A newly calibrated long-term radar dataset of tropical convection

VALENTIN LOUF[1], ALAIN PROTAT[2], AND CHRISTIAN JAKOB[1]
[1]Monash University, Melbourne (Australia) [2]Australian Bureau of Meteorology

1. Introduction

The C-band POLarimetric (CPOL) radar stationed near Darwin (11°S, 131°E) Australia from 1998 to 2017 is a great tool for studies of **tropical convection**. CPOL is a research **dual-polarization Doppler** radar that has collected **18 wet seasons (November to May)** of observations since 1998, producing more than 350,000 PPIs.

The objective of this work is to produce a new quality-controlled dataset using latest developments in radar post-processing, in order to facilitate tropical convection studies.

We use a **3-step calibration** technique to calibrate CPOL.

2. Step 1: Monitoring clutter.

A ground monitoring technique: Pros: can be automated, precision, speed. Cons: relative calibration value.

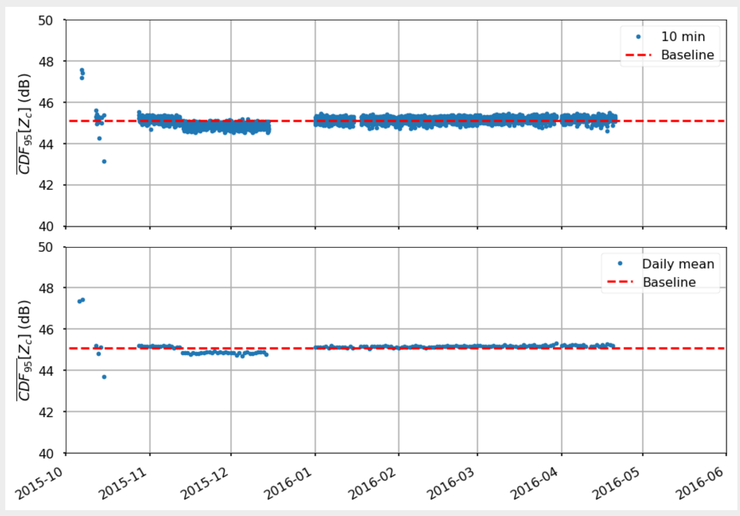

Figure 1: Ground clutter monitoring for season 16/17.

3. Step 2: Comparison with TRMM/GPM.

Statistical comparisons with TRMM/GPM provide absolute calibration (Warren et al. 2017). Pros: Absolute calibration. Cons: accuracy of ±3 dB, only a dozen of comparisons available for each season.

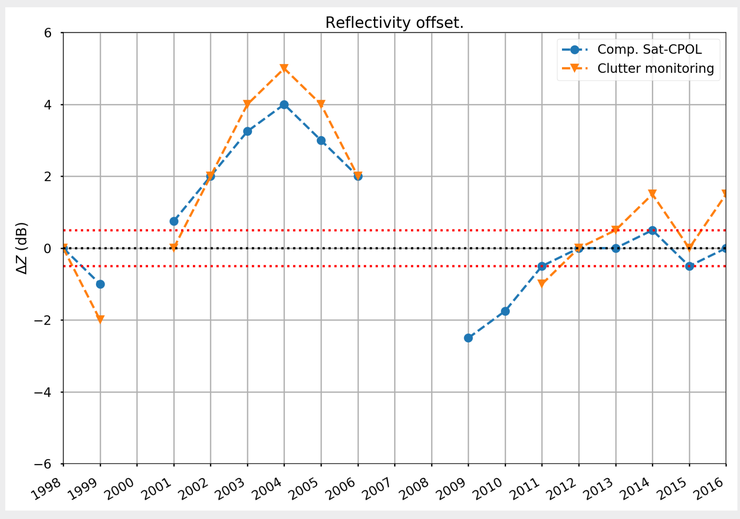

Figure 2: Reflectivity offset for all seasons. CPOL-TRMM/GPM comparison in blue, RCA offsets in orange.

4. Step 3 - Self-consistency check.

The self-consistency technique has been also used. Disdrometer measurements and for selected stable calibration periods. Pros: Absolute calibration of both Z_h and Z_{dr}. Cons: T-matrix calculations (small changes have an important impact, DSD, canting angle, ...), some cases of ambiguity between Z_H and Z_{dr}.

