analysis in specific cloud regimes:

Cloud top temperature (CTT)



(image from Yong-Sang Choi's ICWG talk)

Suggested Action Items to CGMS from ICWG-1

(From Cloud Inter-Comparison Group)

- CGMS members to submit their 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 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.

Cloud Models (CMo) for Remote Sensing

Aim: Obtain a collective view on current cloud modelling issues and solutions (both employed and proposed), document to provide a group resource and an encouragement for collaborative endeavour.

Baseline to define a modelling issue:

Single layer, plane parallel, homogeneous microphysics and temperature

ICWG CMo Issue 1 – Multi-Layer Cloud
ICWG CMo Issue 2 – Horizontal Inhomogeneity
ICWG CMo Issue 3 – Vertical Inhomogeneity
ICWG CMo Issue 4 – Ice scattering parameters
ICWG CMo Issue 5 – Aerosol (with cloud, over, in or below)
ICWG CMo Issue 6 – Fractional Cover (n<1)
ICWG CMo Issue 7 – index of refraction
ICWG CMo Issue 8 – Effective variance

These are topics considered by the Modelling and Uncertainty Groups. Issues 1-2-4 are critical for the IWWG collaboration.

Active Cloud Sensors

- ICWG TGs recognize importance of CALIPSO, ISS/CATS, and the upcoming EarthCARE mission for validation of the cloud properties retrieved from passive sensors. The absence of space cloud lidars will severely impact our ability to evaluate cloud products from new sensors, and product uncertainty from advanced cloud retrievals.
- The availability of future spaceborne lidar cloud measurements is essential for validation of long-term cloud records. Lack of plans for space cloud lidars beyond EarthCARE has raised ICWG's concern.

- **Recommendation to Space Lidar Providers**
  - Long-term lidar measurements from space are important for validation of atmospheric retrievals from passive sensors. The Climate Product Topical Group encourages satellite providers to provide sufficient funding for future lidar missions.

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.

Going Forward with the ICWG / IWWG Collaboration

Relevant ICWG actions from last meeting:

- ICWG Uncertainty group has taken an action to expand our inter-comparisons to include uncertainty estimates.
- This includes cloud top pressure errors which are often provided to AMV algorithms.

Potential new actions to ICWG from IWWG:

- Does the IWWG want a standard cloud height quality calculation from cloud product generators?
- The AMV / CTH data set from Steve Wanzong may offer a good starting point for ICWG / IWWG collaboration. Are there comments on how to improve this? Are other wind providers interested? (**see the next talk**).
- We are open to modifying our analysis to be more relevant for IWWG.

ICWG Changes and Updates

- Andy Heidinger (NOAA/NESDIS) to replace Bryan Baum as ICWG Co-Chair

Information Exchange

The ICWG members are encouraged to exchange data and code with the aim to foster development of cloud retrieval algorithms and the generation data records for meteorological and climatologic applications.

- ICWG-1 discussion to consider open source community validation software
  - Suitable for GEO and Polar orbiters (even high resolution)
  - Python based library -> Pytroll (http://www.pytroll.org)
  - Cost sharing and possible partial funding?

Website

The ICWG website hosts information on the workshops, access to common data records and tools, and information on the Topical Groups. Please visit:

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

Thanks to ICARE, Université de Lille 1 - Sciences & Technologies

The End, Thank You!

Assumptions for Taylor and Scatter Plots.

This is done to mimic Hamman (2014) paper Figure 5 which was generated from the CREW SEVIRI Data.

- Thick vs thin clouds: use CALIPSO column-integrated COD value of 3 as threshold;
- Multilayer flag: use CALIPSO number of cloud layers (Nlay) detected, denote single layer if Nlay is 1; multilayer if Nlay larger than 1;
- Multi-layer clouds are not separated based on COD;
- For each product, phase is defined as either water or ice. Comparisons shown here are conducted on all water/ice pixels without phase match.
- Cloud top height (CTH) are available from PATMOS-x, NOAA, LaRC, JMA, NWCSAF and CALIOP;
- Cloud top temperature (CTT) are available from the above 6 products, as well as from UKM and KMA.

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

CMA, EUM, JMA, NASA, NOAA, WMO	WGII/3	A42.02	The new task team on calibration events logging to identify a common set of parameters to be monitored as part of the calibration events logging and sensor performance monitoring.

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.

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