The Quantification of Uncertainty in Cloud Retrievals (QUICR) Focus Group

Shaocheng Xie and Alain Protat (Co-Chairs)

Participants

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Agenda

- *Shaocheng Xie* - Review and update on QUICR (15 min)

- *Alain Protat* - Development of a cloud retrieval case library for testing and developing cloud retrieval methods – Current Status (10 min)

- *Sally McFarlane* - Integrating ACRED with RIPBE to facilitate use of BBHRP in evaluating retrieval products – plan and issues (20 min)

- *Chuanfeng Zhao* - Uncertainties in MICROBASE (15 min)

- *Qilong Min* - MFRSR retrievals for SGP., TWP, and NSA sites (15 min)

- *Greg McFarquhar/David Mitchell* - Ice Microphysical and Radiative Properties Focus Group – potential collaboration with QUICR (15 min)

- Discussion (~ 30 minutes) led by *Alain Protat and Shaocheng Xie*

Mission Statement

"to develop a methodology for characterizing and quantifying uncertainties in current and future ARM cloud retrievals, separately for different cloud regimes, in support of both retrieval algorithm improvement and cloud modeling study"

Objectives

- **Systematically analyze differences in current widely accepted cloud retrievals algorithms and their products**
- **Understand potential uncertainties in each of the selected algorithms**
- **Evaluate the accuracy of the test assumptions made in these cloud retrievals with observations and observation system simulation experiment (OSSE) datasets**
- **Apply advanced statistical methods to quantify uncertainties in these cloud retrievals for different cloud regimes**

Approaches

1. **Assemble multiple retrieval products on a common grid with uncertainty for each of the products quantified**
2. **Extensively evaluate these retrievals using BBHRP and in-situ data, as well as OSSE datasets**
3. **Implement advanced statistical methods to quantify uncertainties in these cloud retrievals for different cloud regimes**
4. **Use new instruments and develop synergetic retrievals to improve the accuracy of retrievals**

**BBHRP – Broadband Heating Rate Profile

**OSSE – Observation System Simulation Experiment

Proposed Activities

1. Integrate current cloud retrievals on a common grid to facilitate the use of these data by the community and provide a rough uncertainty estimate of the retrieved cloud properties (1st yr)

2. Create ensemble cloud retrievals by perturbing key parameters used in retrieval techniques (2nd – 3rd yrs)

3. Build-up a cloud retrieval case library for testing and developing retrieval methods (2nd – 3rd yrs)

4. Develop some statistics of cloud properties from observations for different cloud types (3rd yr)

5. Extensively validate these retrievals against available observations (case studies and statistical intercomparison) (3rd – 4th yrs)

6. Identify cloud types that each retrieval method is applied to (4th – 5th yrs)

7. Implement advanced statistical methods to quantify uncertainties in these cloud retrievals for different cloud regimes (4th – 5th yrs)

Expected Outcomes from the QUICR Focus Group

- We will build-up a cloud retrieval case library along with BBHRP testbed for testing and improving cloud retrievals.

- Through the integrated group effort, in the next 3-5 years we should be able to retrieve cloud properties with their uncertainties better quantified.

- We should be in a better position to provide recommendation on including or excluding certain retrieval algorithms, simple (applied for many cases) vs. comprehensive schemes (only for certain case), to the science community

We have created and released the ARM Cloud Retrieval Ensemble Dataset (ACRED)

9 ARM Ground-Based Cloud Retrievals

SITE	RETRIEVALS	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
SGP	MICROBASE													
	MACE													
	CLOUDNET													
	DENG													
NSA	MICROBASE													
	SHUPE_TURNER													
	WANG													
	DENG													
TWPC1	MICROBASE													
	COMBRET													
	DENG													
TWPC2	MICROBASE													
	COMBRET													
	DENG													
TWPC3	MICROBASE													
	COMBRET													
	CLOUDNET													
	DENG													
	VARCLOUD													
	RADON													

- **Provide a rough estimate of uncertainty in current retrievals**
- **Contain LWC/LWP/Re_liq, IWC/IWP/Re_ice, Optical depth**
- **Use CMBE resolution: 45m, hourly data**
- **Web Page for quick plots**

  http://www-pcmdi.llnl.gov/ARM/cred/cred.html

- **Technical report**

Thanks to all relevant PIs

A Journal Article submitted

- Zhao et al. 2012, submitted to JGR

- The paper uses the ACRED data to explore the differences in various cloud retrievals is currently under minor revisions. After a major revision, all the reviewers are quite happy with its current form with only a few minor points.

- Issues raised in the paper could be served as a baseline for future studies.

We are building-up a cloud retrieval case library

- Uniform input data files for running different algorithms

- In-situ data from both ARM and non-ARM field campaigns and radiative fluxes for evaluation and validation

- The focus group is liaising with the PIs producing those in-situ datasets to produce a library of "golden cases" from each field experiment.

- In-situ datasets allows for extensive checking of cloud retrieval assumptions and performances while on a limited number of meteorological situations.

Alain's talk

We are incorporating ACRED into RIPBE for BBHRP

- Create a high-resolution ACRED consistent with RIPBE to facilitate the use of BBHRP in evaluating various cloud retrievals

- Define cases for intercomparison studies

Sally's talk

We are analyzing uncertainties associated with selected retrievals

- Perturbing key parameters and/or changing key assumptions used in several selected algorithms
    - Understand uncertainty associated with individual retrievals
    - Provide necessary uncertainty information for further optimization
    - Create an ensemble dataset for selected cloud retrievals

- MICROBASE; MACE; VARCLOUD

Chuanfeng's talk

Discussion

- Comments on the current activities
- Identify cases for group studies
- Collaborations with other focus groups?
- Data needs to the efforts of QUICR?

Questions?