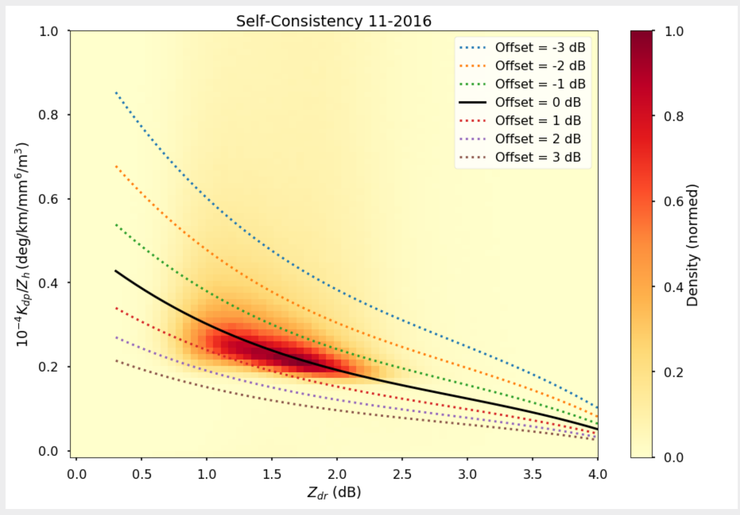

Figure 3: Self-consistency results for CPOL (Nov. 2016).

5. New radar processing

Level 1a: Calibrated raw products (CF/radial PPI format only): Z_h, Z_{dr}, ϕ_{dp}, ρ_{hv}, spectrum width, and Doppler velocity.

Level 1b: 18 new fields, including rainfall rate, N_0, D_w, radiosounding temperature, echo classification, etc. Available in CF/radial PPI formats or gridded format at two resolutions: 150 km range (2.5 km grid) and 70 km range (1 km grid).

Level 2: Daily files with constant dimensions. All level 1b fields at 2.5 km altitude plus Steiner classification, echo top height, 0-dB height, etc.

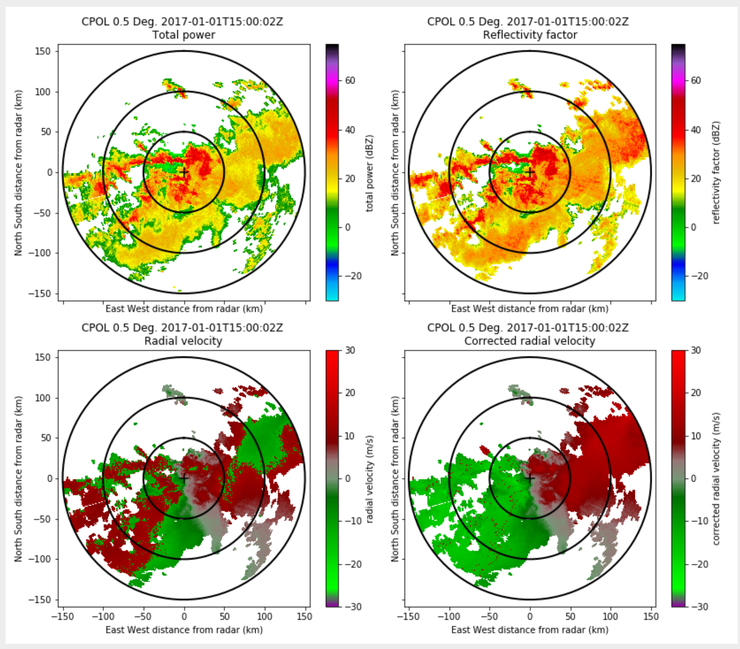

Figure 4: First elevation scan from 2017-01-01 at 15:00. Top: (left) raw reflectivity, (right) corrected reflectivity. Bottom: (left) raw velocity, (right) dealiased velocity.

6. New CPOL radar processing.

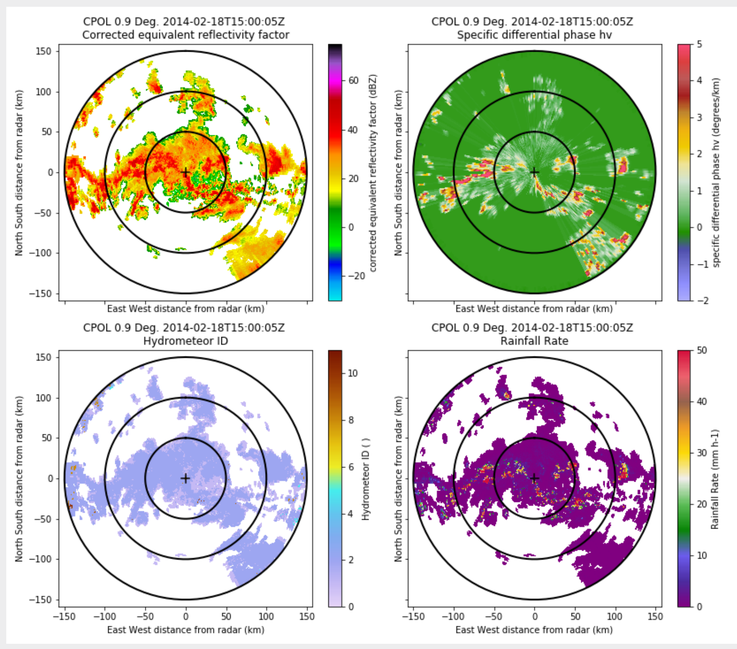

Figure 5: Top: (l) corrected reflectivity, (r) specific differential phase. Bottom: (l) hydrometeors classification, (r) rainfall rate.

