Atmos. Meas. Tech. Discuss.,
doi:10.5194/amt-2018-184-RC1, 2018

Atmospheric Measurement Techniques Discussions

Open Access

EGU

Interactive comment on "Doppler W-band polarization diversity spaceborne radar simulator for wind studies" *by* Alessandro Battaglia et al.

Anonymous Referee #1

Received and published: 18 July 2018

This article provides a nice and thorough description of the expected performance and added-value of a scanning spaceborne Doppler radar with polarization diversity. The article describes the ability of such an instrument to retrieve atmospheric winds from Doppler measurements at W band. The originality of this study is that it considers the scanning operation of a Doppler radar from space, whereas many such studies have focused on the nadir-looking case (with EarthCARE in mind). For scanning radars, error sources such as NUBF become particularly important. The article is well written and the Authors do a good job of reviewing the existing literature and establishing a niche to be addressed. Another strength of this article lies in the use of spaceborne (CloudSat granules), reanalysis (wind fields) and field-campaign (LDR climatology) data for the simulations. The sensitivity analysis places the results of this study in a wider and

Printer-friendly version

Discussion paper

more realistic context. Three error sources are investigated in detail, viz. NUBF, wind shear and cross-talk between orthogonal polarization channels. Analytical formulae (Eqs 3,4)are provided to correct for the first two types of Doppler errors. Results of the simulations indicate a high skill of the NUBF correction and of the shear correction (albeit only for larger SNR).

For all the aforementioned reasons, this article is particularly relevant as the scientific community designs future spaceborne clouds and precipitation radars. I therefore recommend it for publication once the following points will have been addressed.

see details in attached document.

- A point made by the Authors is the limited amount of spatial variability of the input data (due to the smearing and coarse horizontal sampling of satellite and reanalysis data), and thereby a possible under-estimation of NUBF and wind shear errors. Since, NUBF and wind shear biases are mostly sub-footprint effects, I was wondering if there was any merit in spatially interpolating (if possible with an order higher than linear) the input data (satellite, ECMWF) to a finer resolution, before computing the Doppler velocity errors?

- P9L10-13: For attenuation, do the Authors 1) correct for attenuation in the CloudSat viewing configuration (using the 2C-RAIN products?), 2) generate unattenuated Z in the WIVERN look direction (and resolution), and 3) add attenuation in the WIVERN viewing direction? o If not, how much of a limiting factor is it for the realism of your simulations, especially for large off-nadir look angles? o If so, then regions with invalid radar data aloft (due to attenuation or multiple scattering) would invalidate radar data in their “shadow” to the surface (along the viewing direction). This limits the amount of radar data available for the statistical analysis. Could you assess/comment on the penalty incurred by this effect?

- P12L7-9: Wouldn’t the dominant contribution come from the vertical only if the look angle exceed 45 degrees? It seems to me that more than a “dominant factor”, the key here is that, for non-nadir look angles, the gradient in the direction orthogonal to the Boresight (“eta”) becomes correlated to the vertical gradient.

- P15L22-33: For a pulse-pair radar, the noisiness would be injected when building the (I,Q) voltage samples, and this noisiness would affect both reflectivity and velocity (Approach described in Zrnic 1975 or Sirmans and Baumgartner 1975). Is your addition of noise to the WIVERN Doppler data consistent with the (I,Q)-based approach?

- Do the Authors have recommendations for a better correction of wind-shear-induced errors over a wider range of SNR values?

Please also note the supplement to this comment:
https://www.atmos-meas-tech-discuss.net/amt-2018-184/amt-2018-184-RC1-supplement.pdf

---

Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2018-184, 2018.