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Geoscientific Instrumentation Methods and Data Systems Discussions
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Interactive comment on "The next generation airborne polarimetric Doppler weather radar" *by* J. Vivekanandan et al.

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Summary: The described concept would be a very valuable addition for the monitoring of many precipitation types, especially in extreme cases like hurricanes. The article could be published nearly in its current form once the following points are addressed.

Dear Dr. Walter Schmidt, Thank you for your time and comments. We have revised the

manuscript based on your comments. The revisions are as follows.

P8,22: C-band wavelength is in the order of 50 mm, W-band 3 mm, aerosol nuclei 0,05 mm How will the proposed C-band radar measurement contribute to the understanding of sub-mm aerosol effects in the cloud formation? Polarization measurements together with modeling can retrieve information about dimensions significantly below the wavelength, but we are talking about 3 orders of magnitude. Where do the authors see the lower limit for deriving PSD? See qualitative discussion in section 2.4

A. We agree with reviewer's comment that C-band radar is not sensitive enough for detecting aerosol. The sentence regarding this has been revised as follows: "Airborne platform equipped with in situ probes and the APAR offers the opportunity to make concurrent measurements of key aerosol and microphysical constituents respectively. These in situ and remote measurements can be compared to output from climate models (e.g., sedimentation velocities), and hence allow adjustments and improvements to model assimilation and parameterization schemes".

P9,18 Please state expected maximum horizontal and vertical coverage of a typical APAR flight. The text only states that the ceiling altitude would limit its ability, but not to which altitude.

A. The C-130 has a 10 hour flight endurance, a 2900 nautical mile range, and a flight ceiling of 27,000 feet. The above sentence has been added to section 2.3.

P12,16: Timing figure would help to understand better the proposed scheme: single pulse width, Doppler pulse separation, polarization change, direction change, etc

A. A timing diagram Figure 4, showing dual-Doppler (DD), dual-polarization and dual-Doppler (DPDD), and surveillance scans, has been added to the manuscript.

P15,4/P22,8: What kind of pulse compression scheme is used in APAR? What is the estimated range resolution after decompression?

A. A 33 microsecond, non-linear frequency modulated (NLFM) pulse will be com-

GID
4, C8–C14, 2014

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pressed to a final range resolution of 150 m. This sentence has been added to section 4.2.

P20,21: Mention explicitly that the QC algorithm is applied only on ground, if this is the case. The text could be interpreted as if the algorithm is implemented already inside the aircraft before data downlink.

A. The QC algorithm will be applied to radar measurements in real time to aid a mission scientist in making decisions regarding airborne data collection. The same software will also be used for enhanced post-processing of airborne radar measurements.

Table 1 and 2: Both tables should have exactly the same structure to make them comparable. There is no good reason to have most parameters sorted in a different order or omitted in one table compared to the other (e.g., pulse length and velocity resolution appear in table 2, not in table 1).

A. Table 1 and 2 have been merged to a single table as Table 1.

P8,4/8,11/P10,15: A general comment to the formulation “interaction of aerosol and clouds”: Aerosols influence the cloud formation and thereby determine the properties of the formed cloud like cloud droplet sizes and their amount. They do not “interact” with clouds. The presented statement is widely used but misleading. Condensation particles + condensed water vapor are aerosols! The current formulation may be kept if the authors so wish.

A. We agree with reviewer’s comments. The phrase ‘interaction between aerosol and cloud’ has been changed to ‘influence of aerosol on cloud formation.’

Typographic errors: P5,5 no other instrument other ÂżthanÂń p8,11: aerosolÂżsÂń and clouds P12,27: will be collected only over ÂżÂń restricted elevation angles. P20,27: can reduce the editing time ÂżÂń 10 fold. P22,8: uses ÂżaÂń pulse compression scheme for Comments to references: P25,26: Wasn’t the article Bringi, V. N., and Chandrasekar, V.: Polarimetric Doppler Weather Radar, Cambridge University Press,

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4, C8–C14, 2014

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New York published in 2005, ISBN: 9780521019552 ? P26,14: Houghton et al. Did you mean “Climate Change 2001: The Scientific Basis” Cambridge University Press, Cambridge, U.K., 2001 isbn: 9780521014953 The author list and subject match except for C.A. Johnson ? P26,21: The ELDORA/ASTRAIA P26,22: High resolution observations from .. P26,22: B. Am. Meteorol. Soc., 77, P26,28 Correct Science title is: Hurricane Intensity and Eyewall Replacement P27,1: correct title seems to be: Modeling, Error Analysis,: : :.. Transmit Radar. Part II: Experimental Data (delete "illustration") P27,7: correct quotation seems to be J. Atmos. Ocean. Tech., 17, 585-594

A. Typographical errors have been corrected. References have been revised per reviewer’s comments.

Interactive comment on Geosci. Instrum. Method. Data Syst. Discuss., 4, 1, 2014.