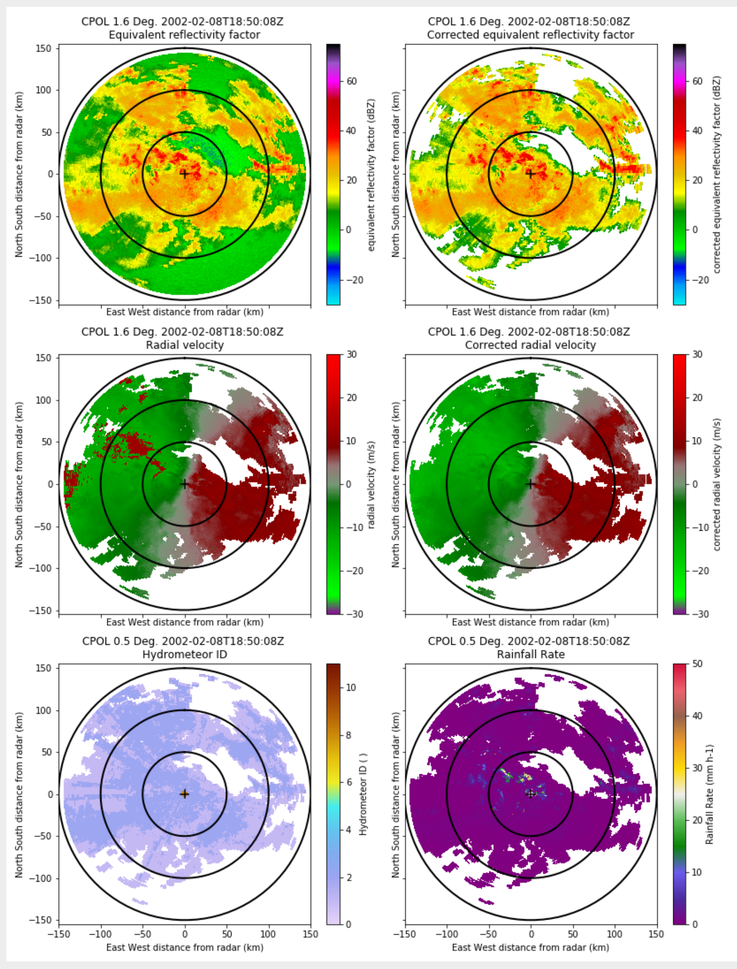

Figure 6: First elevation scan for 2002-02-08 at 18:50.

7. Level 2 processing

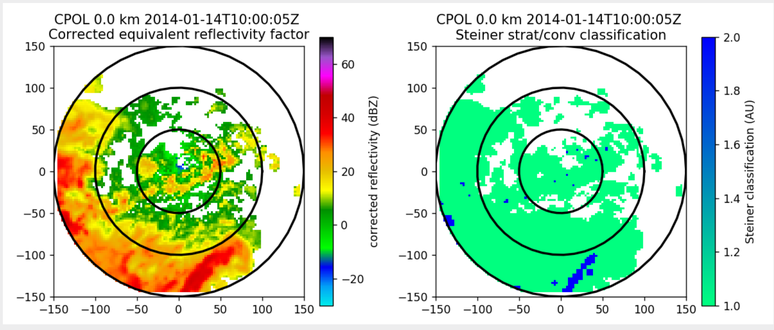

Figure 7: Slice at at 2.5 km of altitude 2014-01-10 at 10:00 (left) corrected reflectivity, (right) Steiner stratiform/convective classification.

Conclusion and Acknowledgment

The **relative calibration adjustment** (RCA) method has revealed previously undetected changes in sensitivity due either to intentional or unknown causes, such as system modifications, antenna offsets, alterations of the receiver, or the data processor. We have used this approach to correct the 19 yr of radar measurements.

A new CPOL dataset has been produced and is available. It will be **publicly available** on the ARM archive very soon.

All the codes for producing these data are available on open-source (see contact information).

This project uses the Python ARM Radar Toolkit (Py-ART, funded by ARM) and the CSU_RadarTools toolkit from Colorado State University.

Contact Information

Github: https://github.com/vlouf
Email: valentin.louf@monash.edu
Twitter: @valentin_louf

Scan this QR code to download this poster and for the full list of references:

fig/QR_code.jpg