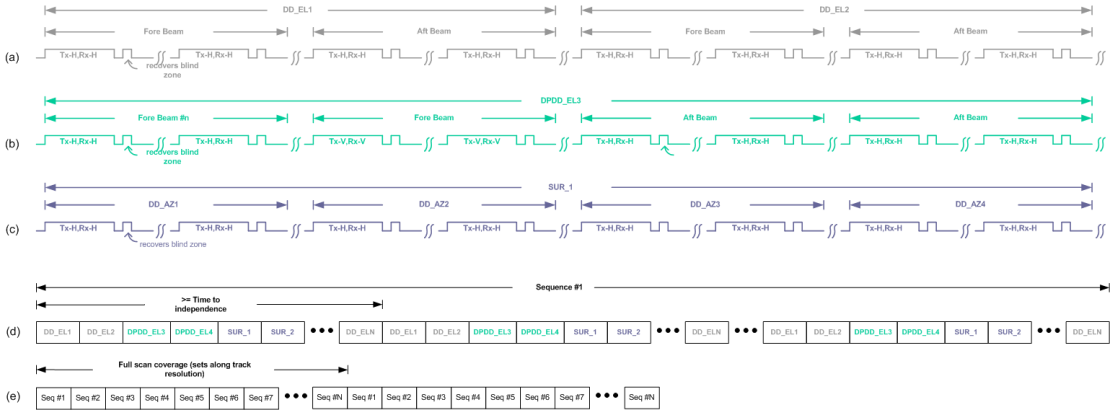

Fig. 1.

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Figure 1. APAR scan timing sequences: (a) Dual-Doppler (DD) timing for two successive elevation angles, (b) dual-polarization and dual-Doppler (DPDD) timing for a single elevation angle, (c) surveillance scan timing for four successive azimuth angles, (d) a typical scan sequence comprising dual-Doppler, dual-polarization, and surveillance scans using beam multiplexing (e) full scan coverage in elevation and azimuth that determine along track resolution. During DD and DPDD scans, measurements are collected at various elevation angles, for both fore and aft beam positions. Surveillance scan is performed for a fixed elevation angle by scanning in azimuth.

Fig. 2.

GID
4, C8–C14, 2014

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Table 1: Technical Specifications of APAR and ELDORA

Parameter	APAR	ELDORA
Frequency	5.4 GHz	9.3 – 9.8 GHz
Wavelength	5.55 cm	3.2 cm
Element spacing along parallel and perpendicular to fuselage	2.78 cm, 2.78 cm	n/a
Number of Elements along parallel and perpendicular to fuselage	56, 64 (3584 elements)	n/a
Line Replacement Unit Size (LRU)	8x8 (64 elements)	n/a
Number of LRU's per PAR	7x8 (56 LRU's)	n/a
Antenna Beamwidth: (Elev, Azim) in Transmit mode (Uniform aperture illumination)	 θ_0: 1.8°, 1.6° θ_{45}: 2.1°, 1.8°	 2.0°, 1.8° n/a
Antenna Beamwidth : (Elev, Azim) in Reception mode (Taylor aperture illumination)	 θ_0: 1.9°, 2.2° θ_{45}: 2.2°, 2.5°	 2.0°, 1.8° n/a
Antenna Gain: Transmit Receive	 40 dB (Uniform) 39 dB (Taylor taper)	 39 dB 39 dB
Polarization	H, V Linear	H only
Peak Transmit Power	~14 kW (4W/TR)	35-40 kW
Range Resolution	150 m	150 m
Minimum Along Track Sweep Spacing	130 m	300 m
Radar Angular Resolution	~0.3 km @ 10km	~0.3 km @ 10km
Minimum Detectable Signal (at 10km)	-14 dBZ	-11 dBZ

1

Fig. 3.

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